The Anatomy of a Credit Crisis: The Boom and Bust in Farm Land Prices in the United States in the 1920s.[1]

Raghuram Rajan (Chicago Booth and NBER) **and** **Rodney Ramcharan** (Federal Reserve Board)

Abstract

Does credit availability exacerbate asset price inflation, especially if there are perceived changes in fundamentals? In this paper we address this question by examining the rise (and fall) of farm land prices in the United States in the early twentieth century, attempting to identify the separate effects of changes in fundamentals and changes in the availability of credit on land prices. We find that credit availability likely had a direct effect on inflating land prices. Credit availability may have also amplified the relationship between the perceived improvement in fundamentals and land prices. When fundamentals turned down, however, areas with higher ex ante credit availability suffered a greater fall in land prices, and experienced higher bank failure rates. We draw lessons for regulatory policy.

[1] We thank Fang-Yu Liang, Michelle Welch and Lieu Hazelwood for excellent research assistance. Rajan benefited from grants from the Stigler Center for the Study of the State and the Economy, from the Initiative on Global Markets, and from the National Science Foundation. Thanks to Amit Seru for helpful comments.

Asset price booms and busts often center around changes in fundamentals or beliefs. Some economists argue that the availability of credit also plays a role (see, for example, the descriptions in Kindleberger and Aliber (2005) or Minsky (1986), the evidence in Mian and Sufi (2008) on the role that securitization may have played in the sub-prime crisis, or theories such as Geanakoplos (2009)). Others claim that the availability of credit plays little role in asset price movements (see, for example, Glaeser, Gottleb and Gyourko (2010)). In this paper, we examine the rise (and fall) of farm land prices in the United States in the early twentieth century, attempting to tease out the separate effects of changes in fundamentals and changes in the availability of credit on land prices.

Usually, it is hard to tell apart the effects of the availability of credit from changes in fundamentals, unless credit is fundamentally misdirected– after all, more credit is likely to flow to entities with better fundamentals. In this paper, we first isolate a natural shock to "fundamentals" and then see how it affects asset prices in a variety of local credit markets with differing degrees of availability of credit.

The shock to fundamentals we focus on is the increase in agricultural commodities prices in the United States in the early 20th century, especially in the years 1917-20, and their subsequent plunge. The reasons for this boom and bust in fundamentals are well documented. Rapid technological change at the beginning of the 20th century and the emergence of the United States as an economic power helped foster a worldwide boom in commodity prices. World War I disrupted European agriculture, especially the production of wheat and other grains. The Russian Revolution in 1917 further exacerbated the uncertainty about supply, and intensified the commodity price boom. However, European agricultural production resumed faster than expected after the war's sudden end, and desperate for hard currency, the new Russian government soon recommenced wheat and other commodity exports. As a result, agricultural commodity prices plummeted starting in 1920 and declined through much of the 1920s (Blattman, Hwang and Williamson (2007), Yergin (1992)). Different counties in the United States had different propensities to produce the crops that were particularly affected, and therefore experienced the initial perceived positive (and subsequent negative) shock to fundamentals to different degrees.

We also take advantage of the fact that credit markets in the United States in the early 1920s, especially the markets for farm loans, were localized. There was substantial variation across counties in the number of banks in a county (as well as the banks per capita or banks per unit of area – for simplicity, we will refer to all three as the *number of banks*). Since more banks in a county meant more funds available to lend, more local competition to make loans, as well as more proximity between potential lenders and borrowers (and till recently, physical proximity was important in determining credit access for potential small borrowers– see Petersen and Rajan (2002)), it typically meant greater access to credit.[2]

We find that the more a county is exposed to the perceived positive commodity price shock, and the greater the number of banks in a county, the higher the land prices in that county at the peak of the shock in 1920. Thus both the perceived shock to fundamentals as well as the availability of credit seem to be correlated with higher land prices. What is particularly interesting is the interaction between the two. As the availability of credit increases from a low level, the shock to fundamentals is associated with a greater impact on land prices, suggesting that the availability of credit amplifies shocks. At very high levels of credit availability, though, the relationship between the shock to fundamentals and land prices becomes more attenuated.

These correlations, of course, need not imply that we can draw causal inferences. Banks probably did enter into areas where the shock to fundamentals was perceived to be strong, and the number of banks in a county may reflect aspects of the shock to fundamentals that are not captured by our proxies for the county's exposure to commodity price increases. We do find that the number of banks in 1920 is negatively correlated with the average interest rate on mortgage loans in the county in 1920, suggesting that credit availability was higher in counties with more banks. But that could be because the unmeasured aspects of the quality of borrowers were better in those

[2] This leads to the immediate question why counties differed in the number of banks. In previous work (Rajan and Ramcharan (forthcoming), we have argued that the differences in the number of banks stemmed in part from differences in the political economy of the county, which in turn stemmed from differences in the technology of agricultural production and the degree of concentration of land holdings it led to. The number of banks must have been affected by regulation, which we also show was related to political economy in the county (Rajan and Ramcharan (2010)). And finally, as we argue in this paper, bank entry was clearly also driven by the size of the commodity shock itself.

counties, rather than because credit was more available for a given borrower quality -- the more standard measure of credit availability.

However, an interesting feature of credit markets in the 1920s allows us to offer more convincing evidence that the availability of credit has an independent effect on land prices. Inter-state bank lending was prohibited in the United States in the early 1920s. If the number of banks primarily reflects fundamentals associated with land, then the number of banks in neighboring counties should affect land prices in a county the same way, regardless of whether the neighboring counties are within the state or out of state. If, however, the number of banks reflects the availability of credit, then banks in neighboring counties within-state should affect land prices much more (because they can lend across the county border) than banks in equally close neighboring counties that are outside the state (because they cannot lend across the county border).

Similarly, the difference in land prices across a county border should be positively correlated with the differences in the number of banks across the border, but more so when the border is also a state border, because banks cannot lend across the border to equalize price differences.

We find evidence for both the above predicted effects, suggesting the availability of credit does matter for determining asset prices, over and above any effect of the change in fundamentals themselves.

The skeptical reader might still doubt the independent role of credit in elevating asset prices. However, there was another factor influencing credit availability but not fundamentals: Several states experimented with deposit insurance before the commodity boom. Some have argued these regulations may have been a source of moral hazard, prompting banks to engage in riskier lending, as evinced by their higher failure rates in the 1920s (Calomiris (1990), Wheelock and Wilson (2003)). It is plausible that banks covered by deposit insurance are more aggressive in granting credit, and therefore, for a given number of banks, credit availability is higher if those banks are covered by deposit insurance. We find that the relationship between the number of banks and land prices becomes significantly larger in areas where banks operated under deposit insurance, suggesting once again that greater availability of credit may have inflated land prices during the commodity boom.

There is another important piece of evidence suggesting that the number of banks does not proxy for some underlying positive fundamental other than the commodity shock that helped support land prices. As commodity prices declined in the 1920s, land prices fell. Interestingly now, for a given fall in commodities prices, land prices in counties with the largest number of banks fell furthest. Thus credit seemed to accentuate the rise in land prices, and past exposure to credit seemed to accentuate the fall.

Historians and economists have long observed that the collapse in commodity prices and the ensuing agricultural distress of the 1920s may have contributed to that decade's spate of bank failures (see Alston, Grove and Wheelock (1994), Calomiris (1990), Gambs (1977), Johnson (1973/74), and Wheelock (1992)). However, much of the evidence in these studies is drawn from state level data, using aggregate measures of land prices, market structure and other key variables. We can correct for state level differences (in regulation, deposit insurance, etc.) by focusing on counties. It turns out again that in counties with more banks and with higher exposure to the positive commodity price shock leading up to 1920, the fraction of banks that failed was higher in the subsequent decade.

That the number of banks is positively associated with land prices in the boom phase ending in 1920, the extent of the land price bust, and the fraction of bank failures in the 1920s suggest strongly that the number of banks was primarily a proxy for the availability of credit rather than some unmeasured fundamental source of value in the county. A final piece of evidence comes from cross-border lending. As we discussed earlier, credit could flow from banks in nearby counties within the same state, and the number of banks in these counties correlates positively with the subsequent failure rate in a given county. And consistent with the number of banks being a proxy for credit availability, the strength of this correlation declines with the distance of the neighboring county, and vanishes if it is across state lines, regardless of distance.

In sum, this period provides a rich environment to study the nexus between credit availability and asset prices. Our evidence suggests that the availability of credit played an important role in exacerbating the farm land price boom that peaked in 1920, and the subsequent spate of bank failures, over and above the direct effect of the commodity price boom (and collapse).

Throughout the paper, we are agnostic about whether misplaced over-optimism boosted land prices or whether expectations were indeed correct ex ante, but changed as uncertainty about European production resolved itself. Moreover, we cannot say whether the availability of credit played a role in boosting beliefs about commodity and land prices. All we can say is that the availability of credit seemed to influence both the rise and the subsequent fall, in asset prices, and that there seem to be interaction effects between the perceived shock to fundamentals and credit availability. All of this could be perfectly rational. Equally, it could reflect an irrational credit-fuelled asset price boom and bust.

In the absence of more detailed evidence, our study does not imply that credit availability should be restricted. We do seem to find that greater credit availability increases the relationship between the perceived change in fundamentals and asset prices, both on the positive and negative side. This suggests credit availability might have improved allocations if indeed the shock to fundamentals had been permanent. Our focus on a shock that was not permanent biases our findings against a positive role for credit availability.

A more reasonable interpretation of our results is that greater credit availability tends to make the system more sensitive to all shocks, whether temporary or permanent, rational or otherwise. Prudent risk management might then suggest regulators should "lean against the wind" in areas where the perceived shocks to fundamentals are seen to be extreme, so as to dampen the fallout if the shock happen to be temporary.

The rest of the paper is as follows. Section I provides an overview of the theoretical literature, and the main predictions, while Section II describes the data and historical context. The basic correlations between banks and prices are in Section III; Section IV takes up the issue of causality, and Section V focuses on the collapse in commodity prices and banking sector distress. Section VI concludes.

I. Theories

Land purchases are large-ticket items. Purchasers typically require credit, which makes the demand for land dependent on credit availability (Stein (1995)). Indeed, it is the broad based availability of credit rather than its availability to a limited few, that is expected to shape the demand for land, since managerial capacity, as well as crop specificity and agricultural technologies, tend to create diminishing returns to owning large tracts of land. Similarly, broad credit availability would make it easier to resell the asset, rendering the land market more liquid, and embedding a liquidity premium in the price of land in those areas (Shleifer and Vishny (1992), Williamson (1988)).

Furthermore, it is reasonable to expect that the positive association between any positive shock to fundamentals and land prices would be enhanced in areas with greater credit availability. For one, when credit is more freely available, potential buyers can borrow against more of the value of the underlying collateral (that is, loan to value ratios are higher) which could push land prices closer to fundamental value.[3]

There are other rationales for such a relationship. To the extent that a shock changes the optimal ownership structure of the land, and widespread credit availability allows those who can optimally use the land to have the purchasing power necessary to buy it, greater credit availability brings about a closer association between land-use efficiency and ownership, and should enhance the effect of a positive fundamental shock on asset prices.

There are, of course, reasons why greater credit availability could push land prices above fundamentals, when expectations are shocked upwards. Geneakoplos (2009) suggests that buyers tend to be the optimists in the population, restrained in their enthusiasm for buying only by the funds they can access; greater credit availability allows them to pay even more for the asset.

The nature of land markets may exacerbate these effects. Scheinkman and Xiong (2003) argue that low transaction costs and a ban on short sales play a central role in allowing disagreement over fundamentals and overconfidence to lead to speculative trading: Investors bid up the price of land beyond their own assessment of its fundamental value in the hope of a future sale to someone with a more optimistic valuation. Transaction costs are likely to have been lower in areas with more competitive banking systems, while nationwide, short selling in the land market was extremely difficult during this period. The trading gains from these transactions, as well as

[3] Consider, for example, a situation where sellers sell only for liquidity reasons, so they take what competitive buyers will pay. In that case, the price of land will be determined by how much buyers can borrow. The better the credit availability, the more the price will reflect the fundamental value. Hence the price of land varies more with fundamentals in areas with higher credit availability.

expectations of further gains, could have push prices above fundamentals during periods of positive sentiment.

The above theories focus on buyer sentiment. Other theories focus on lender behavior. Rajan (1994) models the interaction between banks in an environment where credit is expanding; banks are unwilling to stop "ever-greening" bad loans or to hold back on new lending for fear of realizing losses or signaling a lack of lending opportunities, and thus revealing their lower ability. Thus good times lead to excess credit. Since loan losses are more likely in bad times (and creditworthy lending opportunities limited), all banks have an incentive to take advantage of the more forgiving environment (where losses are blamed on the environment rather than on low ability) to cut back on credit. Thus credit tends to follow cycles that amplify real shocks, both positive and negative, especially in areas where banks are more competitive.

Collateral-based lending (see the theory in Fisher (1933), Bernanke and Gertler (1989), and Kiyotaki and Moore (1997) as well as the evidence in Adrian and Shin (2008)) also results in credit cycles that tend to amplify real shocks. An initial shock to land prices leads to more borrower net worth, a greater ability to borrow, and thus an amplification of the demand for land. On the way down, lower land prices mean lower net worth, lower ability to borrow, and a significant contraction in demand for land, further amplifying the price decline as fire sales push down prices.

II. Historical Background and Data

Historical Description

Historians argue that the boom in land prices up to 1920 had its roots in optimism that "…European producers would need a very long time to restore their pre-war agricultural capacity…" (Johnson (1973, p178)). The national average of farmland values was 68 percent higher in 1920 compared to 1914, and 22 percent higher compared to 1919. However, the rapid agricultural recovery in Europe and elsewhere led to a collapse in commodity prices and farm incomes. Farm incomes fell 60 percent from their peak in 1919 to their depth in 1921. Farm incomes did recover steadily after that. Indeed, by 1922, farm incomes were back up at the level they reached in 1916, before the 1917-1920 spike, and by 1929, were 45 percent higher still (though still short of their 1919 levels).

So the "depression" in agricultural incomes was only relative to the heady levels reached in the period 1917-1920 (Johnson (1973), Alston, Grove, and Wheelock (1994)).

Unfortunately, farmers took on substantial amounts of debt as they expanded acreage in the boom times. Mortgage debt per acre increased 135% from 1910 to 1920, approximately the same rate of increase as the per acre value of the ten leading crops (Alston, Grove, and Wheelock (1994) citing Federal Reserve documents). Credit was widely available, with borrowers putting down only 10 percent of the amount, obtaining 50 percent from a bank, and getting a second or junior mortgage for the remainder (Johnson (1973)). Loan repayments were typically bullet payments due only at maturity, so borrowers had to make only interest payments. As long as refinancing was easy, borrowers did not worry about principal repayment. And the long history of rising land prices gave lenders confidence that they would be able to sell repossessed land easily if the borrower could not pay, so they lent willingly. Debt mounted until the collapse in commodity prices put an end to the credit boom.

Thus we have here a perceived shock to fundamentals that reversed itself. If nothing else, we can document the longer term effects of that build-up of debt (e.g., on land prices and on bank failures). But we can also tease out whether access to credit had incremental effects.

Land and Commodity Prices

We collect data on land prices per acre from two sources. The decennial Census provides survey data on the average price of farm land per acre for roughly 3000 counties in the continental United States over the period 1910-1930. The Census data are self reported and these surveys may only partially reflect prevailing market prices. As a check on the survey data, we use hand collected data from the Department of Agriculture (DOA) on actual market transactions of farm land for an unbalanced panel of counties observed annually from 1907-1936. These data are recorded from state registries of deed transfers, and exclude transfers between individuals with the same last name in order to better capture arm's length market transactions.

Table 1 summarizes the land price data from the two data sources. In 1910, the mean price level is similar in the counties sampled by both the Census and the Department of Agriculture (DOA). Differences in the average price level between the two series emerge later. The average price level from the DOA market transaction data is higher at the peak in 1920 than in the Census survey based sample; the DOA average price level is also lower in 1930 than the average price surveyed in the Census. In nominal terms, the Census data suggest that the average price per acre of land increased by about 60 percent from 1910 to 1920, but declined by about 22 percent from 1920 to 1930.[4] The DOA market transactions data suggest greater gyrations, with prices rising by 80 percent during the 1910s, and declining by over 43 percent during the 1920s. That said, as Table 1 indicates, the cross-section in both series is similar: the correlation coefficients of prices drawn from both sources in 1910, 1920, and 1930 are 0.97, 0.95 and 0.83, respectively.

Using the Census data, Figure 1 shows that at the peak of the boom in 1920, the price per acre of farm land was typically highest in the Mid Western grain regions, especially in those counties around the Great Lakes. Prices were also high in parts of the cotton belt in the South along the Mississippi river flood plain. The price level generally was lower in those Southern counties further removed from the Mississippi River, and in the more arid South West.

To illustrate the connection between county level land prices and world commodity prices, we construct a simple index of each county's "agricultural produce deflator" over the period 1910-1930 using the 1910 Agricultural Census and world commodity prices from Blattman et. al (2004). The census lists the total acreage in each county devoted to the production of specific agricultural commodities. The index is constructed by weighting the annual change in each commodity's price over the relevant period by the share of agricultural land devoted to that commodity's production in each county at the start of each decade. The index consists of the seven commodities for which world prices are consistently available during this period: cotton, fruits, corn, tobacco, rice, sugar and wheat.

The cost of agricultural production can vary, and climate and technology may allow crop substitutions in some areas depending on relative crop prices. But a rising index would generally portend a higher dividend yield from the underlying land, thereby

[4] The Bureau of Labor Statistics Historic CPI series, ftp://ftp.bls.gov/pub/special.requests/cpi/cpiai.txt, suggests a real decline in the price per acre of land of about 10 percent over 1920-1930; CPI data for 1910 is unavailable.

supporting higher land prices. Figure 2 plots the annual average change in the index, as well as the average annual change in the price of land from the DOA series over the period 1910-1930. The index spiked up with the outbreak of WWI, and land prices rose soon after the resumption of trans-Atlantic shipping circa 1915. The index then peaked in 1920, and plummeted once Russian and European grain and oil re-entered world markets. There is a concomitant collapse in the price of agricultural land, with deflation setting in for the rest of the decade. The positive association between log land prices in 1920 and the growth in the index from 1910-1920 across counties (see Figure 3) suggests that world commodity prices played an important role in shaping US land prices.

Credit

There was a massive expansion in both state and national banks in the period leading up to 1920. There were 28,885 banks in operation on June 1920, two thirds in towns of less than 2500 population. Despite 3200 entrants over the 1920s, the number of banks had declined to 23,712 by the end of 1929 (Alston, Grove, and Wheelock (1994) citing Federal Reserve documents). Many of the banks that closed were in rural areas, with the annual failure rate for rural banks nearly twice that for banks in larger cities.

From the FDIC, we collect data on the total number of banks and the quantity of deposits in each county within both the state and national banking systems. We also hand collected data from the agricultural census of 1920 on the average interest rate charged on farm loans for about 2800 counties. We scale the number of banks by either land area or population within a county to obtain a commonly used proxy of local bank market structure (Evanoff (1988), Rajan and Ramcharan (2011a)). We summarize these credit variables in Table 2. Counties in western states were generally larger and less populated than other regions, but banks scaled by area and population are positively correlated in the cross-section. The correlations also suggest that areas with greater bank density appeared to have lower interest rates. Figure 4 indicates that counties with lower interest rates were typically in the upper Mid West; credit was costliest in the South.

III. Land Prices and Credit Availability

The theoretical arguments outlined earlier yield several predictions about the relationship between proxies for credit availability, the shock to fundamentals, and land prices in the cross-section of counties in 1920. First, land prices should be higher in counties with higher credit availability, if nothing else because land becomes intrinsically more liquid when credit is available. Second, land prices should be higher in counties that experience a stronger demand for the traditional commodities they produce, in the years leading up to 1920. Finally, the estimated interaction coefficient between credit availability and the demand shock on land prices should be positive at low levels of credit availability – more credit availability should result in a higher effect of the demand shock on land prices, either because buyers have the funding to pay more of the true value of the property or because more efficient owners have the chance to buy or because bank competition accentuates both optimistic and pessimistic beliefs about the future.

At higher levels of credit availability, the effect is likely to be more ambiguous, and depend on the theory. For instance, indiscriminate lending in a credit frenzy may attenuate the relationship between the demand shock and land prices at high levels of credit availability.

In the discussion above, we have taken credit availability as exogenous. Clearly, there are reasons why some components of credit availability will be exogenous to local demand. A number of authors have argued that credit availability will be driven by local political economy (see, for example, Engerman and Sokolof (2002), Galor et al. (2009), Haber et al. (2007), Ransom and Sutch (1972), Rajan and Zingales (2003), Guiso, Sapienza, and Zingales (2004), Rajan and Ramcharan (2011a)). One strand in this literature suggests that the constituencies for and against finance are shaped by economic conditions such as the optimal size of farms, which varies with climatic and soil conditions. These constituencies then drive bank regulation (see, for example, Rajan and Ramcharan (2011b)) including capital requirements, branching regulations, and deposit insurance, which then determines bank entry and credit availability. Some of these components of credit availability could, in fact, be exogenous to the commodity shock. Of course, bank entry will also be driven by the demand for credit, as well as general prosperity. We will have to show that banks and credit availability cause changes in asset prices, rather than simply mirror changes in perceived prosperity.

3.1. Land Prices and Credit Availability: The Basic Regressions

We want to explain the level of (log) land price per acre in a county in 1920, as well as the growth in land prices per acre between 1910 and 1920. Let us start by simply illustrating the relationship between land prices and credit availability in 1920, correcting for obvious explanatory variables.

As a measure of credit availability, we use the log of the number of banks (state plus national) in the county, as well as banks per capita and banks per square mile. We will focus primarily on log banks, but present results for all three whenever appropriate.

Until the relaxation of the 1864 National Bank Act in 1913, national banks were barred from mortgage loans – that is, loans against land (Sylla (1969)). There is disagreement about the effectiveness of this restriction (Keehn and Smiley (1977)). Clearly, to the extent that both state and national banks could make farm loans during the boom period, the sum of national and state banks is a better measure of credit availability than each number alone. However, state and national banks had different regulators, and different capital regulations (national banks had a higher minimum capital requirement – for example, see Wheelock (1993)). Moreover, in states with deposit insurance, only state banks benefited from that insurance. So we will check whether our key results hold when we focus only on state banks or when we look at state and national banks separately.

Summary statistics are in Table 3, while the regression estimates are in Table 4.[5] As a benchmark, Table 4 column 1 includes state fixed effects as the only controls. The log number of banks is significant at the 1 percent level. A one standard deviation increase in the log number of banks in a county is associated with a 0.55 standard deviation increase in the log price level per acre. To put this elasticity in context, moving from a county with banks at the 25th to the 75th percentile level in the cross section suggests a 41.2 percent increase in the land price level. This is obviously a likely upper bound to the true effect.

In column 2, we include a number of variables that we should correct for in estimating an independent effect for credit availability. We include in addition to the log number of banks and state fixed effects, the log of the average value of crops per acre in the county, which helps account for the current income the land produces; the share of

[5] All variables are winsorized (that is, the variables are set at the 1 percentile (99 percentile) level if they fall below (exceed) it).

value added in the county that comes from manufacturing (to account for land that is more urban); the log number of farms and the Gini coefficient of land holdings (to account for variety in farm sizes).[6]

Areas with higher average rainfall that is also less volatile might for example have more productive agriculture, leading to both higher prices and a greater demand for banking services in the cross section (Binswanger and Rosenzweig (1986)), so we include the average rainfall in the county and the standard deviation of rainfall in the county. Waterways were a major source of transportation and irrigation, and we also include geographic variables (the log area of the county, and the distance from major waterways), which, as Figure 1 suggests, could enhance the value of land. In addition, we also include a number of demographic variables (log total population, the log fraction of Black population, the log fraction of urban population, the log fraction of illiterate population, and the log fraction that is between 5-17 years old).

The explanatory variables are a veritable kitchen sink of variables that should help explain land prices. Some are truly exogenous (e.g., rainfall), others are likely to be pre-determined in the short run (e.g., the size of farms), yet others likely to be driven by credit availability (e.g., the value of crops may be enhanced by access to fertilizers, which may depend on credit availability). So this regression is primarily an attempt to check that our proxy for credit availability matters correcting for the usual suspects, and what its independent effect might be. The magnitudes are unlikely to represent the true, all-in effect of credit availability on prices, given the various channels through which credit availability could work, and we are probably overcorrecting.

The coefficient on the number of banks falls to about 40 percent of its value estimated in column 1 when we include these various explanatory variables, but the coefficient estimate remains significant at the one percent level (column 2). The other controls themselves also enter with intuitive signs. For example, a one standard deviation increase in agricultural income per acre is associated with a 0.76 standard deviation increase in land prices. Similarly, wetter, more fertile areas tend to support higher land prices; likewise, prices are higher in those areas with many people, but lower in counties

[6] See for example Galor et. al (2009), Rajan and Ramcharan (2011a), and the survey in Easterbrook et. al (2010).

with more land. We check systematically for outliers in this basic regression, and column 3 replicates the analysis excluding the outliers.[7] Most of the counties classified as outliers are dominated by manufacturing rather than agriculture. Among the 152 counties classified as outliers, the average share of value added derived from manufacturing is 54 percent. The average in the remaining sample is 38 percent. Omitting these outliers in column 3, we obtain an estimate for the number of banks coefficient that is slightly larger than in the full sample.[8]

Given that areas dominated by manufacturing may be different, in column 4 we retain only the observations for counties where the share of value added in manufacturing is at or below the 95th percentile of its share across counties. To further assess the potential impact of the purely urban counties, in column 5 we restrict the sample to counties where the manufacturing share is at or below the 50th percentile, thus focusing primarily on rural counties. While we lose an increasing number of observations, the magnitude of the coefficient estimate on the number of banks is stable across the subsamples and continues to be significant at the 1 percent level.

Rather than repeat all these variants in subsequent regressions, in what follows we will restrict regressions to counties with the share of value added in manufacturing at or below the 95th percentile for all counties. Given that the United States was predominantly rural at that time, this allows us to drop primarily urban counties from the analysis without losing too many observations. None of the results are qualitatively dependent on dropping these counties.

In column 6, we focus on the smaller data set we collected from the Department of Agriculture that includes actual annual transactions prices for land for about 10 percent of the counties. The coefficient estimate for log number of banks is again significantly positive at the 1 percent level, and comparable in magnitude to the estimates in columns 2-5.

In column 7 and 8, we substitute log number of banks with number of banks per area and number of banks per capita respectively. These proxies essentially normalize the

---

[7] We use the Cook's D method, dropping those observations with values greater than the conventional cutoff of 4/N (Hamilton (1991)).

[8] The conditional median estimate of the relationship between banks and land price, which is also robust to outliers, is similar, and available upon request.

number of banks by different measures of the potential demand for their services. The coefficient on the number of banks is positive, statistically significant, and similar in the magnitude of effect across both specifications. A one standard deviation increase in bank density, as defined in columns 7 and 8, is associated with a 0.16 and 0.19 standard deviation increase in the price per acre respectively.

3.2. Land Prices and Credit Availability: Robustness

The pairwise correlation of log state banks in the county in 1920 with the average interest rate charged on mortgage loans made on farm land in 1920 is significantly negative at the 1 percent level (p-value=0.00).[9] In Table 5 column 1, we replace the log of the number of banks in our baseline regression with the average interest rate charged in the county in 1920 on farm land mortgage loans. The coefficient estimate for the average interest rate charged is the expected sign and statistically significant: lower interest rates are associated with higher land prices. Of course, the interest rate charged is an endogenous function of bank market structure, so we will continue to focus on the number of banks as our fundamental measure of credit availability.[10]

An immediate question is whether the number of banks proxies for the quantity of available credit, for the proximity of banks, or for competition between banks, all of which should influence credit availability. While we do not have the aggregate lending by banks locally, we do have the total amount deposited in state banks in the county. This should be a good proxy for local liquidity and the lending capacity of local banks. When we introduce the log of the amount deposited as an explanatory variable in column 2, we find that the coefficient on the number of banks is somewhat larger (one would expect a smaller coefficient if the number of banks was primarily a proxy for the quantity of lending), and remains statistically significant at the one percent level. This suggests the number of banks proxies for something other than simply the quantity of available credit – for example, proximity or competition -- but clearly, we cannot say much more here.

[9] The pairwise correlations also suggest that counties with lower interest rates also had higher average loan to value ratios (p-value=0.00). The latter variable is however not significantly correlated with the banking variables.

[10] When we include both the interest rate and the log of banks per capita as explanatory variables, they both continue to be highly statistically significant, with smaller coefficients, as might be expected if they both proxy for credit availability.

Finally, we have argued that there was some ambiguity about whether nationally chartered banks could make mortgage loans. To check whether there is much difference between state banks and national banks, we include the number of state banks and national banks separately in the baseline regression in Table 5 (see columns 3-5 for each of the proxies for number of banks). The coefficient on the number of national banks is positive and statistically significant always. The coefficient estimate is smaller for number of national banks than for the number of state banks when the functional form (for number of banks) is log number of banks or number of banks per area, while it is larger when it is number of banks per capita. This suggests that national banks too were important participants in the market for farm land credit but their relative importance is ambiguous. In what follows, we will estimate separate coefficients for the number of national and state banks only when there might be reasons to expect important differences in behavior.

3.3. Land Prices in 1920 : Credit vs Fundamentals

What we have shown thus far is that proxies for the availability of credit are positively correlated with higher farm land prices. We have not, however, examined the precise relationship between changes in fundamentals, credit, and asset prices. Some theories would suggest no interaction between fundamentals and credit in influencing asset prices, while others would suggest some interaction effects. We now try and shed more light on this.

Our dependent variable continues to be the log level of land prices in 1920. We use the county-specific increase in its acreage-weighted agricultural commodity prices over the period 1917-1920 (henceforth termed the commodity price index shock) as a measure of the shock to fundamentals in the county.[11] We include in Table 6 columns 1-3, the number of banks (respectively log, per area, or per capita), the county-specific change in the commodity price index, the interaction between the number of banks and the change in the index, as well as the interaction between the square of the number of banks and the change in the index. This last interaction is to capture possible non-linear

[11] It does not make any qualitative difference to the results if we use a longer period to compute the change, such as 1914-1920 or 1910-1920.

effects. We include the other explanatory variables that were included in our earlier baseline specification for land prices (Table 4 column 2), except for the log of the value of crops per acre, which we exclude because the change in the commodity index should capture the effect of the enhanced expectation of a "dividend" from the land.

The coefficient estimates for the log number of banks as well as the change in the index are both significantly positive in Table 6 column 1. So too is the interaction term. But the interaction between the square of the log number of banks and the change in the index is significantly negative. This pattern is similar when the number of banks is measured differently (Table 6, columns 2 and 3). Credit availability and anticipated changes in fundamentals are therefore important separate correlates with the growth in land prices. Moreover, as some theories suggest, the influence of anticipated fundamentals on land prices grows with credit availability at low levels of credit availability. However the negative coefficient on the interaction between the square of the log number of banks and the change in the index suggests that at higher levels of credit availability the link between anticipated fundamentals and land prices starts becoming more attenuated.

Specifically, the estimates in column 1 suggest that the peak impact of changes in the commodity index occur in areas with the log number of banks around the 93rd percentile. In areas with the number of banks beyond that threshold, the role of the index in shaping land price growth becomes increasingly less important.

The specifications thus far attempt to examine the determinants of the level of land prices per acre in 1920. We could also include the level of land prices per acre in 1910 as an explanatory variable (or replace the level of land prices in 1920 with the growth in land prices between 1910 and 1920). Estimates are available from the authors and the qualitative findings are similar.

One way to visualize the relationship between credit availability and the index shock is to tabulate the mean land price residual, after partialling out all other variables other than the log number of banks, the commodity index shock, and their interactions.[12] We report the mean land price residual for different quartiles of the log number of banks

[12] The reported residuals are for a specification which also includes the level of land prices in 1910 as an explanatory variable, though the qualitative picture is similar when we leave it out.

and the commodity shock in Table 7. Clearly, land prices increase with the positive commodity price shock – the average land price residual for counties experiencing shocks in the first quartile is -0.006 and it goes up to 0.035 for counties experiencing shocks in the fourth quartile. Similarly, land prices increase with the number of banks, with the average residual going up from -0.026 in the first quartile to 0.008 in the fourth quartile. Interestingly, the change in residual from first to fourth quartile is approximately the same for both explanatory variables.

What is particularly interesting is the interaction. For counties that are in the lowest quartile of number of banks, increases in the (positive) commodity price shock are associated, if anything, with *declines* in the land price residual; when the commodity shock is in the lowest quartile, the land price residual averages -0.007, while if the commodity shock is in the highest quartile, the land price residual averages -0.022. Thus the "spread" -- the difference in land price residual between counties with the highest commodity shock and counties with the lowest shock -- is -0.015 for counties with few banks. Prices do not align well with anticipated fundamentals in areas with limited credit.

The spread turns mildly positive (0.006) for counties that are in the second quartile of the number of banks, and increases substantially to 0.11 for counties that are in the third quartile of number of banks. So land prices are now very strongly related to the fundamental shock, with the land price residual being a negative -0.035 in counties with the lowest quartile shock and land prices being a positive 0.078 for counties with the highest quartile shock. Interestingly, land prices are lower when the fundamental shock is low (than in counties hit by a comparable shock but with few banks) and higher when the fundamental shock is higher. Therefore, more banks do not mean uniformly higher prices, but more sensitivity of prices to fundamentals.

Finally, as we go to counties in the fourth quartile of number of banks, the spread is still strongly positive at 0.043 but lower than for counties with the number of banks in the third quartile. This then accounts for the negative quadratic interaction term in the regression estimates. In sum then, the sensitivity of land prices to fundamentals increases with the availability of bank credit at low levels of availability, but becomes more attenuated at high levels of availability.

A final point to note in the table is that amongst counties in the lowest quartile of the number of banks, a disproportionate number experience a commodity shock that falls in the lowest quartile, while for counties in the highest quartile of number of banks, a disproportionate number experience a commodity shock in the highest quartile. In other words, the number of banks is higher in counties that get a substantial positive commodity shock; there are two possible explanations. First, more banks entered counties that received a positive commodity shock. Second, the shock was more positive in counties that already had more banks.

Clearly the first conjecture is plausible – the number of U.S. banks expanded substantially in the years prior to 1920 – from 22030 in 1914 to 28885 in 1920, and many of the new entrants must have entered areas that were booming.[13] Unfortunately, we do not know the number of banks in each county prior to 1920, so we cannot tell how many banks entered in each county. The second conjecture is also not implausible. Rajan and Ramcharan (2011a) argue that areas in the United States where agricultural land was more evenly distributed tended to have more banks. These were also areas that produced the kinds of crops, such as wheat, that were grown in Europe. So these were likely areas that would experience a more positive commodity shock because of disruptions in Europe. Indeed proxies for the availability of credit in 1910, such as the ratio of farms with mortgages to farms owned free of debt, which ought to reflect the number of banks in 1910, are strongly positively correlated with the size of the commodity price shock hitting the county in 1917-1920.

Neither explanation immediately implies our use of number of banks as a proxy for the availability of credit is incorrect. If more banks flock to areas or are in areas that receive a stronger fundamental shock, the availability of credit will be higher there – our arguments do not depend on why credit is more available. However, either conjecture could suggest an alternative explanation for the correlation between the number of banks and the price of land that is unrelated to the availability of credit – the number of banks proxies for components of the positive commodity price shock that are not captured by the change in the commodity index. While we will address this concern carefully, the

[13] The first number is from White (1986) and the second number comes from Alston, Grove, and Wheelock (1994).

estimates in Table 6 and the residual tabulations in Table 7 suggest a more nuanced view than simply that more banks means a more positive commodity shock and hence a higher land price; The number of banks seems to modulate the effect of the commodity shock rather than enhance it across the board. When banks are few in number, the size of the commodity price shock matters little for land prices. When banks are many in number, it is not that land prices are lifted uniformly. Prices in counties experiencing weak shocks are actually lower than for comparable counties with few banks, while prices for counties experiencing strong positive shocks are higher. Instead of being proxies for unmeasured fundamentals, banks may actually modulate their effects through credit. But let us first establish that the credit channel is actually operative.

IV. Land Prices and Credit Availability: Causality

The correlations we have documented, of course, need not imply causality. The number of banks in a county may reflect aspects of fundamentals that are not captured by the value of the crops per acre, the size of the commodity price shock, or the other observables included in the various specifications.

One way to address the issue of causality is to use proxies for credit availability from the 1890 census as instruments for credit availability in 1920. Unfortunately, data on the number of banks in each county before 1920 are unavailable, but there is information on the average interest rate charged for mortgage loans for about two thousand counties in 1890. This information predates the commodity shock by decades, and is statistically uncorrelated with the change in the commodity index over the 1910s.[14] Yet despite the significant economic changes that occurred between 1890 and 1920, column 1 of Table 8 suggests substantial persistence in the spatial variation in the average cost of credit: areas that had higher interest rates in 1890 also tended to have higher interest rates in 1920. When we use the interest rate in 1890 as an instrument for the interest rate in 1920, the coefficient estimate in column 2 of Table 8 is almost identical to the OLS estimate in column 1 of Table 5 -- reproduced here in column 3 of Table 8 to facilitate comparisons in this smaller sample. This similarity between the estimates in

[14] After controlling for state fixed effects, the conditional correlation between county level variation in the 1890 interest rate and the change in the commodity index of 1910-1920 is -0.48 (p-value=0.77).

columns 2 and 3 might imply that the large number of control variables help attenuate the biases in the OLS estimates that can arise from latent fundamentals.

However, one could still argue that some persistent fundamental, such as the fertility of the terrain, might drive both credit availability in 1890 as well as the size of the fundamental shock that hits the county later in the 1910s (fertile counties would have higher yields, and thus produce more of all crops, including crops that are hit by the commodity price shock). Although the 1890 variable may be predetermined, this possibility of latent fundamentals could still render the IV estimates biased.

4.1. Distance and Borders

However, an interesting feature of credit markets in the 1920s allows us to offer more convincing evidence that the availability of credit has an independent effect on land prices. Inter-state bank lending was prohibited in the United States in the early 1920s. If the number of banks primarily reflects fundamentals associated with land, then the number of banks in neighboring counties should affect land prices in a county the same way, regardless of whether the neighboring counties are within the state or out of state.[15] If, however, the number of banks reflects the availability of credit, then banks in neighboring counties within-state should affect land prices much more (because they can lend across the county border) than banks in equally close neighboring counties that are outside the state (because they cannot lend across the county border).

To implement this test, we calculate the number of banks that lie in neighboring in-state counties and the number of banks that lie in neighboring out-of-state counties. Clearly, the ability of a bank to lend to a farmer will fall off with distance. While we do not know where a bank is located, we do know the distance of the centroid of the county it is located in from the centroid of the county of interest. Assuming that all banks in a neighboring county are located at that county's centroid, we can ask if they have an effect on land prices in the county of interest. If the number of banks is a proxy for credit availability, the coefficient on the number of banks in nearby *in-state* counties should be

[15] Counties on either side of a state border tend to have similar geographic fundamentals. For counties along a state border, the correlation coefficient between rainfall in border counties and counties located in the same state up to 100 miles away is 0.94. The correlation coefficient between rainfall in border counties and rainfall in counties 100 miles away across state lines is 0.92.

positive and greater than the coefficient on the number of banks in nearby *out-of-state* counties. Moreover, the coefficients should become smaller for distant in-state counties, because the scope for lending from banks in those distant counties becomes small.

At first pass, we consider "nearby" counties to be counties with a centroid less than 50 miles away from the centroid of the county of interest (this number is probably the outer limit of what could be termed "near" and we will try shorter distances for robustness). We start with the basic regression from Table 6, column 1 and include in addition, the log number of banks for within state counties that are less than 50 miles away, for within state counties that are greater than 50 miles but less than 100 miles, and for out-of-state counties at similar distances. The sample consists of those counties whose nearest neighbor across state lines is no further than 100 miles, centroid to centroid. We report coefficient estimates for only the variables of interest in column 1 of Table 9. Consistent with the idea that the number of banks proxy for credit availability, the coefficient estimate on the log number of banks within 50 miles of the county and in the same state is positive, statistically significant, and about ten times greater than the coefficient estimate for log number of banks in counties at the same distance but across state lines.

To ensure that the results are not an artifact of the bin size we picked, we repeat the exercise for a couple of other bin sizes. Whether the bin sizes are {0-40, 40-80} in column 2, or {0-30, 30-60, 60-90} in column 3, the coefficient estimate for the nearest within-state counties is positive and significant, and substantially larger in magnitude than the coefficient for nearby out-of-state counties. The test at the bottom of the table examines whether the coefficients of the nearest within-state and out-of-state counties are statistically different at conventional levels. They are, for all three columns. In sum, it does appear that lending, and not just some unobserved fundamental correlated with the presence of many banks, does affect asset prices.[16]

[16] The other functional forms for the number of banks – banks per area and per capita – are less suited for this test. More banks per area in a neighboring county may not necessarily help farmers in this county as much. Put differently, it is not clear that the normalization is an appropriate measure of credit availability in this county. Nevertheless, the qualitative results are broadly similar with the other functional forms.

4.2. Border discontinuities in prices

An analogous intuition provides another test to help distinguish between the role of local bank market structure in shaping land prices from the latent fundamentals that might determine both land prices and market structure. To the extent that the number of banks proxy for credit availability, counties with more banks would be expected to have higher prices. This difference should be reflected across the borders of adjacent counties. But since credit can flow across in-state county borders to equalize prices, but not across county borders which also form state borders, the size of the positive correlation between land prices and bank differences should be much larger when computed across state lines. Also, for neighbors that are sufficiently close, geographic fundamentals like soil fertility and the types of crops grown are likely to be similar, and unobserved fundamentals are thus unlikely to bias the correlation between land prices and bank density differences.[17]

Specifically, the estimating equation can be obtained by expressing the log price level in county i, y_i, as a linear function of the log number of banks in county i, b_i; the number of banks in the nearby county j, b_j; latent geographic fundamentals, g_i; as well as observable characteristics, X_i, and an error term e_i:

$$(1) \qquad y_i = \beta_1 b_i + S_j \beta_2 b_j + X_i \alpha + e_i + g_i$$

To model the fact that credit could not easily flow across state lines during this period, we use an indicator variable, S_j, that equals 1 if county j is in the same state as county i, and 0 if the two neighbors are separated by a state border. From equation (1), the price difference between counties i and j is:

$$(2) \qquad y_i - y_j = \left(\beta_1 - S_j * \beta_2\right)\left(b_i - b_j\right) + \left(X_i - X_j\right)\alpha + g_i - g_j + e_i - e_j$$

[17] In the Appendix we show that for counties less than 30 miles away, state borders are not associated with signifcant differences in rainfall, or the acreage devoted to a number of different crops. However, as distance grows, differences tend to emerge across state lines for some crops.

where the impact of bank differences on price differences is expected to be larger for out-of-state relative to in-state comparisons: $\beta_1 > \beta_1 - \beta_2$. Moreover, since geographic factors are similar for nearby counties, $g_i - g_j \approx 0$, estimates of $\beta_1 - \beta_2$ are unlikely to be biased by these latent fundamentals.

To estimate equation (2), county i is defined as a reference county and included in the sample if its nearest out of state neighbor is no more than a given number of miles away—centroid to centroid. For each reference county i, we then identify all of its neighbors—centroid distances within the given radius—and compute the difference amongst these pairs as in equation (2). Clearly, since counties i and j can appear in multiple pairs, we use two dimensional clustering to adjust the standard errors (Cameron, Gelbach and Miller (2011).

The results from estimating equation (2) are in Table 10. In column 1, we focus on the sample of counties whose nearest out of state neighbor is no more than 25 miles away; column 2 consists of only those counties whose nearest out of state neighbor is less than 30 miles; the remaining columns expand the sample in 10 mile increments up to 100 miles. In the upper panel of Table 10, banks are scaled by population, and the bottom panel scales banks by county area.

The upper panel of Table 10 suggests that differences in the number of banks are significantly associated with price differences, and this relationship appears significantly larger when computed across state border. From column 2—the 30 mile window—a one standard deviation increase in the difference in the number of banks is associated with a 0.15 standard deviation increase in the land price difference between the two counties. However, a similar increase in bank differences computed across state lines suggests a 0.22 standard deviation increase in the price difference. The magnitude of the relationship between bank differences and price differences, when the former is scaled by area—the bottom of panel of Table 10 is almost identical.[18] For counties within the same state, a one standard deviation increase in bank differences is associated with a 0.15 standard

[18] This is one regression where differences in normalized amounts (banks per capita, banks per area) may be a better indicator of differences in access between counties than the difference in log banks. Nevertheless, the incremental out-of-state coefficient for the difference in log banks is positive but not statistically significant.

deviation increase in the price difference between the two counties, but a 0.24 standard deviation increase in the price difference when the comparison is made across state lines.

As the border window expands, the coefficient on bank differences increases, but despite the greater variability in price differences as the sample expands, the estimated impact of bank differences on price differences remains relatively stable, especially in the case of banks per capita. For example, at the 60 mile window (column 5), a one standard deviation increase in banks per capita differences is associated with a 0.15 standard deviation increase in the price difference, while at the 90 mile window, the impact is around 0.13 standard deviations (column 8). However, the relative magnitude of the state border effect declines as the border window expands. While the additional impact of bank differences on price differentials between counties when the counties lie across state borders is around 57 percent in the sample of counties with out of state neighbors less than 25 miles away (column 1), this effect drops to 48, 40, 38, 30, 27,percent at the 30, 40, 50, 60 and 70 mile windows respectively. Beyond the 70 mile window, the border effect remains constant at around 26 percent.

Similarly, from the top panel of Table 10, there is evidence that the direct conditional impact of state borders on land price differences between counties is insignificant below the 50 mile radius (column 4), as those counties are likely to be geographically and otherwise fairly similar. But this “out of state” indicator variable becomes significant as the border window expands, suggesting that at greater distances, there is more heterogeneity across, than within, state lines.

Likewise, when we go to banks per area, in the bottom panel of Table 10, there is again evidence both that the relationship between price differences and bank differences is significantly larger when computed across state borders , and that the direct impact of state borders is insignificant at close distances—generally under 40 miles. However, there is considerable regional variation in county areas, as Western counties are much larger than counties in other regions, and the results when scaling by area tend to be less uniform as the border windows expands to include county pairings that contain some of this regional heterogeneity.

4.3. Deposit Insurance

The cross state variation in deposit insurance regulations can help in further understanding the relationship between local bank market structure and land prices. Well known arguments suggest that poorly designed deposit insurance schemes can induce moral hazard, prompting banks to finance riskier investments and extend credit more widely, especially in those areas where banks both operate under deposit insurance, and face plentiful local competition (see, for example, Benston, Eisenbeis, Horvitz, Kane, and Kaufman (1986)). There is evidence that deposit insurance may have played a significant role in bank failures during the 1920s (Calomiris (1990), Alston et. al (1994), Wheelock and Wilson (1996)). And we might expect then that if the correlations between banks and prices reflect credit availability and the effects of competition amongst banks, then the relationship between banks and land price should be significantly larger when banks operate under deposit insurance.

In 1920, eight states had in place some kind of deposit insurance scheme. [19] These states had more banks on average, as these schemes generally encouraged the entry of smaller banks.[20] But as Table 11 indicates, holding constant the number of banks, the relationship between banks and land price was significantly larger in those counties located in deposit insurance states. Column 1 includes the number of state banks (which benefited directly from insurance) and the number of state banks interacted with an indicator if the state had deposit insurance. The estimated coefficient on state banks is about 50 percent larger for counties in states covered by deposit insurance than otherwise.

Although national banks operated outside the remit of state deposit insurance schemes, they competed directly with state banks for business, and the presence of these regulations may have also affected the lending behavior of national banks. In column 2 of Table 11, the estimated relationship between national banks and prices is almost twice as large in deposit insurance counties, but remains less than state banks. Deposit insurance, through competition, must have affected the incentives of both types of banks, and

[19] The eight states are: Oklahoma (1907-23), Texas (1909-25), Kansas (1909-29), Nebraska (1909-30), South Dakota (1909-31), North Dakota (1917-29), Washington (1917-29), and Mississippi (1914-30) (Wheelock and Wilson (1996)).

[20] See White (1981). The mean log number of banks in deposit insurance counties is about 20 percent higher than in counties without deposit insurance (p-value=0.00).

column 3 includes both types of banks. This evidence suggests deposit insurance regulations amplified the relationship between banks and prices.

Of the eight states with deposit insurance, three adopted these regulations during the boom. This timing raises the possibility that, at least among these late adopters, the passage of deposit insurance regulations may have been in response to the effects of the agricultural boom on the banking system. Of course, relative to the other states which had deposit insurance schemes in place for over a decade before 1920, a sample that includes these late adopters may understate the impact of deposit insurance in amplifying the relationship between banks and land prices.

Column 4 of Table 11 addresses these concerns by classifying as deposit insurance states only those five states that had introduced insurance before 1910. In column 4, the deposit insurance interaction term is now significant at the 1 percent level. It is also 56 percent larger than the previous estimates in column 3, suggesting that the impact of deposit insurance on credit availability, and thence on land prices, may have been more pronounced the longer the insurance was in place.

Of course, even if pre-determined, deposit insurance may have been implemented in states with particular characteristics that could independently affect the relationship between banks and prices. States with many small rural banks and small farmers—key supporters of deposit insurance—may have both been more likely to pass deposit insurance, and specialize in particular types of agriculture that benefited from bank credit.

To narrow differences in the underlying characteristics between counties, we rerun the regression in column 4, but limit the sample to counties located on the border between states with deposit insurance and those states without these schemes. Geography, the incidence of small scale farming, and the types of crops grown are likely to be similar in counties on either side of the border. In column 5 of Table 11, we use a window of 30 miles, including only those counties that are no more than 30 miles on either side border for each of the five states that had deposit insurance before the boom. In addition, we also include both border and state fixed effects, and report standard errors clustered along these two dimensions, as some counties can appear on multiple borders. The evidence continues to suggest that crossing the border into a deposit insurance state significantly amplifies the relationship between banks and prices.

4.4. Summary

In general, credit will flow when perceptions of fundamentals improve. As a result, it is extremely hard to offer convincing evidence that the supply of credit has an independent effect on asset prices. However, two pieces of regulation have allowed us to identify a supply side effect. First, banks could not lend across state borders. Second, deposit insurance regulations differed across states.

What is less easy is to estimate the magnitude of the supply side effects. We can, however, surmise they might have been large. For instance, the estimates in column 5 of Table 11 suggest that for two otherwise similar counties having the mean number of banks in the sample, land prices would have been about one and half times higher in the county located in a deposit insurance state than in the county across the border in a non deposit insurance state.

V. The Collapse and the Consequences of Initial Credit Availability

As described earlier, commodities prices collapsed starting in 1920, as European production revived. The correlation between the commodity price index rise for a county between 1917-1920 and the subsequent fall in the commodity price index for that county between 1920 and 1929 is -0.96. So counties that experienced a greater run up also experienced a greater fall.

What is of interest to us, however, is the correlation of the number of banks in 1920 with subsequent land price declines. If the number of banks proxies largely for some fundamental aspect of the county, unrelated to the commodity price boom and subsequent bust, then counties with more initial banks should suffer a lower land price decline in the bust years. If the number of banks represents easy credit availability that influenced land prices in the boom (because credit availability allowed the perceived positive shock to agricultural commodities to filter more easily to land prices), then counties with more banks in 1920 could suffer a greater land price decline in the bust years. In estimates that are available from us, this is precisely what we find.

However, what we are interested in is whether banks stretched themselves in the boom years by lending too much. Correcting for state fixed effects, regression estimates suggest counties that experienced a higher commodity price shock tended to have higher debt to value ratios in 1920. Coupled with the fact that land prices were higher in these counties, the extent of farm leverage in these counties was significant when commodity prices collapsed. We now examine whether greater credit availability led to subsequent bank failures.

5.1. Commodity Prices, Initial Credit Availability, and Bank Failures

The collapse in commodity prices would have made it hard for farmers to service their debt, especially in counties where land prices rose more, and debt increased, leading to greater debt-service burdens, defaults, and fire sales. This should have led to bank failures. So we now turn to examining bank failures as evidence that excessive credit (at least with the benefit of hindsight) accompanied the rise in land prices.

We can compute the average annual bank failure rate (number of bank failures in the county during the year divided by number of banks in the county at the beginning of the year) in the county between 1920 and 1929, as well as the average annual share of deposits of failed banks (which effectively weights failures by the share of their deposits). In Table 12, we examine the effect that credit availability and the positive shock to fundamentals in the period 1917-1920 had on the subsequent bank failure rate.

In columns 1, 3, and 5, the dependent variable is the average annual bank failure rate while in columns 2, 4, and 6, the dependent variable is the average annual share of deposits of failed banks. The explanatory variables are as in Table 4 column 2, with the proxy for number of banks being log banks in columns 1 and 2, banks per area in columns 3 and 4, and banks per capita in columns 5 and 6.[21] We find that across all specifications, the coefficient estimate for the number of banks in 1920 is positive and statistically significant. And the estimated interaction effects between the commodity shock and the number of banks on bank failures have the same quadratic shape as they had in with land prices (except for banks per capita where the interaction effects are statistically insignificant).

The estimates in column 1 suggest that, evaluated at the mean of the index, moving from the 25^{th} to 75^{th} percentile in the log number of banks in 1920 implies a 0.01 percentage point or a one third standard deviation increase in the failure rate over the

[21] As with the specifications in Table 6, we also included the land price in 1910. This made little difference to the estimates, and we do not report the estimates.

subsequent decade. All this suggests that the same factors proxied for by the number of banks and the commodity shock that were associated with higher land prices were also associated with subsequent bank failures.

Smaller banks may have been more prone to failure, and may have also been more common in counties with many banks. In results available upon we request, we control for the average bank size in a county—the total deposits in the county divided by the number of banks in the county; our results are little changed.

Given that whatever the number of banks proxies for is associated with higher subsequent failure rates, it suggests that the number of banks does not proxy for some deep unchanging positive fundamental (such as fertile land or a prosperous local population) that might have led to lower failures. It may be that the commodity shock was more pronounced in counties that had, or attracted, more banks. However, unless that was accompanied by more credit to buy higher priced land, it is hard to explain higher subsequent failures – especially given the earlier observation that farm incomes recovered to their 1916 level by 1922 and rose subsequently throughout the 1920s. More plausibly, though, the number of banks proxies for credit availability, which both helped push up land prices and debt funded purchases when there was a mistaken belief that the European disruptions would be more long lasting, and led to subsequent farm loan defaults and bank failures when they proved to be short lived.

If indeed the number of banks proxies for credit availability, then given the evidence in Table 9 that banks in nearby in-state counties may have been a source of credit that helped inflate local prices, we would expect that the presence of these nearby in-state banks would also explain higher failure rates in 1920s. We would also expect from Table 9 that the magnitude of this correlation between the failure rate within a county and the number of banks outside a county to decline with the distance of these banks and vanish when they are located across state borders.

In columns 1 and 2 of Table 13 we include the log number of banks up to 50 miles away, and 50-100 miles away, separately for in state and out of state neighbors to the specifications in Table 12. The estimates are generally imprecise. But the estimated impact of the log number of banks at the 0-50 window among in state neighbors on the failure rate is second only the number of banks within the county itself. And this coefficient is significant at the 20 and 10 percent level respectively in columns 1 and 2. A similar pattern emerges for bin sizes at the {0-40, 40-80} mile range: the impact of the nearest in state neighbors is second only to banks within the county, and in this case the coefficient estimate for the nearest in state neighbors is significant at the one percent level. At the finer interval however, {0-30, 30-60, 60-90}, outliers from lumpy failure outcomes implies that none of the coefficients are precisely estimated. Nevertheless, a reasonable summary would be that there is moderate evidence that the presence of banks in neighboring in-state counties precipitated more failures in the county of interest than the presence of banks in equally near out-of-state counties. Since the primary difference between the two is their ability to lend to the county of interest, this evidence is also suggestive that greater credit availability during the boom precipitated more subsequent failures

VI. Conclusion

How important is the role of credit availability in inflating asset prices? And does credit availability render the financial system sensitive to changes in sentiment or fundamentals? In this paper we broach answers to these questions by examining the rise (and fall) of farm land prices in the United States in the early twentieth century, attempting to identify the separate effects of changes in fundamentals and changes in the availability of credit on land prices. This period allows us to use the boom and bust in world commodity prices, inflated by World War I and the Russian Revolution and then unexpectedly deflated by the rapid recovery of European agricultural production, to identify an exogenous shock to local agricultural fundamentals. The ban on interstate banking and the cross-state variation in deposit insurance are also important regulatory features of the time that we incorporate in the empirical strategy.

Of course, the influence of credit availability on the asset price boom need not have implied it would exacerbate the bust. Continued easy availability of credit in an area could in fact have cushioned the bust. However, our evidence suggests that the rise in asset prices and the build-up in associated leverage was so high that bank failures (resulting from farm loan losses) were significantly more in areas with greater ex ante credit availability.

Given that we do not know whether expectations of price increases were appropriate ex ante or overly optimistic, and whether credit availability influenced those expectations, it is hard to conclude on the basis of the evidence we have that credit availability should be restricted. With the benefit of hindsight, it should have, but hindsight is not a luxury that regulators have. We do seem to find that greater credit availability increases the relationship between the perceived change in fundamentals and asset prices, both on the positive and negative side. This suggests credit availability might have improved allocations if indeed the shock to fundamentals turned out to be permanent. Our focus on a shock that was not permanent biases our findings against a positive role for credit availability.

A more reasonable interpretation then is that greater credit availability tends to make the system more sensitive to all fundamental shocks, whether temporary or permanent. Prudent risk management might then suggest regulators could "lean against the wind" in areas where the perceived shocks to fundamentals are seen to be extreme, so as to dampen the fallout if the shock happen to be temporary.

Tables and Figures

Table 1. Land Price Per Acre, 1910-1930, Summary Statistics.

	Observations	Mean	Standard Deviation	Correlation
	1910			
Department of Agriculture Data	132	42.41	34.13	0.97
US Census Data	3009	41.80	146.55	
	1920			
Department of Agriculture Data	3117	66.59	136.62	0.96
US Census Data	329	75.82	67.43	
	1930			
Department of Agriculture Data	3149	51.03	149.68	0.83
US Census Data	436	42.72	37.52	

This table presents summary statistics for the two sources of land price data from 1910-1930. The column entitled "Correlation" reports the correlation coefficient for land prices between the Census and Department of Agriculture in the 1910, 1920 and 1930 crossection.

Figure 1. Land Price Per Acre Across US Counties, 1920 US Census.

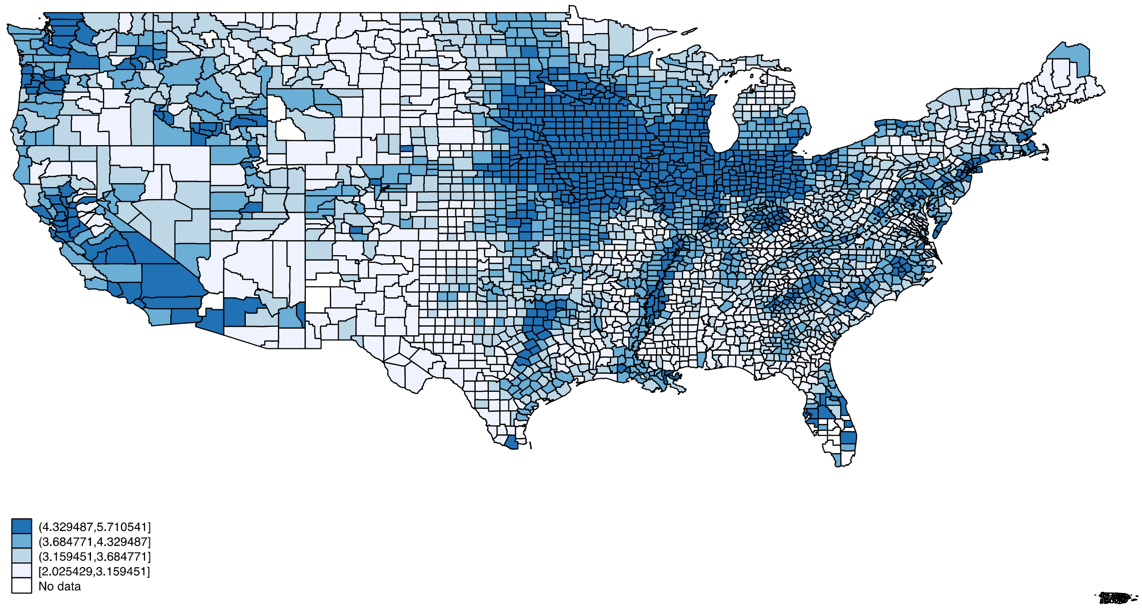

Figure 2. Changes in the Commodity Price Index and in the Price of Land Per Acre, 1910-1930.

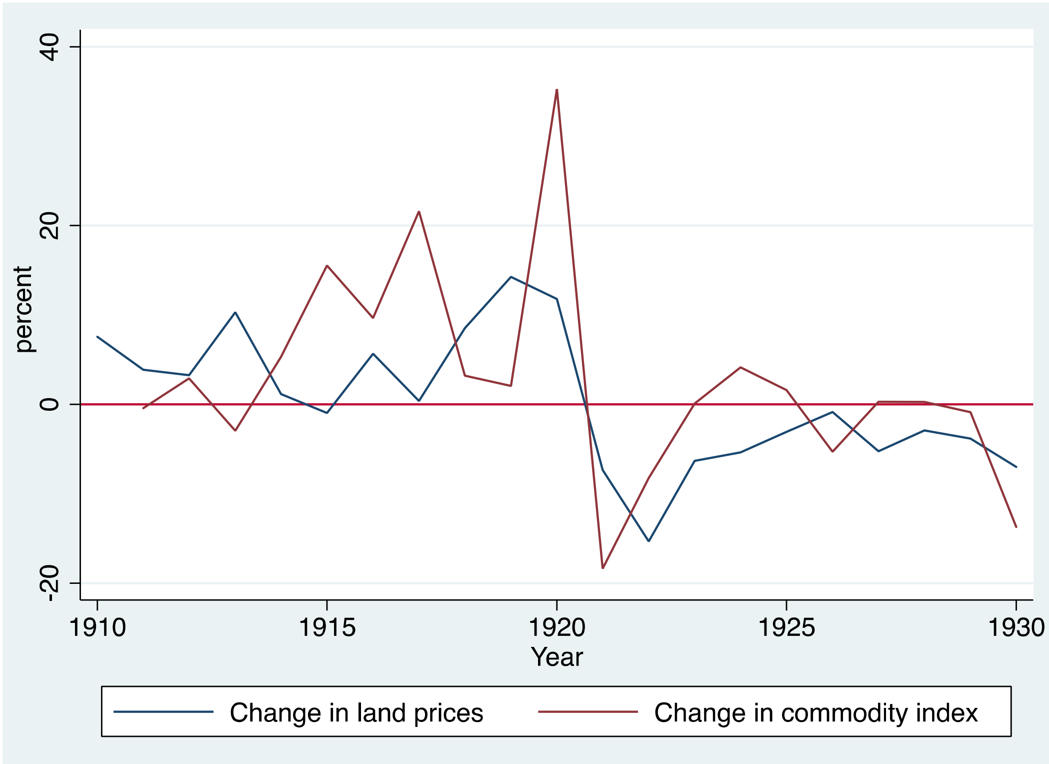

Figure 3. Land Price in 1920 vs Change in Commodity Index, 1910-1920.

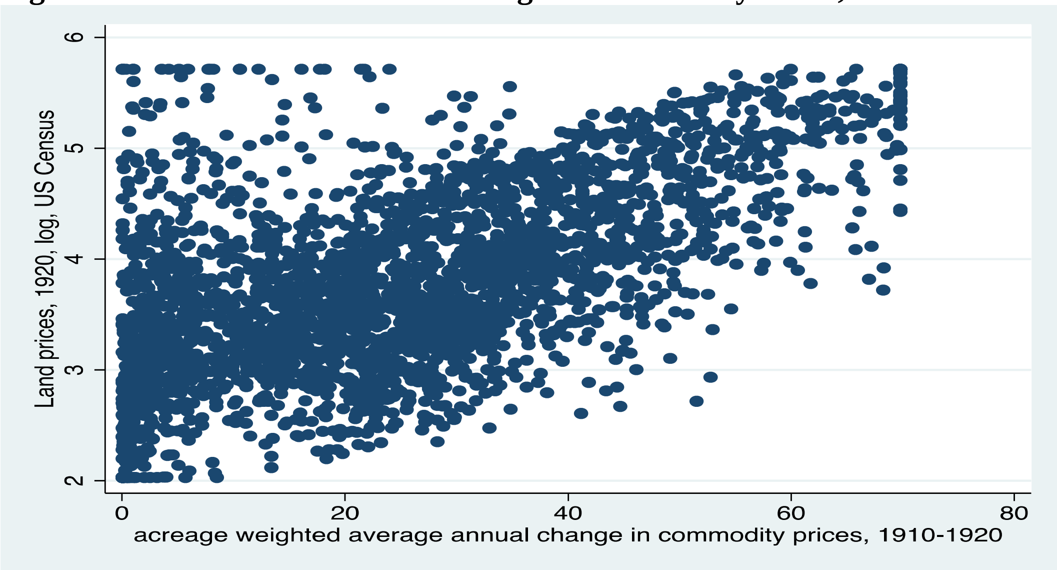

Table 2A. Banking Variables, 1920, Summary Statistics.

	Obs	Mean	Standard Deviation
Number of banks per area	3001	0.007	0.007
Number of banks per capita	3006	0.001	0.0001
Log number of banks	3046	2.098	0.764
Interest rate	2856	6.405	0.872

Table 2B. Banking Variables, 1920, Correlations.

	Banks per area	Banks per capita	Log banks	Interest rate
Number of banks per area	1.00	0.02	0.67	-0.39
Number of banks per capita	0.02	1.00	0.29	-0.08
Log number of banks	0.67	0.29	1.00	-0.32
Interest rate	-0.39	-0.08	-0.32	1.00

All correlations are significant at the 10 percent level or higher. The data in these tables are from the FDIC.

Figure 4. Average Interest Rate on Farm Loans, 1920 US Census.

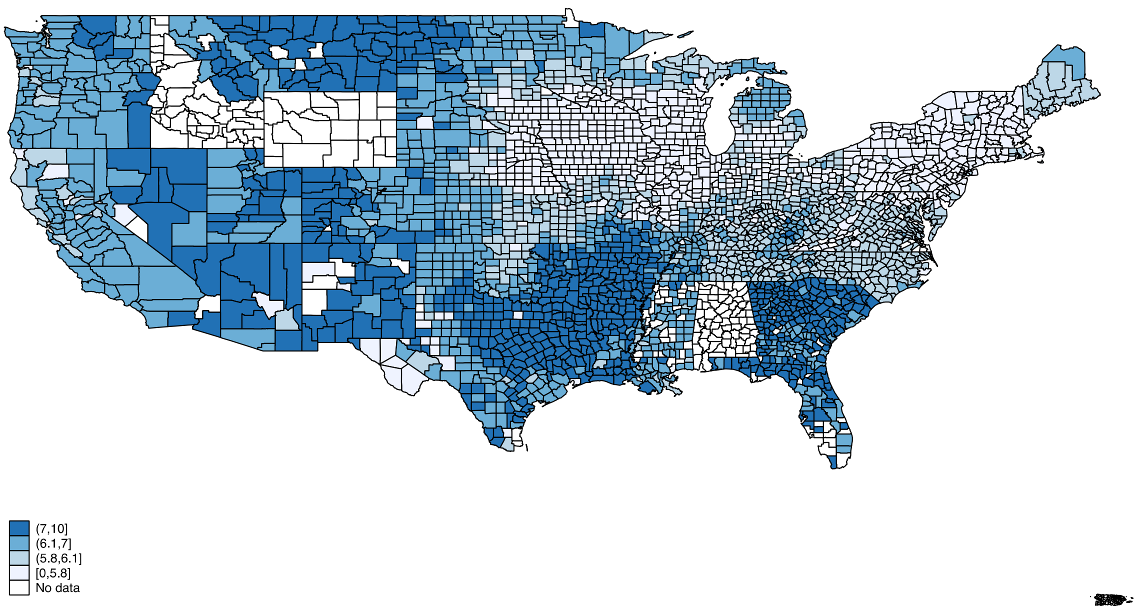

Table 3. Covariates, Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Average rainfall	2744	36.91	13.09	8.60	63.50
Standard deviation, rainfall	2744	7.50	2.72	2.38	17.42
Area, log	2744	7.33	0.72	4.96	9.64
Mississippi distance, log	2744	13.39	1.11	9.68	15.10
Atlantic distance, log	2744	13.98	1.15	9.69	15.57
Great Lakes distance, log	2744	13.71	1.02	10.06	15.18
Pacific distance, log	2744	14.98	0.77	10.95	15.61
Black population, log	2744	5.48	2.95	0.00	10.47
Urban population, log	2744	7.22	6.93	0.00	17.26
Illiterate population, log	2744	6.61	1.51	2.16	9.86
Population 5-17 years, log	2744	8.63	0.85	5.69	11.34
Total population, log	2744	9.86	0.87	6.96	12.77
Manufacturing share	2744	0.39	0.30	0.01	0.99
land concentration	2744	0.43	0.09	0.20	0.69
Value of crops per acre	2744	18.08	11.66	0.28	67.67
log number of farms	2744	7.48	0.76	3.22	8.75
Average annual change in commodity index, 1917-1920	2656	4.31	3.05	0.01	12.36

Distance is in kilometers, area is in square miles, and value is in dollars. All variables are calculated by county.

Table 4. Land Price Per Acre and Banks—Baseline.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Data from Census					Data from Dept of Agriculture	Data from Census	
	Dependent variable: Log Land Price per Acre in 1920							
Bank variable	Log Number of Banks						Banks per area	Banks per capita
EXPLANATORY VARIABLES								
Banks	0.603***	0.253***	0.271***	0.229***	0.229***	0.392***	18.72***	411.8***
	(0.0351)	(0.0395)	(0.0347)	(0.0394)	(0.0561)	(0.0889)	(3.429)	(64.43)
Average rainfall		0.000368	-0.00141	-0.000515	-0.00378	-0.00154	0.000435	0.00139
		(0.00198)	(0.00154)	(0.00209)	(0.00254)	(0.00541)	(0.00192)	(0.00197)
Standard deviation, rainfall		0.0118**	0.0132***	0.0118**	-0.00626	0.00627	0.0107*	0.0114**
		(0.00567)	(0.00455)	(0.00574)	(0.00963)	(0.0209)	(0.00583)	(0.00563)
County Area, log		-0.272***	-0.266***	-0.267***	-0.390***	-0.495***	-0.172***	-0.263***
		(0.0439)	(0.0366)	(0.0505)	(0.0736)	(0.101)	(0.0436)	(0.0430)
Mississippi distance, log		0.0408	0.0554*	0.0411	0.0432	-0.00604	0.0357	0.0387
		(0.0330)	(0.0308)	(0.0326)	(0.0399)	(0.0445)	(0.0352)	(0.0307)
Atlantic distance, log		0.0888***	0.104***	0.0971***	0.0860*	0.148**	0.0881**	0.0871**
		(0.0323)	(0.0311)	(0.0361)	(0.0448)	(0.0610)	(0.0360)	(0.0329)
Great Lakes distance, log		-0.0878*	-0.0937***	-0.101*	-0.202*	-0.119	-0.0783*	-0.0883*
		(0.0448)	(0.0340)	(0.0520)	(0.102)	(0.0879)	(0.0464)	(0.0447)
Pacific distance, log		0.0340	0.0232	0.0350	0.366**	-0.182	0.0114	0.0458
		(0.0723)	(0.0564)	(0.0740)	(0.144)	(0.158)	(0.0674)	(0.0737)
Black population, log		-0.00539	-0.00128	-0.00464	0.00218	-0.000401	-0.00562	-0.00473
		(0.0118)	(0.00955)	(0.0109)	(0.0103)	(0.0230)	(0.0125)	(0.0123)
Urban population, log		0.00194	0.00197	0.00174	-0.000354	0.00686	0.00417***	0.00356**
		(0.00143)	(0.00137)	(0.00152)	(0.00219)	(0.00524)	(0.00153)	(0.00154)
Illiterate population, log		-0.0436*	-0.0404*	-0.0336	-0.0366	-0.0122	-0.0648**	-0.0444*
		(0.0241)	(0.0208)	(0.0245)	(0.0278)	(0.0591)	(0.0253)	(0.0237)
Population 5-17 years, log		-0.982***	-1.101***	-1.136***	-1.432***	-1.792***	-0.948***	-1.019***
		(0.261)	(0.204)	(0.271)	(0.318)	(0.484)	(0.278)	(0.267)
Total population, log		1.110***	1.178***	1.231***	1.766***	1.803***	1.124***	1.321***
		(0.224)	(0.176)	(0.223)	(0.273)	(0.422)	(0.246)	(0.234)
Manufacturing share		-0.253***	-0.206***	-0.221***	-0.480**	-0.314*	-0.277***	-0.236***
		(0.0608)	(0.0472)	(0.0614)	(0.194)	(0.156)	(0.0655)	(0.0620)
land concentration		0.944***	1.025***	0.904***	1.040***	0.755	0.914***	0.957***
		(0.294)	(0.218)	(0.305)	(0.369)	(0.576)	(0.289)	(0.296)
Value of crops per acre		0.0343***	0.0372***	0.0350***	0.0347***	0.0308***	0.0345***	0.0352***
		(0.00268)	(0.00284)	(0.00271)	(0.00351)	(0.00394)	(0.00283)	(0.00273)
log number of farms		0.0118	0.0316	0.0541	-0.117	0.0872	0.0782**	0.0323
		(0.0385)	(0.0265)	(0.0459)	(0.0787)	(0.0979)	(0.0371)	(0.0387)
Observations	3008	2744	2588	2584	1341	312	2744	2744
R-squared	0.612	0.848	0.893	0.859	0.882	0.881	0.845	0.847

All standard errors clustered at the state level. ***,**,* denotes significance at the 1, 5 and 10 percent level. All columns include state fixed effects. All variables are measured at the county level. In column 3, we exclude outliers; in columns 4 and 5 we exclude manufacturing counties above the 95th and 50th percentiles. In column 6, we use log land price per acre data from the Department of Agriculture as the dependent variable, while in columns 7 and 8, we scale the number of banks by area and population respectively.

Table 5. Log Land Price Per Acre and Banks—Robustness.

	(1)	(2)	(3)	(4)	(5)
	Dependent Variable: Log Price Per Acre in 1920, Census				
EXPLANATORY VARIABLES					
Average Interest Rate on Land Mortgage Loans	-0.255***				
	(0.0431)				
Log number of Banks		0.230***			
		(0.0356)			
Deposits (Log)		-0.000804			
		(0.0164)			
Log Number of State Banks			0.182***		
			(0.0259)		
Log Number of National Banks			0.116***		
			(0.0224)		
State Banks Per Area				21.78***	
				(4.262)	
National Banks Per Area				16.91*	
				(8.476)	
State Banks Per Capita					395.6***
					(68.10)
National Banks Per Capita					636.1***
					(129.7)
Observations	2443	2584	2744	2744	2744
R-squared	0.867	0.859	0.849	0.845	0.848

All standard errors clustered at the state level. ***,**,* denotes significance at the 1, 5 and 10 percent level. All columns include state fixed effects, and the baseline controls in Table 4 column 2.

Table 6. Land Prices, Banks and Commodities.

	Dependent Variable: Log Price Per Acre in 1920, Census		
	(1)	(2)	(3)
Banks variable	Log number of banks	Banks per area	Banks per capita
EXPLANATORY VARIABLES			
Banks	0.243***	31.76**	277.2***
	(0.0608)	(12.22)	(90.25)
Acreage weighted average annual change in commodity prices, 1917-1920	0.0613*	0.0709**	0.0682***
	(0.0309)	(0.0271)	(0.0196)
Commodity index* banks, 1920	0.0451**	9.079***	167.4***
	(0.0174)	(2.667)	(32.23)
Commodity index* squared banks, 1920,	-0.00714**	-354.0***	-78167***
	(0.00335)	(86.60)	(19117)
Observations	2500	2500	2500
R-squared	0.809	0.812	0.810
F test: index*banks=index*squared banks=0	3.591	8.353	14.00
Prob > F	0.0359	0.000	0.000

All standard errors clustered at the state level. ***,**,* denotes significance at the 1, 5 and 10 percent level. All columns include state fixed effects, and the baseline controls in Table 4, column 2. Commodity index is the acreage weighted average annual change in commodity prices in the county, 1917-1920.

Table 7. Land Price Residual, Banks and Commodity Index

				Commodity Index, 1917-1920				
				Quartiles				
				1	2	3	4	Total
Banks 1920, (log)	Quartiles	1	Mean	-0.0076	-0.0254	-0.0770	-0.0221	-0.0262
			Std. Dev	(0.2798)	(0.2152)	(0.1970)	(0.2343)	(0.2437)
			Obs	262	197	106	90	655
		2	Mean	0.0145	-0.0230	0.0141	0.0228	0.0057
			Std. Dev	(0.2707)	(0.2225)	(0.2017)	(0.2196)	(0.2335)
			Obs	202	181	155	124	662
		3	Mean	-0.0346	-0.0031	0.0013	0.0783	0.0147
			Std. Dev	(0.2746)	(0.1905)	(0.1748)	(0.2141)	(0.2151)
			Obs	123	137	197	175	632
		4	Mean	-0.0106	-0.0447	0.0149	0.0323	0.0077
			Std. Dev	(0.2613)	(0.1919)	(0.1767)	(0.1789)	(0.1943)
			Obs	68	103	155	225	551
		Total	Mean	-0.0062	-0.0230	-0.0056	0.0355	0.0001
			Std. Dev	(0.2741)	(0.2084)	(0.1888)	(0.2083)	(0.2241)
			Obs	655	618	613	614	2500

Means and standard deviations are computed for the residual from a regression of the log land price on the variables in Table 4, column 2, excluding the log number of banks. Commodity index is the acreage weighted average annual change in commodity prices in the county, 1917-1920.

Table 8. Land Prices and the Average Interest Rate, 1920, IV Estimates

	(1)	(3)	(3)
	Dependent Variable		
	Interest rate, 1920 (OLS) (First Stage)	Log Land Price Per Acre in 1920 (IV) (Second Stage)	Log Land Price Per Acre in 1920 (OLS)
EXPLANATORY VARIABLES			
Interest rate, 1920		-0.328**	-0.308***
		(0.163)	(0.0501)
Interest rate, 1890	0.149***		
	(0.0436)		
Observations	1928	1928	1928
R-squared	0.802	0.880	0.880

All standard errors clustered at the state level. ***,**,* denotes significance at the 1, 5 and 10 percent level. All columns include state fixed effects, and the baseline controls in Table 4 column 2. Interest rate is the average rate charged on land mortgage loans in the county.

Table 9. Borders, Banks and Prices

	Dependent Variable: Log Price Per Acre in 1920, Census.		
	(1)	(2)	(3)
	100 mile border window	80 mile border window	90 mile border window
EXPLANATORY VARIABLES			
log number of banks, 1920	0.194***	0.201**	0.210***
	(0.0712)	(0.0762)	(0.0753)
In state banks 0-50 miles	0.106***		
	(0.0367)		
In state banks 50-100 miles	-0.0890**		
	(0.0439)		
Out of state banks 0-50 miles	0.0102		
	(0.00833)		
Out of state banks 50-100 miles	-0.00275		
	(0.0194)		
In state banks 0-40 miles		0.105***	
		(0.0233)	
In state banks 40-80 miles		-0.0811*	
		(0.0448)	
Out of state banks 0-40 miles		0.00777	
		(0.00787)	
Out of state banks 40-80 miles		0.0159	
		(0.0173)	
In state banks 0-30 miles			0.0330**
			(0.0140)
In state banks 30-60 miles			0.0467
			(0.0414)
In state banks 60-90 miles			-0.0783**
			(0.0357)
Out of state banks 0-30 miles			0.00665
			(0.00725)
Out of state banks 30-60 miles			-0.00208
			(0.00748)
Out of state banks 60-90 miles			0.0130
			(0.0232)
Observations	2168	1915	2068
R-squared	0.835	0.838	0.835
F test: In state-Out of State =0	7.860	17.55	3.070
Prob > F	0.00749	0.000132	0.0867

All standard errors clustered at the state level. ***,**,* denotes significance at the 1, 5 and 10 percent level. All columns include state fixed effects, and the baseline controls in Table 6, column 1. The F-test assesses whether the nearest within-state and out-of-state counties are statistically different at conventional levels. Column 1 includes only those counties whose nearest out of state neighbor is less than 100 miles away—centroid to centroid. Columns 2 and 3 restrict the sample to border windows of 80 and 90 miles respectively. “In state banks 0-50 miles” refers to the average log number of banks in in-state counties whose centroid is less than 50 miles from the centroid of the county of interest. “Out of state banks 0-50 miles” refers to the average log number of banks in out-of-state counties whose centroid is less than 50 miles from the centroid of the county of interest.

Table 10. Borders: Banks and Price Differences

	Dependent Variable : Difference in Log Land Price per Acre Across a County Border							
	25 miles	30 miles	40 miles	50 miles	60 miles	70 miles	80 miles	90 mile
	Bank variable: Banks Per Capita							
EXPLANATORY VARIABLES								
Bank Difference	348.3***	296.4***	348.1***	365.7***	376.4***	398.8***	416.0***	416.4*
	(54.91)	(39.95)	(37.06)	(37.36)	(36.76)	(34.19)	(32.67)	(31.64
Bank Difference*Out of State	198.6*	143.5**	138.6**	137.8**	116.3**	108.5**	107.1**	110.3*
	(114.5)	(70.14)	(60.46)	(56.73)	(52.37)	(49.15)	(46.16)	(44.38
Out of State	-0.00318	-0.0249	-0.0287	-0.0391**	-0.0463***	-0.0387**	-0.0400***	-0.037
	(0.0256)	(0.0194)	(0.0181)	(0.0171)	(0.0159)	(0.0157)	(0.0155)	(0.015
	824	1856	4546	9005	15302	22623	30986	40418
	0.594	0.625	0.625	0.656	0.678	0.692	0.701	0.704
	Bank Variable: Banks per Area							
Bank Difference	15.68***	12.65***	15.30***	14.13***	16.09***	18.19***	19.29***	20.32*
	(3.663)	(2.673)	(2.619)	(2.375)	(2.401)	(2.358)	(2.388)	(2.337
Bank Difference*Out of State	8.826**	7.603**	-0.0577	5.490*	-1.759	-2.421	-2.225	-1.914
	(4.475)	(3.666)	(3.671)	(3.192)	(2.584)	(2.530)	(2.372)	(2.247
Out of State	0.00879	-0.0222	-0.0308*	-0.0407**	-0.0498***	-0.0420***	-0.0439***	-0.041
	(0.0252)	(0.0196)	(0.0187)	(0.0176)	(0.0164)	(0.0162)	(0.0159)	(0.015
	824	1856	4546	9005	15302	22623	30986	40418
	0.584	0.613	0.610	0.643	0.665	0.680	0.689	0.693

Standard errors are clustered for both members of a pair (two dimensional clustering). ***,**,* denotes significance at the 1, 5 and 10 percent level. All columns also include the baseline controls in Table 4 column 2, computed as differences across pairs. The distance in the top row is the maximum distance between the centroids of county pairs across borders. Bank difference is the difference in the number of banks across borders. Out of state is an indicator that equals 1 if the county pair is across a state border.

Table 11. Deposit Insurance, Banks and Prices

	(1)	(2)	(3)	(4)	(5)
	Dependent variable: Log land price per acre in 1920				
					30 mile window
EXPLANATORY VARIABLES					
Log number of state banks	0.145***				
	(0.0262)				
Log state banks*Deposit Insurance	0.0717*				
	(0.0373)				
Log number of national banks		0.0659***			
		(0.0218)			
Log national banks*Deposit Insurance		0.0650**			
		(0.0301)			
Log number of banks			0.239***	0.239***	0.064
			(0.0420)	(0.0402)	(0.133)
Log banks*Deposit Insurance			0.0834**	0.132***	0.163***
			(0.0404)	(0.0430)	(0.028)
Observations	2743	2743	2743	2743	152
R-squared	0.846	0.842	0.850	0.850	0.957

All standard errors clustered at the state level. ***,**,* denotes significance at the 1, 5 and 10 percent level. All columns include state fixed effects, and the baseline controls in Table 4, column 2. The "Deposit Insurance" indicator variable in columns 1-3 equal one for counties in the eight states that had deposit insurance in 1920. In the remaining columns, the indicator variable equals one only for counties in the 5 states with deposit insurance before 1914. For states with deposit insurance, column 5 includes only those counties that lie 30 miles on either side of the state border. Column 5 also includes border fixed effects, and standard errors are clustered along both the state and border dimensions.

Table 12. Banks, Commodities and Suspensions

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	State Banks Suspension Rate, 1921-1929	State Deposits Suspension Rate, 1921-1929	State Banks Suspension Rate, 1921-1929	State Deposits Suspension Rate, 1921-1929	State Banks Suspension Rate, 1921-1929	State Deposits Suspension Rate, 1921-1929
Bank variable	Log Banks		Banks Per Area		Banks Per Capita	
EXPLANATORY VARIABLES						
Banks, 1920	0.0112***	0.0122***	1.169***	1.231***	23.37***	23.15***
	(0.00295)	(0.00293)	(0.324)	(0.300)	(5.341)	(5.494)
acreage weighted average annual change in commodity prices, 1917-1920	-0.00136	0.000671	0.000591	0.000825	0.00149**	0.00164**
	(0.00142)	(0.00150)	(0.000801)	(0.000829)	(0.000722)	(0.000727)
commodity index* Banks, 1920	0.00259**	0.000938	0.115	0.0547	-1.824	-2.866
	(0.00103)	(0.000958)	(0.0903)	(0.106)	(2.083)	(2.048)
commodity index* squared of Banks, 1920,	-0.000672***	-0.000371**	-10.17***	-7.728**	432.7	1232
	(0.000191)	(0.000165)	(2.677)	(3.218)	(1297)	(1171)
Observations	2464	2461	2464	2461	2464	2461
R-squared	0.389	0.336	0.382	0.330	0.387	0.338
F test: index*banks=index*squared banks=0	8.833	7.011	12.58	9.996	0.805	1.030
Prob > F	0.000596	0.00228	4.78e-05	0.000264	0.454	0.366

All standard errors clustered at the state level. ***,**,* denotes significance at the 1, 5 and 10 percent level. All columns include state fixed effects, and the baseline controls in Table 6, column 1. Commodity index is the acreage weighted average annual change in commodity prices in the county, 1917-1920.

Table 13. Borders, Distance and Suspensions

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable					
VARIABLES	State Banks Suspension Rate, 1921-1929	State Deposits Suspension Rate, 1921-1929	State Banks Suspension Rate, 1921-1929	State Deposits Suspension Rate, 1921-1929	State Banks Suspension Rate, 1921-1929	State Deposits Suspension Rate, 1921-1929
	100 mile window		80 mile window		90 mile window	
log number of banks, 1920	0.00957***	0.0103***	0.0102***	0.0113***	0.00950***	0.0107***
	(0.00281)	(0.00276)	(0.00310)	(0.00306)	(0.00279)	(0.00278)
In state banks 0-50 miles	0.00169	0.00235*				
	(0.00127)	(0.00120)				
In state banks 50-100 miles	-0.00106	-0.000516				
	(0.00252)	(0.00244)				
Out of state banks 0-50 miles	-0.000330	-0.000108				
	(0.000389)	(0.000490)				
Out of state banks 50-100 miles	0.000628	0.000444				
	(0.000991)	(0.00115)				
In state banks 0-40 miles			0.00347***	0.00330***		
			(0.00122)	(0.00105)		
In state banks 40-80 miles			-0.00186	-0.000762		
			(0.00172)	(0.00145)		
Out of state banks 0-40 miles			-8.14e-05	6.27e-05		
			(0.000357)	(0.000364)		
Out of state banks 40-80 miles			0.000457	0.000462		
			(0.00111)	(0.00104)		
In state banks 0-30 miles					0.000184	-0.000546
					(0.00101)	(0.00100)
In state banks 30-60 miles					-0.000287	-0.000181
					(0.00146)	(0.00140)
In state banks 60-90 miles					-0.000586	0.000570
					(0.00179)	(0.00163)
Out of state banks 0-30 miles					0.000137	-0.000226
					(0.000442)	(0.000337)
Out of state banks 30-60 miles					-0.000527	-0.000498
					(0.000488)	(0.000528)
Out of state banks 60-90 miles					0.00120	0.00155
					(0.000998)	(0.00115)
Observations	2135	2132	1884	1882	2035	2032
R-squared	0.381	0.327	0.376	0.321	0.380	0.327

All standard errors clustered at the state level. ***,**,* denotes significance at the 1, 5 and 10 percent level. All columns include state fixed effects, and the baseline controls in Table 6, column 1. Column 1-2 includes only those counties whose nearest out of state neighbor is less than 100 miles away—centroid to centroid. Columns 3-4 and 5-6 restrict the sample to border windows of 80 and 90 miles respectively. "In state banks 0-50 miles" refers to the average log number of banks in in-state counties whose centroid is less than 50 miles from the centroid of the county of interest. "Out of state banks 0-50 miles" refers to the average log number of banks in out-of-state counties whose centroid is less than 50 miles from the centroid of the county of interest.

Appendix

Using an estimation framework similar to Equation (2), this appendix examines whether state borders influence the types of crops grown in counties, or demarcate differences in rainfall. In column 1 top panel of Table A1 for example, county i is defined as a reference county and included in the sample if its nearest out of state neighbor is no more than 25 of miles away—centroid to centroid. For each reference county i, we then identify all of its neighbors—centroid distances within 25 miles. We then compute the difference in average rainfall between county i and the average rainfall in each of its neighbors. The indicator variable "Out of State" measures whether the average differences computed across state lines differ relative to average differences computed between counties in the same state. After 30 miles, the results tend to remain the same at different 10 mile window increments, and in the interest of concision, we report results for 25, 30 and 100 miles—other increments available upon request. In the case of rainfall, up to the 100 mile window, state lines do not demarcate significant differences in average rainfall. This could well reflect the fact that actual rainfall is highly spatially covariant, as well as the fact that rainfall measurements are highly granular and unable to detect differences between nearby counties.

Using the same methodology, we next turn to the acreage devoted to several crops from the 1910 Agricultural Census that comprise the commodity index used in the paper. At the 25 and 30 mile window, state lines do not appear to influence the acreage devoted to crops. However, at the 100 mile window, differences in the acreage assigned to cereals and corn do appear larger when the comparison is made across state lines, than among counties within the same state. For the other crops, acreage differencs do not appear to be shaped by state borders.

Table A1. Crops, Rainfall and State Lines.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	25 miles						
	rainfall	cereals	wheat	rice	tobacco	cotton	sugar
Out of State Indicator	0.308	0.00447	-0.000817	-0.00133	-0.00159	-0.0174	0.000187
	(0.339)	(0.00812)	(0.00457)	(0.000930)	(0.00192)	(0.0131)	(0.000123)
Observations	964	943	943	166	658	436	171
R-squared	0.083	0.053	0.077	0.561	0.086	0.035	0.084
	30 miles						
Out of State Indicator	0.270	0.00834	0.00238	0.000751	-0.00274	-0.0142	0.00165
	(0.316)	(0.00660)	(0.00401)	(0.000625)	(0.00158)	(0.00999)	(0.00173)
Observations	2045	2000	2000	412	1329	964	428
R-squared	0.043	0.033	0.039	0.036	0.081	0.017	0.068
	100 miles						
Out of State Indicator	0.0631	0.0140***	0.00238	0.000267	-0.000642	0.00346	0.00265
	(0.191)	(0.00445)	(0.00242)	(0.00117)	(0.000834)	(0.00604)	(0.00201)
Observations	54061	52521	52521	12143	31302	26197	13050
R-squared	0.031	0.028	0.028	0.047	0.069	0.013	0.017

Standard errors are clustered for both members of a pair (two dimensional clustering). ***,**,* denotes significance at the 1, 5 and 10 percent level. All columns include a state fixed effect for the reference county.

References

Adrian, Tobias and Hyun Song Shin, “Liquidity and Leverage”, Staff Reports 328, Federal Reserve Bank of New York.

Allen, Franklin and Douglas Gale. Competition and Financial Stability. Journal of Money, Credit & Banking (2004) vol. 36 (3)

Alston, Lee, Wayne Grove and David C. Wheelock. Why do banks fail? Evidence from the 1920s. Explorations in Economic History (1994) vol. 31 (4) pp. 409-431

Benston, George, Robert A. Eisenbeis , Paul M. Horvitz, Edward J. Kane and George G. Kaufman, 1986, *Perspectives on Safe and Sound Banking: Past, Present, and Future* , MIT Press, Cambridge.

Bernanke, Ben S., and Gertler, Mark. ‘‘Agency Costs, Net Worth, and Business Fluctuations.’’ A.E.R. 79 (March 1989): 14–31.

Blattman, Chris, Jason Hwang and Jeffrey Williamson. 2007. Winners and Losers in the Commodity Lottery: The Impact of Terms of Trade Growth and Volatility in the Periphery, 1870-1939, *Journal of Development Economics.*

Binswanger, Hans P., “Attitudes towards Risk: Experimental Measure- mint in Rural India,” *American Journal of Agricultural Economics* 62 (1981), 395–407.

Binswanger, Hans P., Klaus Feininger, and Garson Feder, “Power, Distortions, Revolt and Reform in Agricultural Land Relations” (pp. 2659–2772), in Jere Behrman and T. N. Srinivasan (Eds.), *Handbook of Development Economics* (Amsterdam: Elsevier, 1995).

Calomiris, Charles. 1990. “Is Deposit Insurance Necessary? A Historical Perspective”, *Journal of Economic History*, 50, 283-295.

Cameron, Colin, Jonah Gelbach and Douglas Miller. 2011. “Robust Inference with Multi-way Clustering, *Journal of Business and Economics Statistics, 29(2), pp. 238-249.*

Cressie, Noel A. C., *Statistics for Spatial Data* (New York: Wiley, 1993).

Eastwood, Robert, Michael Lipton, and Andrew Newell, “Farm Size” (pp. 3323–3397), in R. Evenson and P. Pingale (Eds.), *Handbook of Agricultural Economics* (Amsterdam: North-Holland, 2010).

Evanoff, Douglas, 1988, Branch banking and service accessibility, *Journal of Money Credit and Banking* 20, 191-202.

Fisher, Irving. ‘‘The Debt-Deflation Theory of Great Depressions.’’ Econometrica

1 (October 1933): 337–57.

Gan, Jie. Banking market structure and financial stability: Evidence from the Texas real estate crisis in the 1980s. Journal of Financial Economics (2004) vol. 73 (3) pp. 567-601

Galor, Oded, Omer Moav, and Dietrich Vollrath, "Inequality in Land Ownership, the Emergence of Human Capital Promoting Institutions and the Great Divergence," *Review of Economic Studies* 76 (2009), 143–179.

Gardner, Bruce L., *American Agriculture in the Twentieth Century: How It Flourished and What It Cost* (Cambridge, MA: Harvard Univer- sity Press, 2002).

Geneakoplos, John "The Leverage Cycle." In D. Acemoglu, K. Rogoff and M. Woodford, eds., *NBER Macroeconomic Annual 2009*, vol. 24: 1-65, University of Chicago Press [plus erratum] [CFP 1304]

Glaeser, Edward, Joshua Gottleb and Joseph Gyourko (2010), "Can Cheap Credit explain the Housing Boom", mimeo, Harvard Economics Department.

Guiso, Luigi, Paula Sapienza, and Luigi Zingales, 2004, "Does Local Financial Development Matter?", *Quarterly Journal of Economics*, Vol. 119.

Heady, Early O., *Economics of Agricultural Production and Resource Use* (Upper Saddle River, NJ: Prentice Hall, 1952).

Holmes. The effect of state policies on the location of manufacturing: Evidence from state borders. Journal of Political Economy (1998) vol. 106 (4) pp. 667-705

Holmes, Thomas J., Sanghoon Lee. Economies of Density versus Natural Advantage: Crop Choice on the Back Forty, forthcoming, *Review of Economics and Statistics*.

Hong, Harrison and Jeremy Stein. Disagreement and the stock market. The Journal of Economic Perspectives (2007) vol. 21 (2) pp. 109-128

Keeley, Michael. Deposit Insurance, Risk, and Market Power in Banking. The American Economic Review (1990) vol. 80 (5) pp. 1183-1200.

Kindleberger, Charles, and Robert Z Aliber (2005), *Manias, Panics, and Crashes: A History of Financial Crises* (Wiley Investment Classics)

Mian, Atif and Amir Sufi, The Consequences of Mortgage Credit Expansion: Evidence from the U.S. Mortgage Default Crisis, *Quarterly Journal of Economics,* November 2009, 124(4), 1449-1496

Minsky, Hyman (1986), *Stabilizing an Unstable Economy*, Yale University Press, New Haven, CT.

O'Hara, M. 1983. "Tax exempt Financing, Some lessons from History" *Journal of Money Credit and Banking* 15, 425-441.

Petersen, Mitchell A., and Rajan, Raghuram G. 1995. The Effect of Credit Market Competition on Lending Relationships. *Quarterly Journal of Economics,* vol.110, No. 2, pp. 407-443.

Rajan, Raghuram and Rodney Ramcharan, 2011a, "Land and Credit: A Study of the Political Economy of Banking in the United States in the Early 20th Century", *Journal of Finance,* December.

Rajan, Raghuram and Rodney Ramcharan, 2011b, "Constituencies and Legislation: The Fight over the McFadden Act of 1927", mimeo, University of Chicago.

Rajan, Raghuram, 1994, "Why Bank Credit Policies Fluctuate: A Theory and Some Evidence", *Quarterly Journal of Economics,* vol 109, pp 399-442.

Scheinkman, Jose and Wei Xiong. Overconfidence and speculative bubbles. Journal of Political Economy (2003) vol. 111 (6) pp. 1183-1219.

Shleifer, Andrei and Robert Vishny. Liquidation values and debt capacity: A market equilibrium approach. Journal of Finance (1992) vol. 47 (4) pp. 1343-1366

Stein, Jeremy. Prices and trading volume in the housing market: A model with down-payment effects. The Quarterly Journal of Economics (1995) vol. 110 (2) pp. 379-406

Wheelock, David and Paul Wilson. 1995. Explaining Bank Failures: Deposit Insurance, Regulation, and Efficiency. *The Review of Economics and Statistics, November, 77(4), pp 689-700.*

White, Eugene, 1981, "State-Sponsored Insurance of Bank Deposits in the United States, 1907-1929", *The Journal of Economic History* Vol. 41, No. 3 (Sep., 1981), pp. 537-557

White, Eugene, 1982, "The Political Economy of Banking Regulation, 1864-1933", *The Journal of Economic History* Vol. 42, No. 1, The Tasks of Economic History (Mar., 1982), pp. 33-40

Williamson, O.E. 1988. Corporate Finance and Corporate Governance, *Journal of Finance, 43, 567-592.*

Yergin, Daniel. 1991. *The Prize: The Epic Quest for Oil, Money and Power.* New York: Simon and Schuster.