Finance and Economics Discussion Series
Divisions of Research & Statistics and Monetary Affairs
Federal Reserve Board, Washington, D.C.

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

Rodney Ramcharan and Raghuram Rajan

2012-62

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)

Rodney Ramcharan
(Federal Reserve Board)

May 30, 2012

Abstract

Does credit availability exacerbate asset price inflation? What channels could it work through? What are the long run consequences? In this paper we address these questions by examining the farm land price boom (and bust) in the United States that preceded the Great Depression. 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 the perceived fundamentals soured, however, areas with higher ex ante credit availability suffered a greater fall in land prices, and experienced higher bank failure rates. Land prices stayed low for a number of decades after the bust in areas that had higher credit availability, suggesting that the effects of booms and busts induced by credit availability might be persistent. We draw lessons for regulatory policy.

JEL classification: E44; G21.
Keywords: Consumer credit, banking, land prices.

[1] We thank Eric Hardy, Lieu Hazelwood, Fang-Yu Liang, Maxim Massenkoff, and Michelle Welch for excellent research assistance, and for comments from participants in the Basel RTF Conference, Cornell, Chicago Finance lunch, FDIC, Federal Reserve Board, Harvard PIEP conference, IMF, INSEAD, the Paris School of Economics, and the NBER Macro Workshop. 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 Craig Brown, Raquel Fernandez, Paul Kupiec, Amit Seru and Amir Sufi for helpful comments. The views in this paper do not necessarily reflect those of the Federal Reserve System.

Asset price booms and busts often center around changes in credit availability (see, for example, the descriptions in Kindleberger and Aliber (2005) and Minsky (1986), theories such as Geanakoplos (2009), and the evidence in Mian and Sufi (2008)). Some economists, however, 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 boom (and bust) of farm land prices in the United States in the early twentieth century, using both the variation in credit availability across counties in the United States as well as the exogenous boom and bust in agricultural commodity prices at that time to tease out the short- and long-run effects of the availability of credit on asset prices.

The usual difficulty in drawing general lessons from episodes of booms and busts in different countries is that each crisis is *sui generis*, driven by differences in a broad range of hard-to-control-for factors. The advantage of focusing on farm lending in the United States in the early twentieth century is that lending was local. So in effect, we have a large number of distinctive sub-economies, specifically, counties within each state, with some common (and thus constant) broad influences such as monetary policy and federal fiscal policy. At the same time, differences in state regulations allow us to isolate exogenous differences in credit availability.

In addition, we have an exogenous boom and bust in agricultural commodity prices in the years 1917-1920, to which counties were differentially exposed. The reasons for the commodity price rise are well documented. The emergence of the United States as an economic power helped foster a worldwide boom in commodities in the early 20th century. The boom, especially in the prices of wheat and other grains, accelerated as World War I disrupted European agriculture, even while demand in the United States was strong. 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)).[2]

Because different counties differed in the kind of crops they were most suited to produce, and each crop was affected to a different extent by the events in Europe, we have county by county variation in the perceived shock to fundamentals. Taken together with the variation across counties in credit availability, we can tease out the separate effects of the availability of credit and the perceived positive shock to fundamentals on land prices in 1920 (the peak of the boom). We find that both factors had independent effects, but there was also a positive interaction effect; the shock boosted land prices even more in counties that had greater credit availability. We also explore the channels through which credit might have operated – whether it allowed marginal land to be brought into operation, facilitated the more intensive use of existing land, allowed more investment in machinery, or primarily facilitated more leverage.

The post 1920 collapse in commodity prices, induced by the resumption of European production, also allows us to examine the aftermath of the boom. Importantly, agricultural incomes fell, but only to levels before the acceleration in commodity price growth that started in 1917. This allows us to focus on the role of the financial leverage – both at the farm level and at the bank level – that built up in the boom years. If the role of credit is relatively benign – borrowers simply sell the assets they had bought and repay credit – we should see relatively little independent effect of the prior availability of credit on asset prices, other than what rose the most falls the most. But if purchased assets are illiquid and hard to sell, and leverage cannot be brought down easily, we should see prices fall even more in areas that had easy access to credit. Distress, as evidenced in bank failures, should be more pronounced. This is indeed what we find – bank failures were significantly greater in areas that had greater credit availability during the commodity price boom. Perhaps most important, we find that the credit-fuelled boom and bust depressed land prices decades after the episode, suggesting that the role of credit and financial distress is substantial and long lasting indeed.

[2] The price of a bushel of wheat fell from $3.08 in May 1920 to $1.68 in December; corn fell from $2.00 to $0.76 over the same period (Benner (1925)).

Throughout the paper, we are agnostic about whether beliefs about fundamentals were over-optimistic 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 helped allocate land towards overly optimistic buyers or towards more potentially efficient ones. What we can say 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 long-drawn fallout if the shock happens to be temporary.

Finally, the focus on history should not detract from the paper's relevance today. Clearly, the long run consequences of financial disaster can only be seen through the lens of history. More important, history offers regulatory peculiarities (for example, the prohibition on inter-state banking) that allow us to identify the effects of credit availability. Finally, the commodity price boom and bust towards the end of World War I offers an exogenous temporary (and fully reversed) shock to fundamentals that allows us to see what the consequences of financial leverage built up in the interim might be.

The rest of the paper is as follows. In section I, we provide an overview of the theoretical literature and the main predictions, the historical episode we focus on, and the data we use. In section II, we describe the basic tests on the importance of credit availability during the commodity price run up. In section III, we examine the separate roles of credit availability and the commodity price run up, their interaction, as well as the other channels through which credit mattered. In section IV we focus on the collapse in commodity prices, the consequent banking sector distress, and the long run effect on land prices. We conclude in section V.

I. Theories, Historical Background, and Data

1.1. Theories

Land purchases are large-ticket items. Purchasers typically require credit, which makes the demand for land dependent on credit availability (Stein (1995)). Land use efficiency could improve as more of the skilled obtain the finances to buy land. Also, smaller land holdings could reduce the agency costs associated with employing workers to farm large land holdings at a time when mechanization was difficult. Furthermore, crop specificity and intensive farming technologies could also mean more efficient widely distributed land ownership. Finally, greater 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)).

It is reasonable to expect that the positive association between any improvement in perceived 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 (the increased) 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 more efficient ownership of land, and should enhance the effect of a positive fundamental shock on asset prices.

There are also reasons why greater credit availability could push land prices even 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 (of borrowing and buying) are likely to have been lower in areas with greater access to credit, while nationwide, short selling in the land market was

[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 (see, for example, Kiyotaki and Moore (1997) or Adrian and Shin (2008)).

extremely difficult during this period. The trading gains from these transactions, as well as expectations of further gains, could have pushed 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 competitive interaction between banks in an environment where credit is expanding; banks are unwilling to stop "ever-greening" bad loans or hold back on new lending for fear of realizing losses or signaling a lack of lending opportunities, thus revealing their lower ability. Therefore 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.

All these theories suggest that the availability of credit should have a direct effect of land prices. It could also amplify the effects of fundamental shocks, both on the up side and the down side.

1.2. 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 to 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, as local banks, as well as life insurance companies, joint stock land banks and Federal land banks competed in some areas to provide credit (Alston (1983a, b). Borrowers often only had to put 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 until maturity. And as long as refinancing was easy, borrowers did not worry about principal repayment. 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 and refinanced willingly. Debt mounted until the collapse in commodity prices put an end to the credit boom.[4]

Thus we have here a perceived, largely exogenous, 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 additional effects.

1.3. Data

1.3.1. Credit Availability

In the early 20th century, it was difficult for farmers to travel long distances (few had cars) or to communicate at a distance (few had phones). Therefore, credit markets in

[4] There was also considerable debate at the time about the role of tight monetary policy in amplifying the impact of the price collapse on the banking sector. To counter the speculative frenzy of 1919, and the sharp rise in inflation during the war years, the Federal Reserve raised interest rates early in 1920 to 7 percent—the highest level in its history to that point. However, once commodity prices collapsed in 1920, the Fed kept the discount rate unchanged from its historic high, even as liquidity dried up in the country side amid a wave of bank failures (Davis (1921), Benner (1925) and Wicker (1966)).

the United States in the early twentieth century, especially the markets for farm loans, were localized. Indeed, even in the late 20th century, Petersen and Rajan (2002) find that physical proximity was important in determining credit access for small potential borrowers. We therefore focus on local markets for credit, using data from U.S. counties. Also, by focusing on counties, we can correct for state fixed effects, which enables us to remove the confounding effects of myriad state banking regulations. This is an advance over prior work which has largely focused on state level data.

From 1920 onwards, the FDIC provides data in electronic form on the total number of banks and the quantity of deposits in each county within both the state and national banking systems. We supplement these data, hand-collecting information on the number of state and national banks in each county for 1900 and 1910 from the Rand McNally Bankers Directory and the Bankers Register for those respective years. We also hand-collected data from the US Agricultural Census of 1920 on the average interest rate charged on farm loans as well as on mortgage debt to farm value ratios in 1910 and 1920.

Ceteris paribus, the more the banks in a county, the more is the competition for depositor funds, as well as the competition to offer credit, and hence greater is the potential supply of intermediated funds. Also, given county area, more banks imply that on average any potential borrower or saver is closer to a bank, making it easier for them to borrow or deposit in the bank. So our proxy for credit availability, through much of the paper, will be the log number of banks in a county, or the number of banks scaled by either land area or population within a county (see, for example, Evanoff (1988) for prior use of such measures in the literature).[5]

One important concern will be the extent to which credit availability, especially as measured by the number of banks, is exogenous and not simply a response to local demand. While we will address this issue empirically, there are reasons why some components of credit availability will be exogenous. 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

[5] States varied in the extent to which banks could open branches, with some states disallowing branching altogether, while others circumscribed bank branching privileges according to geographic and population criteria. However, information on the number of branches within a county is not readily available, and in what follows, the variation in state level bank branching regulation are absorbed in state level fixed effects.

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 distribution of farm size, 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 latent changes in perceived prosperity.

We summarize our proxies for credit availability in Table 1A and report their correlations in Table 1B. Counties in western states were generally larger and less populated than other regions, but the number of banks scaled by area and population are positively correlated in the cross-section. Areas with greater bank density appeared to also have lower interest rates. Figure 1 indicates that counties with lower interest rates were typically in the upper Mid West; credit was costliest in the South.[6]

1.3.2. Land 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 1900-1930. The Census data are self-reported. 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 2 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

---

[6] The correlation coefficient between the log number of banks in 1920 and the average interest rate in 1920 is -0.31 (p-value=0.01).

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.[7] 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 2 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. We will use the more widely available census data through much of our study.

Using the Census data, Figure 2 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.

1.3.3. Agricultural Commodity Prices

To track the connection between county level land prices and world agricultural 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 in 1910. 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.

[7] 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.

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 supporting higher land prices. In Figure 3, we plot 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 thereafter after the resumption of trans-Atlantic shipping circa 1915 allowed US exports to Europe. The index peaked and started falling in 1920, 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 4) suggests that world commodity prices played an important role in shaping US land prices. The speculative frenzy was most intense from 1917-1920 and we will use the county-specific change in the commodity price index from 1917 to 1920 as a measure of the fundamental shock throughout the paper; its correlation with the shock between 1910 and 1920 is 0.98 and with the shock between 1914 and 1920 is 0.98.

II. Land Prices and Credit Availability

The theoretical arguments outlined earlier suggest land prices should be higher in counties with higher credit availability in the cross-section of counties in 1920. We will first test this cross-sectional prediction, correcting for obvious geographic, demographic, and economic fundamentals that might directly bear on land prices. We will undertake some straightforward robustness checks. To try and rule out the possibility of some omitted fixed factor affecting both land prices and the availability of credit, we turn to panel data to see if changes in our proxy for the availability of credit are correlated with changes in land prices. Given the limitations of this exercise in establishing causality, we turn to instrumental variables to see if pre-determined components of credit are correlated with land prices. Finally, we use variations in regulations governing banks to provide the most powerful evidence that the availability of credit did influence land prices.

2.1. Land Prices and Credit Availability: The Basic Regressions

We want to see if differences in credit availability can help explain the variation across counties in the level of (log) land price per acre in a county in 1920, correcting for obvious explanatory variables. As described earlier, we use the log of the number of banks (state plus national) in the county or the number of banks per capita or banks per square mile as our measure of credit availability. We will focus primarily on log banks, but present results for all three whenever appropriate.

Summary statistics are in Table 3, while the regression estimates are in Table 4A.[8] As a benchmark, Table 4A 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 0.56 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 percent increase in the land price level. This is obviously a likely upper bound to the true effect.

In column 2, we include in addition to the log number of banks and state fixed effects, a number of variables that account for the economic conditions of the county. These include the log of the average value of crops per acre in the county (which helps account for the current income the land produces) as well as the share of value added in the county that comes from manufacturing (to account for land that is more urban).

We also include a number of variables that account for climatic and geographic factors. Areas with higher average rainfall that are also less volatile may 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, so we also include the log of distance from major waterways, which, as Figure 2 suggests, could enhance the value of land. We include the log area of the county. In addition, we also include a number of demographic variables (log total population, the log Black population, the log

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

urban population, the log illiterate population, and the log population 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), 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 0.49 standard deviation increase in land prices. Similarly, wetter, more fertile areas tend to have higher land prices; likewise, prices are higher in those areas with many people, but lower in counties with more land.

We check systematically for outliers in this basic regression, and column 3 replicates the analysis excluding the outliers.[9] Most of the counties classified as outliers are dominated by manufacturing rather than agriculture. Among the 145 counties classified as outliers, the average share of value added derived from manufacturing is 53 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.[10]

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

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

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

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 of Table 4A, we substitute log number of banks with number of banks per area and number of banks per capita respectively. These proxies essentially normalize the 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 0.12 and 0.15 standard deviation increase in the price per acre respectively.

2.2. Land Prices and Credit Availability: Robustness

The pairwise correlation of log 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).[11] In Table 4B column 1, we replace the log of the number of banks in our baseline regression with the average interest rate

[11] The pairwise correlations also suggest that counties with lower interest rates also had higher average loan to value ratios (p-value=0.00). We will return to this later.

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.[12]

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.

Another concern is that our results may be driven by a specific region. So in Table 4B columns 3-5, we estimate the regression separately for the South, the East North Central, and the West North Central, which together account for 72 percent of the observations. The coefficient on the log number of banks is statistically significant and of similar order of magnitude in all three regions.

Finally, there was some ambiguity about whether nationally chartered banks could make mortgage loans. 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

[12] 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.

minimum capital requirement – for example, see Wheelock (1993)). Moreover, in states with deposit insurance, only state banks benefited from that insurance.

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 4 b columns 6-8 for each of the proxies for number of banks. 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 ignore the difference between national and state banks unless there might be reasons to expect important differences in behavior.

2.3. Land Prices in 1920: Fixed effects estimates and IV estimates.

The immediate concern with the cross-sectional analysis is that there may be some fundamental omitted attribute of a county, such as the richness of the soil, that is correlated with both land prices as well as, through local wealth, the number of banks. This fundamental attribute may be driving land prices, and the number of banks proxies for it in the basic cross-sectional regression. One way to correct for the existence of some omitted fixed factor is to examine panel data covering counties in the years 1900, 1910, and 1920, when land prices were rising. In Table 5 column 1, we regress log land prices over time on our proxies for demographic and economic fundamentals, including county fixed effects as well. County fixed effects would then absorb any time invariant omitted factors, including the previous geographic controls.

The positive and significant coefficient estimate on the number of banks suggests that the growth in land prices over time is correlated with changes in the number of banks, after taking out the effect of changes in proxies for geographic, demographic, and economic fundamentals, as well as any time invariant attributes of a county such as soil quality. The coefficient estimate is, however, smaller in magnitude than the estimate in the cross-sectional regression.

While the positive significant coefficient estimate on the number of banks in the fixed effects estimate is reassuring, it is not sufficient to conclude that credit availability affects land prices – it should only be seen as adding to the overall evidence.[13] Banks themselves might have entered counties that had booming land prices -- the number of U.S. banks expanded substantially in the years prior to 1920, from 22030 in 1914 to 28885 in 1920.[14] In other words, the causality could run from higher prices to credit rather than the other way round.

We would therefore like to use measures of credit availability that predate the boom. In the baseline cross-sectional regression, we substitute the number of banks in 1920 with the number of banks in 1910, before the war-induced boom in land prices (we obtain similar results using banks in 1900 – these results are available from the authors). As the coefficient estimates in Table 5 column 2 indicate, the log number of banks in 1910 continues to explain land prices in 1920. We could also use banks in 1910 as an instrument for banks in 1920. In Table 5 column 3, we present the second stage estimates, instrumenting the number of banks in 1920 with the number of banks in 1910. The coefficient estimate of the instrumented number of banks goes up in magnitude suggesting that the persistent component of credit availability has a large effect on land prices. Results are qualitatively similar if we use banks in 1900 rather than banks in 1910 as the instrument. All this suggests that higher land prices are "caused", in part, by a persistent factor, for which, the number of banks might proxy.

To show that the persistent factor that the number of banks proxies for is credit-related, we now use some interesting aspects of bank regulation in the early twentieth century: First, banks could not lend across state lines; second, some states had deposit insurance (which typically made banks more eager to lend).

2.4. Distance and Borders

Inter-state bank lending was not allowed in the United States in the early twentieth century. If the number of banks primarily reflects something persistent associated with the quality of land rather than with credit availability, then the number of

[13] The number of banks is itself only a proxy for the availability of credit. If the major factors that determine the availability of credit in each county are likely to be time invariant, then the changes in the number of banks may largely reflect noise, and may not proxy tightly for changes in the availability of credit. The fixed effects "within" estimate need not be tightly estimated nor large in magnitude – we should therefore not be totally surprised that the fixed effect coefficient estimate is smaller than the cross-sectional estimate.

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

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). Furthermore, the influence of within-state banks should diminish with distance, since it is unlikely that banks in distant within-state counties would be lending to buyers in the county of interest.

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 from the centroid of the county it is located to 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 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 4A column 4 and include in addition, the log number of banks for within-state counties that are less than 50 miles away, the log number of banks for out-of-state counties at similar distance, and to check that the effect falls off with distance, the log number of banks for within-state counties that are greater than 50 miles but less than 100 miles distant. The sample consists of those counties whose nearest neighbor is no further than 100 miles, centroid to centroid. We

[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.

report coefficient estimates for only the variables of interest in column 1 of Table 6. Consistent with the idea that the number of banks proxies 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. The coefficient for in-state counties that are more than 50 miles distant is small and not different from zero, as expected.

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 Table 6 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. Indeed, using finer bin sizes suggests that the out-of-state coefficient is not significantly related to land prices across the border. 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 appears that lending, and not just some unobserved fundamental correlated with the presence of many banks, affects asset prices.[16]

An analogous intuition provides a potentially more robust test to help distinguish between the role of credit availability in influencing land prices from the latent fundamentals that might determine both credit availability and land prices. 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 differences 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

[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.

similar, and unobserved fundamentals are thus unlikely to bias the correlation between land prices and bank density differences.[17]

Specifically, let us express 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) $$y_i = \beta_1 b_i + S_j \beta_2 b_j + X_i \alpha + e_i + g_i$$

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

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)).

[17] In the Appendix we show that for counties less than 30 miles away, state borders are not associated with significant 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.

The results from estimating equation (2) are in Table 7. 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 7, banks are scaled by population, and in the bottom panel banks are scaled by county area.

The upper panel of Table 7 suggests that land price differences across county borders are significantly associated with differences in the number of banks across borders, 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 7—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 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 economic 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 the difference in banks per capita is associated with a 0.15 standard deviation increase in the land price difference, while at the 90 mile window, the impact is around 0.13 standard deviations (column 8). However, the relative magnitude of the cross-border bank difference effect declines as the border window expands. While the additional impact of bank differences on price differentials between

[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.

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, and 27 percent at the 30, 40, 50, 60 and 70 mile windows respectively. This is as it should be if the primary effect of the state border is in curtailing lending – there may not be much lending from distant within-state counties, and hence the bank difference effect will be similar for distant counties whether within state or out of state.

Some state borders may consist of natural boundaries, which would make it difficult to lend across them. We therefore have included an indicator when a border is a state border.[19] Consistent with the evidence in the Appendix which shows that for counties less than 30 miles away, state borders are not associated with significant differences in geography or the type of agriculture produced, the top panel of Table 7 suggests that the direct conditional impact of state borders on land price differences between counties is insignificant below the 40 mile radius (column 3), indicating 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.

When we turn to banks per area, in the bottom panel of Table 7, there is again evidence both that the relationship between land price differences and bank differences is 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.[20]

2.5. Deposit Insurance

[19] To the extent that a state border is also a natural border such as a river, it makes lending difficult. Thus it is akin to a legal prohibition on inter-state lending. To the extent that counties are similar on both sides of a river, the smaller effect of bank differences across in-state county borders verifies our point that it proxies for credit availability. Our test is more problematic if the state border separates counties of very different natures, such as a county on the plains from a county in the hills.

[20] For example, the area of the average county in the East North Central states is 563 square miles, but 4174 and 2362 square miles in the Mountain and Pacific regions—San Bernardino county in California is the largest at 20,105 square miles and is larger than the entire state of New Jersey. As the border window grows, the estimates are likely to straddle these different regions, and are thus, likely to be less precise.

Several states experimented with deposit insurance before the commodity boom. 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)). Some have argued that states with deposit insurance had higher bank failure rates in the 1920s (Calomiris (1990), Wheelock and Wilson (2003)). Therefore, we might expect that if the correlation between the number of banks and land prices reflects credit availability, then the relationship between the number of 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. [21] These states had more banks on average, as these schemes generally encouraged the entry of smaller banks.[22] But as Table 8 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 8, the estimated relationship between national banks and prices is almost twice as large in deposit insurance counties, but remains lower in magnitude than state banks. Deposit insurance, through competition, must have affected the incentives of both types of banks, and 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

[21] 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)).

[22] 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).

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 8 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 8, 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.

2.6. 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, variations in regulation have allowed us to identify the supply side effect more plausibly.

Estimating the magnitude of the supply side effects is less easy. We can, however, surmise they might have been large. For instance, the estimates in column 4 of Table 8 suggest that for two otherwise similar counties having the mean number of banks in the sample, land prices would have been about 1.6 times higher in the county located in a deposit insurance state than in the county across the border in a non-deposit insurance state. To the extent that the primary effect of deposit insurance is to augment the flow of credit from banks, this effect is large.

III. Mechanisms

Thus far we have seen that, correcting for fundamentals, land prices in 1920 were positively correlated with the availability of credit. We want to delve a little deeper now and see how credit availability and the county-specific commodity price shock between 1917 and 1920 (the results are not qualitatively different with a longer window) influenced a variety of economic variables. This will give us a deeper understanding of the mechanisms through which credit availability worked.

3.1. Land Prices Again

One way to visualize the relationship between credit availability and the commodity index shock on land prices is to tabulate the mean land price residual, after partialling out the effects of all explanatory variables other than the log number of banks and the value of crops in 1920 (for the list of explanatory variables, see the footnote to Table 9). We then report the mean land price residual for different quartiles of the log number of banks and the commodity shock in Table 9. Clearly, land prices increase with the positive commodity price shock – the average land price residual for counties experiencing shocks in the first quartile of the commodity price shock is -0.01 and it goes up to 0.045 for counties experiencing shocks in the fourth quartile. Similarly, land prices increase with the number of banks, with the average residual going up from -0.03 in the first quartile to 0.011 for counties in the fourth quartile of banks. 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 the 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 -0.023. Thus the "spread" -- the difference in land price residual between counties with the highest commodity shock and counties with the lowest shock -- is -0.016 for counties with few banks. Prices do not align well with anticipated fundamentals in areas with limited credit.

The spread turns positive (0.033) for counties that are in the second quartile of the number of banks, and increases substantially to 0.122 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 -0.036 in counties with the lowest quartile commodity shock and the land price residual being a positive 0.086 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 0.059 but lower than for counties with the number of banks in the third quartile. In sum then, the sensitivity of land prices to fundamentals increases with the availability of bank credit at low levels of availability, but becomes slightly attenuated at high levels of availability.

3.2. Land Price, Commodity Index, and Banks

All this suggests it is useful to examine the direct effects of commodity prices and credit availability as well as their interaction effects. In the first column of Table 10, we include in our baseline regression the log of banks in 1920 as well as the log of banks squared (to account for possible non-linear effects), the change in the county-specific commodity index, and the change in county-specific index interacted with the log number of banks.[23] In column 2, we include the log of land prices in 1910 as an additional

[23] Because we want to focus on the effects of the commodity price increase between 1910 and 1920 on the increase in land prices, we drop farm income per acre in 1920 (which captures the rise in commodity

explanatory variable, and in column 3, we instrument log of banks in 1920 (and its squared and interaction terms) with log of banks in 1910 (and its squared and interaction terms).

Clearly, credit availability has a direct effect in all three specifications, which is attenuated somewhat as credit availability increases (the squared log banks term is negative). Also, the interaction effect between the commodity index shock and credit availability is positive – as Table 9 indicated, land prices are more sensitive to the commodity index shock when more credit is available**.** For a county at the 25 percentile of banks, a one standard deviation increase in the commodity index is associated with a 0.11 standard deviation increase in land prices; but for a county at the 75th percentile of banks, an identical commodity shock suggests a 0.16 percent increase in land prices. Interestingly, once we correct for the level of land prices in 1910, the direct effect of the commodity index shock is highly attenuated, even while the interaction effect remains strong. This suggests that the effect of the commodity price shock in the period 1917-20 on land prices is a departure from earlier trends primarily through its interaction with credit availability.[24]

3.3. New Land, Land Improvement, Farm Equipment, and Debt.

Next, let us examine some of the channels through which credit availability and the commodity shock might affect real and financial activity. Consider first the acreage devoted to agriculture. One of the effects of the commodity boom might have been to bring new land into cultivation. Of course, by 1910, the median county already had 77% of county area cultivated, so the room for bringing marginal land into cultivation may have been small. Indeed, the mean and median change in the share of county land devoted to agriculture over the period 1910 to 1920 is zero.

In the first column in Table 11, we replicate the regression in Table 10 column 3, replacing the dependent variable, the log land price in 1920, by the fraction of acres devoted to agriculture in 1920 (and replacing log land price in 1910 on the right hand side

---

prices) from the baseline regression (Table 4A column 4) and add in as an explanatory variable the log level of land prices in 1910.

[24] We can also examine the growth in land prices (difference in log land prices between 1920 and 1910) as the dependent variable and regress this against changes in the explanatory variables, state fixed effects, as well as log banks, log banks squared, the commodity index, and the interaction. All the coefficient estimates of interest have their expected sign, though only log banks and log banks squared are statistically significant.

with the fraction of acres devoted to agriculture in 1910). As the IV regression estimates suggest, none of the coefficients of interest are statistically significant. This implies that the land price effects previously observed may have been so strong because there was limited room to expand by bringing new land into cultivation – the extensive margin was small.

Perhaps, however, the intensive margin is larger. Within land that was already devoted to agricultural purposes, more land that was fallow, devoted to pasture, or otherwise unutilized, could have been brought into cultivation during the boom. On average, there is indeed a one percentage point increase in the share of land under cultivation that is "improved" between 1910 and 1920 – larger than the increase in extensive margin but not hugely so. In Table 11 column 2, we replace as dependent variable the fraction of acres devoted to agriculture with the share of land under cultivation that is improved. The coefficient estimates suggest that both greater credit availability as well as a larger positive commodity index shock led to more intensive land utilization, but the interaction effects are statistically insignificant.

We turn next to the use of farm implements and machinery. If land use could not be changed significantly during the boom because land was already intensively utilized by 1910, perhaps farmers adjusted by utilizing more capital equipment. Indeed, the total value of farm implements and machinery averaged across counties increased from around $850,000 in 1910 to $2.3 million in 1920—in nominal currency. The dependent variable in Table 11 column 3 is the log of the dollar value of farm implements and machinery in 1920. Interestingly, the factors determining spending on machinery mirror the factors that we earlier found to determine land prices – more credit availability means more spending on machinery, though at a declining rate (the coefficient on the squared term is negative). In this case, evaluated at the mean level of the commodity index, the marginal impact of credit availability on farm equipment is positive up to the 75th percentile in the distribution of log banks. And these estimates suggest that moving from the 25th to the 75th percentile in the log number of banks implies an 11.5 percent increase in the value of farm machinery—evaluated again at the mean level of the commodity index.

Conversely, since the coefficient estimate of the interaction between credit availability and the commodity shock is positive, farmers appear more likely to buy more equipment for a given positive commodity price index shock if credit availability is higher. However, as with land prices, the direct effects of the commodity index shock are not statistically significant.

Finally, did more credit availability lead to greater borrowing to finance land and equipment purchases? Farm land differs from residential property in that it provides a direct financial income rather than just use value. The commodity price shock both increases expectations of income as well as current income of incumbent farmers. Both factors will affect the debt to value ratio, which at any point in time is a stock number indicating current average indebtedness. A greater willingness of banks to lend against collateral value – potentially fostered by competition -- should increase the debt to value ratio banks tolerate. At the same time, counties where farmers have bought more recently are likely to be more indebted (prices are higher, and they have not had time to pay down debt), while counties that have seen a recent appreciation in the price of land, ceteris paribus, will appear less indebted. Finally, counties where farmers have used commodity windfall incomes to pay off debt will also appear less indebted.

The mean and median of the average debt to value ratio in a county across the counties in 1920 is 28.9 percent. To get a non-parametric sense of the relationship between debt to value ratios and credit availability or the commodity price index shock, we tabulate in Table 12 the residual of the debt to value ratio after partialling out all the usual explanatory variables in the standard specification other than log banks and the commodity price index shock (the list of variables is given in the footnote to the table). While the residual debt to value ratio increases with the commodity shock, and it increases with the number of banks, it falls at very high levels of the commodity shock and number of banks – suggesting an inverted U-shaped relationship with both.

The inverted U with respect to the commodity price index may have a straightforward explanation – at low values of the commodity price index, an increasing index allows more liquidity-constrained farmers to borrow and buy land or equipment as they have more equity from their current crops to make the necessary minimum down payments. Leverage might increase, if nothing else because more farmers can borrow. At high values of the commodity index, though, most farmers (apart from the few buying expensive land) may not need to borrow, and may instead use their income to pay down past debt.

The inverted U with respect to the number of banks is a little harder to account for. The persistence of the degree of credit availability in a county may be one explanation. In the well-banked areas, the willingness of banks to lend may have ensured that transactions took place steadily over time as commodity prices rose gently in the early twentieth century. There were fewer landless or tenant farmers that had the unfulfilled desire to buy or incumbent farmers with the unfulfilled desire to sell at the time of the significant commodity price shock (1917-20). As a result, with fewer late-boom transactions, leverage was lower – both because farmers paid down old debt and land values had risen since the debt was taken. In areas with less credit availability, it may have taken the commodity price boom to open up the credit spigot, so leverage was higher. These are conjectures, which will need to be examined in future research.

Let us now turn to the consequences of the boom once commodity prices collapsed.

IV. The Collapse and the Consequences of Initial Credit Availability

As described earlier, commodity 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.

As we described earlier, by 1922 farm incomes had recovered to the levels they had before the 1917-20 boom. So abstracting from the effects of credit and asset illiquidity, farm distress should have been temporary, and the effects should not have been seen beyond 1922. However, if the boom led to land and equipment purchases financed with debt that were hard to undo, we should see subsequent financial distress.

The average farm debt to value ratio moved up from an average of 26.4 percent in 1910 to 28.9 percent in 1920. This may not seem like much until we also recall that land prices were inflated in 1920. As a result, the extent of farm leverage was significant when commodity prices (and thus land prices) collapsed. The collapse in commodity prices would have made it hard for farmers to service their debt, 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.

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

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 13, 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 and 2 of Table 13, the dependent variable is the average annual bank failure rate between 1920 and 1929 while in column 3 and 4 the dependent variable is the average annual share of deposits of failed banks. The explanatory variables are as in Table 4A column 4, with the number of banks in 1920 instrumented in the second of each pair of columns. The coefficient estimate for the number of banks in 1920 in all columns is positive and statistically significant, while the coefficient estimate for the squared number of banks is negative and significant in three of the four specifications.

These estimates suggest that the marginal impact of credit availability, as measured by the log number of banks in 1920, on subsequent banking sector distress is positive up to the 97^{th} percentile of the log number of banks; only at the very top of the distribution then, did the positive marginal impact of credit availability on subsequent failures attenuate**.** The point estimates in column 1 imply that moving from the 25^{th} to 75^{th} percentile in the log number of banks in 1920 is associated with a 0.7 percentage point or a 0.24 standard deviation increase in the failure rate over the subsequent decade. The coefficient on the commodity price index shock and that on its interaction with the number of banks are not statistically significant in any of the columns.[25]

That defaults are higher in counties that had greater credit availability follows directly from our earlier finding that land prices were pushed higher in such counties.

[25] We also included the square of the commodity index as an explanatory variable throughout the paper, with little effect on the coefficient estimates, so for the sake of conciseness, we dropped it.

Also, we know that the direct impact of the commodity price shock on land prices in 1920, correcting for land prices in 1910, was small. So it is not surprising that it has little direct impact on failures. However, we also found that land prices were higher in areas that had both higher credit availability and a higher commodity shock. Interestingly, the interaction effect is insignificant in predicting failures. The explanation may have to do with debt to value ratios. As Table 12 suggests, counties with high credit availability and high commodity index shocks tended to have low debt to value ratios. So even though land prices were higher in these areas (and therefore had further to fall), farmers may have had more cushion because they did not borrow up to the full value of the inflated price.

4.2. Long Run Effects on Land Prices

Greater credit availability before the crisis led to greater subsequent bank failures when the commodity price shock reversed. Bank lending is not easily reversible, especially when loans are made against illiquid assets like farm land and machinery. The final question we address is whether the commodity price shock and credit availability had long run effects – for instance on the price of farm land over time.

The census bureau changed its estimate of land values to also include the value of buildings in 1940. To have the longest series possible, we calculate the value of this variable for each decade from 1920 to 1960—after 1960 the census ceased reporting land values. We then replace the dependent variable in the model estimated in Table 10 column 3 with the (augmented) land price in that and the subsequent decades, holding the explanatory variables the same. The coefficients from this exercise are in Table 14.

As earlier seen, and verified in column 1, the (augmented) land price in 1920 is positively related to the (instrumented) number of banks in 1920, though at a decreasing rate, and it is also positively related to the interaction variable. After the commodity price crash, though, the land price in 1930 is negatively related to the (instrumented) number of banks in 1920, though the coefficient estimate is not statistically significant – this suggests that the froth in land prices generated by credit availability had been completely reversed by 1930, and there is mild evidence of overshooting in the other direction. The land price in 1930 is also strongly negatively related to the positive commodity index shock in 1917-20, suggesting strong reversal. Finally, the coefficient of the interaction term is positive and significant, suggesting that banks in areas with both strong credit availability as well as a commodity price boom before 1920 did not fare as badly as the direct effects might suggest. One possible explanation was hinted at earlier – these were areas that had less leverage going into the crisis.

As we move to 1940, we see that areas that had higher credit availability before 1920 have significantly lower land prices in 1940. Evaluated at the mean level of the commodity index, a one standard deviation increase in the log number of banks in 1920 is associated with 0.28 standard deviation decline in the log price level in 1940. Recall that the early 1930s were a period of great turmoil for banks. So banks weakened by the farm crisis may have succumbed finally during the Depression years, further creating disinflationary pressures. This may be why the adverse effects of pre-1920 credit availability took time to be fully established. The coefficient estimates for the commodity price shock and for the interaction are similar to those estimated in 1930.

By 1950, the effects of the pre-1920 commodity price shock no longer seem to influence land prices significantly, and the coefficient on the interaction term is also no longer statistically significant, becoming greatly attenuated in magnitude by 1960. However, the effects of credit availability at the peak of the boom in 1920 continue to be very strong in 1950, as also in 1960. In 1960, land price in a county that was at the 75^{th} percentile of credit availability in 1920 is about 30 percent lower than the land price in a county that was at the 25^{th} percentile of credit availability in 1920. The effects of booms and busts driven by credit availability are very long lasting indeed.

V. Conclusion

How important is the role of credit availability in inflating asset prices? And what are the consequences of past greater credit availability when perceived fundamentals turn? 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 exogenous 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 and ceilings on interest rates are important regulatory features of the time that allow us to identify the effects of credit availability 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. Moreover, the areas that had greater credit availability during the commodity price boom had depressed land prices for a number of subsequent decades – probably because farm loan losses resulted in the failure of banks that lent to farmers, and depressed agricultural credit in subsequent decades.

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. 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 long run fallout if the shock happens to be temporary.

Tables and Figures

Table 1A. Summary Statistics: Banks, 1900-1920.

	Log Banks	Banks Per Square Mile	Banks per 1000 persons
		1900	
Mean	1.137	0.006	0.168
Standard Deviation	0.793	0.009	0.169
Observations	2716	2708	2611
		1910	
Mean	1.91	0.013	0.38
Standard Deviation	0.71	0.015	0.29
Observations	2832	2824	2817
		1920	
Mean	2.107	0.016	0.507
Standard Deviation	0.757	0.015	0.381
Observations	3015	2970	2975
		1900-1920	
Mean	1.735	0.009	0.360
Standard Deviation	0.861	0.011	0.329
Observations	8563	8502	8403

Table 1B. Correlation: Banks, 1900-1920.

	Log Banks	Banks Per Square Mile	Banks per 1000 persons
Log Banks	1		
Banks Per Square Mile	0.5820*	1	
Banks per 1000 persons	0.4637*	0.0876*	1

*denotes significance at the 5 percent level of better.

Figure 1. Average Interest Rate on Farm Loans, 1920 US Census.

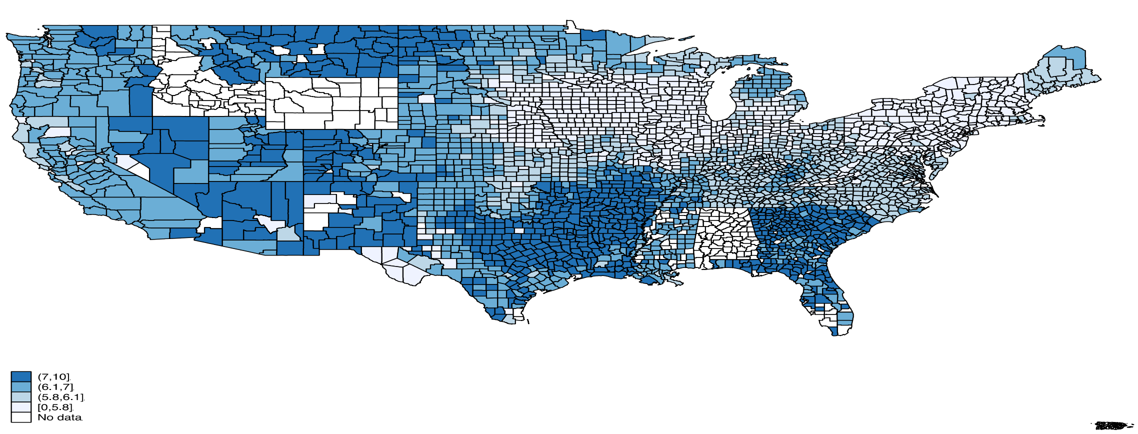

Table 2. Land Price Per Acre, 1910-1930, Summary Statistics.

	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			
US Census Data	3117	66.59	136.62	0.96
Department of Agriculture Data	329	75.82	67.43	
	1930			
US Census Data	3149	51.03	149.68	0.83
Department of Agriculture Data	436	42.72	37.52	

Notes to Table 2. 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 2. Land Price Per Acre Across US Counties, 1920 US Census.

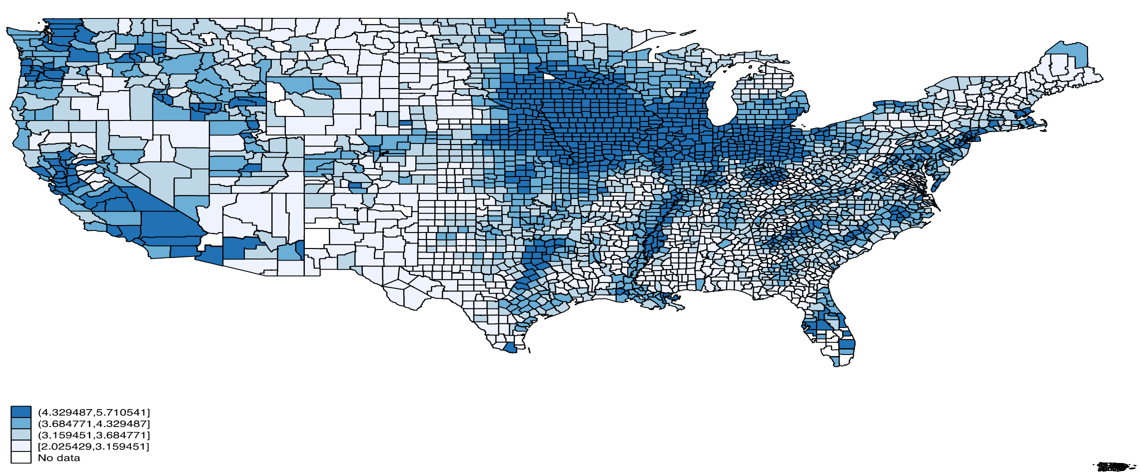

Figure 3. Changes in the Commodity Price Index and in the Price of Land Per Acre, 1910-1930.

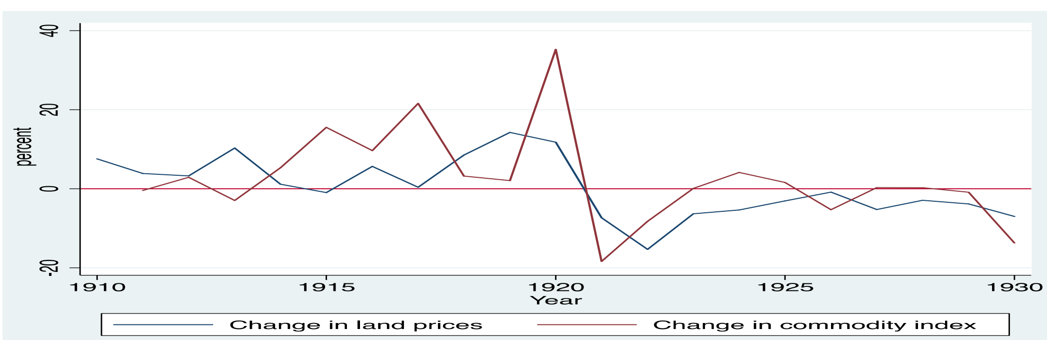

Figure 4. Land Price in 1920 vs Change in Commodity Index, 1910-1920.

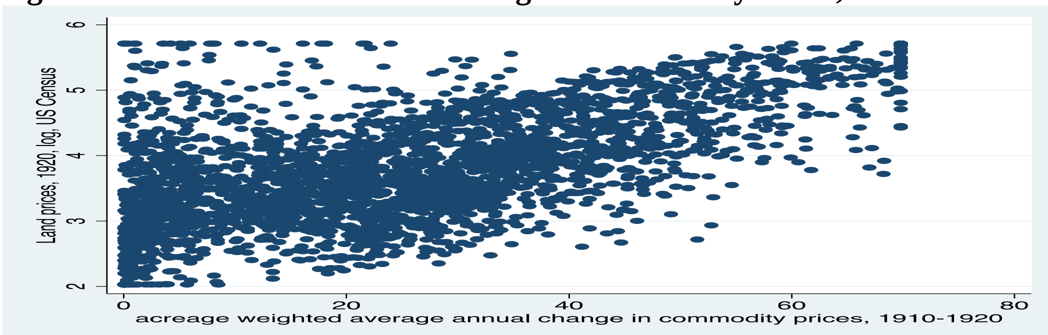

Table 3. Covariates, Summary Statistics

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

Notes to Table 3. Distance is in kilometers, area is in square miles, and value is in dollars. All variables are calculated by county.

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

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	No controls	Controls	Exclude Outliers	Man <95th %	Man <50th %	DOA Prices	Banks per area	Banks per capita
log number of banks, 1920	0.603***	0.234***	0.253***	0.213***	0.208***	0.393***	18.63***	332.2***
	(0.0351)	(0.0387)	(0.0321)	(0.0384)	(0.0546)	(0.0978)	(4.403)	(57.99)
Average rainfall		0.000674	-0.000528	8.77e-05	-0.00343	-0.000688	0.000316	0.000910
		(0.00191)	(0.00162)	(0.00196)	(0.00309)	(0.00538)	(0.00197)	(0.00198)
Standard deviation, rainfall		0.0126**	0.0144***	0.0131**	-0.00594	0.0114	0.0113*	0.0130**
		(0.00596)	(0.00494)	(0.00607)	(0.0106)	(0.0197)	(0.00623)	(0.00613)
Area, log		-0.277***	-0.268***	-0.269***	-0.406***	-0.469***	-0.185***	-0.262***
		(0.0434)	(0.0361)	(0.0501)	(0.0742)	(0.0908)	(0.0482)	(0.0492)
Mississippi distance, log		0.0357	0.0474	0.0350	0.0459	-0.0156	0.0310	0.0332
		(0.0334)	(0.0313)	(0.0329)	(0.0406)	(0.0425)	(0.0332)	(0.0309)
Atlantic distance, log		0.0602*	0.0708**	0.0719*	0.0577	0.137**	0.0734*	0.0707*
		(0.0337)	(0.0339)	(0.0368)	(0.0482)	(0.0549)	(0.0393)	(0.0371)
Great lakes distance, log		-0.0758*	-0.0835**	-0.0924*	-0.189*	-0.107	-0.0905*	-0.0936*
		(0.0429)	(0.0347)	(0.0485)	(0.106)	(0.0832)	(0.0489)	(0.0479)
Pacific distance, log		0.00638	-0.0187	0.00618	0.295*	-0.200	-0.0125	0.0154
		(0.0693)	(0.0596)	(0.0722)	(0.165)	(0.165)	(0.0680)	(0.0738)
Black population, log		-0.00269	0.00297	-0.00161	0.00380	0.00558	-0.000387	-0.00127
		(0.0124)	(0.0103)	(0.0118)	(0.0113)	(0.0242)	(0.0124)	(0.0122)
Urban population, log		0.00174	0.00170	0.00133	0.000764	0.00656	0.00190	0.00227
		(0.00147)	(0.00138)	(0.00154)	(0.00223)	(0.00540)	(0.00158)	(0.00162)
Illiterate population, log		-0.0313	-0.0326*	-0.0247	-0.0118	-0.0102	-0.0443*	-0.0276
		(0.0228)	(0.0176)	(0.0228)	(0.0280)	(0.0628)	(0.0224)	(0.0220)
Population 5-17 years, log		-1.009***	-1.122***	-1.126***	-1.600***	-1.753***	-1.053***	-1.161***
		(0.265)	(0.206)	(0.273)	(0.340)	(0.522)	(0.286)	(0.280)
Total population, log		1.160***	1.241***	1.281***	1.822***	1.836***	1.312***	1.488***
		(0.239)	(0.190)	(0.244)	(0.302)	(0.438)	(0.264)	(0.263)
Manufacturing share		-0.251***	-0.247***	-0.263***	-0.356*	-0.401***	-0.337***	-0.267***
		(0.0534)	(0.0425)	(0.0486)	(0.177)	(0.120)	(0.0616)	(0.0520)
Value of crops per acre		0.0335***	0.0354***	0.0342***	0.0334***	0.0302***	0.0340***	0.0349***
		(0.00265)	(0.00280)	(0.00268)	(0.00339)	(0.00368)	(0.00277)	(0.00270)
Observations	3,008	2,744	2,599	2,584	1,341	312	2,584	2,584
R-squared	0.612	0.845	0.889	0.855	0.876	0.879	0.852	0.854

Notes to Table 4A. 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 4B. Log Land Price Per Acre and Banks—Robustness.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Interest Rate	Deposits	East North Central	West North Central	South	State and National Banks		
Interest Rate	-0.251***							
	(0.0453)							
log number of banks, 1920		0.217***	0.130*	0.325***	0.170***			
		(0.0337)	(0.0537)	(0.0500)	(0.0368)			
log deposits, 1920		-0.00305						
		(0.0173)						
log number of state banks						0.152***		
						(0.0257)		
log number of ntl banks						0.103***		
						(0.0220)		
State banks per area							20.14***	
							(5.102)	
Ntl banks per area							15.05*	
							(8.488)	
State banks per capita								309.9***
								(61.90)
National banks per capita								540.8***
								(131.6)
Observations	2,443	2,584	429	587	851	2,584	2,584	2,584
R-squared	0.864	0.855	0.905	0.928	0.788	0.855	0.852	0.855

Notes to Table 4B. All standard errors clustered at the state level. ***,**,* denotes significance at the 1, 5 and 10 percent level. The dependent variable is the log of land price per acre in 1920. All columns include state fixed effects, and the baseline controls in Table 4A column 2.

Table 5. County Fixed Effects and IV Estimates

	Dependent Variable: Log Land Price Per Acre		
	(1)	(2)	(3)
VARIABLES	1900-1920 county and year fixed effects	OLS	IV
log number of banks	0.0925**		
	(0.0373)		
log number of banks, 1910		0.277***	
		(0.0379)	
log number of banks, 1920			0.587***
			(0.0775)
Observations	8,137	2,478	2,464
R-squared	0.954	0.742	0.752

Notes to Table 5. All standard errors clustered at the state level. ***,**,* denotes significance at the 1, 5 and 10 percent level. Column 1 includes county and year fixed effects along with the baseline demographic controls in Table 4A column 2. Columns 2 and 3 restrict the sample to the 1920 crossection. The controls include the demographic and geographic controls in Table 4A column 2, along with state fixed effects. In column 3 the instrument is the log number of banks, 1910. The first stage point estimate is 0.470 with a t-statistic of 18.03.

Table 6. Borders, Banks and Prices

	(1)	(2)	(3)
VARIABLES	Dependent Variable: Log Price Per Acre in 1920, Census		
	100 mile window	80 mile window	90 mile window
log number of banks, 1920	0.187***	0.202***	0.111**
	(0.0365)	(0.0372)	(0.0531)
In state banks 0-50 miles	0.117***		
	(0.0295)		
In state banks 50-100 miles	0.00694		
	(0.0440)		
Out of state banks 0-50 miles	0.0240***		
	(0.00788)		
In state banks 0-40 miles		0.107***	
		(0.0210)	
In state banks 40-80 miles		0.0129	
		(0.0419)	
Out of state banks 0-40 miles		0.0234***	
		(0.00741)	
In state banks 0-30 miles			0.0381**
			(0.0147)
In state banks 30-60 miles			0.0563
			(0.0357)
In state banks 60-90 miles			-0.0376
			(0.0318)
Out of state banks 0-30 miles			0.00890
			(0.00675)
Out of state banks 30-60 miles			0.0119
			(0.00719)
Observations	2,226	1,962	2,067

Table 6 Continued			
R-squared	0.865	0.866	0.878
F test: In state “0-nearest” -Out of State “0-nearest” =0	11.58	18.08	3.916
Prob > F	0.00143	0.000109	0.0541

Notes to Table 6. 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 4A, column 2. 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-x miles” refers to the average log number of banks in in-state counties whose centroid is less than x miles from the centroid of the county of interest. “Out of state banks 0-x miles” refers to the average log number of banks in out-of-state counties whose centroid is less than x miles from the centroid of the county of interest.

Table 7. 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 miles	100 miles
	Bank variable: Banks Per Capita								
Bank Difference	343.1***	289.8***	347.2***	366.8***	375.4***	395.5***	411.3***	407.9***	416.5***
	(57.06)	(40.83)	(37.93)	(38.34)	(38.20)	(35.23)	(33.50)	(32.34)	(32.19)
Bank Difference*Out of State	207.3*	158.1**	143.8**	148.1**	138.0**	116.7**	117.0**	120.9***	125.8***
	(113.7)	(69.82)	(61.53)	(58.05)	(53.84)	(50.82)	(47.61)	(45.76)	(43.26)
Out of State	-0.0135	-0.0300	-0.0313*	-0.0384**	-0.0490***	-0.0441***	-0.0453***	-0.0448***	-0.0432***
	(0.0266)	(0.0203)	(0.0184)	(0.0176)	(0.0165)	(0.0164)	(0.0161)	(0.0157)	(0.0154)
	824	1,856	4,546	9,005	15,302	22,623	30,986	40,418	50,362
	0.570	0.607	0.613	0.645	0.664	0.679	0.688	0.692	0.697
	Bank Variable: Banks per Area								
Bank Difference	15.92***	12.33***	15.13***	13.78***	15.18***	16.98***	18.07***	19.06***	20.25***
	(3.691)	(2.728)	(2.698)	(2.476)	(2.573)	(2.490)	(2.533)	(2.461)	(2.493)
Bank Difference*Out of State	7.352	7.867**	-0.382	4.221	-2.616	-3.517	-3.225	-2.971	-1.856
	(4.630)	(3.853)	(3.746)	(3.317)	(2.693)	(2.617)	(2.443)	(2.314)	(2.228)
Out of State	-0.000952	-0.0275	-0.0333*	-0.0402**	-0.0530***	-0.0478***	-0.0498***	-0.0497***	-0.0475***
	(0.0264)	(0.0206)	(0.0190)	(0.0181)	(0.0171)	(0.0168)	(0.0165)	(0.0160)	(0.0157)
	824	1,856	4,546	9,005	15,302	22,623	30,986	40,418	50,362
	0.559	0.595	0.597	0.630	0.649	0.666	0.675	0.680	0.686

Notes to Table 7. 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 4A 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 (scaled by county population (top panel) or area (bottom panel) across borders. Out of state is an indicator that equals 1 if the county pair is formed across a state border.

Table 8. Deposit Insurance, Banks and Prices

	(1)	(2)	(3)	(4)	(5)
	Dependent variable: Log land price per acre in 1920				
EXPLANATORY VARIABLES					
Log number of state banks	0.131***				
	(0.0255)				
Log state banks*Deposit Insurance	0.0771**				
	(0.0364)				
Log number of national banks		0.0644***			
		(0.0227)			
Log national banks*Deposit Insurance		0.0625*			
		(0.0323)			
Log number of banks			0.218***	0.218***	0.064
			(0.0411)	(0.0394)	(0.133)
Log banks*Deposit Insurance			0.0865**	0.134***	0.173***
			(0.0406)	(0.0436)	(0.028)
Observations	2,743	2,743	2,743	2,743	152
R-squared	0.843	0.839	0.846	0.846	0.946

Notes to Table 8. 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 4A, 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 9. Land Price Residual, Banks and Commodity Index

				Commodity Index, 1917-1920				
				Quartiles				
				1	2	3	4	Total
Banks 1920, (log)	Quartiles	1	Mean	-0.007	-0.033	-0.081	-0.023	-0.030
			Std. Dev	0.290	0.211	0.198	0.243	0.246
			Obs	244	211	109	91	655
		2	Mean	0.006	-0.029	0.018	0.039	0.005
			Std. Dev	0.274	0.228	0.198	0.225	0.236
			Obs	191	180	163	128	662
		3	Mean	-0.036	-0.003	-0.005	0.086	0.016
			Std. Dev	0.282	0.194	0.174	0.219	0.219
			Obs	118	134	198	182	632
		4	Mean	-0.017	-0.047	0.014	0.042	0.011
			Std. Dev	0.261	0.191	0.177	0.184	0.196
			Obs	64	101	157	229	551

	Table 9 Continued							
		Total	Mean	-0.010	-0.028	-0.008	0.045	0.000
			Std. Dev	0.280	0.209	0.188	0.214	0.227
			Obs	617	626	627	630	2500

Notes to Table 9. Means and standard deviations are tabulated for the residual from a regression of the log land price on the variables in Table 4A, column 2, excluding the log number of banks and crop values per acre. Commodity index is the acreage weighted average annual change in commodity prices in the county, 1917-1920.

Table 10. Land Prices, Banks and Commodity Index

	(1)	(2)	(3)
VARIABLES	OLS	OLS	IV
log banks, 1920	0.434***	0.209***	0.202**
	(0.0978)	(0.0421)	(0.0832)
log banks, 1920, squared	-0.0474**	-0.0354***	-0.0627***
	(0.0233)	(0.00931)	(0.0183)
Commodity Index, 1917-1920	0.125***	0.00722	-0.00415
	(0.0349)	(0.0171)	(0.0205)
Commodity index* log banks, 1920	0.0117	0.0134**	0.0192***
	(0.0105)	(0.00577)	(0.00742)
Observations	2,505	2,505	2,464
R-squared	0.816	0.928	0.927

Notes to Table 10. All standard errors clustered at the state level. ***,**,* denotes significance at the 1, 5 and 10 percent level. The dependent variable is the log land price per acre in 1920. All columns include state fixed effects, and the baseline controls in Table 4A, column 2, excluding crop values per acre. Columns 2 and 3 include the log land price per acre in 1910 as an additional control variable. Column 3 instruments log banks in 1920; log banks, 1920, squared; and Commodity index* log banks, 1920 with log banks in 1910; log banks, 1910, squared; and Commodity index* log banks, 1910.

Table 11. Margins, Investment, Banks and the Commodity Index

	(1)	(2)	(3)
VARIABLES	Fraction of land in farming, 1920	Fraction improved land, 1920	Log value of farm equipment and machinery, 1920
	IV		
log banks, 1920	0.0230	0.0322*	0.420***
	(0.0241)	(0.0179)	(0.0853)
log banks, 1920, squared	-0.0111	-0.00578	-0.0979***
	(0.00714)	(0.00488)	(0.0185)
Commodity Index, 1917-1920	-0.00251	-0.000188	0.0136**
	(0.00217)	(0.00152)	(0.00639)
Commodity index* log banks, 1920	0.00709	0.0121***	-0.00922
	(0.00579)	(0.00445)	(0.0187)
Fraction of land in farming, 1910	0.847***		
	(0.0283)		
Fraction improved land, 1910		0.751***	
		(0.0337)	
Log value of farm equipment and machinery, 1910			0.756***
			(0.0423)
Observations	2,464	2,464	2,464
R-squared	0.923	0.939	0.940

Notes to Table 11: 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 4A, column 2, excluding crop values per acre. In all specifications, log banks in 1920 and its various interaction terms are instrumented by log banks in 1910. The fraction of land in farming is defined as the ratio of farmland to total land in the county. The fraction improved land is defined as the ratio of improved acreage to total farmland.

Table 12. Debt to Value, Banks and Commodity Index

				Commodity Index, 1917-1920				
				Quartiles				
				1	2	3	4	Total
Banks 1920, (log)	Quartiles	1	Mean	-0.467	-0.004	0.193	-0.315	-0.162
			Std. Dev	5.344	5.283	4.817	6.215	5.272
			Obs	222	226	104	31	583
		2	Mean	0.341	0.107	0.447	0.308	0.294
			Std. Dev	4.655	4.125	3.878	4.127	4.238
			Obs	156	141	119	55	471
		3	Mean	0.263	0.450	0.462	-0.633	0.115
			Std. Dev	3.707	3.440	3.513	3.049	3.442
			Obs	138	137	211	187	673
		4	Mean	-0.088	0.015	0.268	-0.478	-0.178
			Std. Dev	3.013	2.675	3.005	2.606	2.782
			Obs	81	90	163	325	659
		Total	Mean	-0.036	0.130	0.359	-0.446	0.002
			Std. Dev	4.553	4.292	3.715	3.182	3.979
			Obs	597	594	597	598	2386

Notes to Table 12. Means and standard deviations are tabulated for the residual from a regression of the average debt to value ratio in 1920 on its 1910 value along with the variables in Table 4A, column 2, excluding the log number of banks, and crop value per acre. Commodity index is the acreage weighted average annual change in commodity prices in the county, 1917-1920.

Table 13. Banking Distress 1920-1929, Banks and Commodity Index

	(1)	(2)	(3)	(4)
VARIABLES	Bank Suspension Rate, 1920-1929		Deposits Suspension Rate, 1920-1929	
	OLS	IV	OLS	IV
log banks, 1920	0.0269***	0.0171*	0.0198***	0.0197**
	(0.00510)	(0.00973)	(0.00433)	(0.00813)
log banks, 1920, squared	-0.00410***	-0.00334	-0.00192*	-0.00286
	(0.00120)	(0.00214)	(0.00110)	(0.00175)
Commodity Index, 1917-1920	-6.24e-05	-6.07e-05	-0.000682	1.94e-05
	(0.000462)	(0.000699)	(0.000556)	(0.000594)
Commodity index* log banks, 1920	0.000782	0.000951	0.00197	0.000235
	(0.00108)	(0.00172)	(0.00152)	(0.00156)
Observations	2,477	2,447	2,474	2,446
R-squared	0.396	0.395	0.339	0.341

Notes to Table 13. 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 4A, column 2, excluding crop values per acre. In all IV specifications, log banks in 1920 and its various interaction terms are instrumented by log banks in 1910.

Table 14. The Evolution of Land Prices, Banks and Commodity Index

	(1)	(2)	(3)	(4)	(5)
VARIABLES	Log Price Per Acre, 1920	Log Price Per Acre, 1930	Log Price Per Acre, 1940	Log Price Per Acre, 1950	Log Price Per Acre, 1960
	IV				
log banks, 1920	0.205**	-0.104	-0.386***	-0.722***	-0.331***
	(0.0820)	(0.0710)	(0.0859)	(0.146)	(0.105)
log banks, 1920, squared	-0.0585***	-0.0154	0.0408	0.130***	0.0441
	(0.0185)	(0.0225)	(0.0267)	(0.0312)	(0.0288)
Commodity Index, 1917-1920	0.0147**	0.0223***	0.0197*	0.0185	0.00878
	(0.00682)	(0.00788)	(0.0103)	(0.0134)	(0.0118)
Commodity index* log banks, 1920	-0.00264	-0.0903***	-0.104***	-0.0405	-0.0283
	(0.0184)	(0.0238)	(0.0253)	(0.0375)	(0.0340)
Observations	2,454	2,454	2,453	2,454	2,454
R-squared	0.928	0.874	0.836	0.747	0.777

Notes to Table 14. 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 4A, column 2, excluding crop values per acre. In all specifications, log banks in 1920 and its various interaction terms are instrumented by log banks in 1910.

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. "Farm Foreclosure Moratorium Legislation: A Lesson from the Past", *American Economic Review*, vol 74, No. 3, June 1984, pp 445-457.

Alston, Lee J. "The Role of Financial Institutions as Sources of Farm Mortgage Credit: 1916-1940," in D. Martin and G.T. Mills eds., *Dictionary of the History of American Banking*, Westport: Greenwood Press.

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

Benner, Claude L. "Credit Aspects of the Agricultural Depression, 1920-1921", *Journal of Political Economy,* Vol 33, 1925, 217-233.

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).

Davis, Joseph. "World Banking, Currency, and Prices, 1920-1921", *Review of Economics and Statistics*, Vol 3, No 9, 1921, pp 304-325.

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

Wicker, Elmus. "A Reconsideration of Federal Reserve Policy During the 1920-1921 Depression", *Journal of Economic History, vol 26, No. 2, 1966, pp. 223-238.*

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.