Developments in Land Prices and Bank Lending in Interwar Japan: Effects of the Real Estate Finance Problem on the Banking Industry

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This paper investigates the relationship between fluctuations in asset prices and the real economic activity in interwar Japan, focusing on the effects of land price movements on the volume of bank lending. When what is called the "real estate finance problem" arose in the 1920s and the beginning of the 1930s, falling land prices may have affected bank lending, possibly due to the reduced collateral value of real estate held by borrowers and the reduced risk-taking capacity of the banking industry caused by impaired equity capital. Fluctuations in land prices and changes in the volume of lending made by ordinary and savings banks show similar developments, and regression analyses including panel data analyses at the prefectural level have indicated a significant relationship between land prices and bank lending. With respect to the equity capital of banking industry, consideration has been given to the scale of losses in real estate collateral loans caused by falling land prices, based on data from the Nihon Kangyo Bank.

Key words: Interwar economy; Financial crisis; Showa depression; Asset prices; Stability of the financial system

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I. Introduction

Much effort has been devoted to investigating the cause of the Great Depression in the United States, the focus of which has ranged from monetary factors to real factors and to debt-deflationary factors. In recent years, we have seen progress in theoretical and empirical studies. Bernanke (1995), who has conducted empirical research on the interwar U.S. economy, argues that when there is asymmetry of information between borrowers and lenders in financial markets, a reduction in the net worth of indebted corporations and households resulting from a decline in asset prices constrains the supply of funds at the macro level, influencing the real economic activity. This effect is of particular concern when the soundness of the banking industry is undermined.

Turning to Japan, falling asset prices and an unsound banking industry likely dragged down the economy during the interwar period just as in the United States. The 1920s witnessed deflation, low growth, and instability in the financial system with the repercussive depression of 1920, the Great Kanto Earthquake of 1923, and the financial crisis of 1927, followed by the Showa depression (1930–31), which coincided with the worldwide Great Depression. In the context of the "real estate finance problem," prior research on asset values during the interwar period has explored individual financial institutions and developments in policy measures. However, there has been little research on the overall banking industry or on the effects on the real economic activity.

This paper investigates the question of whether the decline in land prices during the interwar period constrained bank lending or undermined the soundness of the banking industry as a whole. The paper is organized as follows: Section II outlines developments in asset prices and the economy during the interwar period, including industrial structure and flow of funds, and then surveys leading research on asset prices and the real side of the economy during this period in Japan. Section III reviews the state of collateral lending by ordinary and savings banks,[1] examines the relationship between fluctuations in land prices at the national and prefectural levels and changes in lending volume of these banks, and looks at losses incurred by these banks due to falling land prices. Section IV provides a summary of the arguments presented in this paper.

II. Asset Prices and the Economy

A. Economic Developments in Asset Prices during the Interwar Period
1. Economic growth, commodity prices, stock prices, and land prices
This subsection reviews developments in the interwar Japanese economy, including the real side of the economy, and looks at fluctuations in asset prices, especially land and stock prices. The interwar period can be divided into four sub-periods as

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1. In the interwar period, the banking industry in Japan consisted of two sorts of banks, ordinary and savings banks established by the Bank Act or the Savings Bank Act and specialized banks established by special acts for particular policy purposes such as the Nihon Kangyo Bank and the Hokkaido Takushoku Bank.

described by Nakamura (1989): the boom period around World War I (WWI), the period of deflation during the 1920s, the period of global depression at the beginning of the 1930s, and the period of recovery and growth after 1932 (the period of the Takahashi Economic Policy) (Table 1 and Figure 1).

Table 1 Real GNP, GNP Deflator, Asset Prices, and Bank Lending in Interwar Japan

Percent, except as indicated

	Real GNP					Annualized percentage change in GNP deflator	Annualized percentage change in stock prices	Annualized percentage change in agricultural land prices (rice paddies)	Annualized percentage change in lending by ordinary and savings banks	Annualized percentage change in local bank lending (excluding the five largest banks)
	Amount of the final year (¥ billions)	Annualized percentage change	Individual consumption	Capital investment	Others					
1913–19	11.4	5.4	4.5	14.9	3.5	12.2	10.6	13.2	22.2	21.6
1920–29	13.7	1.8	2.3	−3.2	3.5	−1.3	−6.5	−3.0	0.7	−0.4
1930–31	13.9	0.8	1.4	−10.2	3.7	−10.3	−14.8	−12.0	−4.0	−5.9
1932–36	18.7	6.1	2.8	15.4	20.1	1.5	6.0	1.3	−0.2	−3.1

Sources: Ohkawa *et al.* (1974); Fujino and Akiyama (1977); Takamatsu (1966); Goto (1970).

Figure 1 Stock Prices and Land Prices in the Interwar Japan

1919 = 100

Sources: Fujino and Akiyama (1977); Takamatsu (1966); Committee for Compiling the One-Hundred-Year History of the Bank of Japan (1986).
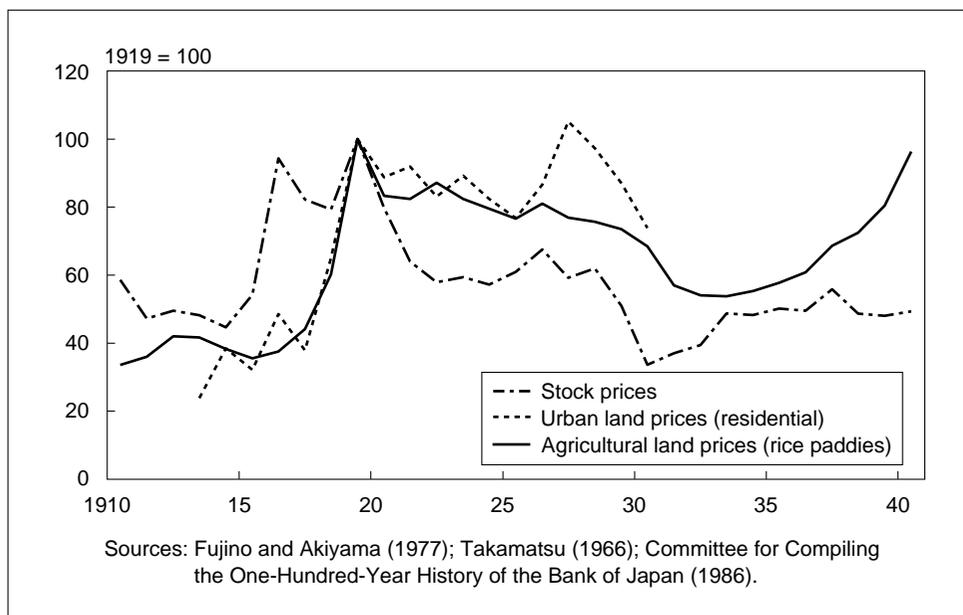
In the boom period (1913–19) around WWI, an increase in the export of textiles to Asia and North America and the emergence of the heavy and chemical industries resulting from reduced imports from the United States and Europe fueled real economic growth. Domestic prices rose significantly, reflecting tight demand in domestic and overseas markets and rising prices in international commodity markets. Though the economy temporarily backtracked following the end of the war, it rebounded in mid-1919, owing to increases in domestic demand led by consumption and investment and in overseas demand associated with economic restoration in Europe. Along with

the economy, stock prices rose by 22 percent in 1915 and by 74 percent in 1916 over the previous year. After falling slightly in 1917–18, stock prices rebounded in 1919 to a level 2.1 times that of 1913.[2] Agricultural land prices (rice paddies) declined during 1913–15, rose in 1916–19, and in 1919 reached a level 2.4 times that of 1913.[3] Urban land prices (residential) followed a modestly increasing trend during 1914–17, and then rose significantly in 1918–19, attaining in 1919 a level 4.2 times that of 1913.[4]

The 1920s (1920–29) witnessed low real economic growth and instability in the financial system, with the repercussive depression (1920) resulting from a decline in exports, the destruction caused by the Great Kanto Earthquake in 1923, and the financial crisis of 1927. The low real economic growth in this period is referred to as "chronic recession" by some observers (Ouchi [1962]). Nevertheless, domestic demand rose steadily, driven by the growth in heavy and chemical industries, by investments in infrastructure including electric power, railroads, and telecommunications, and by rapid urbanization. Domestic prices declined slightly in the first half of the 1920s and substantially in the latter half of the 1920s, as commodity prices fell in international markets and international supply capacity grew with postwar reconstruction. Stock prices began to fall in 1920, and by 1922 declined to 58 percent of their peak values in 1919. They were flat during 1923–24, increasing slightly in 1925–26, before falling thereafter. During this period, agricultural land prices were in overall decline, and had fallen to 74 percent of their peak in 1919 by 1929. During the first half of the 1920s, urban land prices fell overall, then rose in 1926–27 before falling again, so that the 1929 level was 87 percent of the 1919 level.

In the wake of the Great Depression, the years 1930–31 witnessed the appreciation of exchange rates, which accompanied the lifting of the gold embargo and resulted in a receding economy. The rate of real economic growth plunged and commodity prices fell dramatically in this period. In 1930, stock prices fell by 34 percent from the previous year, before increasing by 10 percent in 1931. Meanwhile, agricultural land prices fell by 7 percent from the previous year in 1930 and by 17 percent in 1931.[5]

During the recovery and growth period in 1932–36, the rate of real economic growth rose, with commodity prices beginning to rise as well, due to the Takahashi

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2. Stock price indexes are from Fujino and Akiyama (1977). These stock indexes are a composite of 76 stocks listed on the Tokyo Stock Exchange in industries including coal mining, oil, fisheries, railroads, marine transportation, gas, electric, cotton spinning, foodstuffs, chemicals, utensils, banking, insurance, stock exchange, and others. Estimates are made by the Fisher formula, using 1934–36 transaction volumes as weight, with each stock price standardized according to the 1934–36 level.

3. Agricultural land prices are based on long-term estimates made by Takamatsu (1966). While agricultural land includes plowed fields as well as rice paddies, this paper focuses its analysis on the prices of rice paddies. On this point, Hashimoto (1994) analyzes land prices during the period 1913–41, based on *Sales Prices of Agricultural Land and Rents* by the Nihon Kangyo Bank, and comments that price fluctuations for rice paddies and plowed fields are similar, and that there is no year during which the direction of price movements differed between rice paddies and plowed fields. Thus, he concludes that the factors determining the prices of rice paddies and plowed fields are the same.

4. Urban land prices are average residential land sales prices in the six major metropolitan areas of Tokyo, Kyoto, Osaka, Yokohama, Kobe, and Nagoya as given in publications from the Committee for Compiling the One-Hundred-Year History of the Bank of Japan (1986). Figures are computed for the period 1913–30.

5. Statistics for urban land prices after 1936 are available from the Japan Real Estate Institute, but there are few statistics available for the period 1931–36, and details are unclear. In a study by the Nihon Kangyo Bank (1953), the average land price index for the districts in the city of Tokyo (computed by the bank) was 84 in 1930, 67 in 1931, 69 in 1932, and 65 in 1933. Accordingly, land prices in the area fell by more than 20 percent in 1931, but were almost flat in 1932–33.

Economic Policy, which conducted an exchange rate policy featuring the free depreciation of the yen, lower interest rates, and increased government expenditures. Stock prices increased, so that they were up by 34 percent in 1936 compared to the level of 1931.[6] Agricultural land prices bottomed out in 1933, and by 1936 they had risen to 13 percent above the 1933 level.

In summary, the boom period around WWI witnessed rising real GNP, commodity prices, and asset prices. During the 1920s, real GNP continued to grow, whereas commodity prices and asset prices fell. At the start of the 1930s, commodity prices and asset prices plunged, whereas real GNP remained roughly flat. In the ensuing period of recovery and growth beginning in 1932, commodity prices and asset prices rebounded, and real GNP increased.

2. Changes in the industrial structure

It is useful to look at the characteristics of and changes in the industrial structure and financial intermediations in order to properly assess the relationship between asset prices and the real economic activity. Ohkawa *et al.* (1974) estimates net domestic product by industry for the prewar and interwar period.[7] Prior to WWI, the "agricultural, forestry, and fishery industries" and "commercial and service industries" each accounted for more than 30 percent, whereas "mining and manufacturing industries" totaled only 20 percent (Table 2). The "commercial and service industries" included large numbers of traditional domestic wholesale and retail businesses in addition to trading companies owned by the *zaibatsu*. From 1928, the proportion of the mining and manufacturing industries exceeded that for the agriculture, forestry, and fishery industries. The 1920s witnessed increasing proportions for "transportation, telecommunications, and public utilities industries," led by the electric power and telecommunications industries. The contribution of mining and manufacturing industries further increased in the 1930s, and such trends became especially marked in the latter half of the 1930s during the transition to a wartime economy.

Table 2 Percentage Distribution of Net Domestic Product by Industry in Japan

Percent, except as indicated

	Net domestic product (¥ billions)	Agricultural, forestry, and fishery industries	Mining and manufacturing industries	Transportation, telecommunications, and public utilities industries	Commercial and service industries
1910	3.6	30.8	20.4	6.3	33.1
1915	4.6	27.8	24.4	7.4	32.0
1920	13.6	29.5	23.5	7.8	32.0
1925	15.5	26.9	20.5	10.2	32.6
1930	13.0	16.6	24.2	12.2	35.7
1935	16.4	17.3	29.0	9.8	33.5
1940	35.6	18.3	38.6	6.9	26.0

Source: Ohkawa *et al.* (1974).

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6. During this period, the total market value of the stocks listed on "long-term settlement" section of the Tokyo Stock Exchange increased approximately threefold, from ¥2.6 billion at the beginning of 1931 to ¥7.6 billion at the beginning of 1937, owing to a rise in stock prices and the increased number of listed stocks.

7. Ohkawa *et al.* (1974) does not estimate the gross domestic product by industry due to inaccuracy of data.

Shinohara (1972) calculates the value of production by sectors in the manufacturing industry. Prior to WWI, the majority of production was light manufacturing, including food products and textiles. The proportion of textiles continued to increase in the first half of the 1920s, but industries such as chemicals and steel increased their proportion in the latter half of the 1920s. In the 1930s, the proportion of food products and textiles declined, whereas the proportion of both steel and machinery increased rapidly (Table 3).

Table 3 Percentage Distribution of Industrial Production by Industry in Japan

Percent, except as indicated

	Industrial production (¥ billions)	Food products	Textiles	Chemicals	Steel	Nonferrous metals	Machinery
1910	2.0	34.0	33.6	11.4	1.8	1.6	6.5
1915	2.8	27.2	33.1	11.8	4.5	3.8	9.3
1920	9.5	23.9	34.3	12.4	4.6	1.9	14.5
1925	10.1	25.6	39.4	10.1	4.4	2.0	7.2
1930	8.8	25.0	30.6	12.8	6.2	2.5	11.3
1935	14.9	16.4	29.1	14.4	10.0	2.8	16.3
1940	33.2	12.2	16.8	16.6	14.0	2.4	25.9

Source: Shinohara (1972).

3. Finance in the private sector

In their estimate of the flow of funds in the interwar period, Fujino and Teranishi (2000) show that "borrowings" totaled over 60 percent of the overall private sector fund-raising in 1915, followed by "securities," which was over 30 percent. Thereafter, the proportion of securities gradually increased, pulling ahead of borrowings in the latter half of the 1920s (Figure 2).

It is difficult, however, to establish a convincing interpretation of private financing, as no statistics exist that provide a breakdown of corporate and household financing. Past analyses utilize mainly individual statistics and materials, such as financial statements of corporations and farm-household surveys. The views in such analyses vary depending on the perspective of the observers, as well as the statistics and materials used. Leading research on corporate financing can be divided into two major categories: the direct financing view and the indirect financing view. For the former, Okazaki and Okuno (1993) assert that the primary source for funds had been direct financing through the issuance of stocks or bonds on the open market, and that corporate capital demand was met primarily by borrowings from financial institutions only after around 1936. Kataoka and Teranishi (1996) also state that corporations prior to the World War II (WWII) period raised funds primarily through direct financing via the securities market, and that the proportion of funds by indirect financing through banks was small.[8] On the other hand, for the latter, Ishii (1997)

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8. In regard to the function of capital markets, Teranishi (1989) observes that some companies could finance through the capital markets (companies such as the rising *zaibatsu*, which were active in the heavy and chemical industries in which the minimum capital requirements were large, and electrical companies, which raised funds from the

Figure 2 Funding Patterns in the Private Sector in Japan

Source: Fujino and Teranishi (2000).
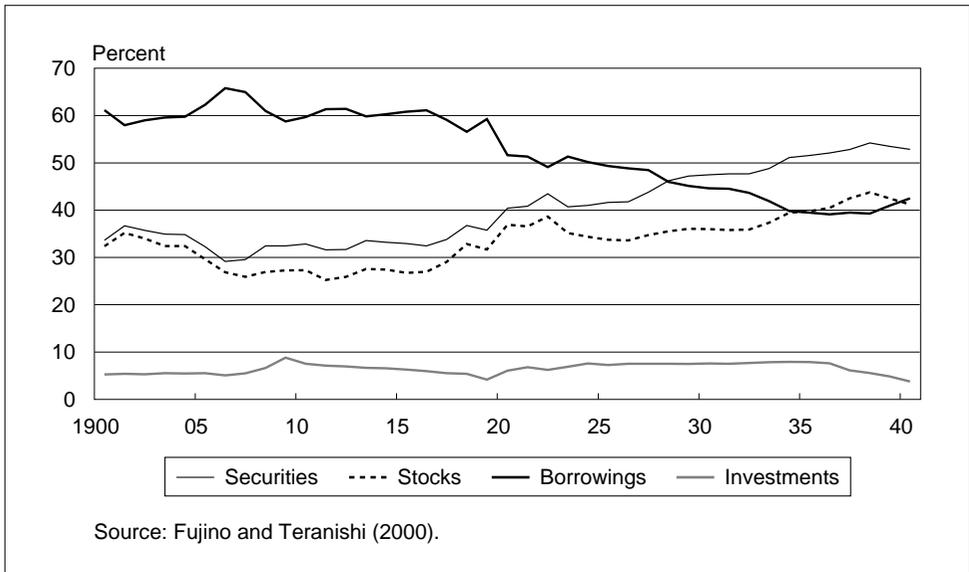
emphasizes the importance of the indirect financing. He points out that shareholders depended on borrowings from banks for their capital payments, and that banks had purchased corporation bonds extensively.[9]

There was heavy borrowing in the private sector, which consists of households engaged in the agricultural, forestry, and fishery industries (the primary interwar industries) and also includes those engaged in commercial and handicraft industries as subsidiary businesses. It is likely that they borrowed mainly from specialized banks and local ordinary and savings banks, as well as through the granting of credit between individuals.

B. Leading Empirical Research on the Relationship between Asset Prices and the Real Economic Activity

Much research has been conducted on the relationship between asset values and the real economic activity. This subsection takes up exclusively those issues related to fluctuations in asset values during the interwar period, and in particular, the effects of falling stock prices and land prices on the real economic activity after WWI.

Land prices and stock prices affect the real economic activity, possibly through credit rationing effects and wealth effects. Credit rationing effects refer to the process in which fluctuations in asset prices affect collateral values and consequently affect

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European and U.S. markets using foreign currency-denominated bonds). Teranishi argues that the growth of capital markets was promoted by increasing demand for securities by middle-class households. However, he notes that since the issuers tended to avoid disclosure of information, the growth of the securities markets was limited.

9. Ito (1995) notes the importance of "stock collateral financing" of banks to individual stockholders; this served as a kind of "detour funding" from the banks to the corporations through the individual stockholder. However, Hoshi and Kashyap (2001) argue that even if the banks actually provided the funds by means of stock collateral financing, the stockholders controlled the activities of the borrowing corporations, so that there was no difference with direct financing in terms of corporate governance.

the constraints on expenditures of corporations or individuals. This includes cases in which banks hold nonperforming loans, thereby putting constraints on new lending and reinforcing the collection of past loans. On the other hand, wealth effects refer to the process in which prices of assets held by individuals or corporations fluctuate and affect decisions of corporations concerning capital investment and decisions of individuals concerning consumption and housing investment.

1. Credit rationing effects

A good deal of research has focused on credit rationing effects in relation to lending by local banks and farm household expenditures during the interwar period in Japan. For example, Takahashi (1955) argues that, during the Showa depression of the early 1930s, farm households were unable to finance their agricultural production due to a shortage of collateral resulting from depressed land prices, which led to reductions in income and consumption of the households. Asakura (1988) cites the expanding bank losses stemming from the decline in value of collateral properties as a reason for bank runs and failures of local banks after the repercussive depression of 1920. Ito (1983a) and Takeda (1983) conclude that the Great Kanto Earthquake in 1923 and the financial crisis in 1927 entailed the concentration of deposits at the five largest banks, constraining funds in rural areas.

A series of studies on the real estate finance problem have explored the effects of falling asset prices on bank lending. Ito (1983b) describes the real estate finance problem as a problem over how to resolve overdue loans collateralized by real estate, an issue that gradually became a serious problem for the Nihon Kangyo Bank, agri-industrial banks, and ordinary banks in the 1920s. The real estate financial problem had been recognized as early as the 1910s. The nationwide bankers' meeting in 1917 decided to submit a request to the Diet for liquidation of real estate collateral. The goal of the request was to prepare for liquidity emergencies through mutual consultation among banks including ordinary banks, the Nihon Kangyo Bank, and agri-industrial banks. At that time, the government imposed a tentative administrative guidance restricting loans collateralized by real estate, but the problematic loans continued to grow. The financial crisis of 1927 called for an urgent liquidation of real estate, both for banks and for small and medium-sized corporations, all of which faced financial difficulties. The Nihon Kangyo Bank, the Japan Chamber of Commerce, and others from the business community offered various proposals, and the government established a new facility to refinance loans collateralized by real estate. Based on the report of the Financial System Research Committee in 1930, the government enacted the Mortgage Certificate Act in 1931, and the Real Estate Financing and Loss Indemnification Act in 1932. Nevertheless, Murakami (1983) concludes that, because the government was unable to produce an effective policy for improvement, the problems were resolved only after an increase in real estate prices following the transition to a wartime economy.

A number of case studies on the real estate finance problem have been conducted. Shindo (1977) examines bad loans at local banks and finds that the banks refrained from making new loans and sought to collect outstanding loans.[10] Asakura (1978)

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10. Shindo (1977) also points out that many local banks took consolidation as a measure for disposing of nonperforming loans and strengthening management, leading to difficulty in small and medium-sized companies' finances.

asserts that banks tightened conditions on loans collateralized by real estate in light of increasing nonperforming loans, altering the traditional attitude toward real estate collateral that had prevailed since the Meiji Period (1868–1912). Ueda (1983) examines the disposition and its effects of nonperforming loans at the Agri-Industrial Bank of Hiroshima Prefecture in 1928–32. Hashimoto (1995) reviewed the disposition of overdue loans collateralized by real estate by the Nihon Kangyo Bank when land prices bottomed out in the first half of the 1930s.

2. Wealth effects

There have been virtually no explicit analyses of the wealth effects caused by the decline in asset prices after WWI. Nevertheless, stock prices could have affected expenditures of landowners, given that the landowners invested in financial assets such as stocks out of their revenue from rental and commodities sales such as rice and silk.

III. The Relationship between Land Prices and Bank Lending during the Interwar Period

This section examines the relationship between fluctuations in land prices and bank lending. While the effects of stock price fluctuations on capital investment and the wealth effects are important in analyzing the effects of asset price fluctuations on the real economic activity, I will concentrate the present analysis on land prices and bank lending.

Bernanke (1995) and other leading researchers on the Great Depression in the United States suggest two primary channels by which a decline in land prices constrains bank lending. First, a decline in land prices reduces the net worth of borrowers and/or the collateral values of real estate owned by borrowers, and harms the borrowers' credibility in the financial market. Second, losses incurred by banks from the decline in the collateral value of real estate may decrease the risk-taking capacity of banks.

This section employs several empirical analyses in an effort to examine these two channels. First, it reviews the use of real estate as collateral. Second, it performs a regression analysis to estimate the loan supply function of banks with land prices as an explanatory variable, and investigates the relationship between fluctuations in land prices and changes in the lending at the prefectural level. Third, based on the nonperforming-loan and loss data of the Nihon Kangyo Bank in the 1930s, it calculates the potential losses incurred in the banking industry due to the decline in land prices to look at the risk-taking capacity of the banking industry.

A. Loans at Ordinary and Savings Banks

Goto (1970) classifies loans at ordinary and savings banks into six categories by collateral type.[11] According to his study, prior to WWI, the proportion of loans with

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11. The categories are loans with collateral of "governmental bonds and municipal bonds," "stocks," "foreign bonds, corporate bonds, and others," "land, housing, and other real estates," "products, shipping and others," and loans on "guarantees and credit." Loans on "guarantees and credit" at savings banks include loans to depositors without

real estate collateral represented as land, housing, and other real estate was the largest category, amounting to over 30 percent. During WWI, the proportion of loans with stocks increased significantly, and the proportion of loans with land, housing, and other real estate declined (Table 4). The proportion of loans with land, housing, and other real estate recovered in the 1920s, while stock proportions declined. This situation was reversed in the first half of 1930s, as stock proportions increased and land, housing, and other real estates proportions declined. From the 1920s onward, the proportion of loans on guarantees and credit was always above 30 percent.[12] In many cases, local banks in rural areas primarily accepted real estate as collateral in lending because there were few candidates for collateral other than real estate. Meanwhile large banks in urban areas presumably relied less on real estate collateral.[13]

Table 4 Loans of Ordinary and Savings Banks by Type of Collateral in Japan

Percent, except as indicated

	Governmental bonds and municipal bonds	Stocks	Foreign bonds, corporate bonds, and others	Land, housing, and other real estate	Products, shipping, and others	Guarantees and credit	Loan amount (¥ millions)
1910	5.5	22.2	1.5	35.3	9.1	26.4	665
1915	3.3	21.5	2.9	39.4	6.8	26.1	917
1920	1.8	31.8	3.7	15.4	11.5	35.9	5,954
1925	2.6	27.1	5.5	21.1	8.2	35.4	7,424
1930	3.3	21.3	7.4	24.6	6.2	37.2	6,866
1935	4.4	26.4	13.4	18.6	3.7	33.5	6,032

Note: A statistical discontinuity exists between the period up to 1915 and the period thereafter. Up to 1915, "loans on bills" were not included in "loan" statistics, and were reckoned as a type of "bills discounted"; from 1916 on, "loans on bills" were included in "loans."

Source: Goto (1970).

There are several views regarding the background of the changes in the proportion of stock collateral lending and real estate collateral lending. Hashimoto (1995, 2000) argues that loans with real estate collateral increased as a result of higher land prices around the time of WWI, and that land prices fell less in the 1920s relative to stock prices, encouraging the use of real estate as collateral. On the other hand, Ishii (2001) concludes that loans collateralized by stock increased due to rising stock prices around the time of WWI, and that borrowers offered real estate as additional collateral in the event of plunging stock prices in the 1920 depression, especially to

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explicit collateral. A statistical discontinuity exists between the period up to 1915 and the period thereafter. Up to 1915, "loans on bills" were excluded from "loans" and were reckoned as a type of "bills discounted."

12. Bills were usually discounted on "guarantees and credit." For example, bills discounted on "guarantees and credit" accounted for 93.2 percent of the total, ¥1.4 billion, at ordinary and savings banks in 1920. The figures for "loans" do not include bills discounted. Accordingly, the sum of loans and bills discounted is supposed to have a larger weight of "guarantees and credit," whereas the weight of other collateral decreases.

13. It should also be noted that there were tiers based on the level of capital amounts. Shindo (1977) finds that, in 1926, the proportion of real estate collateral at banks having official capital of ¥2 million or more was 15 percent, whereas that at banks having official capital of less than ¥2 million was 34 percent.

local banks. According to Eiichi Baba, head of the Nihon Kangyo Bank at that time, many farmers during the boom years after WWI invested in stock by borrowing with land collateral (Baba [1935]).

Real estate also served as implicit collateral for "guarantees and credit" loans during the interwar period. Shindo (1977) notes that stock and real estate commonly served as latent collateral for credit loans, and that when repayment of a loan fell in arrears, real estate was provided as final collateral to preserve a claim even though it was initially made in credit.

B. The Relationship between Land Prices and Bank Lending
1. Nationwide trends

In the interwar period, volumes in lending (the sum of "loans" and "bills discounted")[14] and prices of agricultural land show similar developments. Figure 3 shows year-on-year percentage changes in lending by ordinary and savings banks and year-on-year percentage changes in agricultural land prices from 1913 to 1936. When land prices declined from 1913 to 1915, increases in volumes of bank lending lessened. In 1916, the land prices and the volumes of lending picked up and showed subsequent increases from 1917 to 1919. Due to the repercussive depression, in the

Figure 3 Agricultural Land Prices (Rice Paddies) and Bank Lending in Japan

Sources: Takamatsu (1966); Goto (1970).

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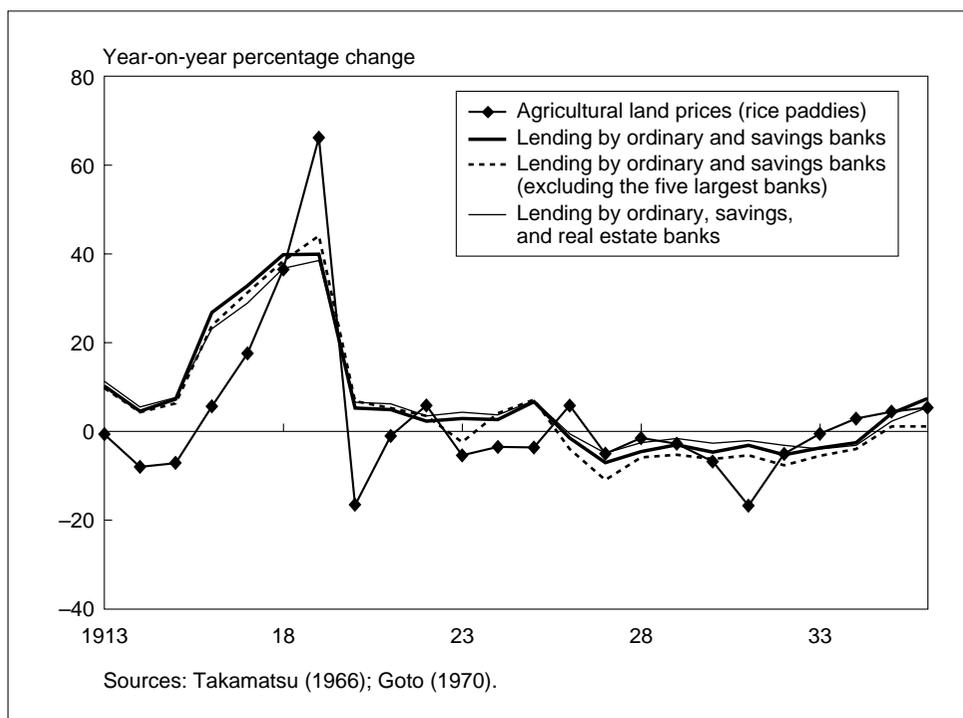
14. There is no statistical discontinuity (referred to in Footnote 12) in this subsection unless otherwise indicated as "lending" includes "bills discounted."

first half of the 1920s the land prices turned down and the volumes of lending showed a sharp decline in the growth rate. Both generally decreased from the latter half of the 1920s to the beginning of the 1930s.[15,16] Presumably, lending volumes were affected by land prices through the use of real estate either as explicit collateral for lending, or as implicit collateral of guarantees and credit loans.

The two variables, land prices and bank lending, moved differently in some cases. For example, land prices increased in 1922 and 1926, while increases in bank lending weakened in 1922 and bank lending declined in 1926. In 1931, lending continued to decline slightly, while land prices fell significantly.

This study applies a similar analysis to different data categories of bank loans. During the interwar period, real estate banks consisting of the Nihon Kangyo Bank, agri-industrial banks, and the Hokkaido Takushoku Bank, as well as ordinary and savings banks, provided real estate collateral loans to individuals in the agricultural, commercial, and industrial sectors. The sum of the lending by these specialized banks (or real estate banks) and that of ordinary and savings banks shows almost the same developments as the lending by ordinary and savings banks alone.[17]

Ordinary and savings banks consisted of the five largest banks (Mitsui, Mitsubishi, Daiichi, Yasuda, and Sumitomo) with a low proportion of real estate collateral lending and local banks with a high proportion. Lending by local banks fluctuated in almost the same manner as the lending by ordinary and savings banks as a whole, while the rate of change after the middle of the 1920s was lower than that of ordinary and savings banks as a whole.

This study embarks on a closer examination of this by conducting a regression analysis to estimate loan supply function for the period between 1913 and 1936. The estimate uses year-on-year percentage changes of bank lending (L) as a dependent

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15. The coefficient of the dynamic cross-correlation between year-on-year percentage changes of agricultural land prices and year-on-year percentage changes of lending by ordinary and savings banks is highest (0.795) when the time difference is zero (see table below).

**Dynamic Cross-Correlation between Year-on-Year
Percentage Changes in Agricultural Land Prices
and Bank Lending in Japan**

	Lending by ordinary and savings banks	Lending by ordinary, savings, and real estate banks
Land price precedent		
−3	−0.032	0.000
−2	0.130	0.168
−1	0.385	0.408
0	0.795	0.799
1	0.602	0.567
2	0.382	0.338
3	0.237	0.214
Lending precedent		

Sources: Takamatsu (1966); Goto (1970).

16. For the period 1914–30, the correlation coefficient between year-on-year percentage changes of urban land prices and year-on-year percentage changes of lending by ordinary and savings banks was 0.539.
17. Lending by ordinary, savings, and real estate banks totaled ¥8.37 billion in 1933, including ¥6.08 billion by ordinary banks, ¥0.34 billion by savings banks, ¥1.07 billion by the Nihon Kangyo Bank, ¥0.65 billion by agri-industrial banks, and ¥0.20 billion by the Hokkaido Takushoku Bank.

variable and interest rates (i), year-on-year percentage changes of land prices (P), year-on-year percentage changes of equity capital of banks (C), and year-on-year percentage changes of deposits (D) as explanatory variables.[18,19]

$$L_t = \alpha + \beta i_t + \gamma P_t + \delta C_t + \varepsilon D_t.$$

Bank lending (L) is represented by the sum of ordinary and savings bank lending including bills discounted. Interest rate (i) is represented by interest rates for loans on deeds.[20] Land price (P) is represented by agricultural land prices as estimated by Takamatsu (1966). Equity capital (C) is represented by the sum of paid-in capital and reserves at ordinary and savings banks. Deposit (D) is represented by the sum of deposits, savings, and periodic deposits at ordinary and savings banks. The estimate is based on the two-stage least-squares method, as the ordinary least-squares method would bias the results (a bias known as a "simultaneous equation bias") in estimating simultaneous equations comprised of a supply function and a demand function. Instrument variables include the constant α, year-on-year percentage changes of agricultural production, those of manufacturing production, and one-period lags of explanatory variables (interest rate, i, year-on-year percentage changes of land prices, P, those of equity capital, C, and those of deposits, D).

The results of estimation are shown in Table 5. Coefficients for year-on-year percentage changes of land prices, equity capital, and deposits are positive and statistically significant, whereas the coefficient for interest rates, although positive, is not significant.[21] Estimation of a loan supply function for ordinary, savings, and real estate banks yields almost the same results.[22] These estimation results suggest that bank lending was constrained as a result of the fall in land prices during the interwar period. Still, a more rigorous interpretation is required, and it demands an examination of other factors affecting bank lending and refinement of methods of estimation.[23]

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18. Loan demand function is estimated with explanatory variables consisting of loan interest rates, year-on-year percentage changes of agricultural production, and year-on-year percentage changes of manufacturing production. Agricultural and manufacturing production data come from Ohkawa *et al.* (1974).
19. There are few studies estimating a loan supply function in the interwar period. Teranishi (1991) estimates a loan supply function for informal credit by using data of individual prefectures.
20. Interest rates are represented by the rates on loans ranging between ¥500 and ¥10,000 with a contract term of less than three months and collateralized by securities and products.
21. In regard to the loan demand function, the two-stage least-squares estimate is conducted using year-on-year percentage changes of land prices, equity capital, deposits, and the one-period lags of the explanatory variables (interest rates, year-on-year percentage changes of agricultural production and manufacturing production) as instrument variables. The coefficient for the year-on-year percentage changes of agricultural production is positive and statistically significant. Although the coefficients for interest rates and the year-on-year percentage changes of manufacturing production are positive, they are not statistically significant.
22. As real estate banks depended heavily on bonds as a means of financing, in addition to my estimation using the year-on-year percentage changes in the sums of deposits, I also examine changes in the sums of bonds and deposits. The results are almost the same as presented here on the sums of deposits.
23. Further investigation is required in regard to the determination of formulas for loan supply functions and loan demand functions, as well as the selection of interest rates variables.

Table 5 Results of Regression Analysis of Banks' Loan Supply Function

Estimate equation: $L = \alpha + \beta i + \gamma P + \delta C + \varepsilon D$
(Period of estimation: 1913–36)

	Lending by ordinary and savings banks	Lending by commercial, savings, and real estate banks
Constant (α)	–3.960 (–0.379)	–9.885 (–0.964)
Loan interest rates (i)	1.006 (0.257)	3.710 (0.967)
Land prices (P)	0.317 (2.901)**	0.345 (3.225)**
Equity capital (C)	0.253 (2.339)*	0.239 (2.245)*
Deposits (D)	0.585 (4.741)**	0.472 (3.834)**
Adjusted R^2	0.915	0.898
D-W statistic	1.509	1.452

Notes: 1. Figures in parentheses are t-values. The symbols * and ** denote the statistical significance at the 5 percent and 1 percent levels, respectively.
  2. Estimates are made with the two-stage least-squares method, in which the percentage changes from the previous year in the amount of agricultural and manufacturing production and the one-period lags of the explanatory variables are used as the instrument variables.

Sources: Ohkawa *et al.* (1974); Takamatsu (1966); Goto (1970); Ministry of Finance, Banking Bureau, *Annual Report of the Banking Bureau* (annual editions); Ministry of Finance, Financial Bureau, *Reference Book of Financial Matters* (annual editions).

2. Analyses by individual prefecture
a. The use of collateral in rural areas and cities by individual prefecture

Among the 47 prefectures of Japan, there were significant differences in the development of bank lending and land prices, and the use of real estate as collateral in the interwar period. In this subsection, all 47 prefectures are classified as either rural or urban. In one group, agricultural land was used as primary collateral, while in the other urban land was used more than agricultural land as collateral.

There are no statistics to distinguish loans collateralized by agricultural land and those by urban land. However, the Nihon Kangyo Bank categorized real estate loans by "rural areas" and "cities" in *Statistics on Japanese Real Estate Financing*, and examination of this can yield a rough proportion between agricultural land and residential land. Presumably, agricultural land served as primary collateral in rural areas, while residential land served as that in cities. In 1927, loans in rural areas accounted for 52.3 percent and those in cities accounted for 47.7 percent of the nationwide loans collateralized by real estate. There were significant differences by prefecture. Among 47 prefectures, the proportion for cities was highest in Tokyo (94.6 percent), Osaka (82.3 percent), Hyogo (64.1 percent), Aichi (61.9 percent), and Kyoto (61.8 percent). Each of these five prefectures, plus Kanagawa, contains one of six biggest cities: the city of Tokyo in Tokyo, the city of Osaka in Osaka, the city of Kobe in Hyogo, the city of Nagoya in Aichi, the city of Kyoto in Kyoto, and the city of Yokohama in Kanagawa. In contrast, the proportion for rural areas was generally high in the remaining 41 prefectures, with the proportion for rural areas highest in Akita (90.8 percent), Iwate (89.0 percent), Chiba (88.5 percent), Saitama (87.8 percent), and Shimane (86.4 percent). Accordingly, for the 41 rural prefectures, excluding the six urban prefectures, this study investigates the relationship between

loans collateralized by real estate and agricultural land prices, regarding the real estate loans as approximations of loans collateralized by agricultural land. For the six prefectures with big cities, an analysis was made of the relationship between real estate loans and urban land prices, regarding the real estate loans as approximations of loans collateralized by urban land.[24]

b. Panel data analysis and its interpretations

This subsection employs panel data analysis to examine the relationship between bank loans and land prices.[25] The dependent variables are year-on-year percentage changes of bank loans. As sequential data of individual prefectures are not available for real estate banks, the loans of ordinary and savings banks represent the bank loans in this analysis. The explanatory variables are year-on-year percentage changes of agricultural land prices for the 41 rural prefectures, and those of urban land prices for the six urban prefectures. Land price data of each prefecture are available in the Ministry of Finance's *Annual Report on Statistics of the Taxation Bureau*. Average sales prices of rice paddies are used to represent agricultural land prices, and those of residential land are used to represent urban land prices. The estimation period is from 1914 to 1930.[26] Both a fixed-effect model and a random-effect model were applied to this analysis.[27]

Table 6 shows the results of regressions for the 41 rural prefectures. The coefficient of agricultural land prices is positive and statistically significant, indicating that loans and agricultural land prices move in the same direction.[28] The statistically significant relationship between agricultural land prices and bank loans in rural prefectures suggests that loans were constrained by the decline in land prices during the interwar period in these areas.

Table 7 shows the results of regressions for six urban prefectures. The coefficient of urban land prices is not statistically significant, as in these areas collateral values seem to have had no or little effect on bank lending. The hypothesis is that loans increased steadily owing to urbanization and industrialization, and/or that real estate served as a small proportion of collateral. However, more detailed and extensive analysis is required, and should include various factors that influence loan supply and demand as well as developments in real estate markets in individual prefectures.

Table 6 Results of Panel Data Analysis of Year-on-Year Percentage Changes in Lending by Ordinary and Savings Banks (41 Rural Prefectures)

Coefficient	Fixed-effect model	Random-effect model
Constant	—	5.752 (10.958)*
Dummy variable	47.841 (18.385)*	55.903 (18.764)*
Agricultural land prices (rice paddies)	0.338 (12.902)*	0.332 (11.359)*
Adjusted R²	0.340	0.389
D-W statistic	1.742	1.737

Notes: 1. Figures in parentheses are *t*-values. The symbol * denotes the statistical significance at the 1 percent level.
2. The dummy variable is one for 1916 and zero for all other years.

Sources: Ministry of Finance, Banking Bureau, *Annual Report of the Banking Bureau* (annual editions); Ministry of Finance, Taxation Bureau, *Annual Report on Statistics of the Taxation Bureau* (annual editions).

Table 7 Results of Panel Data Analysis of Year-on-Year Percentage Changes in Lending by Ordinary and Savings Banks (Six Urban Prefectures)

Coefficient	Fixed-effect model	Random-effect model
Constant	—	8.196 (1.857)
Dummy variable	168.215 (19.224)*	215.039 (16.774)*
Urban land prices (residential)	0.008 (0.362)	0.009 (0.299)
Adjusted R²	0.694	0.737
D-W statistic	1.982	1.974

Notes: 1. Figures in parentheses are *t*-values. The symbol * denotes the statistical significance at the 1 percent level.
2. The dummy variable is one for 1916 and zero for all other years.

Sources: Ministry of Finance, Banking Bureau, *Annual Report of the Banking Bureau* (annual editions); Ministry of Finance, Taxation Bureau, *Annual Report on Statistics of the Taxation Bureau* (annual editions).

C. Estimation of Losses Incurred by the Banking Industry Due to Falling Land Prices

1. Development at the Nihon Kangyo Bank: Overdue loans collateralized by real estate and disposition of collateral

No statistics exist regarding the development of a shortage of real estate collateral as a result of falling land prices and of the corresponding losses experienced in the banking industry as a whole. As a specialized bank, the Nihon Kangyo Bank conducted lending against real estate collateral as its primary business during the interwar period. Nihon Kangyo Bank (1953) contains data on the bank's nonperforming loans, losses, and the disposition of real estate collateral from the second half of 1932 to the first half of 1936.[29,30]

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29. Hashimoto (1995) examines the overdue credits and the disposition of real estate collateral by the Nihon Kangyo Bank in the 1930s, using the data from the Nihon Kangyo Bank (1953).

30. Ueda (1983) examines the status of nonperforming loans at the Agri-Industrial Bank in Hiroshima Prefecture by using the bank's business reports and so forth. Based on these sources, the amount of overdue principal in the latter half of 1928 totaled 6 percent of the amount to be repaid in the same period, whereas overdue interest accounted for 13 percent of the loan interest to be paid during the same period. Although there are no data thereafter based on the same sources, presumably, overdue principal and interest rapidly increased. The number of cases of two or more years overdue at the head office increased from four cases in April 1928 to 39 cases in

The bank's balance of outstanding loans collateralized by real estate was ¥757 million in the second half of 1932. This amount included overdue principal of ¥46 million, or 6.1 percent of the real estate collateral loans (Table 8). The ratio of overdue principal rose to 6.6 percent in the first half of 1933, but declined as the economy recovered afterwards.

The bank collected some part of the overdue principal by the exercise of security rights and subsequent auction of real estate collateral. Since the bank believed auctions were not always advantageous, especially if real estate prices had fallen too far (Nihon Kangyo Bank [1953]), auctions were often held only after land prices began to recover from 1932, with auction volume expanding from the second half of 1932. However, beginning in the second half of 1934, cases without successful bids began to rise, and, as a result, the bank increased its real estate holdings through repossessions due to unsuccessful auctions of real estate collateral. There were 4,564 successful auctions between the second half of 1932 and the first half of 1936. The bank sold real estate collateral corresponding to ¥29 million of loan principal at auctions from the second half of 1932 to the first half of 1936. The total amount of the credit balance was ¥34 million, including overdue interest and auction expenses. The appraised value of real estate collateral auctioned was 138 percent of loan principal, while the auction value was 72 percent of the loan principal. The loss from the disposition of the real estate collateral amounted to 27.9 percent of the principal, or ¥8 million, while the loss including overdue interest and auction expenses amounted to 44.5 percent of the principal, or ¥13 million.

2. Estimation of the Nihon Kangyo Bank's overall losses

While it is relatively easy to calculate the "realized" losses associated with real estate collateral sold at auction, it is quite difficult to estimate the "potential" losses associated with nonperforming loans at any given point in time, such as 1933, when there was a peak in the ratio of overdue loans to total loans. This difficulty is due to the lack of two statistics essential for the estimation of the potential losses: the loss ratio for overdue loans (for which the real estate collateral was not yet auctioned), and the loss ratio for the real estate collateral (which failed to be auctioned off) owned by lenders.[31]

There are many issues that should be taken into consideration in estimating the loss ratio for overdue loans. When loans were overdue, lenders often waited for the recovery of borrowers' financial conditions and did not exercise their security right immediately if the borrower's condition seemed likely to improve. Real estate collateral, which was subject to auction, had been primarily offered by insolvent parties or parties at risk of insolvency. Thus, it is likely that the ratio of potential losses for total overdue principal was lower than that of realized losses for the overdue principal, the real estate collateral for which was sold at auction. On the other hand,

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April 1930, then to 136 cases in April 1931, and to 223 cases in April 1932 (56 times the number in 1928). The deteriorating situation encouraged both collections of loans by auctions of collateral properties and nominal reduction of overdue loans with forbearance lending.

31. This study defines the nonperforming loans as the sum of overdue loans and real estate collateral that failed to be auctioned off. The nonperforming loans at the Nihon Kangyo Bank at the end of 1933 consisted of overdue principal of ¥45 million and real estate collateral of ¥3 million.

Table 8 Losses from the Disposition of Real Estate Collateral and Nonperforming Loans of the Nippon Kangyo Bank in the 1930s

	Disposition of real estate collateral and resulting losses during the period								Nonperforming loans at period-end				
	Loan principal of which real estate collateral was auctioned (¥ thousands) (A)	Credit balance of which real estate collateral was auctioned (including interest in arrears and auction expenses) (¥ thousands) (B)	Auctioned amount of real estate collateral (¥ thousands) (C)	Appraised amount (¥ thousands)	Auctioned amount/ appraised amount (percent)	Losses from auctions (including interest in arrears and auction expenses) (¥ thousands) (D) = (B) − (C)	Loss ratio of loan principal (including interest in arrears and auction expenses) (percent) (D)/(A)	Real estate collateral that failed to be auctioned off (¥ thousands) (E)	Balance of loans collateralized by real estate (¥ thousands) (F)	Overdue principal (¥ thousands) (G)	Ratio of overdue principal (percent) (G)/(F)	Non-performing loans (¥ thousands) (H) = (E) + (G)	Ratio of non-performing loans (percent) (H)/(F)
1932 (second half)	2,090	2,238	1,665	3,152	52.8	573	27.4	3,512	757,901	46,527	6.1	50,039	6.6
1933 (first half)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	3,688	743,029	48,697	6.6	52,385	7.1
1933 (second half)	3,268	3,441	2,163	4,749	45.5	1,278	39.1	3,738	717,534	45,680	6.4	49,418	6.9
1934 (first half)	2,996	3,587	2,259	4,846	46.6	1,328	44.3	3,822	681,729	41,281	6.1	45,103	6.6
1934 (second half)	4,422	5,469	3,336	6,299	53.0	2,133	48.2	5,731	689,587	40,420	5.9	46,151	6.7
1935 (first half)	6,465	7,925	4,741	8,733	54.3	3,184	49.2	7,551	665,731	33,581	5.0	41,132	6.2
1935 (second half)	5,781	5,996	3,707	6,918	53.6	2,289	39.6	8,500	661,854	29,847	4.5	38,347	5.8
1936 (first half)	4,957	6,290	3,746	6,658	56.3	2,544	51.3	10,032	647,635	27,574	4.3	37,606	5.8
Total	29,979	34,946	21,617	41,355	52.3	13,329	44.5	42,886	—	—	—	—	—

Notes: 1. The total does not include the first half of 1933.
2. The first half covers January to June, and the second half covers July to December.

Source: Data prepared by the Nippon Kangyo Bank (1953).

the auctions tended to fail if the market value of the real estate collateral was low. Thus, the ratio of potential losses for real estate owned by lenders due to unsuccessful auction could be higher than that of realized losses by disposition of real estate collateral through auction.

If the loss/principal ratio (loss divided by corresponding principal) of all non-performing loans is assumed to be the same as that of the overdue principal with collateral successfully sold at auction, the potential total loss can be roughly estimated at ¥19 million at the end of 1933.[32] Although this amount exceeds the bank's 1933 net profit of ¥12 million, it amounts to 11 percent of its stockholders' net accounts, which totaled ¥171 million (capital plus reserves and profits minus unpaid capital and losses).

3. Outlook for ordinary and savings banks

In this subsection, I extend our analysis to ordinary and savings banks. Unlike the case with the Nihon Kangyo Bank, there are no statistics on nonperforming loans and collateral dispositions for these banks, so I provide here an estimate of the losses of these banks by referring to the data of the Nihon Kangyo Bank. Assuming that the overdue ratio to total outstanding loans and loss ratio for overdue loans were the same as for the Nihon Kangyo Bank, the potential loss amount can be estimated at ¥36 million at the end of 1933, when the overdue ratio reached its peak. At that time, the real estate loans amounted to ¥1.37 billion.[33]

In an examination of the equity capital of ordinary and savings banks, it is necessary to look at other factors that could affect their equity capital, such as the collateral shortage for loans secured by other property or personal guarantees. It is generally accepted that real estate appraisals by the Nihon Kangyo Bank were conducted according to more rigorous standards than ordinary and savings banks, and that the ratio of actual lending to appraised value of collateral was lower than at these banks. Consequently, the loss amount incurred by ordinary and savings banks may be underestimated when relying on overdue ratios and loss ratios of the Nihon Kangyo Bank.

Guarantees and credit loans are a candidate for the source of loss due to declining land prices. When these kinds of loans become overdue, real estate collateral is typically offered. The ultimate solvency of the borrower and guarantor is supported by their assets, especially their real estate. As a result, the value of the real estate, particularly the land price, affects the loss amount when guarantees and credit loans become nonperforming. When land prices fall, guarantees and credit loans generally give rise to the same kind of losses as loans collateralized by real estate.

32. Losses include overdue interest and auction expenses. Since data indicating the disposition of real estate collateral in the first half of 1933 are not available, it is assumed that the loss ratio in 1933 was the same as in the latter half of the year (39.1 percent). The amount of potential losses at the end of 1933 can be computed by multiplying the nonperforming loans (¥49 million) by this ratio.
33. The ratio of the total amount of overdue principal and real estate collateral that failed to be auctioned off was 6.9 percent at the Nihon Kangyo Bank in the latter half of 1933, and the ratio of losses by the disposition of real estate collateral to loan principal was 39.1 percent (including overdue interest and auction expenses). By multiplying these two ratios, the loss/principal ratio is estimated to be 2.7 percent.

Another candidate is the type of loans collateralized by securities, including governmental and municipal bonds, stocks, foreign bonds, and corporate bonds. The Ministry of Finance's *Annual Report of the Banking Bureau* shows the development in these loans. The value of securities used as collateral exceeded the loan amounts during the interwar period, including the financial crisis of 1927 and the Showa depression of 1930 (Table 9). If one assumes that the value was based on a proper valuation of security and takes into account fluctuations in market value, that means no loss would be incurred upon the disposition of collateral securities. The standard for valuation at that time remains to be investigated, and the conclusions of the preceding case studies are not uniform. Therefore, this study has excluded collateral lending based on securities collateral from the estimation of potential losses.[34] In addition, it has excluded loans collateralized by products, shipping, and others, as they account for a relatively small proportion of lending.

Table 9 Loans of Ordinary and Savings Banks by Type of Collateral and Estimated Value of Securities Collateral

	1927			1930		
	Loan amount (¥ millions)	Estimated value of collateral (¥ millions)	Estimated value of collateral as portion of loan (percent)	Loan amount (¥ millions)	Estimated value of collateral (¥ millions)	Estimated value of collateral as portion of loan (percent)
Securities	2,622	3,767	144	2,194	2,820	129
Stocks	1,969	2,916	148	1,459	1,873	128
Governmental bonds	164	202	123	201	237	118
Municipal bonds	0	1	—	24	31	129
Corporate bonds	150	203	135	173	230	133
Land, housing, and other real estate	1,672	—	—	1,688	—	—
Products, shipping, and others	497	—	—	427	—	—
Guarantees and credit	2,493	—	—	2,556	—	—
Total	7,285	—	—	6,866	—	—

Source: Ministry of Finance, Banking Bureau, *Annual Report of the Banking Bureau* (annual editions).

Next, this study examines the loss amount from loans collateralized by real estate and from loans on guarantees and credit, which accounted for around 60 percent of total loans at ordinary and savings banks in 1933.[35] As there are no overall statistics

34. With respect to individual banks, the value of the securities by which loans are collateralized might have fallen below the amount of the loans. Shindo (1977) indicates that the collateral securities at large banks and at the branches of small and medium-sized banks in the prefectures where their headquarters did not exist were sound. On the other hand, Nishimura (2001) investigates the securities held by the Shinano Bank (in Nagano Prefecture), which went bankrupt in 1930. She points out that the securities mainly consisted of local equities, many of which were storehouse equities relating to the silk industry, and that most of their value in fiscal 1934 was zero.
35. Savings banks' guarantees and credit loans include loans collateralized by products, shipping, and others.

on overdue ratios and loss ratios for overdue loans for ordinary and savings banks, this subsection tries to explicate the financial condition in which overdue loans and shortage of collateral impaired the equity capital of the banks.

According to the Ministry of Finance's *Annual Report of the Banking Bureau*, the equity capital of ordinary and savings banks in 1933 was ¥1.8 billion. Excluding the five largest banks, which had low ratios of real estate loans, I find that local banks' equity capital was ¥1.2 billion in 1933.[36] The ratio of equity capital to the sum of loans collateralized by real estate and loans with guarantees and credit, ¥3.4 billion, was 36 percent. Therefore, the entire equity capital of local banks would be impaired by losses from real estate loans and loans with guarantees and credit when the loss/principal ratio exceeded 36 percent. This occurred when, for example, the overdue ratio of these loans was 100 percent of total loans of the banks and the potential loss ratio for overdue loans resulting from a decline in land prices was 36 percent, or when the overdue ratio was 36 percent and the potential loss ratio for overdue loans was 100 percent. Loan losses impaired one-half of the equity capital of local banks when either the overdue ratio or loss ratio was one-half of the percentages stated above.

It is possible to examine loss ratios gathered at the time of business suspension for some banks that either went bankrupt or merged with other banks during the interwar period. This enables us to test whether the loss/principal ratio of 36 percent mentioned above is relatively high compared to the loss/principal ratios of bankrupt banks. The Bank of Japan (1969) provides the reasons for suspension of business and the method of disposition for 20 banks that went bankrupt or merged in the 1920s, especially during the financial crisis of 1927. In its study, the Bank of Japan and other organizations conducted an assessment of loans and estimated loss/principal ratios of bankrupt banks at the time of their bankruptcies. Excluding the Taiwan Bank, a specialized bank, and the Dai-65 Bank, for which the loss ratio was not available, 11 of 18 banks had loss/principal ratios of 36 percent or greater at the time of bankruptcy, while seven had the ratios below that level.[37] Assuming that loans by the bankrupt banks were worse than those by ordinary and savings banks overall, some banks went bankrupt while maintaining a loss/principal ratio below 36 percent. Thus, it cannot be concluded that the loss/principal ratio exceeded 36 percent for real estate collateral loans and loans by guarantees and credit at ordinary and savings bank during the interwar period, and that the majority of their equity capital was impaired. Still, possible losses that damaged the equity capital of ordinary and savings banks were attributable not only to loans, but to a variety of other factors related to the banking business. Therefore, further analysis from

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36. Data on the equity capital of the five largest banks come from each bank's company history and business report (Institute for Japanese Business History [1978], Committee for Compiling the History of the Mitsubishi Bank [1954], Office for Compiling the Eighty-Year History of the Daiichi Bank [1958], Committee for the Sixty-Year Commemorative Project of the Yasuda Bank [1940], and Committee for Compiling the History of the Sumitomo Bank [1955]).

37. Even if the ordinary and savings banking industry had sufficient equity capital as a whole, failures by a portion of the banks that incur significant losses to their equity capital could destabilize the banking industry overall through the elicitation of systemic risk. On the other hand, the amount of individual equity capital might be a less serious problem for the banks with close relationships with the five largest banks.

many points of view is necessary to determine whether equity capital was damaged seriously enough to undermine the soundness of the overall banking industry during the interwar period.[38]

IV. Conclusions

This paper has examined several arguments related to the effects of the real estate finance problem on the real side of the economy in interwar Japan, primarily from the perspective of the credit rationing effects of falling asset prices. From 1913 to 1936, agricultural land prices and volume of lending by ordinary and savings banks were closely related. This is illustrated by the results of my estimation of banks' loan supply function, which suggest that changes in land prices had a positive and statistically significant effect on those of lending by ordinary and savings banks. Also, panel data analysis by individual prefecture shows that, in 41 rural prefectures where agricultural land was the primary collateral, there was a statistically significant relationship between changes of agricultural land prices and those of loans by ordinary and savings banks. No significant relationship was determined between changes of urban land prices and those of loans by ordinary and savings banks in six urban prefectures where urban land was the primary collateral. The results of these analyses suggest that falling land prices during the interwar period, particularly in agricultural regions, constrained bank lending.

The relationship between the loans and equity capital of the ordinary and savings banks suggests that falling land prices did not necessarily give rise to the high ratio of nonperforming loans nor to the loss ratio for nonperforming loans that led to the utter devastation of the equity capital of ordinary and savings banks. Still, many issues remain to be investigated regarding overall assessment of losses of equity capital in the ordinary and savings bank industry during the interwar period, such as developments in stock and bond prices and the impact of the use of these securities as collateral.

In addition, there remain many other factors influencing credit rationing effects that must be investigated. In-depth analysis must be undertaken on such matters as the role of direct and indirect financing underlying the funding and investment behavior of corporations and households, and their assets and liabilities. Another potential topic for research is a comparison of the interwar Japanese economy and the economies of the United States and other countries, as well as a comparison with the postwar Japanese economy.

The underlying mechanism that determined how developments in asset prices affected the real economic activity during the interwar period remains to be fully understood. Research by Bernanke (1995) and others emphasizes the information

38. As stated above, the proportion of real estate financing in banks during the interwar period was tiered according to the bank size. There are constraints on the availability of data in order to extend these analyses for tiers of bank size. Some observers argue that small and medium-sized banks could have been strongly affected by falling land prices due to relatively large proportions of real estate collateral loans. In this regard, Ishii (2001) pointed out that, beginning in 1927, the difference between the rates of net return on equity capital expanded rapidly between city banks and other ordinary banks mainly composed of local banks.

asymmetry between lenders and borrowers in the financial markets as a premise for credit rationing effects.[39] In relation to this, another important topic for further research is banks' ability to adequately assess risk. The question remains whether banks could have appropriately evaluated the profitability and risks of their borrowers, based on past experiences in lending to local farmers and small and medium-sized businesses, to take an example.[40] Also, I must ask whether the situation in the interwar period is similar in the mining and manufacturing industries, many of whose technologies and management skills were imported from Europe and the United States. Another factor to consider is that many ordinary and savings banks during the interwar period in many ways resembled "organ banks" (*kikan ginko*),[41] a theme that has generated a significant amount of research addressing the "moral hazard" problem posed by the "organ banks." One thing to keep in mind is that it is possible that the accumulation of corporate information through long-term business relationships in some ways alleviates information asymmetry. Investigation of these intriguing issues will lead to a more comprehensive understanding of the relationship between land prices and bank lending in interwar Japan, especially in light of loan collateral and the screening capabilities of banks.

39. Ogawa and Kitasaka (1998) discuss the relationship between fluctuations in land prices and bank lending after WWII. They argue that banks extended their lending to small and medium-sized corporations, facing a shift of large corporations to direct financing during the liberalization of capital markets in the 1980s. Then, due to the difficulties in assessing their new borrowers' profitability and financial condition, they relied increasingly on real estate collateral.
40. Some observers point out that the structure of Japan's interwar financing was "multitiered," and that risk assessment for lending to small borrowers was difficult, leading to "informal credit" through such sources as loan sharks (refer to Teranishi [1991]).
41. The banks that had a large part of their funds tied up with a single firm or a small handful of firms are often called organ banks. It has been pointed out that the lack of diversification of funds made their management risky.

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