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Abstract

Domestic western-style banks emerged as China's leading financial sector during the Republican era, an environment characterized by economic and political uncertainty and weak property rights. We document that these modern banks nevertheless flourished, especially during the Nanjing decade in the 1930s, with strong social and commercial relationships throughout the sector. Focusing on interlocking directorates we trace the shape, structure and development of the network of cooperation between these banks. This network shows a dominating central cluster, indicating that the sector was characterized by internal cooperation rather than competition. Similarly, new entrants were strongly linked to existing banks, indicating that entry was driven by the expansion of existing banks rather than the rise of new competition. Finally, central locations of public banks within the cluster indicate that the government gained influence over the sector through direct bank ownership. This paper shows that the domestic financial sector reacted successfully to the threats of the external environment by weaving a close web of interdependence, including with the government.

I Introduction

Around the fall of the Chinese Empire the financial sector in China was split between traditional, domestic financial institutions and international banks. By the outbreak of the Sino-Japanese war in 1937 domestic Chinese banks patterned on Western counterparts had risen to dominance (Cheng, 2003, p.75). The emergence of these new financial institutions happened in an external environment of political uncertainty, weak property rights and limited governmental reach, which obviously influenced the internal structure of this rapidly developing industry. This paper focuses on one central aspect of the sector's response, namely the extent of cooperation, as well as competition, between its banks. How did they relate to each other while facing external uncertainty and a weak government?

Cooperation and links between firms, and in particular banks, have been a topic for economic and financial historians. One important approach to measure formal relationships is to focus on explicit links created by common personnel. Directors and managers might work for multiple firms, linking them together through an interlocking directorate. Such relationships have been shown to influence multiple aspects of involved firms, from access to capital to formal cooperations and even mergers[1].

While most analyses focus on the effects such a link has on individual firms, another viewpoint is to see that link as one edge of a network formed between the firms in the sector. This opens up the utilization of tools developed by Social Network Analysis to describe and understand the internal structure of an industry such as this domestic Chinese banking sector. This builds on Sheehan (2005), who uses basic cross-sectional network statistics to demonstrate that the traditional focus of the literature on the influence of cliques is much too small and a wider, modern business focused approach is more appropriate. Consequently, we take this up and construct the network of interlocking directorate between relevant banks for the years 1933 to 1936, which form the end of the Nanjing era, the final decade of the Chinese Republic leading up to the Sino-Japanese war in 1923 and World War II on a global scale.

The next section provides the historical background of China's political development for the time period from the fall of the Empire to the Warlord era ending in the Nanjing decade. We also provide additional detail about the development of the financial sector at large, which leads into a deeper look into these new modern Chinese banks and their rise over this time period. This includes a

[1] Mizruchi (1996) provides a nice analysis framework over interlock directorates and the economic implications in early times. More recently, a voluminous literature stress the inter-firm relations on firms behavior and economics outcomes, for example, Fracassi (2017); Dass et al. (2014); Larcker et al. (2013); Helmers et al. (2017).

categorization into different business models, public and private ownership, and the geographic distribution of their headquarters.

The technical and methodological background for the network analysis is outlined in the following section, which provides also more details about the interlocking directorates that form the network. This includes the reasons and motivations for firms in general and Chinese banks in particular to institutionalize their relationships with each other in this way. The section also provides more information about the construction of the network, in particular the data for and definition of interlocking directorates used in the analysis, setting the stage for applying network analysis tools.

The initial analysis of the annual networks reveals that the sector was characterized by a dominant core cluster and a number of essentially unconnected banks. That section demonstrates this indication of a high level of cooperation in the sector in detail and then focuses on the characteristics of the core cluster, revealing more aspects of the cooperation between the banks. Based on different centrality measures from Social Network Analysis we argue that although larger banks were at the centre of this cluster banks at the periphery also formed a dense network of interlocking directorates with each other, reducing the dependency on dominant, central institutions. The link patterns of relatively young institutions also show a surprisingly large number of connections, indicating that new entrants reflected expansionary motives of existing banks rather than new competitors.

Analysing the characteristics of this core cluster shows also the participation of publicly owned banks. This section traces the governments involvement in the sector and argues that the relationships of public banks with private banks in the sector were the main control mechanism the government had to influence the sector and monetary arrangements at large.

II Historical environment of China in 20th century

China in the early 20th century: historical background

The period from 1900 to 1937 straddles several sub-periods of a tumultuous era in modern Chinese history. In the wake of a heavy defeat by the Japanese navy in 1895, the Chinese Qing empire started on a path towards constitutional reform. Efforts were directly modelled on Japan's thorough Meiji reforms. Constitutional reforms covered broad aspects of government affairs including education, with the adoption of a western-style schooling system and the end of the traditional imperial examination scheme, and the legal system with a new code and judicial system. Importantly, the so-called "New

Policies" recognized the central role of the private sector for a market economy and paved the way for the introduction of property rights that contradicted the traditional philosophy about property, which could be summarized as: *Kings have long arms. All the lands and people belong to the emperor.* However, these reform efforts were short-lived and collapsed with the end of the empire in 1911[2].

From the fall of the Qing dynasty in 1911 onwards, China was caught in a situation of internal strife during the era of the Beijing or Northern regime (1911-1928). During this time span, the country was divided among former military cliques of Qing Army and various regional factions. The era was characterized by constant clashes and multiple military conflicts between varying alliances of these groups[3].

Although the Beijing government was nominally considered to be the central government, actual political power was widely dispersed among local regimes and warlords. Consequently, its influence over local affairs was severely limited, including in law enforcement and commercial regulations.

In September 1926, the armies of the Chinese Nationalists, the Kuomintang (KMT), marched into the central Yangzi region, opening their "Northern Expedition" that saw them prevail military over most opposing forces. By the end of 1928 the KMT had successfully united China. Although resistance initially remained, in particular it flared up with the Central Plains War of 1930, the unification marked the beginning of the Nanjing decade (1928-1937), which a number of historians [4] label as China's "Golden Decade." The era came to an end in 1937 when tensions with Japan escalated into the second Sino-Japanese War. China's political unification under the Nationalist government provided the modern Chinese economy with a more stable environment for its development, resulting in rapid modernization in urban areas during these years.

Internationally, the emergence of a unified China coincided with the advent of the Great Depression. Although its international exposure was limited, China was not fully immune to the ramifications. One important difference was that China's monetary system was based on silver in contrast to the generally prevailing gold standard. Consequently, China's initial experience differed, in particular it did not experience a massive price drop in the first years (Shiroyama, 2008, p.2-p.3).

In 1934, however, the US government approved a silver purchase agreement, known as the Silver Purchase Act, which led to an increase in silver production in the United States and a rise in global

[2] For a comprehensive interpretation of the late Qing dynasty, see Fairbank (1978); Fairbank and Liu (1980).
[3] Bonavia (1995) details the warlords and political cliques during the post-Qing era.
[4] For example, Bergere (1989) and Xu (2000).

silver prices. Chinese exports suffered and the simultaneous deflation affected domestic industries as well. In order to shield the economy from the negative effects of silver price fluctuations, the KMT government implemented a new currency policy, the ”Fabi” reform, on November 4, 1935. It abandoned the silver backing of the yuan and declared notes issued by four publicly owned banks to be the only legal tender. As former governments had left the management of silver to private smelting shops and further monetary arrangement to private markets, this marks the first time in Chinese history that the central government asserted direct control over the national money supply. These reforms also marked the end of the free banking era and the start of a more active monetary policy. The consequences of this new currency policy became readily apparent in the general rise in prices. An index of wholesale prices in Shanghai rapidly increased from 90.5 during the deflationary period of 1935 to 118.8 by December 1936(Commission, 1936, p. 4.).

the Great Depression led to many governments around the globe pursuing more interventionist economic policies. China experienced a similar shift not only in monetary policy but also economic issues, though this was driven strongly by its political unification than by a reaction to the global crisis. The concentration of power and nationwide control by the KMT shifted the previously hands-off approach by the central government, which was admittedly in place due to powerlessness rather than strong ”laissez-faire” convictions, to more directed and committed interventions in the market.

One example was the industrial promotion and rural rehabilitation program, which led to initiatives like the Raw Silk Improvement Committee (RSIC), created in Jiangsu province under the aegis of the government’s National Economic Council in 1934. Together with local organizations like the Silk-Reeling Industry Improvement Committee it targeted quality improvements[5] of silk products, one of China’s leading export goods at the time, and a reorganization of the marketing of relevant products, including cocoons. To address one structural problem, namely the issue of tight credit, the government involved a number of bankers in those committees, most notably Zhang Jiaao, the principal director of the Bank of China.(Okumura, 1979) Programs like the RSIC indicate that the government involved the banks, public and private, in its interventions and the strategic appointment of bankers into multiple positions was one central aspect of that strategy.

[5] As a result of a series of stringent regulations, inferior quality domestic breeds were soon completely replaced by Japanese silkworms. Consequently, the percentage of silkworms affected by disease dropped from 6.24% in 1930 to 0.37% in 1935

Chinese financial environment in the early 20th century

The Chinese modern financial sector emerged during the first quarter of the 20th century. It comprised banking institutions, financial organizations, and other associations, public and private, handling monetary and financial transactions under the laws and regulations of Chinese authorities while operating along the lines and methods of modern Western businesses Tamagna (1942, p.5.).

This gave rise to the ”Three Kingdoms” structure of China’s financial market (Cheng, 2003, p.10), comprised of traditional, native financial institutions, foreign international banks and the new domestic modern banking sector. Each of the three came to enjoy considerable autonomy in its specific field of operations and no close, sustained coordination developed between them.

The native money market was formed by institutions dating back to the 17th century, focusing on monetary and financial transactions of traditional Chinese businesses and consumers (NISHIMURA, 2005). They originated as the product of local needs, remained independent of support and supervision from authorities and established local self-regulated guilds which contributed towards maintaining the decentralized state of activities and traditional methods of management and business (Tamagna, 1942, p.5). There is no evidence they financed foreign trade directly or engaged in exchange business.

The foreign banking sector arrived in China during the second half of the 19th century. Foreign banks located in a few treaty ports with Shanghai developing as the most important financial hub. Based on concessions by the imperial government to major powers these institutions were legally exempt from the jurisdiction and regulations of Chinese authorities and operated under the control of foreign powers. Their main business activities were to provide financing for international trade and the presence of international companies in China. In Shanghai, foreign-exchange banks also managed the import and export of silver and international currency transactions. Given these legal and economic conditions, these banks remained institutionally distinct from the rest of China’s financial system. The sector expanded substantially after 1891 when China was increasingly pressured to integrate into the world economy. Additionally, no Chinese financial institutions ever developed into relevant competitors for this type of business [6].

During the final years of the empire and the begin of the republican era the new domestic banks initially had difficulties breaking into business fields that were traditionally dominated by the other

[6] An extended description of the sector is given by Tamagna (1942).

two sectors. Consequently, while traditional, native banks financed domestic trade and foreign banks continued to dominate international transactions the growth of these new banks was driven by financing governments, including new loan issues and direct advances to the government Tamagna (1942, p. 45.). Nevertheless, modern Chinese banks only played a minor role when the KMT took over the central government in 1927.

The fundamental changes to the economy and progressive introduction of new economic structures after the KMT's rise to power created a much more favourable environment for the modern banking sector. In particular, the new modernization policies, which were linked to the nation's political unification, opened new business opportunities. Additionally, external shocks led to a substantial change in the public perception. In the mid 1920s, several prestigious foreign institutions like the Banque Industrielle de Chine and the Russo-Asiatic Bank failed, destroying the myth of foreign banks' force majeure with their demise. As a consequence, social elites like former imperial officials and influential merchants became concerned about the safety of their assets and started to transfer their wealth to Chinese banks. According to reports of the "Southern Three" and "North Four", two important Chinese bank syndicates, the total deposits of these 7 banks expanded from 140 million yuan in 1924 to 240 million yuan in 1926 (Zhaojin, 2016, P. 166).

III The modern Chinese banking industry during the Nanjing Decade

Formally, the first Chinese modern domestic bank was established in 1897, more than half a century after a British bank had set up its first branch in China. The number of banks slowly increased until the fall of the Qing Dynasty in 1911 and then accelerated during the period of the warlords. From 1912 to 1927, despite the political turbulence of this time, a total of 266 new banks opened for business, around eighteen each year. However, almost half as many went out of business during the same period shown in table 1. Although the historical statistics used by *The National Yearbook of Banks 1937* have sufficient information to illustrate trends, the exact numbers are somewhat uncertain as details for some banks are rather sparse.

The Nanjing decade (1927-37), China's "golden decade" of modernization, saw another period of strong growth in the number of banks established, though in contrast to the warlord era the number of bankruptcies remained considerably lower — a total of 124 new modernstyle Chinese banks was

established and 23 liquidated from 1928 to 1937 according to Young (1971, p. 264). Overall, table 1 presents the numerical development of Chinese modern banks from 1896 to 1937.

However, not only the number of modern Chinese banks increased. Their total paid-up capital rose from C$167 [7] million in 1927 to C$403 million in 1936. From 1927 to 1936, these banks more than doubled their capital and reserve funds, tripled their loans and total assets, and quadrupled their deposits as reported by the Bank of China the *The National Yearbook of Banks 1937* and Cheng (2003).

The growth of modern Chinese banks during this decade was unmatched by either traditional institutions or foreign banks and consequently the sector became the dominant player in China's "Three Kingdom " financial structure. As table 2 illustrates, by 1936 the total assets of modern Chinese banks had far surpassed those of native banks and foreign institutions combined.

Although the emerging modern Chinese banks differed from institutions in the other two sectors in its focus of operations, they followed their western counterparts by differentiating further along other dimensions. Following a contemporary classification from the *Bank Year Book 1936* the sector was comprised of the following subgroups of banks:

- Central banking group. These were large public banks under the direction and control of the central government [8]. They only took on direct central banking functions as commonly understood with the 1935 "Fabi reforms". Four banks formed this group, namely the Central Banks of China, the Bank of China, the Bank of Communications and the Farmer Bank of China.

- Commercial and saving banks. The daily operations of these banks covered commercial and general banking, including savings and investment business. These banks tended to have a wider branch network while having their headquarters in one of the major metropolitan areas. Banks in this category comprised the biggest proportion of modern Chinese banks.

- Province and city banks. These were established by local authorities as a consequence of political decentralization after the fall of Qing empire in 1911. Their autonomy from the central government varied with the degree of political control of the KMT over local governments. Main

[7] C$= Chinese yuan

[8] These institutions were not consistently fully owned by the government before the 1935 currency reform, but it had always maintained a substantial stake in them.

functions included, but were not limited to, handling and coordinating monetary transactions at a local level such as tax collection and the issuing of legal tender notes.

- Farmer and industry bank. Financial institutions categorized into this group were banks whose business focused on agricultural and industrial loans. The origins of many banks in this group had a government background, in same cases these had been established by local authorities with the express purpose of supporting the local economy.

- Specialized banks. Although the business spectrum of these banks overlapped with that of commercial and saving banks, they had a special focus on specific fields like silk, mining, or salt.

- Oversea Chinese banks. This refers to banks, whose owners were ethnically Chinese, yet bank headquarters were located outside of mainland China, most notably the British colony of Hong Kong. Given their position they also functioned as intermediaries between foreign and domestic Chinese banks.

Modern Chinese banks not only differed in their business model but also geographic locations. Although some of them had extensive networks of branches, they did show a strong geographic concentration in their centre of operations (Tamagna, 1942, p121). This becomes visible in the summary statistics about headquarters and corresponding capitalization shown in table 3. Shanghai was by far the most prominent financial centre; Tianjin, a major port in proximity to Beijing, was the regional centre in northern China and Chongqing a counterpart in the south-west. Hong Kong was the leading financial market in southern China, although it was not territorially part of China. Banks located in other metropolitan areas fall in the ”Others” category.

Shanghai clearly dominated with 80 banks having their operations headquartered there, a number substantially greater than those of the regional centres in Tianjin, Chongqing and Hong Kong. The aggregate assets controlled by Shanghai banks were over 4 billion Chinese yuan, an amount almost tenfold greater than that held by banks in Tianjin, the most significant financial hub in Northern China. The average bank size in Shanghai was also the highest with average assets of C$ 76,149,984.

The table also demonstrates that the type of bank influenced the level of geographic concentration. Three of four central banking group banks were located in Shanghai, which despite not being the official capital was the dominant economic, commercial and population centre. This is also reflected in the locations of Commercial bank headquarters, more than half of which were located in the city.

Banks with a more focused agricultural or specialist focus were also more likely to be located there, but with shares of a third (Specialized banks) to a quarter (Farmers & Industry banks) the concentration was substantially less strong. However, none of the other major centres had anywhere as strong a concentration in any of these categories. This difference of strength in concentration points towards the importance of agglomeration forces in the banking sector. Banks with a predominantly financial focus were strongly clustered while banks with a specialized industry or agriculture emphasis followed their customers more strongly in terms of geographical location. Similarly, the Province & City banks clearly showed their origins in and links to regional locations as they were spread all over different metropolitan areas, while Oversea-Chinese banks were primarily clustered in Hong Kong, the major foreign colony in China.

IV Links and Networks

Geographic concentration might be a good indicator for the presence of agglomeration forces, but it does not necessarily say that much about the level of competition or cooperation between individual institutions within the sector.

If cooperation between firms within a particular industry is driven by institutions outside of the sector, it is usually banks and financial institutions who act as such third party coordinators. An important mechanism is the access to and allocation of capital (Holmes and Ploeckl, 2014; Wilson et al., 2017; RINALDI and VASTA, 2005). In the case of financial sectors, however, there usually is no such external coordinator, consequently we focus on the internal relationship structure of the modern Chinese banking sector to understand how it successfully developed and operated in an uncertain environment.

The idea of strong cooperation within the sector was certainly present in the minds of directors and managers at the time. Leaders of the major institutions seemingly believed that only by cooperating would their banks survive the fierce competition and expand further as detailed in He and Xuan (2015). One practical manifestation of this cooperation mindset was the creation of the Shanghai Bankers' Association (SBA). This industry organization was established in 1918 in Shanghai with the intent to promote not only the welfare of its members but also to coordinate their strategic plans. By 1931, the number of member banks had increased to 29 from the original seven (Cheng, 2003).

Practically, cooperation between banks, today as in republican China, can take a number of different forms. One strong link is ownership and control; one bank might directly own another or be at least a large enough shareholder to be able to exercise control over it[9]. Less strong forms of cooperation are commercial ties and joint projects; banks might cooperate with other institutions in financing a common investment project, in issuing stocks and bonds, or in accepting each other's issued notes. These have in many, though not all, cases more of an ad-hoc character and not the systematic permanence of ownership and control. Besides commercial ties banks can also have more social and informal ties, which include activities on bank-level, for example membership in industry associations such the Shanghai Bankers' Association (Tamagna, 1942, p.175), as well as on individual level between directors or senior managers. The latter includes common background, such as based on a particular location or educational institution, or common social activities like memberships in clubs and organizations like the Freemasons. Cliques based on location were clearly an important characteristic of Chinese financial institutions (Sheehan, 2005). Such informal ties, however, can lead to another, more visible form of linkage that combines firm-level and individual level ties, namely an interlocking directorate. This means that the same person has formal roles in two (or more) financial institutions. Roles can vary depending on management and governance structures, but it obviously does require the consent of both banks. Such an arrangement is usually referred to as ab interlocking directorate.

There are a number of possibilities to quantitatively measure the cooperation between banks within a sector, each with a different focus and reflecting different aspects of cooperation and competition. We chose the network of interlocking directorates as it balances direct, formal links like outright ownership and informal or commercial cooperation ties. This reflects that cooperation arose out of different motives, including direct control, profitability, and social ties, all of which are linked to interlocking directorates[10]. In addition, interlocking directorates present practical advantages for an analysis due to the relative simplicity of the measure, its public nature and consequently the comparatively good data availability over the whole sector.

[9] A typical example was the KMT gaining control of private banks through bailouts and resulting nationalizations. For more detail see section VI.

[10] The literature concerning the relevance of interlocking directorates for the analysis of cooperation and corporate governance see for example Anjos and Fracassi (2015); Parker and Cross (2004); Renneboog and Zhao (2014); Larcker et al. (2013).

Interlocking directorates

An interlocking directorate exists between two banks if one employee has recognizable roles in both institutions. Although it is possible to restrict it purely to company directors we utilize a more extensive definition and include besides directors also employees[11] that work in senior management and similar operational roles. There is a substantial literature in Finance and Financial History that defines and investigates interlocking directorates and the connectedness of banks, for example Larcker et al. (2013), Fich and Shivdasani (2006), Field et al. (2013) and El-Khatib et al. (2015).

As the names of directors and senior management usually became public knowledge an interlocking directorate had to be based on tacit or explicit permission of both institutions involved. More importantly, it often was based on instigation of at least one of the banks. One common scenario is that if one banks either outright owns or at least holds a substantial equity stake then it installs some of its own employees in important roles at the other bank. This can be done for monitoring and control purposes as well as for operational and performance motives[12]. Such an interlock is a link between two firms. This can be translated into a network structure with the banks representing nodes and the connecting interlock representing edges. Based on this concept, we are able to construct an undirected bank network formed by shared directors[13]. In terms of Social Network Analysis we take the banks as actors who decide about forming links between them. This implies that edges are the resulting outcomes of decisions by actors, the nodes, and do not constitute actors themselves.

The interlocking directorate network illuminates inter-banking relationships which are reflecting a number of underlying economic intuitions and motivations of corporate behaviour. An analysis approach with social network analysis tools is adopted by a growing literature investigating social connection patterns between companies and related implications both from theoretical and empirical aspects (Jackson, 2014; Dass et al., 2014; Parker and Cross, 2004; Fracassi and Tate, 2012). Particularly, existing literature highlights some features that are important aspects in our setting: bankers on the boards of other corporations can provide know-how and better access to financial support (Gao et al., 2012); interlocking directors act as monitors and adviser, since those directors are experienced and possess professional expertise (Fich and Shivdasani, 2006; Field et al., 2013). Overall, Mizruchi (1996)

[11] For simplicity reasons, in the following we will include these also under directors.

[12] This understanding aligns with Lan (2015, p.171- 183).

[13] An undirected network assumes that edges between two nodes do not have a direction, so there is no distinguishing of origin and destination for any link. This also implies symmetry, so bank A is linked to bank B and vice versa. For formal network construction and description processes, see Jackson et al. (2016)

provides an in-depth examination of interlocks over organizations and systematically summarizes both explicit and inadvertent incentives for the formation of inter-firm linkages as collusion, cooptation and monitoring, legitimacy, career advancement for individual directors, and social cohesion. As the various implications of interlocks may carry as to the corporate governance and management, Brayshay et al. (2007) suggests that examination of boardroom networks provides an initial basis for studies of how inter-organization connections may have influenced firm activity.

Interlocking Directorates of modern Chinese banks

As indicated above, this study focuses on modern Chinese banks in the period 1933-1936, the end of the Nanjing era before the Sino-Japanese war. This excludes traditional financial institutions as well as foreign banks. While a number of Chinese banks did interact with foreign financial institutions, the two banking sectors did remain clearly separated. This is similar to the clear distinction of these institutions from the traditional financial institutions. Besides, as we showed earlier in table 2 modern-style Chinese banks had risen to dominance by the 1930s with collective bank capital surpassing that of foreign and traditional institutions combined. Consequently, we only look at domestic Chinese financial institutions that were patterned on western banking institutions.

The main data source is *The National Yearbook of Banks*, which was published by the department of economic research of the Bank of China. The annual issues for the years from 1934 to 1937 contain summaries about the whole sector as well as accounting and operational data about individual banks including names and positions of their directors and managers. We construct the dataset of boardroom composition by extracting information from the summary descriptions of the sector as well as the included annual reports of individual banks.

This data, which includes names, positions, and branch locations, is used to identify interlocking directorates by matching names of listed directors of all included banks. Due to the structure of traditional Chinese names duplicate names are not a significant concern. Nevertheless, we address this by complementing the basic information about individual directors with information on middle name, birthplace, and age from various biographies and other sources[14].

[14] The major data source we use in the article is based on (Jiang, 2014).

For a very small number of institutions the recorded data is substantially incomplete or inconsistent. We exclude these as they are very small, local institutions and account for only a minuscule proportion of the full dataset. Consequently, our final sample consists of an unbalanced panel of 628 bank-year observations for the four-year period from 1933 to 1936[15]. While the coverage is complete for interlocking directorates, some of the operational and other bank characteristics are missing for a small number of observations.

Table 4 presents annual counts of directors and banks involved in interlocking directorates. Despite the unbalanced nature of the panel being responsible for a substantial share of the fluctuations, a consistent picture emerges that a comparatively small number of directors were linking together a major share of the whole domestic Chinese banking sector.

Furthermore, the average number of directors per bank involved in interlocking directorates is close to two, implying that many banks were linked in different directions rather than just by a single link[16]. This is confirmed by figure 2, which shows the number of links per bank in 1933. Although there is a substantial number of banks that are completely unconnected and some with a single link only, the majority of banks formed part of two or more interlocking directorates. Figure 2 also shows the corresponding cumulative capitalization/asset distribution for 1933. Banks without connections account for a quarter of the total assets in the sector, while linked banks account for 75% of assets by their well-connected counterparts.

As table 4 indicates the network of interlocking directorate was changing substantially over the four years. Although a certain amount is due to the unbalanced nature of the panel a good number of banks, according to table 5 about a quarter to a third, changed their board composition during the course of a year. As interlocking directorates are defined by board members, changes in board membership obviously has implications for the persistence and stability of the interlocking directorate network. Consequently, the network was clearly not a static, inert structure but was continually adjusted and modified by the involved banks.

[15] Specifically, the dataset includes board information of 142,159,164, and 163 banks from 1933 to 1936 respectively.

[16] This also indicates that interlocking directorates are not just representing ownership and control.

V Connections and cooperation

Clusters

The previous section introduced the interlocking directorate network as a representation of the nature and structure of cooperation within the domestic Chinese banking sector.The shape of the network reveals and illuminates a number of internal characteristics of the banking industry. The main aspect we look at here is the question of competition and cooperation. How did the sector structure respond to an environment that despite some progress in the Nanjing decade still was characterized by uncertainty and weak property rights?

Figure 3 gives a graphic visualization of the network in each of the four years with the banks categorized into three types, namely the central banking group, provincial and city banks, and regular banks[17].

The four panels, as well as the close-up on a subgraph in figure 1 reveal the following about the sector:

- First, the sector was split into one dominant, large principal component with a dense network between the banks in that component and a set of essentially unconnected banks.
- Second, the central banking group banks were all at the core of this principal component as were a number of regular private banks.
- Third, many, but clearly not all, of the local and provincial banks were unconnected outside the central component

These network characteristics lead to some conclusions about the nature of cooperation in the sector. It was clearly dominated by a central cluster indicating a high level of cooperation. If the industry were more competitively oriented we would expect a number of distinct components, groups of banks, in competition with each other without substantial inter-group links. The absence of smaller clusters and the presence of a substantial number of unconnected banks point towards market segmentation where the central component integrates the major economic centres while regional institutions captured a specific local market without strong or even any local competition.

[17] This groups Commercial & Savings banks, Farmers & Industry banks, Specialized banks, and Oversea-Chinese banks in one category.

These two conclusions, cooperation rather than competition and market segmentation at the periphery of the industry, are also consistent with the shown positions of public institutions. As figure 1 shows, the major central banking group banks were not forming a separate group but were linked widely with private banks. The isolation of local and provincial banks, especially the substantial number of unconnected such banks, points towards a lack of competition in the home markets of these public institutions, which were located outside the major financial centres.

The principal component

The ”bird view” impression of the sector shows one dominant network component and a number of isolated banks. This identified principal component of the network represents a large share and core of the sector, as visible in table 6, so its internal structures illuminate the nature of cooperation in the sector even further. Consequently,the following looks at the positions of individual institutions within that central component.

Social Network Analysis provides measures about the relative and absolute positions of individual actors within networks (Padgett and Ansell, 1993). Here we utilize three of these, namely Degree, Closeness and Betweenness [18].

The simplest measure of centrality is called Degree. It is the number of links a node has with other nodes. Thus, a node a's degree in a network n, denoted as $d_a(n)$, is defined as

$$degree_a(n) \equiv \sum_{a \neq b} g(a,b) \quad (1)$$

where $g(a,b)$ is an indicator that there is a direct link between node a and b.

This measure illuminates the relative importance of actors, banks, within the network. This can have practical consequences: for example, in terms of information contagion, an actor who is linked with a larger number of other actors is likely to receive external messages differently, potentially more frequently and faster, than actors that are relatively less connected (Jackson et al., 2017; Lamberson, 2016).

[18] Literature using these measures to conduct the analysis including Larcker et al. (2013); Fracassi (2017) etc..

In a network of interlocking directorates the degree measure shows for each bank with how many other banks it shares a director, so has an interlocking directorate. A well-connected bank in this way is expected to have more channels for communications and the exchange of resources.

Table 7 shows summary statistics regarding the Degree for central component banks. The average fluctuates between 7 and 9 over the four years. This high number shows that the involved banks formed a dense web of connections with other institutions. Although there are a number of banks with a single link the median value of seven and a lower quartile value of 3 do show that the cooperation in the sector is not just one dominating bank linking to everyone else but a substantial set of connections between banks that are not at the core of this component. This indicates the benefit of cooperations were more evenly distributed across the whole sector rather than just accruing to a few dominant institutions.

In addition to direct connections we are also interested in how close each one is to every other bank in the network. This idea leads to the second concept of Closeness centrality. Mathematically, it is defined as the inverse of the sum of all the distances between a node a and all other nodes in the network:

$$closeness_a(n) \equiv \frac{1}{\sum_{a \neq b} l(a,b)} \tag{2}$$

where $l(a,b)$ is the number of connections in the shortest path between the two nodes a and b. For comparison across graphs and with other centrality measures, this measure is normalized to lie in the interval $[0,1]$ through multiplication by a factor (N_v-1), where N_v is the total number of nodes in the network.

The Closeness centrality measure attempts to capture the notion that a node is ”central” if it is ”close” to many other nodes. In the corporate context, if an actor has comparatively closer ties to more boards, it facilitates better information diffusion and exchange to this node (Larcker et al., 2013). As more central actors can quickly interact with many other boards across the network these nodes find it easier to profit from the benefits of these connections.

Banks with higher Closeness values are engaging in more exchange of information, which allows them to operate more profitable as well as a better understanding of the outside environment. This

easier information access implies an advantage for these banks also in the way they are able to react to changes in an unstable political and economic environment[19].

The results in table 7 shows for the four years the average normalized closeness values of 0.288 to 0.383, which imply average path lengths of 2.6 to 3.4 connections. The distribution of the values also shows that they are fairly close between the observations with the shortest and the longest average path lengths. This implies that pretty much all involved banks were linked well throughout the whole principal component without subsets having been only remotely linked to the rest of the cluster.

Thirdly, we look at the Betweenness centrality measure to understand how central an actor is for the connections between pairs of other actors (Freeman, 1977). It highlights the extent to which an actor performs as an intermediary by investigating how frequently that actor is a link in the shortest connection between pairs of actors. A formal definition of betweenness centrality of a node is

$$betweeness(n) \equiv \sum_{j<k} \frac{g_{jk}(n)}{g_{jk}} \tag{3}$$

letting g_{jk} denote the geodesic between nodes k and j, where geodesic is the shortest path between two nodes. $g_{jk}(n)$ denotes the total numbers of shortest paths between nodes k and j. Analog of the closeness centrality, the value of betweenness can be restricted to the interval between 0 and 1 through division by a factor of $(N_v - 1)(N_v - 2)/2$.

A node with a high value of betweenness is prominent, as that actor is in a position to observe or control the flow of information in the network. In other words, the measure illuminates how central an actor is as intermediary between other actors. This relies on the importance of shortest paths, assuming that such paths with the lowest amount of steps, and consequently going through the least number of actors, are the relevant connections between two actors in question[20].

In the case of banks a more central, intermediary position can provide easier access to more information relevant for financial operations. A high difference in this measure also indicates that one bank is substantially more important than another in structuring the sector as it facilitates more coordination between different banks with the potential to improve diversification in geographic or operational focus and to influence others according to its own preferences.

[19] Recent studies confirm the information spillover of boardroom network as well as other social connections among firms, for example, Helmers et al. (2017), HOCHBERG et al. (2007) and Gao et al. (2012).

[20] For a comprehensive summary of the network centrality measure, see Luke (2015).

The derived values for this measure as shown in table 7 indicate a substantial spread between banks in the principal components. This points towards a core set of banks that did sit at the heart of the cluster without however restricting links between other banks. These more central banks potentially shaped the internal structure more strongly, however that was predominantly through their influence rather than through direct control.

Putting the results from the three measures together a more detailed picture of the principal component of the bank network emerges. While there was a core of banks within this cluster, the web of interlocking directorates around that core was fairly strong without clear sub groups or dependency on the core banks. Consequently, the internal structure of this principal component indicates that a major part of the banking sector acted in a unified and coordinated manner rather than outright competition or a separation into linked but distinct groups. Although the sector looked coordinated, this coordination did not rest on the dominant position of a single institution.

Network centrality and bank characteristics

Banks not only differed in their centrality but also in size and related characteristics. Does this differentiation in terms of size not only hold for involvement in the principal component, but also for the importance within the component? In short, were larger banks more connected and more central within the principal component?

Panel A of table 8 clearly confirms that. It shows summary statistics for quartiles based on the number of links. Banks in quartile 4, so those with the highest Degree centrality, were clearly larger in terms of assets, locations, staff and size of their boards than banks in lower quartiles. This result is not very surprising as larger banks were usually more likely to have substantial stakes in or ownership of smaller banks, and interlocking directorates were a related monitoring and control mechanism. Larger banks also operated larger branch networks in substantially more locations, which offered more opportunities for cooperation and led to a higher demand for information from geographically more diverse sources.

Panels B and C of table 8 confirm the conclusions about the nature of the principal component. Larger banks not only had a higher degree but also a higher Betweenness value, so they were sitting more central within this network component. This is consistent with the existence of a core group of banks within the network and the domestic Chinese banking sector at large. Closeness however is not substantially correlated with size, which indicates that smaller banks also formed connections directly

with each other all throughout the network, therefore reducing the average distances between banks within the periphery of this network component, and consequently their reliance on core banks.

Next to their size and connections, banks in the central component also differed in their business specializations, their headquarter locations and private or public ownership. Table 9 lists statistics about the headquarter locations[21] of the banks in the principal component.

The geographic scope of the principal component shows an even stronger focus on Shanghai than the network at large, which illustrates the dominance of this coastal metropolis for the financial sector in China and the development of a modern banking industry.

The geographic concentration was also closely linked to the different types of banks in the sector. While the central banking group banks were operating on a national scale as full commercial banks, the provincial banks were predominantly focused on their local home market in providing financial services. Consequently, in 1935, all central bank group banks were in the principal component and three out of hour had their headquarter in Shanghai, while only seven out of 27 province and city banks were in the principal component, and out of those only two were in Shanghai.

The correlation between spatial concentration and bank type not only held for public banks but also private institutions. Regular commercial banks were overrepresented in the principal component and were stronger concentrated in Shanghai. Only six out of 34 Farmer and Industry banks were linked into the principal component network, however all of these were located in Shanghai. This reflects their dual purpose, while some were located close to China's industrial centre at the time, the others were spread regionally close to agriculture. Specialized banks were somewhat more geographically diverse as they were linked to different specialized industrial sectors, but they were mostly within the principal component. Their focus on important industries meant that they were either linked to the central banking group banks reflecting rising government involvement in industrial development or to important commercial and savings banks due to the coordination of private supply of capital to those industries. Overseas-Chinese banks obviously differed in their geographic locations as their headquarters were outside the Chinese republic. With two out of four banks located in Hong Kong, both of which were part of the principal component network, the British colony represented the main

[21] In addition to the cities used above we also list Wuhan. Although it was not a treaty port we include it to give a more complete picture of locations, in particular with the Farmer Bank of China, a central banking group bank, located in Wuhan.

gateway for the domestic Chinese banking sector to interact with overseas Chinese financial institutions.

Entrants, Competition and Cooperation

The picture drawn in the previous section indicates that the domestic Chinese banking sector was characterized by a core structure of cooperation that covering all major financial centres and to some degree banking specializations. And although the network of interlocking directorates did show significant turnover, this structure remained consist over the years in question.

In such a system competition could arise either through a group of banks splitting off from the central cluster and creating their own cooperation network or through new entrants that remain independent of the core cluster. The characteristics of the core network structure does not show any indication of such a drive towards a breakup, and even more strongly the low closeness scores also indicate that a large number links would have to be severed for such a breakup.

The Nanjing decade saw a substantial number of new banks created. Given the shape of the network, isolated banks and a central core network, these new entrants could either increase competition or be part of the cooperation within the sector. If new entrants were predominantly isolated, so without interlocking directorates with existing banks, this would point towards new entrants fostering competition. However, if they started already as part of the core cluster, so with interlocking directorates with existing banks, then new entrants were supporting the existing cooperation structure and the rise in bank numbers points towards an expansion of the cluster in terms of geographic and operational diversification of the dominating core banks.

To understand which of the two motives, competition or cooperation, characterized the expansion, we look at the average Degree of banks sorted into quartiles according to their age. Table 10 shows the results for each of the four years, including the average age[22] of the banks in each quartile, their network degree and the total number of banks in each quartile. As is clearly visible for each year, newly created banks actually had a larger number of interlocking directorates than any of the other quartiles.

The high number of interlocking directorates of young banks clearly demonstrates that new banks were built on the expertise, knowledge and support from existing banks. As many directors of the new banks remained active with their existing employers this clearly points towards the entry of new banks

[22] Banks with missing age are primarily small, rural banks. These did not represent an increased competition as they only operated in their local home markets without competing substantially against principal component banks.

as an expansion move of existing banks rather than the emergence of new competitors or the breakaway of directors from existing core group of the sector.

This result of new entry being dominated by expansionary motives is also borne out in anecdotal evidence. For example, in 1935, the Chekiang Commercial Banking Corporation (CCBC) had been established by Runquan Jin, a financial veteran, who rose to prominence in the Bank of China after starting his career in 1909 as a branch manager of the Imperial Bank of Qing, its predecessor (XU et al., 1997). Jin took on over time a number of director and supervisor positions with several leading commercial banks in the Yangzi-delta region. Using his social connections and reputation in the sector, CCBC soon attracted a number of promising investors. The board committee included Zuoting Yu, the principal director of Wai Chung Commercial & Saving bank and executive director of dozens of commercial banks in Shanghai. The participation of such ”big linkers” granted an advantage of CCBC in gaining internal information and cooperation with other banks. The total asset of CCBC increased from 2,091,165 Yuan in 1935 to 2,311,154 Yuan in 1936, a 10% expansion in its first year of operations[23].

VI Government and banking cooperation

The presence of the central banking group and provincial and city banks clearly showed an involvement of government in the sector. More general, government has a choice between multiple options of how to systematically intervene in the banking sector, most notably pure regulation, full nationalization and individual bank ownership and cooperation.

After the fall of the Qing Dynasty in 1911 various national governments either had only a limited geographical reach, so were national in name only, or not powerful and stable enough to exert sustained control over the financial industry including the rising domestic bank sector. This political instability explains why despite a series of attempts by various interim regimes no central government was able to achieve dominance over the modern banking sector until the political unification in 1928 under the KMT government. This lack of power and limited geographical reach also explain why only regulation as well as nationalization were not viable options.

Consequently, we argue that the Nationalist KMT government used the partial ownership of the central bank group to gain influence and even control over the modern financial sector. Direct control over individual institutions, however, only allows the government to influence the whole sector if these public banks have substantial links, formal and/or informal, with private institutions. Influence

[23]Performance data extracts from Bank Year Book 1936 and 1937, page D185 and D110, respectively.

through interlocking directorates corresponds to the prevailing view among historians that the Nationalists were considerably more successful than earlier regimes in gaining control over and enforcing their will on members of the social elite (Eastman et al., 1991; Fewsmith, 1985). Leading bankers, including those that held interlocking directorates were important members of the social elite at the time (Lan, 2015, p. 172).

This growth in influence of the government over financial institutions is very visible in the fate of monetary reforms attempts. For instance, in 1916 the Beijing government had attempted to suspend the convertibility of the currency. This move led to fierce condemnation from bankers and local elites and to a declaration of independence by the Bank of China, ultimately resulting in the government abandoning the policy (Cheng, 2003, p.55). In 1935, by contrast, the national government conducted successfully a currency reform by introducing a legal note, *Fabi*, which included the suspension of convertibility per se. This was met with little protest and even with support and promises of cooperation from the domestic banking sector (Young, 1971, p.216). Although the sector was substantially smaller in 1916 than 1935, the lower government involvement meant that it wasn't strong enough to overcome the banks' resistance, while the government's hold over the central public banking group and that groups influence in 1935 was important enough to convince and bring along the rest of the sector

Government involvement with the central/state bank group

The core[24] of the national governments influence were above listed four banks in the central banking group. These were tasked with a number of public functions, including issue of legal tender notes, control over the foreign exchange and domestic money market, and handling of the treasure's funds, with each taking on specific duties(Tamagna, 1942, p.121). For instance, from 1935 the Central Bank of China acted as the depository and fiscal agency of the treasury, while the Bank of China was the lead bank to handle international exchange. Besides these, the banks were also operating as regular commercial and savings banks in competition with private institutions[25].

Public ownership, or at least a substantial equity stake, meant that the government exercised substantial influence or outright control over the appointment of directors of the central banking

[24] Although province and city banks had flourished until 1935, their dependence upon the Ministry of Finance at national level varied with the degree of political control the national government exercised over local authorities.

[25] This is a summary of authors based on Tamagna (1942, p.122-130).

group. For example, it appointed the completed board of the Central Bank of China (Tamagna, 1942, p.122). The Bank of China was jointly controlled the Ministry of Finance and the general meetings of shareholders. The Ministry of Finance was entitled to appointed the bank chairman, nine out of 30 directors and three out of 10 supervisors (Tamagna, 1942, p.127).The government's ability to appoint directors implies that the interlocking directorates between central banking group banks themselves as well as with private institutions were strategic choices by the government. This power allowed them to systematically place the central banking group banks at the core of the internal network of the modern banking sector in China. The KMT thereby successfully increased the reach and strength of its influence on domestic financial institutions and the wider economy through capturing the elites' interests rather than through regulation.

Connections with private financial institutions

This reach is evident in the boardroom connection statistics for 1935 in table 11. The central banking group banks, which were fully linked with each other, had 74 interlocking directorates with private institutions.

These links reflect a motivation to spread the KMT government's influence over the industry to control and coordinate the modern financial sector in an uncertain environment — directly or indirectly — even when its official decrees and regulations were hard to enforce.

This is consist with the theoretical idea suggested by Mizruchi (1996), who argues that cooptation and monitoring are explicit reasons for the formation of interlocks and consequently the absorption of potential disruptive elements into the organization's decision-making structure. Inter-banking social connections can reflect therefore attempts by organizations to coopt and neutralize sources of environmental uncertainty.

Boardroom influence was also reflected in the government's willingness to intervene for individual institutions. In 1935 a number of private banks ran into financial trouble[26], but while three principal commercial banks, — namely, Manufactures Bank of China, National Industrial Bank of China, and Commercial Bank of China — obtained advances of CN$5 million each from the national government[27] were a number of other banks left to their own resulting in their bankruptcies. As table 12 shows, the

[26] According to The National Yearbook of Banks 1936, there were 15 modern banks went bankrupt in 1935, several others ran into economic distress due to the external shock of the global depression.

[27] The government then converted these advances into equity and nationalized these banks in 1937.

three saved banks had existing interlocking directorates with central banking group banks in the years preceding 1935 while the failed ones did not.

Particularly, both National Industrial Bank of China and Dan Hoo Commercial & Savings Bank were prestige institutions in Shanghai before the crisis with similar assets, board sizes and business model. However, the National Industrial Bank of China had been keeping a close relationship at board level with the central bank group, as shown in panel A of table 12, whereas Dan Hoo Commercial & Savings Bank — with a similar magnitude of interlocks — had only a marginal connection to the state-owned banks. As proposed by the cooptation and monitoring model of Mizruchi (1996), interlocks were used as instruments of corporate control in an uncertain environment and utilized as monitor over the connected firms, influencing the responses of the government.

This indicates that interlocks of the central bank group provided an extra conduit beyond conventional methods for the government to get operational information of those linked banks, thus shaping the government's decision to intervene and ultimately nationalize only banks with pre-existing interlocking directorates. The contrast in government actions reinforces the impression that interlocks between Chinese banks were an influential mechanism of inter-banking cooperation and control.

VII Conclusion

Most studies focus on the impact of interlocking directorates on individual firms, but looking at the network of such links within a whole sector can illuminate its inner workings. The modern Chinese banking sector rose to prominence during the inter-war years, facing a volatile external environment with weak institutions. As their network of interlocking directorate shows, the banks reacted with a strong level of cooperation resulting in a single large
cluster.

The cooperation within the sector covered all relevant financial centres and connected banks following similar business models as well as those with a different specialization. Although larger banks were more at the core of the cluster, connections of more peripheral banks weren't just to the core but created a close web throughout the periphery. The large number of links of new entrants and young banks also demonstrate that the expansion of the sector in number of banks was driven by existing banks expanding their reach rather than by the entry of new distinct competitors. The network showed a substantial level of changes over years, the fundamental characteristics of the whole sector

network however remained quite consistent. Nevertheless, the dynamics of the network-formation offers exciting opportunities for further investigations.

The network offers even further insights by reflecting important aspects of the relationship between the sector and government. The central government controlled a core group of larger banks, and through the strong set of links of these banks it was able to exert influence on the whole sector. Direct intervention in an industry through ownership of a few key firms is one particular strategy for government to engage with that sector. The interlocking directorate network of Chinese banks demonstrates that in an environment with weak contract and rules enforcement the rising central government used this strategy to increase its influence and intervention over an important sector at the core of the larger economy.

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Tables

Table 1: Chinese modern bank statistics from 1896 to 1937

year	founded	bankrupt	net change	year	founded	bankrupt	net change
1894	1		1	1921	27	18	9
1902	1	1		1922	27	19	8
1905	1	1		1923	25	20	5
1906	2	2		1924	7	5	2
1907	3		3	1925	9	7	2
1908	4	3	1	1926	7	7	
1909	1	1		1927	2	1	1
1910	1		1	1928	16	5	11
1911	3	2	1	1929	11	3	8
1912	14	10	4	1930	18	6	12
1913	2	1	1	1931	16	6	10
1914	3	1	2	1932	13	4	9
1915	7	5	2	1933	15	3	12
1916	4	3	1	1934	22	4	18
1917	10	9	1	1935	18	15	3
1918	10	6	4	1936	5	7	-2
1919	16	9	7	1937	3	4	-1
1920	16	14	2	unknown	50	24	26
				Total	390	226	164

Source: The department of economic research of China: *Quanguo yinhang nianjian* (The national yearbook of banks[1937]), A7-A8, A24-A25.

Table 2: Capital power in the Chinese financial market (1936)

Name/Items	Chinese Banks		Foreign Banks		Native Institutions		
	Amount	%	Amount	%	Amount	%	Total
Note	1,946.7	87	284.7	13	0.0	0	2,231
Deposits	4,551.3	79	511.2	9	673.6	12	5,736
Capital	402.7	67	113.7	19	84.2	14	600.6
Total	6,900.7	81	909.6	11	757.8	9	8,568

Unit: C$ 1,000,000.
Source: Cheng (2003, P.78)

Table 3: Bank headquarters and capitalization distribution statistics in 1935

Bank Type	Bank Headquarters				
	Shanghai	Tianjin	Chongqing	Hongkong	others
Central and chartered banks	3	0	0	0	1
Commercial & Savings Bank	62	5	5	6	33
Province & City Bank	2	1	2	0	22
Farmers & Industry Bank	8	1	0	0	25
Specialized banks	5	3	3	0	4
Oversea-Chinese Bank	0	0	0	4	4
Total numbers:	80	10	10	10	89
Total assets (in million C$):	4,264.1 Mil	438.6 Mil	78.3 Mil	228 Mil	1,058 Mil
Avg. assets (in C$):	76,149,984	54,830,870	11,185,961	75,996,639	13,924,984

All figures are based on authors' calculation and summary.

Table 4: Summary statistics of connected directors and banks

Year	# Director		# Banks		avg. # busy dirs/bank
	connected	unconnected	connected	unconnected	
1933	148	1267	101	41	1.04
1934	199	1429	114	45	1.25
1935	243	1459	108	54	1.5
1936	169	1530	104	58	1.04

This table presents a summary statistic of the connected director and banks of the data. Directors are considered as connected if they affiliate with more than one bank. Column 5 and 6 reports the number of banks with connected and unconnected director, separately. Avg. # busy dirs/bank refers to the number of connected directors each bank on average. See text for the detailed data source.

Table 5: Summary statistics of bank board composition change rate

Bank Type	1933	1934	1935	1936
All	base year	0.273	0.293	0.325
Central banking group	base year	0.410	0.155	0.221
Local official banking group	base year	0.256	0.432	0.438
Ordinary banking group	base year	0.272	0.264	0.301

Table 6: Summary statistics of bank network characteristics

Panel A: Descriptive Statistics bank network

	1933	1934	1935	1936
#Banks	144	159	162	162
#Links	329	458	424	416
#Isolated Banks	41	45	54	58
Network density	0.033	0.036	0.033	0.032

Panel B: Summary statistics of central component

#Banks	88	89	102	94
Avg. path length	3.026	2.512	3.396	2.903
Diameter	9	8	12	9
Clustering coeff.	0.41	0.40	0.41	0.41

Panel A demonstrates annual summary statistics of aggregate bank Network from 1933 to 1936. A component in network is a subset of the network that all its vertexes are inter-connected. Isolated banks are those nodes, which have no connections to other vertexes in the network. Panel B contains statistics summary for the primary component of our bank network. Average path length indicates the average shortest number of steps among two arbitrary banks (nodes). Diameter is an indicator shows the longest number of steps between any two nodes in the network, and clustering coefficient describes an enumeration of the proportion of vertex triples that form triangles, i.e., all three nodes pairs are connected by edges.

Table 7: Network and bank characteristics statistics

Panel A: Firm counts and sample average in the principal component by year

Year	0bs	degree	close-ness	Between-ness	total assets	est. year	#staff	#branch cities	board size
1933	88	7.320	0.319	0.025	52.3M	1924	223	8.7	13.8
1934	89	9.550	0.383	0.019	53.2M	1924	244	10.2	13.4
1935	102	8.260	0.288	0.026	59.3M	1924	224	3.7	13.7
1936	94	8.740	0.338	0.022	86.1M	1924	296	5.4	14.1

Panel B: Descriptive statistics of main bank characteristics in the principal component

	Mean	St.Dev	Min	P25	Median	P75	Max
Degree	8.470	6.570	1	3	7	12	36
Closeness	0.330	0.074	0.115	0.286	0.340	0.380	0.518
Betweenness	0.023	0.035	0.000	0.001	0.010	0.029	0.267
Assets (million)	63.6M	196M	0.1M	3.07M	7.55M	35.3M	1800
Est. year	1924	8.3	1897	1919	1928	1931	1936
# staff	247	495	6	36	61	205	3505
# branch cities	6.77	15.20	1	1	2	6	156
Board size	13.70	4.70	2	11	13	15	39

Panel C: Firm counts and sample average in the principal component by bank type in 1935

Bank type	obs	degree	closeness	betweenness	Total assets	Est year	#staff	#br. cities	Board size
Central	4	21.50	0.35	0.06	768M	1920	1836	14.3	23.8
Com.& Sav.	60	8.93	0.31	0.03	21.1M	1926	137	3.0	13.0
Farm.& Ind	13	6.00	0.25	0.02	21.9M	1922	166	4.8	16.0
Oversea	3	2.67	0.19	0.03	27.4M	1920	94	2	14.0
Prov.& City	11	5.36	0.24	0.03	49.9M	1923	228	4.2	10.7
Specialized	11	6.82	0.27	0.02	18.9M	1924	79	2.1	12.6

For network measures calculation — namely degree, closeness and betweenness — see text for details. Total assets is the bank assets in Chinese $, the numbers display in scientific notation. # staff and # branch cities indicate the total number of staff in the bank and the cities where the bank had branches, respectively. Board size measures the number of directors in the board. Establish.year is the year in which the bank was founded.

Table 8: Differences in means with alternative network centrality measures

Panel A: Difference in means, based on Degree centrality					
Quartile	size	board size	# cities	sec.asset.ratio	# staff
Least connected	15.28	11.92	3.27	0.08	96.75
Quartile 2	15.83	12.28	4.42	0.13	126.10
Quartile 3	16.50	13.31	4.78	0.11	216.10
Most connected	17/09***	17.89***	15.25***	0.10*	582.10***
Panel B: Difference in means, based on Closeness centrality					
Quartile	size	board size	# cities	sec.asset.ratio	# staff
Least connected	16.04	13.33	9.94	0.10	238.10
Quartile 2	16.56	14.09	5.40	0.12	300.40
Quartile 3	15.78	13.50	3.72	0.12	192.50
Most connected	16.23-	14.11-	8.49-	0.09-	260.70-
Panel C: Difference in means, based on Betweenness centrality					
Quartile	size	board size	# cities	sec.asset.ratio	# staff
Least connected	15.53	11.92	3.48	0.09	109.00
Quartile 2	16.17	12.51	5.28	0.11	188.40
Quartile 3	15.92	13.74	6.03	0.11	167.70
Most connected	16.86***	16.62***	11.90**	0.11**	499.20***

The symbols ***, **, and * denote significant difference in means of Quartile 1 and Quartile 4 at the 1%, 5%, and 10% levels, respectively. − indicates there is no statistically differences between observations in Quartile 1 and Quartile 4.

Table 9: Bank headquarters statistics in the principal component of the network in 1935

	Bank Headquarters				
Bank Type	Shanghai	Tianjin	Chongqing	Hongkong	Wuhan
Central and chartered banks	3	0	0	0	1
Commercial & Savings Bank	38	3	4	1	1
Province & City Bank	2	2	1	0	1
Farmers & Industry Bank	6	0	0	0	0
Specialized banks	5	2	3	0	0
Oversea-Chinese Bank	0	0	0	2	0

All numbers are based on authors' calculation from the boardroom network in 1935.

Table 10: Bank age and corresponding linkages statistics

Panel A: 1933

Quartile	# bank	mean of bank ages	mean of degree
Quartile 1 (oldest)	18	20.94	10.11
Quartile 2	24	3.95	7.57
Quartile 3	21	11.79	3.96
Quartile 4 (newest)	25	0.60***	8.32-

Panel B: 1934

Quartile	# bank	mean of bank ages	mean of degree
Quartile 1 (oldest)	17	22.06	12.65
Quartile 2	16	4.88	9.62
Quartile 3	16	12.56	4.88
Quartile 4 (newest)	19	1.32***	11.26-
age not given	21		

Panel C: 1935

Quartile	# bank	mean of bank ages	mean of degree
Quartile 1 (oldest)	16	23	11.06
Quartile 2	19	5.94	8.12
Quartile 3	16	13.32	4.26
Quartile 4 (newest)	22	2.18***	10.82-
age not given	29		

Panel D: 1936

Quartile	# bank	mean of bank ages	mean of degree
Quartile 1 (oldest)	14	25	13.64
Quartile 2	18	6.61	11.33
Quartile 3	18	14.72	5.39
Quartile 4 (newest)	17	2.71***	8.35*
Age not given	27		

The symbols ***,**,* denote significant difference in means of Quartile 1 and Quartile 4 at the 1%, 5%, and 10% levels, respectively. – indicates there is no statistically differences between observations in Quartile 1 and Quartile 4.

Table 11: Network linkages statistics between bank groups in 1935

bank type	# links	Central	CS	FI	OC	PC	SB
Central	86	0.14	0.48	0.14	0.01	0.15	0.08
CS	539	0.08	0.71	0.07	0.01	0.05	0.09
FI	79	0.15	0.51	0.13	0.03	0.08	0.11
OC	8	0.12	0.38	0.25	0.25	–	–
PC	61	0.21	0.41	0.10	–	0.20	0.08
SB	75	0.09	0.64	0.12	–	0.07	0.08

The table describes the interlock connections between banks in different categories. Central, CS, FI, OC, PC, SB stand for central & chartered banks, commercial & saving banks, province & city banks, farmer & industry banks, specialized banks, oversea-Chinese Banks, respectively. "–" indicates no connection existing.

Table 12: Banks with central bank connections vs. banks without ones

	IDs total		IDs with central Bank bank group	
	1933	1934	1933	1934
Panel A: Nationalized bank in 1935:				
Manufactures Bank of China	25	26	6	6
National Industrial Bank of China	11	7	1	2
Commercial Bank of China	17	19	0	2
Panel B: Banks went bankrupt in 1935:				
Dan Hoo Commercial & Savings Bank	12	7	0	1
The Bank of Lungyu, Ltd.	0	3	0	0
The Bank of Kiangnan Shanghai.	4	0	0	0
The World Commercial & Savings Bank Ltd	2	2	0	0
Hwa Yih Bank,Ltd.	6	2	1	0
The Amoy Commercial Bank, Ltd.	2	0	0	0

Source : see text.

Figures

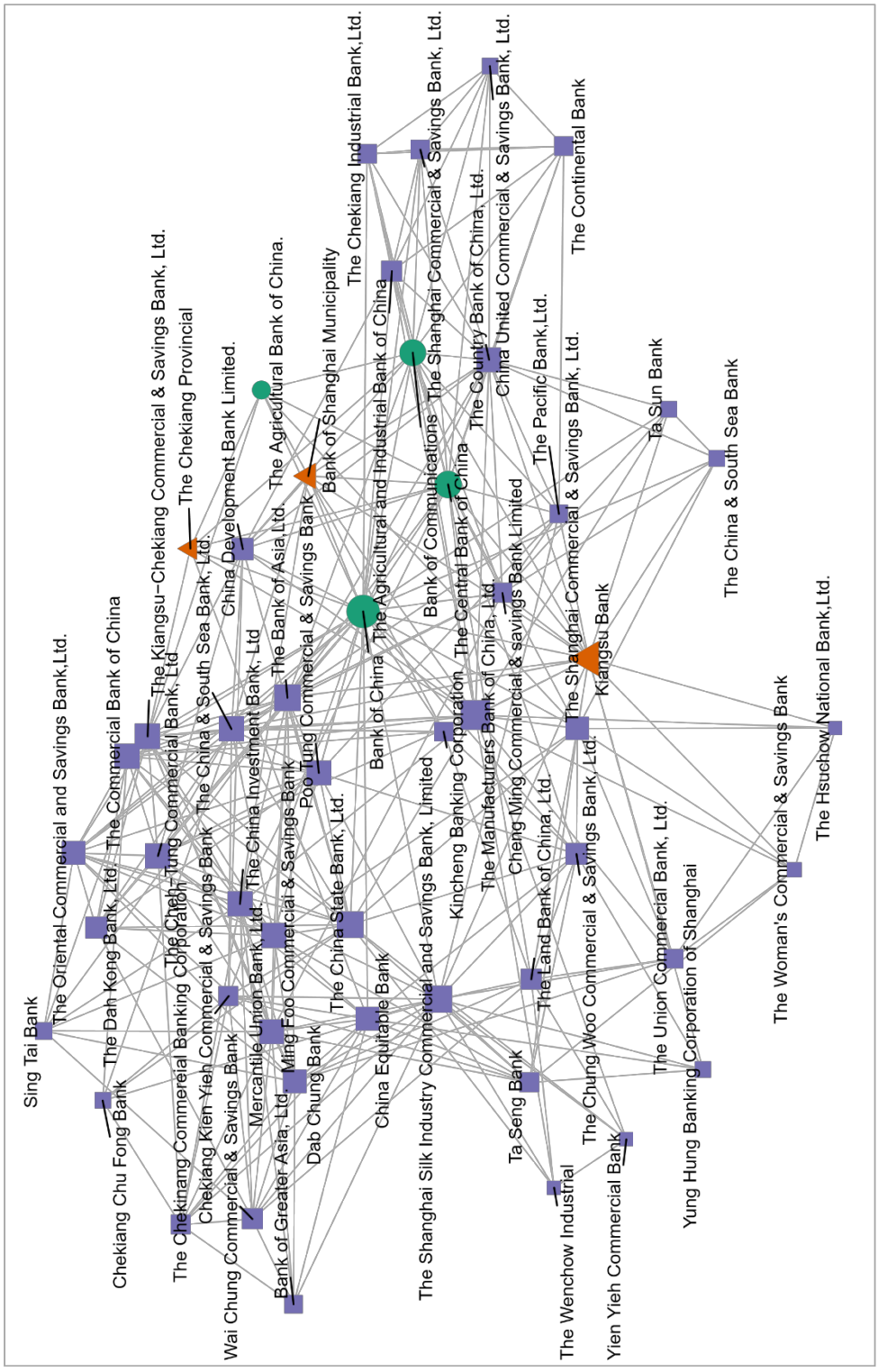

Figure 1: the principal component of bank network in 1935

Figure 2: Bank network connection and assets cumulative distributions in 1933

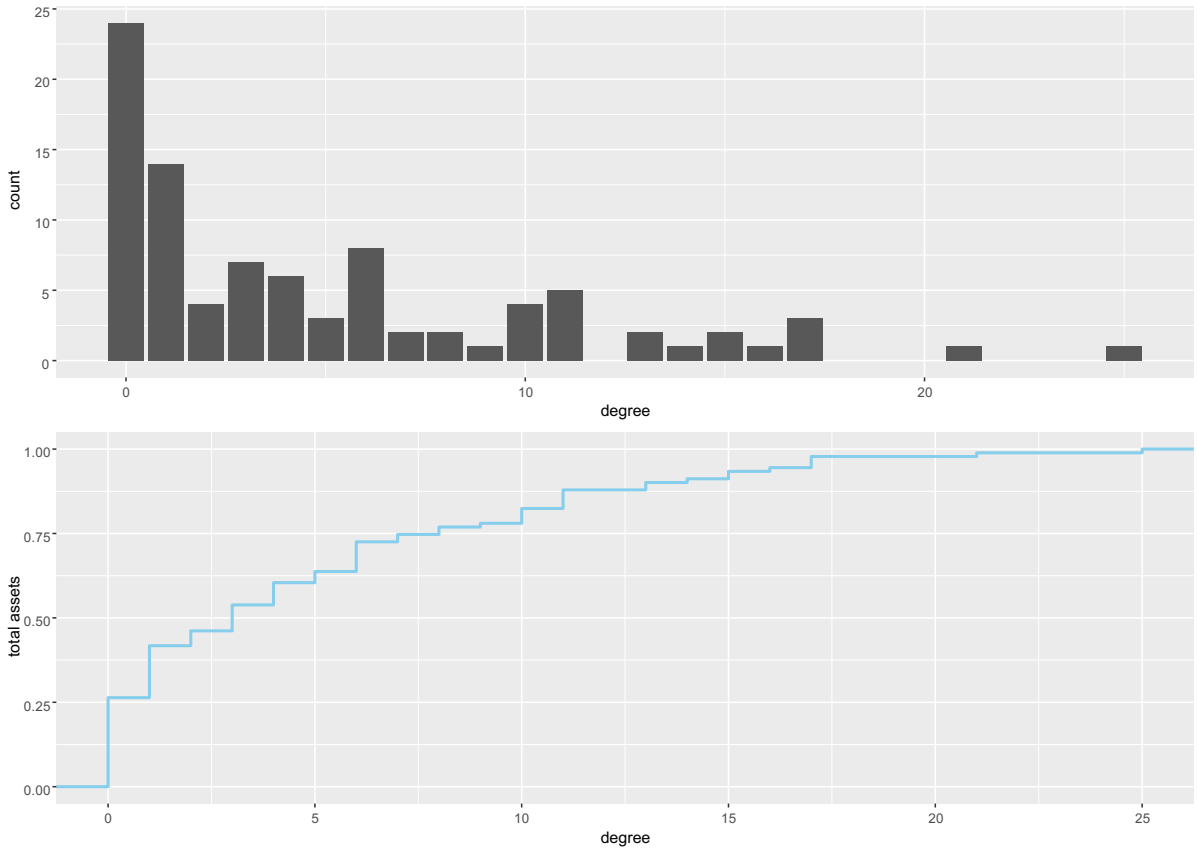

Figure 3: Bank boardroom network from 1933 to 1936