

POSTAL SPACE IN MODERN CHINA: A GIS-BASED ANALYSIS OF THE POSTAL ATLASES*

What is the actual circulation state of modern China's domestic market network? Can researchers only approach the actual flow state of modern economic factors infinitely without being able to truly and thoroughly clarify? The analysis methods and historical data used in the research on the actual circulation state in modern times significantly impact the research conclusions. To make an inappropriate metaphor, this question is close to the "Schrodinger's cat" in the research of economic history, that is, the object of observation is a probability rather than a certain result. For such a seemingly "Uncertainty Principle" problem, we may need to use an "intermedium" for observation and analysis. Judging from the information currently available in academia, the postal network is an ideal "intermedium".

The logic of this paper: the modern China postal network was not a new system and didn't arise from nothing. The postal network was formed by selective composition from the original traffic logistics network, including courier stations in Ming and Qing Dynasties, railways, various levels of roads, coastal ships, inland waterways, private postal agencies, and rural market network. It was a representative subset of modern China transport networks. If we rebuild the modern China postal network to the greatest extent possible, we'll be able to approach, as much as possible, the reality of the modern China domestic network.

The quantitative description and analysis of the modern domestic market network is a difficult problem in the research of modern economic history. Researchers such as Wu Chengming 吴承明, Wang Qingcheng 王庆成, G. William Skinner, Li Bozhong 李伯重, Xu Tan 许檀, and Wang Di 王笛 have made in-depth research on such topic.¹ It was early when Wu Chengming first discussed the Chinese market in the 16th to 17th centuries and the 18th to 19th centuries, focusing on land, silver, taxation, and trade volume estimation, but there was no in-depth discussion on domestic market network structure. After 1840, China has formed a national market, and this was largely undisputed [Li B. 1999]. As years of accumulation and in-depth exploration by researchers are required for obtaining the available data, it is difficult to do research on the reality of the national market internal structure and the network system levels, especially the grassroots market. Xu Tan's research is particularly representative in this regard. She believes that the formation of the urban and rural market network system was an important part of China's economic development during the Ming and Qing Dynasties, while the development of commercial towns and formation of rural market networks were the two complementary and indispensable parts of the market network [Xu 2000]. Xu Tan's analysis of North China's commercial towns and market levels is impressive. She pointed out that the modern postal system, the main indicator used by Skinner to construct the central place hierarchy, did not appear in the middle of the Qing Dynasty. So far, the two main types of materials that can provide data information for the actual market conditions in the Ming and Qing Dynasties are customs files and merchant guild inscriptions [Xu 2016]. In other words, Xu Tan has affirmed the fundamental role of postal data in the construction of regional market networks, central place hierarchy, and even the national urban system. However, in early and mid-Qing Dynasty, the postal business was not fully developed, so there was no postal information available. In the late Qing Dynasty and the era of the Republic of China, there were more abundant statistics, maps, and various survey data of the Chinese Imperial Post (*Daqing youzheng* 大清邮政) and the Chunghwa Post (*Zhonghua youzheng* 中华邮政). They have provided a solid foundation for our research in this paper.

The archives in various regions, especially Tianjin City Archives, have abundant modern postal archives, but they have not been systematically sorted and published due to various reasons. In recent years, with the in-depth excavation of modern customs data and deeper understanding of modern postal historical data, the authors have collected and sorted out more than 10 postal maps (albums) published by the Imperial Post and the Chunghwa Post, and found that they play an important role in the recon-

struction and clarification of Modern China's domestic market network and market operation. Through long-term digitization of postal maps and the construction of postal network database, some typical maps and visualization results are selected in this paper for tentative analysis. The analysis takes the perspective of postal network and looks into modern China's domestic market network originally hidden in the local chronicles, business tax archives, inscriptions, and regional economic surveys.

1. MAIL DELIVERY: A REVIEW OF MODERN POSTAL RESEARCH

The postal system has a long history. The Tabula Peutingeriana in the Roman Empire is a typical traffic postal map [Talbert 2010].² On some postal routes such as from Bordeaux East to Jerusalem, large post offices (mansiones) and small postal stations (mutationes) are clearly visible [Yan 1994: 17]. In medieval Europe, some groups with common interests, such as the University of Paris, the Benedictines and the Hanseatic League, have all established internal independent information transfer systems [Farr 2003: 106]. In the early modern era, long-distance information dissemination methods were still relatively limited. Among letters, parcels, newspapers (newsprint), radio, telegrams and telephones, letters and parcels were most widely used. In the early modern times, most people had no demand to write letters (if they could write) and send letters to other places. Their communication with the outside world was also limited to a radius of several kilometers around where they lived. Only some squires, officials, and merchants who accounted for a very small proportion of the population, and some farmers had such demand. In modern China, there were many "post-like" systems, such as foreign posts (*keyou* 客邮), overseas Chinese postal agencies (*qiaopi* 侨批), and civil post offices (*minxinju* 民信局), but none of them was a truly national postal network operated by the government.

Before modern times, sending letters was costly both at home and abroad. After 1840, the United Kingdom adopted Sir Rowland Hill's proposal to implement postal reform to drastically lower postage. A one-penny access policy for mail (not heavier than half an ounce) was adopted throughout the United Kingdom, thus improving the efficiency and public acceptance of postal services. Other countries in Europe and the United States had also followed suit and implemented similar reform policies.³ Since then, the postal network has gradually become a hub for the dissemination of knowledge, news, and concepts, as well as a transit for the delivery of goods. It has played an increasingly irreplaceable role in people's

lives nationally, and post has since gradually been regarded as the endorsement or incarnation of the government.

The U.S. postal service before its independence was essentially a duplicate of the post service of the British Empire extended into the American continent. Therefore, it was a matter of course to establish a new postal system after the United States became independent. Like all other countries, the U.S. postal service was initially established as a political information network to convey government orders and news to the citizens [Brodie 2005: 1–21]. The U.S. postal network has been widely considered as the prototype of modern government organizations. It has also been considered as the prerequisite for large-scale commercialization and a core topic of the communications revolution in the 19th century. Therefore, the U.S. postal system is often considered as the prototype of communication networks to discuss the history of postal services from the perspective of how information dissemination affects the society. For example, Richard R. John explained, from the perspective of nation establishment, that the new postal network was a tool for the new government to establish authority and disseminate decrees. The establishment of the new national postal network and its assisted stagecoach industry system was an important node in the early history of the United States [John 1995: 64]. The *hikyaku* 飞脚 courier service in Japan began in the Kamakura period, and the Meiji government established a new postal network in 1871. This network also developed from privately owned courier companies called *hikyakuya*, among which many local staff had become postal administrators or transport personnel, and continued to play a role in the new system [Andrews 2008: 1–13]. This kind of inheritance relationship between the new and old systems that appeared in the United States and Japan also happened in almost all countries, including modern China. The major industrial countries have all completed the modernization of postal services in the early stages of industrialization. The establishment of the modern postal service requires a dominant central government. In addition, due to the lack of information dissemination tools in the era, the postal network was almost the only tool that could carry out large-scale information dissemination. It was also regarded as a local stand-in for the central government and a symbol of regime change.

The academic circle has conducted extensive and in-depth research on Chinese *yizhan* 驿站 or *youyi* 邮驿 courier system, especially from the perspective of borderland historical-geographical studies and area studies. The research has been abundant [Pan 1996; Chen J. 2001; Liu W. 2003, 2004]. In contrast, there was less research on the modern post. When one takes modern China post as a part of modern China's transport, the research on

social history of modern Chinese transport shows a trend of multi-polar development. On the one hand, scholars have conducted in-depth discussions on macro issues such as “transport and regional society” and “transport and social change”, and have achieved fruitful results [Jiang and Xiong 2005; Liu Hui and Jiang 2010; Zhang Z., Geng, and Jiang 2010; Ding and Liu J. 2012; Jiang 2016]. On the other hand, some basic issues, such as the material basis of modern transport, transport carriers (or daily transport), and transport network (road network) distribution, have not yet been fully clarified. The compilation of some basic data has not been completed. For example, systematic and solid research is yet to be carried out on the river water transport route map in the era of late Qing and the Republic, the basic estimation of the annual transport volume of each navigable channel, the basic estimation of the transport volume of important commodities on major commercial roads, and the technological evolution of vehicles. The research of modern post is even thinner in the research of modern transport history. This is reflected in the small proportion of postal service studied in monographs of traffic history or compilations of historical materials. This indicates that information dissemination has not yet realize it as an important element in the modernization process within the academic circle.⁴

As a matter of fact, China has established a postal system as early as the Qin Dynasty, with the embryonic form of a modern postal network: refile, fixed route, and guarantee by law [Liu G. 1986: 38–40]. Back in the days, posts basically undertook national tasks and were responsible for the transmission of government orders and public opinion. It was closer to government intelligence agencies rather than civilian agencies. In modern times, the demand for civil postal service, especially for letters and remittances between overseas Chinese and people at home, gave birth to overseas Chinese postal agencies and private postal firms in southern China. Foreign institutions in China also established their own post outlets in the opening cities.

As an important part of modern transportation, the establishment of postal network is one of the core topics of modernization. There has been abundant research on the development and evolution of the postal industry in the late Qing Dynasty and the Republic era, especially the analysis from the perspective of system history, that discussed the constraint relationship among the *yizhan* system, Maritime Customs, and the Ministry of Transportation and Communications, as well as the competition and integration of the public post service and the private postal firms, so we won't cover them here [Cheng Y. 1970: 78; Huang 1996; Su 2005: 8–10; Wu Y. 2010]. In addition, there have been some regional studies describing the changes,

development, and modernization process of postal services in a certain region [Liu Huaming 1999; Pan 1996; Dai 2014: 91]. Bai Shouyi 白寿彝 believes that the post and telecommunications industry in modern China was completely imitated from western countries in terms of telecommunications. As for postal service, it was an imported new system similar to the previous postal system, but had no inheritance relationship with the latter [Bai (1937) 1984: 258]. This was a representative point of view. Yet, with the disclosure of more postal and customs historical data, this point can certainly be challenged. In the discussions that follow, we'll talk about why the postal network was laid out so quickly in the late Qing and the Republic era and reached a relatively high degree of network development and coverage in the early period of the Republic of China. Such development was inseparable from the various "post-like" institutions, such as private postal firms and overseas Chinese postal agencies. For example, Cai Weiping's latest research focuses on the competition between Robert Hart, Gustav von Detring, the Ministry of Foreign Affairs in Qing Dynasty, and the local governments of Shandong, Zhejiang, etc. during the trial construction of winter postal routes by the customs. Although the trial of customs post was strongly promoted by customs officials such as Robert Hart and Gustav von Detring, it was carried out by Chinese employees with grassroots practical experience in the actual implementation process. The experienced messengers hired by the private postal firms, rational postal route planning, and close financial ties with local merchants were all that the customs post lacked. As a result, after the establishment of the customs post, Robert Hart still had to rely on the private postal firms to send mails to the inland regions. The postage was also determined by those firms [Tsai 2013].

Within the scope of the research on the (social) history of modern Chinese transportation, there have been abundant research on the finance, personnel, or system in the railway, inland shipping, postal service, telegraphic service, and other industries that were originated from the western countries, subject to foreigners, foreign companies, or foreign governments, but were finally owned (or partially owned) by Chinese people, and great achievements have been made on research topics such as division of interests, the struggle for dominance, and personnel appointment and removal [Wu Y. 2014a, 2014b]. This paper will focus on the postal network space from a different research idea, analyze the reasons for its formation through the spatial distribution of more than 13,000 post offices (in 1936) in multiple time sections recorded in multiple versions of postal atlas, discuss its development process, and conduct comparative research.

2. THE PARTICULARITY OF MODERN POSTAL NETWORK

The greatest particularity of post service lies in its dependence on a sound network, which also applies to modern China post. Specifically, a network with a certain spatial extension is the foundation for the postal service to survive. Greater network popularity and more postal outlets make the postal service more valuable. However, this is not obvious in highways, shipping, and railways—even if a railway is not networked, for example, there is only one operating route (such as the Qingdao-Jinan Line), its profitability and strategic position won't be affected. This is because the items transported by the post are of low value individually.

Microscopically speaking, the profit of postal transportation of single letter and parcel is extremely low (even to the point where it can't make ends meet). The postal agency can hardly profit from daily deliveries (if not in batches). In other words, at a macro level, greater spatial expansion of the postal network, more postal outlets, and getting closer to the end consumers can lower the operating cost of the postal business and increase the probability to make profits. This can in turn subsidize the huge cost of network construction in the early stage, and offset some loss-making operations in some micro-delivery processes. Such loss at a micro level is almost hard to see in water transportation, railway, and other modes of transportation. Therefore, it must be pointed out that a strong postal network is the core competitiveness of the postal industry. This competitiveness is “spatial”, but not a financial or technical competitiveness, which is very special in the research field of modern Chinese economic history.

Modern China post is both an enterprise and an industry. Different from the diversification of railway, highway, and water transport operators, postal service is monopolized by the state, and the central government's ability to manage and control is key to the success of postal service. Looking back, the foreign-controlled post system came into being after the Tianjin Treaty in 1858. This was the first prototype of modern post that appeared in China. In 1878, Gustav von Detring, the customs commissioner of Tianjin Customs, was assigned to open the postal service, starting the trial operation of modern postal service. In 1896, the Chinese Imperial Post officially opened at the national level. In 1912, the Ministry of Transport of the Republic of China took over the postal business for continuous development. In the same year, the courier station was changed to postal office, clearing the final obstacle for further development. In comparison, China's postal modernization started 60 or 70 years later than that of European and American countries. However, considering that the Universal Postal Union was only established in 1875, the gap in postal service between China and

those countries was bearable.

The development gap of postal service between modern China and European as well as American countries is much smaller than that of capital and technology-intensive industries such as railway, military industry, and shipbuilding. In other words, modern China post may have been the one that modernized the quickest among all industrial or commercial sectors, with the smallest gap with the United Kingdom and the United States. Looking back to the era of traditional post stations, there is no obvious evidence indicating that the post stations in the Qing Dynasty is less effective than that of the postal network in United Kingdom, United States, Japan, and the Islamic countries before the reform [Andrews 2008: 183; Silverstein 2007: 186–190]. Therefore, the adequate development of the modern postal network has also made the following international comparative research more interesting.

3. ATTAINING TO PERFECTION: SEVERAL VERSIONS OF POSTAL MAPS

Postal map is the basis for postal network space analysis. Postal map was the only way to understand the distribution of all levels of postal outlets at that time, so modern postal agencies took great pains to collect grassroots information to make, publish, and distribute postal maps. Whether the postal route planning, which is the most critical element determining the postal delivery efficiency, is reasonable depends entirely on the understanding of postal maps.⁵

Throughout history, China has attached great importance to postal map drawing. For a long time however, it was impossible to independently make scientifically valuable and accurate large-scale maps due to the limited geodetic surveying technology. Thematic maps such as postal maps are the products of map culture at the advanced stage. The postal maps are representative works in the history of modern China maps. Zhang Qiyun 张其昀, a famous geographer regarded them (specifically a collection of postal maps in the 1930s) as the “representative works of humanistic maps” and one of the signs of the progress of Chinese geography within “twenty years” [Zhang Q. 1935].

As mentioned above, the primary purpose of drawing postal maps is to plan new postal routes for the future. In the application No. 274 from Robert Hart to the Ministry of Foreign Affairs on July 3, 1902 (28th of the 5th lunar month in Guangxu 28), Robert Hart wrote in preparation for the 1903 *Qing Postal Promotion Maps* (*Daqing youzheng tuiguang yutu* 大清邮

政推广舆图), “to understand the specific situation, we need to draw an overall map. In this regard, we have gradually drawn the map by province based on the established general office and sub-offices, which was regarded as the first map to promote the postal service. The positions marked with red lines indicate that a post office has been set up in the corresponding prefecture, department, or district, where postal service personnel were assigned to deal with mails for communication” [Zhongguo Jindai Jingjishi Ziliao Congkan Bianji Weiyuanhui 1983: 107]. Postal maps are created to survey the current situation and plan for the future. A reasonable postal route is the key to postal development.

From 1903 to 1936, postal administrations (such as the Imperial Maritime Customs Service and the Directorate General of Posts of the Republic of China) published about 10 more postal maps (albums), with different geographic coverage and accuracy. We select some important ones for description as follows:

In 1903 (Guangxu 29), the Qing government issued the *China Postal Working Map* (*Daqing youzheng gongshu beiyong yutu* 大清邮政公署备用舆图). This map, a single map of 96 cm × 101 cm, includes the postal outlets, postal routes, and telegraph offices in the country. In the same year, the Imperial Maritime Customs Service drew the *Qing Postal Promotion Maps*. This was expanded into an atlas to contain 32 color maps and detailed postal routes of the branches of each general administration.

In 1907, on the basis of the former, the Statistical Department, Inspectorate General of Customs (*Tongshang Haiguan Zaocechu* 通商海关造册处) printed the *China Postal Album* (*Daqing youzheng yutu* 大清邮政舆图) in the form of an atlas, containing 19 provincial postal maps, including 18 mainland provinces and three northeast provinces of China (all in one), along with a large-scale detailed map attached for Zhili and Guangdong each, namely “Zhili Central” and “Guangdong Central”, as well as the two maps of “Chinese Distribution of Officials” and “China Telegraphs”. The maps of each province are marked with the postal boundaries, postal routes (subdivided into horse postal routes, day-and-night services, and waterway services), post offices located at places with access to railways and waterways, post offices located at places with no access to railways and waterways, telegraph offices, railways, railways under construction, prefectures, direct-ruled departments, departments, subprefectures, counties, villages and towns, etc. All of the above-mentioned township offices were marked with solid black, hollow black, and hollow red, indicating a post office established, a postal shop agency established, and post office or shop agency not established, respectively.⁶ Line-segmented scales were used for all maps, which were printed in red, green, and black colors.

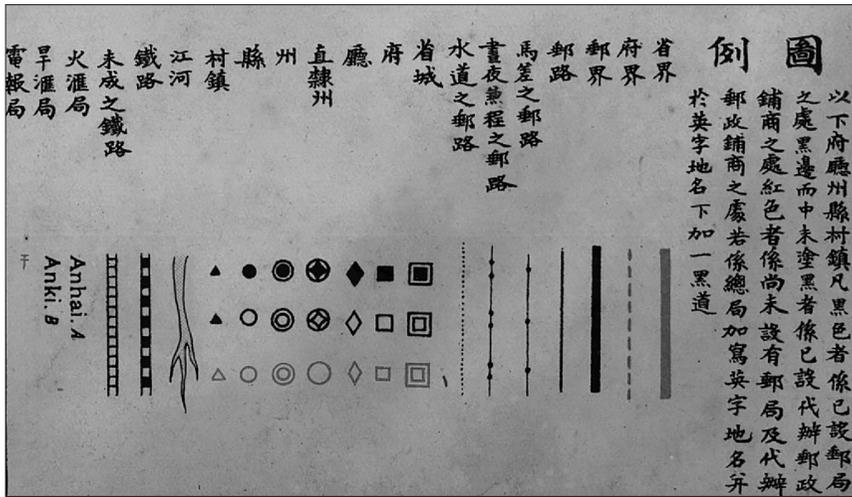


Figure 1. Legends of 1907 China Postal Album (Original image in color)

Source: Tongshang Haiguan Zaocechu 1907.

The transition from traditional to modernized surveying and mapping had been initially completed in the Qing Dynasty. During the Republic era, modernized map surveying and mapping was basically formed as the control of latitude and longitude, map projection, standard legends, standardized surveying, and map compilation all came into shape [Liao and Yu 2008: 205]. After the Directorate General of Posts of the Ministry of Transportation and Communications of the Republic of China took over the national postal services, it successively issued at least 4 editions of the *Postal Atlas of China* (*Zhonghua youzheng yutu* 中华邮政舆图; the 1st edition in 1907, the 2nd edition in 1919, the 3rd edition in 1933, and the 4th edition in 1936). The 2nd edition in 1919 had been greatly improved compared with the 1st edition in 1907, manifested as direct marking of postal agencies and multi-level postal management agencies from top to bottom: district head offices, three classes of offices, agencies, rural box offices, and rural courier services. The transportation frequency of a postal route reflects how busy the postal service is and the frequency of point-to-point information exchange. The postal route marking of the maps is specific to the daily day and night services, bi-daily day and night services, daily services, bi-daily services, tri-daily or more frequent services, postal connection by boat, postal connection by steamer or launch, and motor car service.

The 3rd edition in 1933 and 4th edition in 1936 (Figure 2) saw great improvement in map size, information accuracy, color matching, aesthet-

●	郵政管理局	<i>District Head Office</i>
●	一等郵局	<i>First Class Office</i>
●	二等郵局	<i>Second Class Office</i>
○	郵政支局	<i>Sub-office</i>
●	三等郵局	<i>Third Class Office</i>
○	郵政代辦所	<i>Agency</i>
▲	村鎮信櫃	<i>Rural Box Office</i>
T	電報	<i>Telegraph Service</i>
L	長途電話	<i>Long Distance Telephone Service</i>
—+—+—+—+—	逐日晝夜兼程郵班	<i>Daily Day-and-Night Service</i>
—+—+—+—	間日晝夜兼程郵班	<i>Bi-Daily Day-and-Night Service</i>
———	逐日郵班	<i>Daily Service</i>
- - - - -	間日郵班	<i>Bi-Daily Service</i>
- · - · - ·	每三日或次數較少之郵班	<i>Tri-Daily or Less Frequent Service</i>
———	村鎮郵班	<i>Rural Courier Service</i>
· · · · ·	輪船郵路	<i>Postal Connexion by Steamer or Launch</i>
· · · · ·	民船郵路	<i>Postal Connexion by Boat</i>
———	鐵路與車站	<i>Railway with Station</i>
———	汽車郵路	<i>Motor Car Service</i>
———	正在設法載運郵件之汽車路綫	<i>Motor Highways Contemplated for Mail Transmission</i>
———	郵區界	<i>Limit of Postal District</i>
———	省界	<i>Limit of Province</i>
———	國界	<i>National Boundary</i>

Figure 2. A part of the legends of 1936 *Postal Atlas of China* (Original image in color)

Source: Jiaotongbu Youzheng Zongju 1936.

ics, and detailed level of markings compared to the previous postal maps. They were the pinnacle of modern Chinese postal maps, and even the modern Chinese thematic maps. Its map size is also several times larger than the *New Atlas of China* (*Zhonghua minguo xinditu* 中华民国新地图; 1934) compiled by Ding Wenjiang 丁文江, Weng Wenhao 翁文灏, and Zeng Shiying 曾世英, and published at the 60th anniversary of *Shen Bao* 申报 (*Shanghai News*), which was the most influential postal map.

The core value of these four postal maps lies in the richness and reliability of the traffic information recorded. For example, on the local map of Wuxian 吴县 (Suzhou) in South Jiangsu in the 4th edition in 1936 (Figure 3), there were postal network elements such as motor car services (green solid lines), motor car services under construction (green dashed lines), postal connection by steamer or launch (thin red dashed lines), and daily services (thin black solid lines, walking or carriage), and bi-daily service (thin black dotted line). In addition, the water and land distance between adjacent outlets was marked with Arabic numerals.



Figure 3. Local map of 1936 *Postal Atlas of China*: Wuxian (Suzhou) in South Jiangsu (Original image in color)

Source: Jiaotongbu Youzheng Zongju 1936.

The postal maps were originally drawn to plan the postal routes for the future, so the survey of current postal routes is particularly rigorous. The mileage of the postal route was surveyed on foot by the inspector who drew the postal maps. The postal maps were used to set up postal services, which coincided with the time taken by the postmen [Youdianshi Bianjishi 1984: 102]. In other words, the point-to-point distance marked on the postal maps is the result of years of actual measurement by grassroots personnel. After nearly 100 years of social and regime changes, great changes have taken place in China's grassroots transportation network. In order to restore and rebuild China's grassroots market network and transportation routes from 1900 to 1940, the postal maps should be the only credible data carrier. None of the local chronicles, traffic statistics yearbooks, and regional economic surveys carried out by the Republic government or foreign institutions could have compared to them.

In addition to the above-mentioned atlases, in the 1920s, certain provinces also published a number of provincial-level single color postal maps, whose map size was even more than twice as large as the above-mentioned

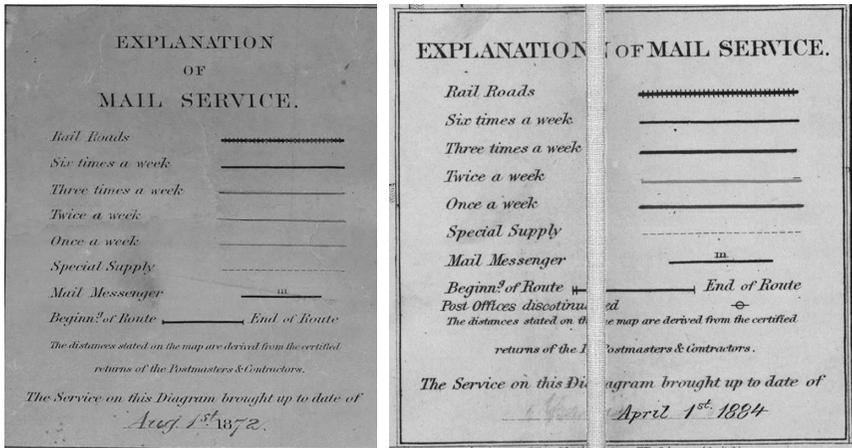


Figure 4. Legends of the post route maps of the State of New York in 1872 (left) and the States of Ohio and Indiana in 1884 (right) (Original images in color)

Source: Post Office Department of Untied States of America 1872, 1884. Both maps can be found in the David Rumsey Map Collection (<https://www.davidrumsey.com/>).

national atlases.

The modern China postal network was not a new system. It took root on the regional market logistics network and can therefore be regarded as a subset of the modern China regional market network. Grassroots postmen are familiar with regional traffic conditions, so they can take more convenient and faster postal routes. For example, you can understand the basic situation of the regional market network around Suzhou at that time from Figure 3. Grass-roots postal route, shuttled between mountains and rivers, should have been the fastest and most time-saving channel at the time. It is also a reliable spatial data for us to understand the market network at that time.

The tradition of making detailed thematic maps is a unified industry practice and industry standard in the postal industry all over the world. Figure 4 is from two U.S. postal maps published in the late 19th century. It also adopts a similar mark form, marking the distribution of postal routes with different transmission frequencies from 6 times a week to once a week. However, the marking of postal outlets is far less detailed than the postal maps of modern China, and is not subdivided into different classes. In summary, a series of postal maps, while being the representative works published in modern China, also serve as the best and even the only sys-

tematically measured data for understanding the national and grassroots market circulation networks.

4. MODERN POSTAL NETWORK SPACE

In September 2013, the Royal Mail of UK, which led the country-based postal business, started an initial public offering (IPO). This marked the beginning of postal privatization, when state-owned postal service worldwide has gradually entered a new stage of privatization. With the Royal Mail taking the lead, since the establishment of modern postal service, almost all countries have operated their postal services at a government level. Unlike the railway and telecommunications industries, the postal industry should not be operated fragmentally and regionally only in some civilized areas. In other words, profit is not its sole purpose.

At the end of the 19th century and the beginning of the 20th century, a variety of “post-like” systems iterated with each other in different time and space in China, including the *yizhan* courier stations, telegraphy offices, overseas Chinese postal agencies, the large private firm of transportation Maxiangyue 麻乡约, foreign posts, private postal offices, the Customs post, and the Imperial Post. These “post-like” systems had different interest demands and service targets with no formed scale effect. This was an inefficient chaos caused by a weak central government. In order to reconstruct the spatial expansion process of modern postal services, the authors digitized four postal maps in 1907, 1919, 1933, and 1936 via the Geographic Information System (GIS). During these 30 years, the postal service had developed rapidly. The main body of postal operations had been transferred from the Chinese Imperial Post to the Directorate General of Posts of the Ministry of Transportation and Communications of the Republic of China, and the number of postal outlets had increased significantly.

In the development process, the spatial distribution of postal networks varied greatly across the country. The Beijing-Tianjin-Hebei region was the most developed area in postal services of the north and had the most typical northern postal network. Its land delivery was completed by postmen on foot and horses and camels. In the middle and lower reaches of the Yangtze River, the postal routes were densely distributed in rivers, lakes, and ports. The postman rowed a boat to the village entrance and blew a horn to remind people to post letters. Taking the Beijing-Tianjin-Hebei region as an example, the day-and-night service (also known as day and night express service) was the fastest among local postal routes. The delivery speed of light-weight items (including letters, postcards, and newspaper) could be

doubled, thus changing the previous practice of resting at night time for all postmen. The average running speed on some postal routes could reach 5 km per hour, with a theoretical maximum of 72.4 miles per day. Correspondingly, in Europe in 1780, a postman could run 3–4 miles per hour (1 mile = 1.6 km), and it was not until 1800 that the coach in Europe reached a speed of 10 miles per hour [Farr 2003: 106]. At that time, the eastern and western countries were basically at the same level in terms of delivery by manpower and animal power.

Postal agency was an invention of modern China formed to suit local conditions and was highly significant to the expansion of postal space. In places that failed to meet the conditions for setting up a formal post office but had a certain amount of business (mostly rural business), agency shops were set up under the control of nearby post offices to implement provisions on similar “mail box” in urban areas. The remuneration of a new agency shop was considerable at 3 dollars per month, plus a commission of 15% of stamp sales [Qiu 1989, 1: 118]. There were more benefits of the agency rights. Many shops in Zhili District competed to act as postal agencies to attract postmen and fought for the postal routes around them. Since a grocery store receiving letters could also open up new business, this was of great help to their daily business and network expansion. As a public utility, the postal agency could also provide political protection and security protection to shops, which was also very attractive to grassroots shops. With the prosperity of the postal agency business, the merchants involved played another role of information transmitter with richer social significance, and temporarily employed postmen were no longer traditional farmers.

The density of the postal network in Zhili District was leading in China because of the existence of the two special cities of Beijing and Tianjin. So, what were the factors that determined the density of postal outlets, especially the grassroots postal outlets? In other words, when the postal network was ideally distributed, how long did it take for farmers in the village to reach the nearest postal agency? This question is essentially the same as the other classic topic in modern economic history—the radius of the grassroots market. Particularly, in the middle of the 20th century when the postal network was greatly improved, what was the relationship between them? This will be discussed in the following chapters.

The following is a macro analysis on the postal space in terms of the number, density, internal delivery rate, and spatial distribution of the postal network outlets.

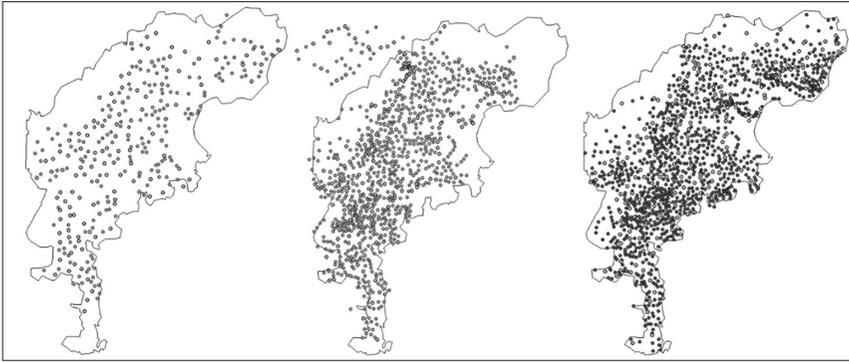


Figure 5. Distribution of postal outlets in the Beijing-Tianjin-Hebei region in 1907 (left), 1919 (middle), and 1936 (right)

Source: The authors' digitized results of *China Postal Album* (1907) and *Postal Atlas of China* (1919 and 1936).

4.1. Absolute Number of Postal Outlets

The absolute number of postal outlets is a comprehensive reflection of social development. Benefiting from the absolute size of population, there were a large number of postal outlets in modern China, which developed smoothly at the initial stage. This paper has digitalized the postal maps in 1907, 1919, and 1936, and the expansion of postal outlets in the Beijing-Tianjin-Hebei region (Zhili District) is shown in Figure 5.

Modern postal service in China originated from Tianjin Customs under the leadership of Gustav von Detring. The original purpose was to facilitate the delivery of mails from Beijing to Dagukou 大沽口 and southward when the river would freeze in the winter. It took about 17 hours to send a mail from Beijing to Tianjin, and about 3 hours from Tianjin to Dagukou by horse riding, which was convenient. This was the prototype of modern postal service in the Beijing-Tianjin-Hebei region. Due to the convenience of railway and flat terrain, the postal network developed smoothly in the Beijing-Tianjin region. As shown in Figure 5, from the late Qing Dynasty in 1907 until the full-scale war broke out between China and Japan in 1936, the postal outlets in this region grew steadily and were gradually encrypted, becoming a model in the northern China post areas.

Table 1. Geographical extension of the U.S. postal network (1790–1840)

Year	Number of Postal Outlets	Average Number of People Served in Each Outlet	Average Service Area of Each Outlet (km ²)
1790	75	43,084	9,046
1800	903	4,876	879
1810	2,300	2,623	467
1820	4,500	1,796	301
1830	8,450	1,289	196
1840	13,468	1,087	159

Source: John 1995: 51.

Note: The original population data includes Indians and slaves.

Compared with the data in Table 1, the number of postal offices, including head offices, three classes of post offices, branch offices, and agencies, totaled 12,007 in 1926 (Minguo 15) [Jiaotongbu Youzheng Zongju 1926: 8], slightly less than the number (13,468) of U.S. postal outlets nationwide in 1840, indicating that they were basically at the same level. Considering that it had been nearly 70 years since the founding of the United States at that time, there was a huge gap in national strength between China and the United States. The U.S. postal network had been relatively mature then. By 1944, there were 12,427 post offices nationwide (post offices and agencies at all levels), and 14,397 rural box offices and rural post stations, totaling 26,824. In terms of the sheer quantity, China had surpassed the United States in the same period [Jiaotongbu Tongjichu 1946: 209]. This similarity in scale between the two countries had a profound urban geographical background. According to the research by the scholar at the time Shen Rusheng 沈汝生, the gap in the number of cities (with a population of over 50,000) between China (193) and the United States (201) was small [Shen 1937].

4.2. Distribution Density of Postal Outlets

The distribution density of postal outlets is the most important indicator to measure the level of development of the postal network. The *Post Route Map of the State of New York* published in 1872 was accompanied by postal statistics for several states, including Maine, Massachusetts, Rhode Island, New York, New Jersey, and Pennsylvania (Table 2) [Post Office Department of the United States of America 1872]. The number of people served by each postal outlet was about 800–1,900, and the area covered by a postal outlet ranged from a minimum of 30 km² to a maximum of 100 km². This

means that even the furthest place from the postal outlet was only 5 km away, which was a 1-hour ride by horse or half a day by walking.

Table 2. Attached table to the postal map of New York and surrounding regions in 1872

Region	Area (km ²)	1860 Population	Population Density (person/km ²)	1868 Number of Postal Outlets	Average Number of People Served	Average Service Area (km ²)
Maine	82,273	628,279	8	796	789	103
Massachusetts	20,202	1,231,066	61	671	1,835	30
Rhode Island	2,732	174,620	64	98	1,781	28
New York	119,657	3,880,735	32	2,588	1,499	46
New Jersey	21,549	672,035	31	498	1,349	43
Pennsylvania	114,780	2,906,215	25	2,626	1,106	44

Source: Post Office Department of the United States of America 1872.

Note: The last two columns of data are calculated by the authors.

According to statistics from the *Special Issue of Chinese Postal Statistics* by the Ministry of Transportation and Communications of the Republic of China, the number of people served by each post office in 1928 was 40,039 nationwide on average. This was about 20–30 times that of the United States in 1872. The area served by each post office was 522.68 km², which was approximately 5–10 times that of the United States in 1872 [Jiaotongbu Zongwusi Diliuke 1931: 7]. Of course, the credibility of modern demographic data is questionable and can only be used as a rough estimate. However, this does not prevent us from drawing trend-oriented conclusions. Obviously, this doesn't mean that the postal service of the Republic of China was more efficient than that of the United States. It only meant that at the time, postal service could only be regarded as a luxury consumption, and there was low postal demand as most people could only solve the problem of food and clothing.

However, by looking at the other indicator, the service area of each postal outlet (Table 3), the service area of the southeastern provinces of China (Jiangsu and Zhejiang) in the middle of the 20th century did not differ greatly from that of the United States in the middle of the 19th century, both of which were 50–200 km², a fairly high distribution density. Due to the high population density of China, the number of people served by each postal outlet was much higher than that of the United States. The data is very close to China today. The set standards of contemporary China's postal offices and the "service radius of major population clusters" for rural offices remain at 5–10 km [Wang Zhe and Wu J. 2008: 100].

Table 3. Overview of postal outlets in representative provinces

Province	Number of Post Offices	Floor Area of the Province (km ²)	Service Area of Each Outlet (km ²)
Jiangsu and Shanghai	926	100,000	108
Hebei and Beijing	1,436	300,000	209
Shandong	843	144,999	172
Zhejiang	479	95,001	198
Guangdong	1,184	259,000	219
National average	—	—	523

Source: Jiaotongbu Zongwusi Diliuke 1931: 7. The number of postal offices is the number in 1930 (Minguo 17, excluding postal agencies). The area is based on Ruan et al. 1924.

4.3. Transmission Speed

Before modernization, the postal networks of various countries were based on horse, manpower, and water transportation. In this period, the gap in postal network delivery rate among various civilizations was small. As shown in Table 4, the average daily travel distance of the postal network in the Islamic world before modernization was only 420 km at the maximum. This was almost the same as the highest speed of “Fly immediately handed” in the Qing Dynasty. The speed of 400 km (800 *li* 里) a day was almost the highest speed of a horse given the nutritional and medical conditions at the time. The Qing government had attached great importance to the communication time limit and speed, and even created the highest day-and-night riding speed of 300 to 400 km (600–800 *li*). During the Kangxi period, when he pacified the revolt of the three feudatories, it took only 9 days to travel a distance of 2,500 km or 5,000 *li* from the capital to the southwest. When Shi Lang 施琅 conquered Taiwan, it took only 9 days for the messengers to report the victory from the Fujian coast to the capital (over 2,400 km/4,800 *li* by land). The messengers were required to send the emergency military situation from Beijing to Urumqi (more than 4,250 km/8,500 *li*) within half a month [Liu G. 1986: 321]. The data obtained by J. K. Fairbank and Deng Siyu’s 邓嗣禹 research was a bit lower. They believed that by the end of the 19th century, the fastest speed within the *yizhan* courier system was 3 days (365 km/730 *li* per day) from Beijing to Nanjing, and 6 days (255 km/510 *li* per day) from Beijing to Hangzhou. There was no evidence that the average transmission speed in a single day could reach 350 or 400 km (700–800 *li*) [Fairbank and Teng 1939].

Table 4. Postal speed in the Arab world before modernization

Route	Land Distance (km)	Historical Time Consumed (days)	Average Daily Travel (km/day)
Damascus to Samarra	1,740	6	200–300
Damascus to Baghdad	1,740	21	60–80
Damascus to Medina	1,500	12	125
Baghdad to Shiraz	1,100	7–8	140–160
Baghdad to Mecca	1,650	4	410
Cairo to Damascus	730	2–4	180–360
Rayy to Marw	1,270	3	420
Jurjan to Baghdad	2,000	13	150

Source: Silverstein 2007: 192.

Note: “Post” in the title of the table is a free translation of *barid*, that is, the communication agency between the Caliph and the provinces.

In areas with a similar natural environment as the above-mentioned Islamic world, such as Xinjiang, China in the 1930s, the postal authority also had statistics on the transportation speed of several important postal routes. The general postal speed was between 100 and 300 km per day, depending on the specific journey.

Table 5. Important postal routes in the 1930s (excerpts)

Route	Distance (km)	Time Consumed (days)	Speed (km/day)
Shule-Yanqi-Korla-Kucha-Kashgar	2,511	15	167
Urumqi -Suilai	196	2	98
Urumqi-Qitai	287	2	143
Hetian-Yutian	276	1	276

Source: Shenyangshi Youzhengju Youzhengzhi Bangongshi, Dou, and Zang G. 1986: 289.

Throughout human history, all postal networks have pursued network expansion along with transmission speed. The scale of modern postal networks had expanded quickly. This is evident by looking at the growth of postal expenditures and the complexity of the aforementioned networks. Yet, the profitability of the postal service, especially the postal service of the Republic of China, had not increased (especially from 1912 to 1928). From 1912 to 1928 (Minguo 1–17), postal expenditure had increased steadily

every year. Within the 17 years, it had increased by 6 times with an average annual growth rate of 40%. However, the corresponding profitability had been stagnant. As a result, the annual variance of net profit was extremely large, and even nearly half of the years were at a loss [Jiaotongbu Zongwusi Diliuke 1931: 254]. This shows that profit, and the amount of profit, were not the most important goals pursued in the initial period of the postal service. Most of the annual steady growth in expenditure had been invested into network construction and labor costs. Even in the face of economic deterioration, regional chaos, and huge postal losses, various regions were still steadily carrying out infrastructure construction, such as building new houses, expanding old houses, purchasing foundations, and completing new offices [Jiaotongbu Zongwusi Tongjike 1934: 200]. This further shows that network perfection was a key goal recognized within the postal industry, as it ensured the rapid expansion of the postal space.

4.4. Spatial Distribution of Post Offices

This paper has digitalized the 1936 postal map and analyzed its spatial expansion trend using the GIS. As early as 1920, in the north China, especially in the Beijing-Tianjin-Hebei region, railways were of great importance to the expansion of postal routes. The postal network was concentrated in a small area sandwiched by the three railways of Beijing-Fengtian, Beijing-Hankou, and Tianjin-Pukou. This was one of the core areas of North China's economy, such as the famous Gaoyang Industrial Zone [Gu 2010: 19–23; Fan 2010]. In the south, the spatial distribution was more balanced: waterway transportation, instead of railway, played a dominant role in postal network expansion.

Similar to the postal map in 1933, the 1936 *Postal Atlas of China* was attached with the spatial information of the full atlas of more than 7,000 post offices (excluding agencies). The spatial distribution trend (Figure 6) was obtained through digital processing and analysis. In terms of spatial distribution, post offices were located along the Hebei-Henan section of Beijing-Hankou Railway, the Suzhou-Wuxi-Changzhou section of the Shanghai-Nanjing Railway, the Sichuan Basin, the Wuhan-Xiaogan Railway in central China, the Luoyang-Kaifeng Railway in the Central Plains, the Hangzhou-Ningbo Railway in northern Zhejiang, and the Pearl River Delta region. The above spatial distribution covers railway-driven areas with superior traffic location (Beijing-Hankou Railway) as well as traditional densely populated areas (Luoyang-Kaifeng) with profound historical background, showing the historical inheritance and complexity of the spatial distribution of post offices. In comparison, there were very few postal

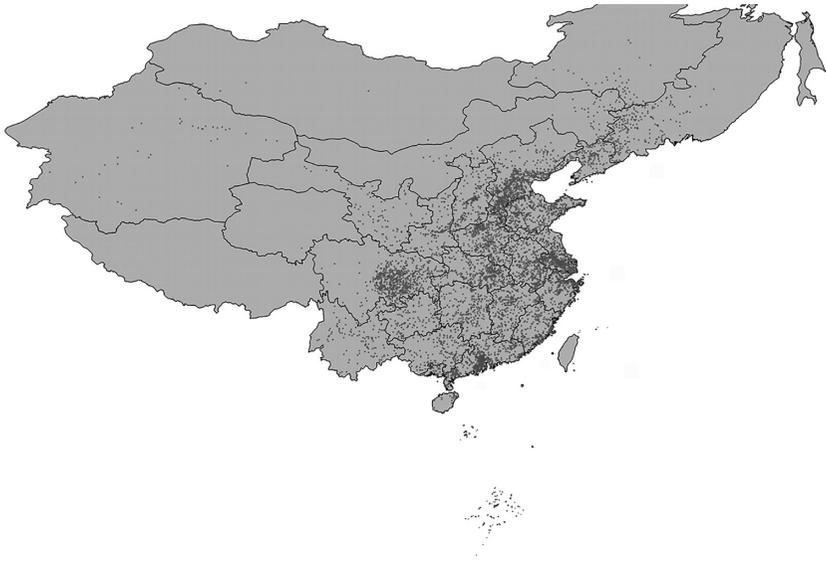


Figure 6. Schematic diagram of the spatial distribution of postal network outlets in 1936

Source: The dots in the figure refer to the over 7,000 post offices recorded by the authors after digitizing; the base map used is the provincial boundary of the 1820-level data of the China Historical Geographic Information System (CHGIS) Datasets V4 (Center for Historical Geographical Studies of Fudan University, June 2003, http://yugong.fudan.edu.cn/views/chgis_download.php); the postal outlet data of Taiwan Province in 1936 is temporarily unavailable.

outlets in Xinjiang, Tibet, Inner Mongolia, and Heilongjiang.

On the whole, the distribution of postal outlets didn't show a high correlation with population distribution. For example, in the traditional densely populated areas and agricultural areas such as northern Henan, central and western Shandong, and northern Anhui at the east of Taihang Mountain and north of Huaihe River, the postal outlets had not reached the corresponding level. As the Northeast region was dissociated from the central government after 1931, the distribution of post offices didn't reach the density required for its per capita income and railway distribution. In the Pearl River Delta region, the distribution of the postal network was much higher than its population density at the national level. It's important to point out that the spatial distribution of post offices in the 1930s had shown the agglomeration characteristics of contemporary urban agglomerations such as Beijing-Tianjin-Hebei, Jiangsu-Zhejiang-Shanghai, and the Pearl River Delta. Therefore, the distribution of postal outlets based on

quantitative data can be regarded as an analysis method for modern cities, which also makes it possible to compare with and discuss the current urban geography and urban planning research.

5. CASE ANALYSIS OF REGIONAL POSTAL NETWORK AND GRASSROOTS MARKET

To explore the relationship between the postal network and the grassroots market network, Sichuan, a region studied by many famous scholars, is taken as the research object in this paper. 1,225 postal outlets in the Sichuan Province sub-map of the 1936 *Postal Atlas of China* have been digitalized to explore the relationship between the postal network and the grassroots market.

To analyze the relationship between postal outlets and terrain, the data of 4 digital elevation model (DEM) (SRTM 90m Digital Elevation Database v4.1) of Sichuan Province have been introduced with a resolution of 90 m to meet the requirements of this research [Jarvis et al. 2008]. See Figure 7.

5.1. Geographical Preference for Postal Outlets

As the DEM image contains the elevation data of each pixel, through GIS technology, this paper extracts the elevation data of 1,225 postal outlets in the Sichuan Province sub-map of the 1936 *Postal Atlas of China*. In the end, 1,223 postal outlets have been selected after removing two abnormal ones.

According to statistics, the average elevation of all 1,223 postal outlets is 489 m, with a median altitude of 402 m. It can be found that terrain factors have an extremely important impact on postal outlets. Coincidentally, the average elevation of all three subgroups of second-class offices, third-class offices, and postal agencies is 400 m, which is lower than the average elevation of the Chengdu Plain (600 m), and the terrain slope value is also very low. This shows that in modern times, postal agencies were carefully selected through manual intervention. They were generally powerful shops in representative rural areas because of convenient transportation and advantageous locations in the center of road network, river valleys, or plain areas.

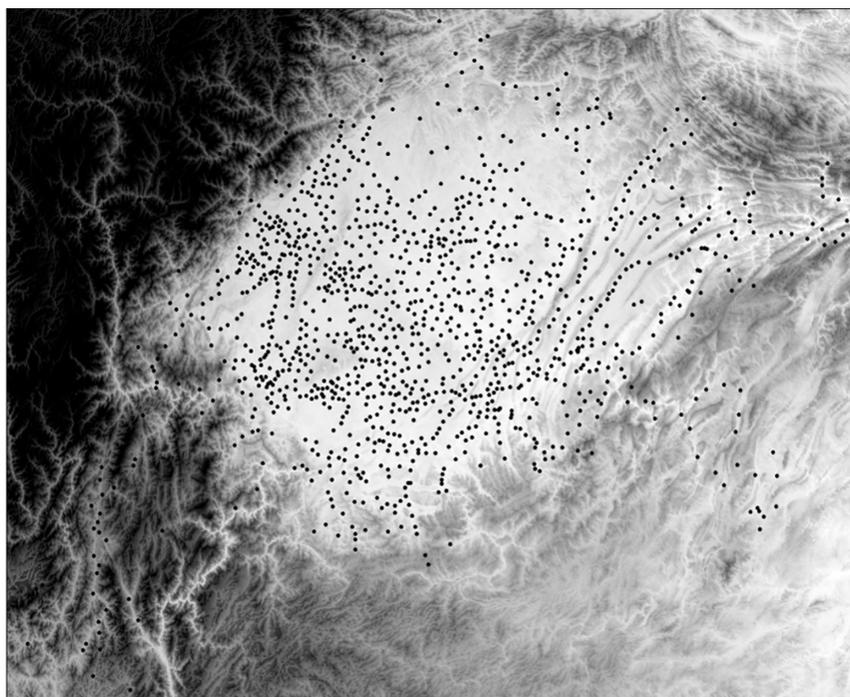


Figure 7. Sichuan Province DEM and the distribution of postal outlets in 1936

Source: Postal outlets are the authors' digitized results of Sichuan Province sub-map of the 1936 *Postal Atlas of China*; DEM data is sourced from SRTM 90m Digital Elevation Database v4.1; DEM is artificially colored and stretched using gray-scale color strips and the hillshade effect; some points are not well displayed in the figure because of too dark background color.

Table 6. Average elevation of postal outlets at all levels in Sichuan Province

Postal Level	Quantity	Average Elevation (m)	Median Elevation (m)	Terrain Slope (degrees)
District Head Office	1	493	—	0.69
First-class Office	2	261	—	8.59
Second-class office	96	424	400	5.64
Third-class office	81	568	402	8.89

Agency	1,043	489	403	6.61
Total/average	1,223	489	402	6.69

Source: The authors' digitized work of Sichuan Province sub-map of the 1936 *Postal Atlas of China*.

5.2. Postal Radius and Market Radius

Many scholars have done in-depth research on the radius of the grassroots market. Chen Zhongping 陈忠平 investigated the primary market of the Jiangnan towns in the mid-Qing Dynasty. Through detailed analysis and calculation, he proposed that the maximum radius from peasant families to the market was only 2–7 km in plain areas, and only 5–9 km even in mountainous areas. In other words, it took only a period of time in the early morning for farmers in the plains and half a day for farmers in mountainous areas to travel from their houses to the town [Chen Z. 1990]. Wang Di conducted research on the upper reaches of the Yangtze River in the Qing Dynasty. He found that the “action radius” (go-to-market distance) of the 17 prefectures, departments, and subprefectures (Chengdu, Chongqing, Baoning, etc.) in the mid-Qing Dynasty (Jiaqing period) was only 3–5 km [Wang D. 2001: 246]. According to statistics, Xu Tan believes that the transaction radius of each rural “market” is 3–5 km in plain areas and 5–7 km in mountainous areas, with an average of about 4–6 km [Xu 2000].

Based on the concept of the grassroots market radius, the distance from residents to the nearest postal outlet is called the “grassroots postal radius”. Postal agency, the lowest level of the postal network, was basically set up in rural areas with convenient transportation. It should be a subset of all natural villages, and would increase when the number of rural markets also increases. However, it is almost impossible to investigate which natural villages were served by a certain postal outlet. It would require a lot of time and cost to summarize such information as it was scattered in the massive local chronicles. Therefore, this paper adopted the Thiessen polygon analysis method in ArcGIS software to construct the grassroots postal service area and the grassroots postal radius.

This method essentially uses N point features (postal outlets in this paper) to generate N Thiessen polygons, that is, N planes (postal service areas in this paper). The principle of generation is: any position in a Thiessen polygon is closer to its point feature than to any other point feature. In other words, the Thiessen polygon analysis method, according to the principle of proximity, divides an area into a net structure around points. A point corresponds to a polygon, and the distance from any position in the

polygon to this point is less than the distance to other points. This principle is very consistent with the principle of postal service. In relatively flat plains, people will naturally choose the postal outlet that's closest to them. The Thiessen polygon method has been maturely applied in archaeology. It has been used for the "Site Catchment" analysis since the 1970s, that is, under the condition of poor remains in the ruins, theoretical methods are used to define the livelihood modes and living areas. At present, the use of GIS to define the site areas is relatively mature in the field of settlement archaeology and environmental archaeology [Qiao 2010; Qin L., Fu, and Zhang H. 2010].

In order to avoid the influence of the mountains, 11 prefectures and departments in the plain areas among the 1,225 postal outlets in Sichuan Province have been selected as the research objects. Those include Mianzhou, Zhuangchuan, Zhiqing, Chongqing, Luzhou, Xuzhou, Zizhou, Chengdu, Meizhou, Yezhou, and Jiading Prefectures, totaling 794 post offices and agencies. Through software calculation, we obtain 732 Thiessen polygons and calculate their area and perimeter. See Figure 8.

According to the Thiessen polygon statistics obtained, we know that among the 732 postal service areas, the average area is 143.5 km², the average perimeter is 47.53 km, and the grassroots postal radius is 5.99–6.76 km.⁷

Table 7. Thiessen polygon statistics

732 Thiessen polygons	Perimeter (km)	Area (km ²)
Maximum value	105.6	460.8
Minimum value	21.5	27.1
Average value	47.5	143.5
Average postal radius: 5.99–6.76 km		

Source: The authors' digitized work of Sichuan Province sub-map of the 1936 *Postal Atlas of China*.

The data is very close to the grassroots market radius obtained from the literature. We have reason to believe that the grassroots postal radius can well represent the grassroots market radius. Also, the grassroots postal service areas are very close to the service range of the grassroots fairs. This provides us with a very good example of dividing the fairs quantitatively across the country, allowing us not to choose the methods of W. Christaller and G. William Skinner to establish cumbersome multi-level centers.

We believe that China's rural economic network presents an extremely "flat" distribution. Take Sichuan as an example, there were tens of thousands of natural villages in Sichuan, whose upper level was the central

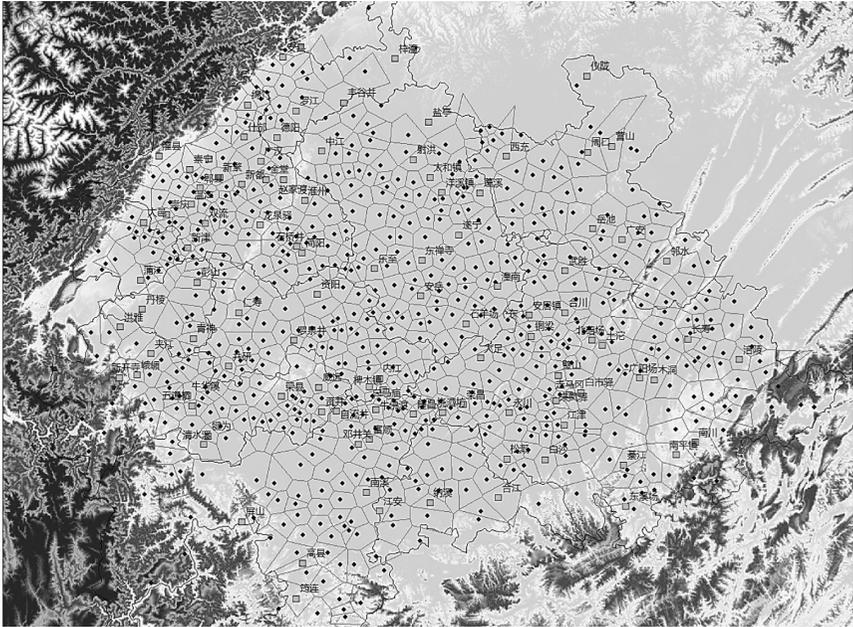


Figure 8. Thiessen polygon analysis on the postal outlets of the 11 representative prefectures in the Sichuan Plain (original image in color)

Source: The authors' digitized work of Sichuan Province sub-map of the 1936 *Postal Atlas of China*.

Note: The square dots represent second-class and third-class offices; the black dots represent the postal agencies; the gray polygons are Thiessen polygons; the black curves represent the prefecture boundary lines; and the base map is a false color stretching of the DEM image of SRTM (changed to grayscale display in the publishing process).

towns with postal outlets (agencies) and fairs (about 1,200). The next upper level was the prefectural, departmental, and district capitals with the political and economic functions. For people in the grassroots, the prefectural, departmental, and district capitals had no special distinction in terms of economic functions. They only traveled there to carry out economic activities that the fairs couldn't satisfy.

6. SUMMARY AND CONCLUSIONS

In the 30 years of the early 20th century, postal outlets and routes had experienced great spatial extension. Considering political instability, finan-

cial constraints, and frequent regime changes, the extraordinary development of such an industry (enterprise) was extremely unique. Due to the low efficiency of state-owned postal service and its weakness in competing with the private logistics industry, it is easy for the current academic circles to ignore the advanced nature of modern postal services under the historical conditions at that time. In fact, modern post service was a relatively advanced industry sector from the beginning. At the time, its impact on society can be comparable to that of the Internet industry in today's society. Therefore, we will deepen the understanding of the postal network if we regard postal services as the embryonic form of the modern information dissemination network. The previous section has analyzed the spatial distribution of the postal network in certain years in the preceding chapters. The next section will cover a deeper discussion in the following aspects.

6.1. Reasons for the Rapid Expansion of Modern Postal Space

“For more than a decade (1912–1928), only the postal office maintained its integrity under the turbulent domestic environment” [Jiaotongbu Zongwusi Diliuke 1931: 6]. Regardless of which indicator we look at (the density, number, and average service area of postal outlets), it's obvious that the modern postal space had expanded rapidly. The main reasons are as follows:

First, the technical content and capital requirements for postal network construction were relatively low. The postal service is different from capital-intensive industries such as the banking industry, nor is it technology-intensive like the military industry or shipbuilding industry. Take 1932 (Minguo 21) and 1931 (Minguo 20) as an example, there were more than 10,000 Chinese and overseas employees in over 13,000 post offices at all levels across the country, creating a total revenue of only 32.23 million yuan and 34.45 million yuan, while the total expenditure was 38.70 million yuan and 40.09 million yuan [Jiaotongbu Zongwusi Tongjike 1934: 198]. In comparison, only the Jiangnan Shipyard (Navy) had created a revenue of 2.89 million yuan in the same period, with an expenditure of 2.52 million yuan [Jiaotongbu Zongwusi Tongjike 1934: 342]. According to the customs statistics of 1932, the import tax alone had reached 226.3 million yuan [Zhongguo Dier Lishi Dang'anguan and Zhongguo Haiguan Zongshu Bangongting 2001, 112: 77]. In summary, it does not require much capital to maintain and develop the modern postal industry. In addition, since the postal industry had low technical content, a country that had just started industrialization like modern China was able to control it calmly. This is well reflected in the means of transportation: in addition to the use of

trains, cars, or motor boats for delivery in the main postal routes or metropolitan areas, single-slot boats, shoulder poles, wheelbarrows, ox carts, and plate trailer were used in the majority of low-class towns and rural areas, making it possible to expand the postal network in a short period of time at very low cost.

Secondly, it had the foundation of people's psychological construction for many years in the early stage. The so-called postal service was essentially a trust mechanism: we believe that a strange person/institution will fulfill its mission to deliver our precious letters or articles thousands of miles away. This was not easy in an acquaintance society like modern China. Without the psychological construction process and foreshadowing of the well-reputed private postal firms, overseas Chinese postal agencies, and the others that operated for a long time early on, the public might not be able to use it with confidence in a short time.

Finally, the operating mechanism was a nationalized monopoly operation. Modern postal service can be regarded as an industry or as an enterprise. Yet, unlike ordinary enterprises, the network coverage, rather than profit, was the first consideration in the start-up period of post services. Partially, it could be that the postal service was a state-owned capital enterprise (industry). As the investment and profits belonged to the central government, it prevented some modern joint-stock enterprises, such as the Shipping Investment Inviting Bureau, from potential traps or "practice usury" that may be encountered in the development process [Zhu 2001, 2006a]. More importantly, just as Zhu Yingui 朱荫贵 said, there was a powerful force that resisted foreign civilization at that time. If there was no top-down political power to impact and change the old order as well as give emerging modern enterprises legal status and provide them with support, or even play up the dual role of demonstration and control, it would be unimaginable for emerging modern enterprises to start and achieve success under the attack of domestic stubborn forces and foreign powers [Zhu 2006b]. The extraordinary development of the modern postal industry has proved the statement above to a certain extent. In certain specific areas in modern China, state-owned capital enterprises were more likely to suppress their impulse to pursue short-term interests and to make some basic construction and long-term investments.

6.2. Postal Service as a Symbol of Modernization

Post, in essence, is a complex of multiple transportation modes covering railways, highways, inland waterways, air transportation, as well as man/animal power transportation. Therefore, the expansion of the postal net-

work relies heavily on the improvement of the entire national transportation system and the level of transportation technology. In the general research context, the postal service serves as a symbol of modernization. As a leader in the public service industry, it represents a more efficient organizational form. Moreover, the postal service is also of great help in shaping a new country. The United States of America, founded in 1776, passed the Post Office Act in 1792. In the first half of the 19th century, it had quickly gone from a country with loose and weak internal management in the early days of the founding to a closely connected country. In this process, post offices throughout the country had played an unrivaled role. No matter how shabby the postal outlets looked, they were regarded by ordinary people as the incarnation and authoritative representative of the new government. This can be reflected in the following figures: in 1816, 69% of the national demilitarized federal employees were postal employees, and this figure rose to 79% in 1841 [Acemoglu, Moscona, and Robinson 2016: 61–67].

In terms of network coverage, the Republic of China post was more extensive in space than the network of the overseas Chinese postal agencies, but each had its own advantages in depth. In the early 20th century, the overseas Chinese postal agencies had entered almost every village in certain areas and even small villages and towns in the surrounding areas of the South China Sea. For example, the multiple operating networks of nearly a thousand post offices in the Chaoshan area covered every village in the Chaoshan area. In the same period, Chaoshan's postal service was still underdeveloped, as thousands of villages still had no access to postal services [Chen C. 2000]. Even by 1936, when the postal network of the Republic of China was the most developed, the postal network in Chaoshan area had not reached the popularization level of the overseas Chinese postal agencies. Therefore, the collation and research of the information on overseas Chinese postal agencies are significant to the study of modern Chinese economic history. Similar to the overseas Chinese postal agencies, private postal firms, which were purely private capital and formed based on blood and geographic relationships, were also worthy of study academically. This has a very good comparative significance for the study of the postal industry established based on national credit. After 1926, the Directorate General of Posts used the license approval system to control the development of the private postal services. It then gradually, purposefully, and systematically weakened its influence in the later stage. In a sense, this was a time when "the state sector advances as the private sector retreats". The overseas Chinese postal agency was a self-financing "post-like" network developed from a traditional Chinese commercial society and promoted by civilian forces.

Yet, its efficiency and popularity (especially in South China area) were much higher than the postal network that was regarded as an advanced element during the same period. This shows that the modern Chinese society had a natural vigorous economic vitality, but not only did the government fail to make good use of it, it even hindered the natural growth of such power. Later on, when the western forces entered China, it had hoped to transplant a set of postal system to China via the Qing government or the Republic of China government, but it was not implemented smoothly. It never reached the popularization level of the overseas Chinese postal agencies. This was due to the fact that there was not enough peaceful time to consolidate the postal network. Additionally, they had failed to introduce private capital and mature networks such as the overseas Chinese postal agencies and private post firms.

The modern Chinese post service promoted the widespread dissemination of government authority information through regular delivery of newspapers. The transmission of new modern knowledge, promoted through private mails, pushed the flow of modernization elements both psychologically and materially.

6.3. The Supplement of Postal Research to the History of Chinese Cities

Postal outlets were a representative subset of the total collection of all towns and villages. From a certain point of view, the postal network research is equivalent to the research of urban system.

Compared with the abundant research on the internal spatial structure of a single representative city, the modern national urban system had not been thoroughly, quantitatively, and comprehensively studied.⁸ In the general history of Chinese cities, the research of modern urban system still relied on the survey of the Republic of China, Christian statistics, or the research of geographers at that time. Research results of contemporary scholars is limited. As Shiba Yoshinobu said, “It may be surprising to readers that no works, no matter in Japanese, European languages, or Chinese, on a comprehensive description of the Chinese urban history are available” [Sibo 2013: 237].

This remained true in the modern times. In addition to G. William Skinner’s well-known works, there were few overall researches based on quantitative cross-basin or nationwide cities (towns)—this was because research on modern urban system lacked a set of core data. Different from the research of ancient urban history, research on modern Chinese urban history is incomplete if it is limited to narrative research, and cannot be comparatively analyzed with foreign urban history research. In particular,

the basic database construction has been completed for the research of European urban history.⁹ After all, the absolute number of modern cities (towns) are quite close to those of today's society, and there is a basis for quantitative research and spatial analysis. Recently, some scholars have made fruitful explorations in the space research of ancient urban system [Xiao 2012: 30].

In the research of urban system, there are two types of data commonly used in the field of geography and regional economics: attribute data and relational data. Urban attribute data generally refers to population size, industrial output value, gross national product, or online shopping transaction volume, etc., which can generally be regarded as "static data". However, as the main object of urban system research is the relationship between cities, the use of attribute data cannot fully resolve the question of relationship between the cities. The development from attribute data to relational data is a major breakthrough in the basic level of research and analysis. G. William Skinner's research is far-reaching and extensive: to a certain extent, he used the very mature economic geography research methods at that time to study modern Chinese cities, and was innovative in the materials used, such as the level of postal outlets. In the authors' opinion, the biggest shortcoming of the "Skinnerian model" is neither the inapplicability of hexagonal analysis framework outside of Sichuan Province (the model limits the applicable conditions and scope) nor its subjectivity to divide 9 economic macroregions. The issue is its lack of awareness in the greater reliability of relational data (such as network information contained in postal maps, modern customs inter-port trade, and source and sink data of transit dues trade) than attribute data (post office level, population and administrative level used by G. William Skinner) [Wang Zhe and Wu S. 2010].¹⁰ Research on the urban hierarchical system based on the central place theory has formed a relatively rigorous explanatory framework. However, it is inadequate to explain the network (such as postal network, inter-city trade network) that can be interconnected between any hub. Therefore, new methods are needed. For example, we can learn from the "flow space" or the global connectivity approach of world cities [Kasite 2003; Chen L., Gu C., and Zhen 2010; Leng and Yang 2012].

This paper has given the Thiessen polygon analysis method a try to divide the grassroots postal service areas in parts of Sichuan Province, and some exciting conclusions have been drawn. The radius of the grassroots postal service area is very close to the radius of the grassroots market. We can even boldly speculate that these two economic spaces should basically coincide. We're thus provided with a very good example to keep using postal maps to analyze China's grassroots market network. Next, we will write

a separate paper, selecting the Beijing-Tianjin-Hebei, the Pearl River Delta, and Yangtze River Delta regions to conduct a thorough research using a similar Thiessen polygon method to comprehensively clarify the spatial relationship between grassroots postal radius and grassroots fairs.

NOTES

- * This article is the English translation of the authors' following paper in Chinese with a slight revision: Jindai Zhongguo youzheng kongjian yanjiu: Jiyu duobanben youzheng yutu de fenxi 近代中国邮政空间研究：基于多版本邮政舆图的分析. *Zhongguo Jingjishi Yanjiu* 中国经济史研究 (Research in Chinese economic history), 2019, no. 2: 63–81. It is a phased achievement of the Youth Fund Project of Humanities and Social Sciences Research of Ministry of Education “Research on Modern China’s Trade Network: An Analysis Centered on the Origin-Destination Data of Old Maritime Customs (1873–1942)” (Grant No. 13YJC770051) and supported by the National Natural Science Foundation of China Youth Project “Research on the Urban System of Modern China: An Analysis Based on the OD Data of the Old Maritime Customs Interport Trade and the Transit Dues Trade (1859–1947)” (Grant No. 41401149).
- 1 See Wu C. 2001; Li B. 2010; Wang D. 1991, 2001; Wang Q. 2004. As there are many results, we won’t repeat them here.
 - 2 René Voorburg digitized this map in 2011, and verified and marked 2,000 out of the 2,760 locations on the Tabula Peutingeriana (<https://omnesviae.org/>).
 - 3 In 1839, Sir Hill’s proposal to lower postage was put into law. The volume of mails quadrupled from 1839 to 1850, and by 1870, it increased by 10 times. The United States began to lower postage in 1845, and France began to make a similar move in 1849.
 - 4 Recently, Professor Cai Weiping 蔡维屏 from the Department of History of Royal Holloway, University of London proposed the idea of understanding the role of postal service in the modernization of modern China from the perspective of “communication network” [Tsai 2016].
 - 5 This can be seen from the analysis of the U.S. post, where postal efficiency is maximized through thoughtful arrangement of postal maps and the “progress of mail” tables [DeBlois and Harris 2010: 105–119].
 - 6 The Harvard University Library has also carried out a digital scan of this version, which can be browsed and downloaded online with high accuracy (HOLLIS Number: 004869163).
 - 7 If we ideally think that the postal service area is square or circular, we will obtain different postal radii of 5.99 km and 6.76 km, respectively. The radius of postal service areas in other shapes (such as regular hexagons) falls somewhere in between.

- 8 There have been abundant researches on the internal spatial structure of cities as follows: Zhang S. 2000: 84; Li X. 2003; Lu 2011. The details of researches by Frederick Mote, Kato Shigeru 加藤繁, and Shiba Yoshinobu 斯波义信, et al. will not be repeated described here. In comparison, there have been a lot of research on regional cities, towns, or urban systems: Fan Yijun 范毅军, Liu Shiji 刘石吉, Fan Shuzhi 樊树志, Chen Zhongping, and Ding Xianyong 丁贤勇 ever made in-depth research.
- 9 The basic database construction has been completed for the research of European urban history [Fulisi 2015; Kelake 2015].
- 10 Ren Fang 任放 published multiple wonderful papers on the evaluation of the Skinnerian model and Chinese urban researches, and the details are not described here. See Ren 2010: 262–344.

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