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Reassessing Agricultural Investment in China: From 1952 to 2017

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ABSTRACT

While the contributions of labor and productivity to agriculture have been extensively studied, agricultural investment and capital accumulation remain underexplored. This gap is largely due to a lack of relevant data, particularly in developing countries. In China, measuring agricultural investment poses significant challenges due to a complex statistical system and frequent changes in official data standards, especially before 1978. This study aimed to construct a comprehensive dataset on agricultural investment from 1952 to 2017, encompassing state-owned, collective, and household agriculture. To ensure consistency and reliability, different estimation methods were applied according to the data sources available in different periods. The analysis revealed that while collective farming was the dominant model before 1978, a substantial share of investment was directed toward state-owned agriculture. After the reform era, the introduction of the household responsibility system led to a surge in household agricultural investment, primarily funded through self-accumulation. However, by 2010, the share of government appropriations and agricultural loans began to decline, with non-household entities accounting for 50% of total agricultural investment. This shift indicates a move away from direct investment by peasant households toward service-oriented agricultural production. Investment in China's agricultural sector exhibits significant cyclical patterns, influenced by economic policies and labor dynamics. Given recent challenges in food self-sufficiency and

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declining agricultural labor, reassessing agricultural investment levels is crucial for ensuring sustainable development.

Keywords: Agricultural Fixed Assets; State-Owned Economy; Rural People's Commune; Peasant Household Agriculture

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1. Introduction

Since Lewis's theory was proposed, the contributions of labor and productivity to agriculture have been extensively studied, yet agricultural investment and capital accumulation remain underexplored. This gap is largely due to a lack of relevant data, particularly in developing countries. China's modern development process has been a form of capital accumulation. How has a country that did not experience an industrial revolution realized such capital formation? Several explanations have been proposed. In simple terms, from the 1950s to the 1970s, when China was closed to the world, its development strategy was to achieve a high rate of capital accumulation at the expense of consumption [1]. Starting in the 1980s, as China opened up, it pursued a strategy to take full advantage of its economic reforms and the benefits of becoming a global workshop to maintain rapid capital accumulation [2,3]. From an internal perspective, economic reforms significantly improved its production efficiency. From an external perspective, China traded its cheap labor and land for foreign capital. Both factors caused a surge in China's post-reform capital stock.

Let us consider the fixed capital formation figures. Deflated by the price index, fixed capital formation in 1978 was almost 14 times higher than that in 1952; the figure in 2018 was approximately 68 times that in 1978 and 923 times that in 1952. In comparison, China's so-called growth miracle seems slight. At constant prices, China's gross domestic product (GDP) in 2018 was 37 times that in 1978 and 175 times that in 1952. However, little is known about how much of this humongous capital accumulation has been invested in agriculture, especially before 1978. This is because, first, China only began officially recording agricultural investments in the non-state-owned and non-collective economies in the 1980s. Second, even after the government started collecting data on agricultural investment across different economic production types, frequent adjustments to statistical methods and inconsistencies in official data from various sources made research on China's agricultural investment and capital particularly challenging, resulting in the scarcity of studies on this topic.

Although there were few relevant official statistics before the 1980s, some studies attempted to estimate investment and capital, including agriculture, in the early years of government funding, primarily in the 1950s [4,5]. The results of these studies are quite similar, suggesting that investment in agriculture in that period was meager and focused primarily on labor-intensive projects, particularly water conservation. The core of Yeh's [5] method was to derive the agricultural investment made by peasant households using commodity flows into rural areas for which data were available. The problem with this method is that it is only suitable when collectively-owned agriculture or the rural non-agricultural sector does not grow. With growth in collectively-owned agriculture or the rural non-agricultural sector, it was difficult to distinguish the specific investments by peasant households. Thus, Yeh's [5] estimates only span 1931 to 1936 and 1952 to 1957. Hollister [4] constructed the investments by setting an initial figure for 1952 and deducing figures for other years by using a relative index. Both these methods inspire this study.

During the early years, a part of the agricultural investment was made via market channels and could be expressed in monetary terms, while another part embodied the imputed value of people's labor in developing water conservation, land reclamation, soil improvement, afforestation, house repair, and construction projects, which did not go through the market channels and was not counted in monetary terms [6]. In this sense, the agricultural investment in these early years was larger than that estimated based on official data. Unfortunately, it

is impossible to solve this problem unless we know exactly how much labor was used to construct those investments.

Another prominent study was by Chow [1], who tried to collect the agricultural investment and capital accumulation data for the early years. The author estimated the sectoral capital stock in China from 1952 to 1985 using the data on accumulation as investment. Accumulation refers to the part of the national income used for the reproduction of goods or services, non-productive construction, and increases in productive and non-productive reserves, which was calculated by subtracting the amount of expenditure from the total national income. This indicator was calculated until 1993. Chow [1] distributed the amount of accumulation into four types of economic units—state enterprises, collective urban enterprises, rural collective enterprises, and individuals—and then distributed the accumulation of each type of economic unit into five sectors. Using this method, the author succeeded in constructing a sectoral investment series from 1952 to 1985.

However, even Chow's [1] method has two limitations. First, considering the accumulation series as data on capital investment is problematic because they include non-productive accumulation. This means that some of this accumulation will never be devoted to production and cannot be classified as capital investment. Second, the ratios according to which the accumulation of each type of economic unit is distributed among the five sectors originated from communications from the State Statistical Bureau and the data on the composition of newly increased fixed assets. For example, the author distributed 77% of the accumulations of fixed assets to industry, 3% to construction, 4.5% to transportation, 2% to commerce, and 4.5% to agriculture for the period 1952–1977. This method of applying constant ratios over a long period ignores the changes in the structure of investment distribution. More importantly, this approach of determining allocation ratios is too subjective and lacks credible evidence.

Two studies, by Li [7] and Wu [8], shed light on China's recent agricultural investment. Li [7] compiled data on sectoral investments from 1986 to 2007, dividing this period into three: 1986–1996, 1997–2002, and 2003–2007. As no data on sectoral investments in fixed assets were available from 1986 to 1996, the author calculated the percentages of sectoral investments in capital construction, renovation, and reformation for that period and then assumed these percentages to remain unchanged for other investments because of the lack of data on the distribution of other investments among the three industrial sectors. The method for the 1997–2002 period is almost identical to that explained above, except that data on real estate investments were available for this period, which he classified as investments in fixed assets in the tertiary sector. For the third period, data on fixed asset investments in the three industrial sectors were obtained from the China Statistical Yearbook [9]. Li [7] combined the data for the three periods to obtain the distribution of fixed assets investments among the three sectors and estimated the capital stock in each sector from 1986 to 2007.

By contrast, Wu [8] added government expenditures on agricultural capital construction, investments in the agricultural fixed assets of collective-owned units, and individual investments in the purchase of productive fixed assets in rural areas to obtain a series of aggregate fixed assets investments in the agricultural sector from 1981 to 1997. However, the drawback of Li's method is that the assumption of fixed sectoral percentages in total investment is too far from China's reality. Meanwhile, the drawback of Wu's method is that China's rural industrial sector had grown significantly during the period of his study, in which a large part of individual investments in the purchase of productive fixed assets went to non-agricultural areas.

The present study compiles long-run time series data on agricultural fixed assets investments to determine China's investments in agriculture from 1952 to 2017, providing the first detailed data on agricultural investment in each economic unit for a period spanning 65 years. The novelty of this study is that it overcomes the shortcomings of previous research by attempting to construct a dataset as close to the real situation as possible, especially for the period lacking official statistics. It is possible that half of the research conclusions on China's investment in non-state-owned agriculture before the 1980s were based on hypotheses and inferences. This

study utilizes official Chinese data to shed light on why these hypotheses and inferences are reasonable and reliable, and discusses the causes and consequences of the official approach to agricultural investments and accumulation.

Addressing this question is crucial for the following reasons. First, China's achievements in self-accumulated capital have long been overlooked. Unlike many developing countries that rely heavily on foreign investment, China pursued a unique path of endogenous capital accumulation during its planned economy era by channeling agricultural surpluses into industrialization. This model holds significant implications for other developing nations, particularly those with limited access to foreign capital. A key argument in this paper is that capital accumulation and development strategies during the planned economy period played a pivotal role in China's subsequent rapid growth and economic takeoff. Even after the economic reforms, China's transformation into the "world's factory" was a calculated move to further accelerate capital accumulation. Agriculture, without a doubt, has been one of the most critical sectors for capital accumulation across different economic phases. Therefore, accurately measuring China's agricultural investment is essential for understanding the broader mechanisms of capital formation. The findings of this study provide valuable insights for developing countries seeking effective capital accumulation strategies.

Second, this issue is closely tied to China's domestic food production and supply, particularly in the years ahead. While labor, land, the Green Revolution, and shifts in agricultural production methods have historically supported China's high food self-sufficiency, capital and technology will be the primary drivers of agricultural development in the future—and technology, to a large extent, depends on capital. Furthermore, agricultural capital not only influences short-term food supply but also determines long-term sustainability, including water resource management, soil improvement, and ecological preservation. As such, prioritizing capital investment in agriculture will be crucial for ensuring both food security and agricultural modernization in the next phase of development. A deeper understanding of China's agricultural investment strategies and capital accumulation pathways will facilitate more precise and effective planning for future agricultural investment.

From a global perspective, the role of agricultural capital accumulation in economic development varies significantly across countries. For instance, in the 1970s and 1980s, many Latin American countries prioritized industrial development and foreign investment while paying relatively little attention to agricultural investment. This resulted in low agricultural productivity, exacerbated urban-rural disparities, and ultimately hindered the industrialization process. In contrast, East Asian economies such as Japan and South Korea placed significant emphasis on agricultural capital accumulation during the early stages of industrialization. Through technological advancements, they improved agricultural productivity, not only strengthening food production but also supporting economic transformation. China's experience highlights that agricultural investment is not only fundamental to economic growth but also critical to long-term development stability. This study provides a reference point for other developing countries in designing sustainable capital accumulation strategies.

The remainder of this paper is organized as follows. Section 2 examines the evolution of various agricultural organizations in China. Section 3 explores the machinery and equipment used in agriculture. Section 4 analyzes agricultural investments by economic type from 1952 to 2017. Section 5 discusses the sources of agricultural investment, and Section 6 concludes the paper.

2. Evolution of Agricultural Organizations in China

In China, production activities are carried out by various organizations created according to the form of ownership, especially in the planned economy era—agricultural production is no different. Since it became the People's Republic of China, the country has built, after a series of reforms, an agricultural production system primarily comprising three types of organizations: state-owned farms (state ownership, listed as owned by the people before 1983 and state-owned after 1983), rural people's communes (collective ownership), and peasant households.

As the name implies, state-owned farms refer to those owned by the nation. In China, state ownership differs from collective ownership. Such division is based on land ownership. The owners of all state-owned land are the citizens of the People's Republic of China, and every Chinese citizen is a co-owner of state-owned land. As the state-owned land belongs to the public, the people's government exercises ownership on behalf of all Chinese citizens. Owners of collectively owned land are members of agricultural collective economic organizations; non-members do not have ownership rights to this land. Collectively-owned land is owned by a minority, and collective organizations generally exercise ownership on behalf of their members (per the Land Administration Law of the People's Republic of China). Prior to 1949, state-owned farms were built in certain areas of China. In the early years of the Republic, state-owned farms experienced rapid development. **Table 1** presents the development of state-owned farms in China. In terms of farm number, they have continued to grow and expand until 1962, when the scale of increase began to level off. Although the arable land area belonging to state-owned farms continues to increase, the golden growth era appears to have passed.

Table 1. State-owned farms in China.

	Unit	1952	1957	1962	1965	1978	2000	2019
Numbers of state-owned farms	Unit	562	804	2,123	2,062	2,067	2,026	1,834
Numbers of workers in state-owned farms	Thousand	359	441	2,168	2,600	5,140	3,919	2,150
Arable land in state-owned farms	Thousand Hectares	377	1,054	2,915	3,335	4,284	4,804	6,481

Source: Data from 1952 to 1965 are from New China's Agricultural Statistics for 60 Years, pp. 61–62 [10]. Data from 1978 to 2019 were obtained from the Annual Database of the National Bureau of Statistics of China.

Before the implementation of agricultural collectivization in 1952, China completed nationwide land reforms, which thoroughly abolished the federal exploitative system and prepared for the launch of the collective agriculture movement. The rise of collective-owned agriculture involved a shift from the mutual aid group production to cooperative production, and then to rural people's commune production. Mutual aid groups were characterized by exchange and mutual aid in terms of labor force, animal power, and farm tools; the cooperatives featured land pooling and unified operations; and rural people's communes were characterized by collective land ownership and the main means of production [11,12]. Collectivization was a gradual process; **Table 2** shows the evolution of collectively owned agriculture in China. By 1958, nearly all peasants had joined the rural people's communes, meaning that China had almost completed its agricultural collectivization, and the Great Leap Forward (1958–1962) pushed this movement to its climax. Such collective agricultural production systems dominated China's agricultural production for approximately two decades until the launch of far-reaching economic reforms in 1978.

After the reforms, the household responsibility system replaced the collective agricultural system and became the primary form of agricultural production. Its most notable characteristic is that peasants are responsible for both profits and losses, although, notably, agricultural land ownership remained collective rather than private. Only land use rights were contracted to peasants. The last column of **Table 2** shows the popularization of the household responsibility system in China; by 1983, over 90% of peasants had adopted it. Although the people's communes had disappeared by then, collective agriculture still existed in China, but its share and importance had significantly shrunk. Agricultural production under the household responsibility system is essentially a type of individual peasant production.

To sum up, state-owned agriculture is characterized by land and production resources being owned by the state, with farmers working as employees, and all outputs belonging to the state. Management is directly controlled by the government, which typically makes the decisions, resulting in limited production autonomy for the farmers. In contrast, collective agriculture involves land and production resources owned by a collective (such as people's communes or cooperatives), where farmers engage in production under collective management, and outputs are distributed within the collective. Management is overseen by collective organiza-

tions, with farmers participating in decision-making to a certain extent, but overall management and production arrangements are determined by the collective institutions.

Table 2. Degree of collectivization and decollectivization in China's agriculture.

	Year	Degree of Collectivization or Decollectivization	Percentage of Peasants in Mutual Aid Group Production	Percentage of Peasants in Cooperative Production	Percentage of Peasants in Rural People's Commune Production	Percentage of Peasants in the Household Responsibility System
Collectivization	1950	10.70	10.70	-	-	-
	1951	19.20	19.20	-	-	-
	1952	40.00	39.90	0.10	-	-
	1953	39.50	39.30	0.20	-	-
	1954	60.30	58.30	2.00	-	-
	1955	64.90	50.70	14.20	-	-
	1956	97.20	0.90	96.30	-	-
	1957	97.50	-	97.50	-	-
	1958	99.10	-		99.10	-
Decollectivization	1978	-	-	-	99.13	-
	1979	-	-	-	99.24	-
	1980	15.00	-	-	99.01	15.00
	1981	67.00	-	-	99.07	67.00
	1982	72.50	-	-	99.01	72.50
	1983	94.50	-	-	-	94.50

Source: The Chinese government first legalized the household responsibility system in 1982. Collectivization figures from 1978 to 1981 were calculated by dividing the number of people in rural people's communes by the number of people with agricultural hukou. The data were obtained from the China Statistical Yearbook 1983 [9].

Meanwhile, household agriculture features land use rights generally owned by farming families, allowing farmers to operate independently, with all outputs belonging to the family. Management is entirely decided by the household, granting them significant autonomy. In terms of production goals, state-owned agriculture is guided by the nation's economic plans and policies, often closely aligned with the country's overall development strategy. Collective agriculture aims to enhance collective economic efficiency and the welfare of farmers, with production objectives related to collective interests. Meanwhile, household agriculture focuses primarily on the economic interests of the family, chiefly aiming to meet the family's subsistence and economic needs.

China's official statistical data are summarized and reported based on these three main classifications. As such, China's agricultural investments primarily comprise investments in state-owned agriculture, collectively-owned agriculture, and agriculture by peasant households. While other types of agricultural production organizations, such as associate agriculture and joint-stock agriculture, have gradually appeared and developed because of China's economic reforms and opening-up, these three have remained the primary forms of Chinese agricultural production.

3. Machinery and Equipment in Agriculture

3.1. General Status

Agricultural capital refers to human-created assets used for agricultural production, including draught animals; agricultural machinery; buildings for agricultural production and storage; and infrastructure for agriculture, such as irrigation systems. Agricultural investment involves investing in these items. Thus, before constructing a dataset of agricultural investment, it is crucial to explore the changes in the machinery and equipment used.

Table 3 summarizes the data on the machinery and equipment used in Chinese agriculture. China had accumulated 51.42 million draught animals, 1307 tractors, and 284 combine harvesters by 1952. During the early period, draught animals were more important than agricultural machinery in agricultural production because of the poor availability of the latter. However, as **Table 3** shows, the number of draught animals began to accelerate only during the 1980s, reached a peak in 1995, and then declined rapidly. By 2017, there were only 13.41 million heads left.

Table 3. Machinery and equipment in Chinese agriculture.

Year	Draught Animals (Million Heads)	Large And Medium-Sized Agricultural Tractors (Thousand)	Small-Sized Agricultural Tractors (Thousand)	Implements and Attachments for Large and Medium-Sized Agricultural Tractors (Thousand)	Implements and Attachments for Small-Sized Agricultural Tractors (Thousand)	Combine Harvesters (Thousand)	Threshing Machines (Thousand)	Irrigation and Drainage Equipment (Thousand)	Irrigation and Drainage Equipment with Electric Power (Thousand)	Irrigation and Drainage Equipment with Diesel Power (Thousand)
1952–1956	55	4	-	-	-	1	-	-	-	-
1957–1961	46	34	-	144	-	4	-	176	-	-
1962–1966	41	63	2	225	-	6	57	447	-	-
1967–1971	50	138	106	379	-	8	540	1,556	-	-
1972–1976	51	289	471	761	-	11	1,311	3,307	-	1,956
1977–1981	51	646	1,609	1,266	1,949	23	2,271	5,177	2,492	2,806
1982–1986	64	845	3,337	1,197	2,976	34	3,187	6,040	3,123	2,917
1987–1991	74	839	6,417	992	5,839	38	4,620	7,889	4,089	3,800
1992–1996	81	703	8,293	1,013	9,223	69	5,909	9,865	5,136	4,730
1997–2001	76	801	11,880	1,310	15,966	219	8,136	13,397	7,018	6,379
2002–2006	66	1,200	14,534	2,008	23,043	426	9,177	16,766	8,918	7,848
2007–2011	42	3,400	17,379	5,195	28,925	868	9,914	20,493	11,294	9,199
2012–2016	23	5,700	17,308	8,940	30,438	1,600	10,449	22,292	12,825	9,468
2017	13	6,700	16,342	10,700	29,314	2,000	10,410	22,465	13,163	9,302

Source: The number of draught animals is from the China Rural Statistical Yearbook [13]. The other data are from A Comprehensive Book of China Rural Economic Statistics, 1949–1986 [14] for 1952–1977, and from the Annual Database of the National Bureau of Statistics of China for 1978 to 2017. Irrigation and drainage equipment numbers from 1978 to 2017 were calculated by summing the numbers of electric-powered irrigation and drainage equipment with those of diesel-powered equipment, because the annual database of the National Bureau of Statistics of China does not report the total figures.

In comparison, the number of agricultural machines has increased significantly. From 1952 to 1957, the number of large and medium-sized agricultural tractors increased tenfold, and the number of combined harvesters grew sevenfold. From 1957 to 1978, the number of large and medium-sized agricultural tractors increased 38 times, and the volume of irrigation and drainage equipment rose approximately 126 times. We could not track the exact number of small-sized agricultural tractors before 1962. However, compared with 1962, the numbers have grown as much as 1500 times. From 1978 to 2017, the fastest growth was in the number of combine harvesters, almost 105 times that in 1978. Combined, the number of large and medium-sized agricultural tractors and their smaller counterparts increased approximately twelvefold; however, the growth of irrigation and drainage equipment was not as fast as before. The number of electric-powered equipment increased more than that of diesel-powered equipment, indicating a shift in the energy used for agricultural irrigation and drainage.

These figures on machinery and equipment in Chinese agriculture provide only a vague profile of China's agricultural investment. Even when China was closed and desperately short of funds, it attempted to invest as much as possible in agricultural modernization. This argument does not contradict the prevailing view that China had sacrificed many growth opportunities for agriculture in preference for the industrial sector during the early stages of its development. However, it shows that things were probably not as bad as we had assumed.

3.2. Distribution of Agricultural Machinery among Different Economic Types

Next, we ask, who invested in and owned the machinery and equipment? While the three primary production modes, state-owned farms, rural people's com-

munes, and peasant households, have successively dominated China's agricultural production, there is no continuous record of the annual distribution of agricultural machinery and equipment among the three types. I collected enough relevant information to shed light on the real situation and found that state-owned farms have the most detailed records.

Table 4 lists the machinery and equipment used in state-owned agriculture. Recall that the whole of China only had 1,307 large and medium-sized agricultural tractors in 1952, and 1,176 of them were owned by state-owned farms; 276 of the 284 combine harvesters were owned by state-owned farms. Based solely on the available data, nearly 90% of modern agricultural machinery and equipment in China was state-owned in 1952; yet, only 0.35% of China's arable land area received the "state-owned" classification at the time.

This situation changed soon with the collectivization movement and the rise of rural people's communes. The share of agricultural machinery and equipment in state-owned farms shrank quickly. From 1952 to 1978, the share of large and medium-sized agricultural tractors in state-owned farms fell to less than one-tenth. The fastest decline in the share of combine harvesters occurred after 1978, from 71.56% to 3.22% in 2017. Based on the numbers and shares of state-owned agricultural machinery and equipment, it is clear that the period of the fastest growth in investment in state-owned farms was from 1952 to 1965. It is possible that agricultural investment in Chinese state-owned farms increased quickly during 1949–1952, but it is hard to make that argument without the relevant data. Moreover, the percentage of small-sized agricultural tractors owned by state-owned farms has never exceeded 2%. Taking together the use of all machinery, one can say that agriculture has primarily involved mass production and that the state is not a major investor in small agricultural implements. **Appendix A** presents the complete table for all available years.

Table 4. Machinery and equipment owned by state-owned farms and their share in the total (selected years).

Year	Area of Cultivated Land	Area Of Cultivated Land Owned by State-Owned Farms		Large And Medium-Sized Agricultural Tractors Owned by State-Owned Farms		Small-Sized Agricultural Tractors Owned by State-Owned Farms		Combine Harvesters Owned by State-Owned Farms	
	Thousand ha.	Thousand ha.	%	Unit	%	Unit	%	Unit	%
1952	107,918.7	376.7	0.35	1,176	89.98	-	-	276	97.18
1957	111,830.0	1,054.0	0.94	4,815	32.81	-	-	1,406	78.59
1965	103,594.0	3,334.7	3.22	18,668	25.71	-	-	5,411	80.71
1978	99,389.3	4,284.0	4.31	51,005	9.15	21,000	1.53	13,587	71.56
1980	99,305.3	4,456.2	4.49	-	-	27,000	1.44	16,000	59.16
1985	96,846.0	3,981.8	4.11	64,183	7.53	54,000	1.41	17,361	50.22
1990	95,672.7	4,427.2	4.63	68,993	8.48	110,050	1.58	17,445	45.06
1995	94,970.9	4,560.1	4.80	60,853	9.06	143,403	1.66	14,584	19.35
2000	130,039.2	4,803.5	3.69	66,562	6.83	214,000	1.69	15,000	5.71
2005	130,039.2	5,038.1	3.87	80,000	5.73	270,000	1.77	20,000	4.16
2010	135,268.3	5,989.0	4.43	146,000	3.72	330,000	1.85	39,000	3.93
2015	134,998.7	6,325.0	4.69	197,000	3.24	309,000	1.81	57,000	3.28
2017	134,881.2	6,456.0	4.79	222,000	3.31	301,000	1.84	64,000	3.22

Source: Data on national cultivated land for 1952–2008 are taken from the China Compendium of Statistics 1949–2008 [15], and data for 2009–2017 are from the China Statistical Yearbook [9]. The data on the cultivated land of state-owned farms for 1952–2008 are from the China Compendium of Statistics 1949–2008 [15], and China Statistical Yearbook for 2009–2017 [9]. The figures of small-sized agricultural tractors owned by state-owned farms for 1978–1987 and those of combine harvesters owned by state-owned farms for 1979 and 1980 are from the China Compendium of Statistics 1949–2008 [15]. The remaining data are from the China Statistical Yearbook [9].

Table 5 shows the agricultural machinery and equipment owned by the peasant households. Before 1983, there were no official statistics on the amount of agricultural machinery or equipment owned by Chinese peasant households. After 1993, China published data on the ownership of agricultural machinery and equipment for every 100 rural households rather than aggregate figures. Hence, **Table 5** spans only the period 1984–1992. However, it covers the years of dramatic change in the amount of agricultural machinery and equipment owned by peasant households. In terms of ownership of large and medium-sized agricultural tractors, threshing machines, and irrigation and drainage equipment, the share of peasant households rose from less than half in 1984 to over 70% in 1992. This is also true of small-sized agricultural tractors. In 1984, peasant households owned over 80% of China's small-sized agricultural tractors; by 1992, this ratio had risen to 96.64%.

Table 5. Agricultural machinery and equipment owned by peasant households and their shares in the total.

Year	Large and Medium-Sized Agricultural Tractors Owned by Peasant Households		Small-Sized Agricultural Tractors Owned by Peasant Households		Threshing Machines Owned by Peasant Households		Irrigation and Drainage Equipment Owned by Peasant Households	
	Unit	%	Thousand	%	Thousand	%	Thousand	%
1984	406,956	47.66	2725	82.63	1,569	48.54	2,707	43.95
1985	526,786	61.80	3,405	89.04	2,085	60.59	3,153	51.15
1986	574,061	66.25	4,164	92.00	2,417	65.75	3,626	55.72
1987	607,878	69.00	4,963	93.64	2,794	70.36	4,139	61.33
1988	616,587	70.86	5,611	94.18	3,130	69.69	4,863	65.65
1989	612,036	72.16	6,216	95.00	3,492	77.17	5,490	68.63
1990	584,730	71.88	6,686	95.77	3,983	80.74	5,958	70.77
1991	555,178	70.77	7,025	96.18	4,251	82.05	6,477	73.01
1992	532,833	70.21	7,255	96.64	4,454	83.64	6,730	74.28

Source: The data are from the China Rural Statistical Yearbook [13], which has, since 1993, published the amount of agricultural machinery and equipment owned by every 100 rural households. However, I cannot estimate the total amount of agricultural machinery and equipment by multiplying those figures by the number of rural households because the amount of agricultural machinery and equipment owned by every 100 rural households is based on rural social and economic surveys and is above the national average. Once this is done, we will find that the calculated numbers of agricultural machinery and equipment in peasant households are even larger than the total national numbers.

By subtracting the number of machinery and equipment owned by state-owned farms and peasant households from the total number in China's agricultural sector, we obtain an approximate figure for the machinery and equipment owned by collective-owned agriculture for the available years, as shown in **Table 6**. In terms of large and medium-sized agricultural tractors, the percentage owned by collective agriculture increased from 10.02% in 1952 to 90.85% in 1978, and then declined to 21.29% in 1992. I assumed the number of machinery and equipment owned by peasant households was zero before 1978. This is a strong but acceptable assumption considering the high degree of collectivization in China's agriculture during that period. However, the machinery and equipment owned by peasant households cannot realistically be zero even during this period. The percentage of small-sized agricultural tractors owned by collectively owned agriculture can only be traced back to 1984, when it was 16.04%. Through the process of decollectivization (1980–1983, as shown in **Table 2**), a considerable number of these small-sized agricultural tractors were transferred to peasant households.

Table 6. Machinery and equipment owned by collective-owned agriculture and their share in the total.

Year	Large and Medium-Sized Agricultural Tractors Owned by Collective-Owned Agriculture		Small-Sized Agricultural Tractors Owned by Collective-Owned Agriculture		Combine Harvesters Owned by Collective-Owned Agriculture	
	(Unit)	(%)	(Unit)	(%)	(Unit)	(%)
1952	131	10.02	-	-	8	2.82
1957	9,859	67.19	-	-	383	21.41
1965	53,931	74.29	-	-	1,293	19.29
1978	506,353	90.85	-	-	5,400	28.44
1984	390,786	45.76	529,000	16.04	-	-
1985	261,388	30.67	365,000	9.54	-	-
1986	225,090	25.98	299,000	6.61	-	-
1987	205,343	23.31	264,000	4.98	-	-
1988	184,798	21.24	251,673	4.22	-	-
1989	166,194	19.59	218,760	3.34	-	-
1990	159,798	19.64	184,950	2.65	-	-
1991	164,463	20.96	170,200	2.33	-	-
1992	161,559	21.29	141,328	1.88	-	-

Source: The figures from 1952 to 1978 were calculated by extracting the figures of state-owned farms from the figures of total national numbers. The figures from 1984 to 1992 were calculated by extracting the figures for state-owned farms and peasant households from the national numbers.

4. Investment in Agriculture by Economic Type

4.1. Agricultural Investment in the State-Owned Economy

This section examines the agricultural investment behind the changes in the machinery and equipment for these economic types. Investment in fixed assets has always been recorded as ownership of means of production in China's statistics. In other words, investment in fixed assets is estimated and reported by economic type. Investment in fixed assets in the state-owned economy is divided into capital construction, technical updates and transformations, fixed assets, and real estate development investments. Capital construction investment consists of investment in construction and installation, purchase of equipment, tools, and instruments, and other costs.

Compared with other economic types, the data on the investment in fixed assets of the state-owned economy are the longest recorded and most detailed. **Table 7** reports fixed assets investments in state-owned agriculture at current prices. As China's official data do not record figures of investment in technical updates and transformations before 1980, we assume that they were zero during those years. This is reasonable because the level of agricultural capital equipment was low, and agricultural investment was primarily focused on constructing new agricultural capital rather than updating or transforming old capital. Moreover, the calculated figures for 1952–2000 conform to China's official statistics for 2001–2017, suggesting that this approximate calculation for 1952–2000 is acceptable.

Table 7. Fixed assets investment in state-owned agriculture at current prices.

Year	Fixed Assets Investment in State-Owned Agriculture	Capital Construction Investment in State-Owned Agriculture	Investment in Technical Updates and Transformation in State-Owned Agriculture
1952–1956	2.58	2.88	-
1957–1961	7.87	7.87	-
1962–1966	9.06	9.06	-
1967–1971	8.69	8.69	-
1972–1976	13.71	13.71	-
1977–1981	20.05	18.80	3.13
1982–1986	22.80	16.42	6.38
1987–1991	36.27	25.45	10.82
1992–1996	85.52	63.61	21.91
1997–2001	289.08	217.79	50.36
2002–2006	520.38	-	-
2007–2011	1,850.27	-	-
2012–2016	2,606.75	-	-
2017	3,720.45	-	-

Source: Data on fixed assets investments in state-owned agriculture for 1952–2000 were obtained by summarizing capital construction investment, technical updates, and transformation investment in state-owned agriculture. The figure for 1952 is missing and was estimated by the author by dividing the figure for 1953 by 1.3617, the ratio of the 1953 agricultural production data to that for 1952. This calculation assumes that the growth rate of fixed assets investment in state-owned agriculture is equal to the growth rate of total agricultural fixed assets investment. Considering the majority of the agricultural investment in that period was conducted by the government, it is rational. The figures from 1966 to 1974 are adjusted following 50 Years' Brilliance. The data on capital construction investment in state-owned agriculture for 1952–2000 and the data on investment in technical updates and transformation in state-owned agriculture for 1981–2000 are from the Statistics on Investment in Fixed Assets of China 1995–2000 [16] and Statistics on Investment in Fixed Assets of China 1950–2000 [17], respectively. Data on fixed assets investments in state-owned agriculture from 2001 to 2017 are from the Statistical Yearbook of the Chinese Investment in Fixed Assets [18]. As there is no Statistical Yearbook of the Chinese Investment in Fixed Assets 2014, no figure of fixed assets investment in state-owned agriculture for 2013 exists. The figure for 2013 was calculated by subtracting the fixed assets investment figure for agricultural service sectors of state-owned agriculture from the total amount of fixed assets investment in state-owned agriculture, obtained from the China Statistical Yearbook 2014 [9]. There is only one aggregate figure of capital construction investment in state-owned agriculture for the periods of 1966–1970 and 1971–1974. Hence, the average number for each year was calculated by dividing the aggregate figure by the number of years.

4.2. Agricultural Investment in the Collective-Owned Economy

China's official statistics on fixed assets investments in collective-owned agriculture commenced in 1981. To estimate the fixed asset investments in collectively owned agriculture prior to this date, I analyzed the financial statistics of rural production teams. First, I aggregated the expenditures on agricultural production means along with other production expenses incurred by these teams. I then calculated one-tenth of this total as an approximation of the fixed asset investments for

rural production teams. Production brigades were primarily the basic accounting and farm production units in the people's commune system. The figures of expenses on purchasing means of production refer to brigades involved in spending on intermediate inputs such as pesticides, fertilizers, and so on. Thus, I adjusted the series by dividing the figures by 10, an empirical value. I verified the doubts about this setting with the early China Rural Statistical Yearbook [13], which published the original values of fixed assets of collectively owned units and peasants' units in rural areas for some years, and can be approximately considered the original value of capital stock in rural areas. Comparing these figures with the estimated agricultural capital stock (**Table 3**), this setting seems reasonable. I did not adopt the figures for 1952–1980 because they concern the value of non-agricultural capital stock in rural areas. This method allows us to estimate the fixed asset investments in collectively owned agriculture for the period of 1952 to 1980. **Table 8** demonstrates a strong consistency between the estimated results for 1952–1980 and China's official statistics for 1981–2017.

Table 8. Fixed assets investment in collective-owned agriculture at current prices.

Year	Fixed Assets Investment in Collective-Owned Agriculture	Purchase of Means of Agricultural Production in Monetary Income and Expenditure of Rural Production Teams	Other Production Expenses of Rural Production Teams
1952–1956	2.57	24.70	1.04
1957–1961	7.44	70.48	3.96
1962–1966	7.81	73.14	5.00
1967–1971	11.93	112.86	6.42
1972–1976	21.38	204.02	9.74
1977–1981	33.28	305.55	25.38
1982–1986	31.83	-	-
1987–1991	54.58	-	-
1992–1996	136.29	-	-
1997–2001	317.35	-	-
2002–2006	362.45	-	-
2007–2011	556.74	-	-
2012–2016	711.73	-	-
2017	602.43	-	-

Source: Data on the purchase of means of agricultural production and other production expenses in monetary income and expenditure of rural production teams from 1952 to 1980 are from the Statistics of China Supply and Marketing Cooperatives [19]. Data on fixed asset investments in collectively owned agriculture from 1981 to 2000 are from Statistics on Investment in Fixed Assets of China 1995–2000 [17], and the data from 2001 to 2017 are from Statistical Yearbook of the Chinese Investment in Fixed Assets [18]. As the 2014 edition of the Statistical Yearbook of the Chinese Investment in Fixed Assets was not available, I could not use the official 2013 figure for fixed assets investment in collectively owned agriculture. Therefore, I calculated this figure by subtracting the fixed capital investment in agricultural service sectors of collectively owned agriculture from the total fixed assets investment in collectively owned agriculture. The relevant data are from the China Statistical Yearbook 2014 [9]. The production team was formerly the basic accounting and agricultural production unit of China's rural people's commune.

4.3. Agricultural Investment by Peasant Households

Official statistics on agricultural investments by peasant households are the most incomplete. China started publishing official statistics on agricultural fixed assets investment by peasant households in 1999. To address the missing official figures of agricultural investment by peasant households, I adopted two different estimation methods for 1952–1980 and 1981–1998 based on data availability.

From 1952 to 1980, the agricultural fixed assets investment of peasant households was calculated as follows [Equation (1)]:

$$\begin{aligned}&\text{Agricultural fixed assets investment of peasant households} = \\ &(\text{Monetary income of peasant households} - \text{Net monetary income of peasant households}) \times 0.05\end{aligned} \tag{1}$$

The figure is calculated by multiplying the difference between peasants' cash income per capita and peasants' consumption per capita by total rural labor, minus the change in peasants' bank deposits, and then multiplying by 0.05. Please note that 0.05 is a practical value based on the fitness of the estimation for the whole period. This ratio reveals that peasant households' investment in agricultural fixed assets was only about one-twentieth of their

total agricultural expenditures at the time. This figure is credible for two main reasons: first, peasant households operated on a very small scale and faced significant development constraints; second, the level of mechanization was extremely low at that time. The data are from A Comprehensive Book of China Rural Economic Statistics, 1949–1986 [14], China Compendium of Statistics 1949–2008 [15], and China Financial Statistics 1949–2005 [20].

Considering that China's official statistics include data on total fixed assets investment of peasant households since 1981, which consists of house investment, fixed assets investment in agricultural investment, fixed assets investment in non-agricultural production, and other investments, the agricultural fixed assets investment of peasant households for the period from 1981 to 1998 is calculated as follows [Equation (2)]:

$$\begin{aligned} &\text{Agricultural fixed assets investment of peasant households} = \\ &\text{Purchase of productive fixed asset investment of peasant households} \times \\ &\text{Percentage of agriculture in the original fixed production value of peasants and collectives} + \\ &(\text{Total fixed assets investment of peasant households} - \text{Housing investment} - \\ &\text{Purchase of productive fixed asset investment of peasant households}) \times 0.3 \end{aligned} \tag{2}$$

Please note that 0.3 is a practical value based on the fitness of the estimation for the whole period. This ratio reflects the expenses that peasant households incur for investments in agricultural storage facilities and the maintenance of existing agricultural machinery.

Table 9 summarizes the calculated and official figures of agricultural fixed assets investment by peasant households as well as the relevant data used in the calculation process. As Column 1 shows, the figures obtained from the estimation for 1952–1980 and 1981–1998 are continuous with each other and with the official data for 1999–2017.

Table 9. Agricultural fixed assets investment by peasant households at current prices.

Year	Agricultural Fixed Assets Investment of Peasant Households	Monetary Income of Peasant Households	Net Monetary Income of Peasant Households	Total Fixed Assets Investment of Peasant Households	Investment in Residential Buildings of Peasant Households	Purchase of Productive Fixed Assets Investment of Peasant Households	Other Fixed Assets Investment of Peasant Households	Agricultural Proportion in the Original Value of Fixed Assets of Peasant Households
1952–1956	2.68	194.76	141.10	-	-	-	-	-
1957–1961	4.87	272.82	175.56	-	-	-	-	-
1962–1966	4.85	295.20	198.18	-	-	-	-	-
1967–1971	7.32	385.94	239.56	-	-	-	-	-
1972–1976	10.92	514.66	296.30	-	-	-	-	-
1977–1981	16.98	895.80	548.00	138.17	140.75	15.00	10.59	1.00
1982–1986	79.06	1,923.93	1,324.90	387.19	262.49	80.88	43.82	0.83
1987–1991	121.26	-	-	874.33	623.78	108.70	141.85	0.72
1992–1996	244.35	-	-	1,642.87	1,111.55	197.06	334.26	0.73
1997–2001	405.95	-	-	2,806.62	1,843.77	398.29	564.56	0.73
2002–2006	835.72	-	-	3,612.73	2,058.51	809.20	745.02	-
2007–2011	1,392.74	-	-	7,096.93	4,376.03	1,291.56	1,429.34	-
2012–2016	2,072.20	-	-	10,303.55	6,534.28	1,659.62	2,109.64	-
2017	2,069.66	-	-	9,554.42	5,899.26	1,589.90	2,065.26	-

Source: Data on the monetary income of peasant households from 1952 to 1985 are from A Comprehensive Book of China Rural Economic Statistics [14], whereas data on the net monetary income of peasant households from 1952 to 1985 are taken from the Statistics of China's Supply and Marketing Cooperatives [19]. The data on the total fixed assets investment of peasant households for 1980–2000 are from the Statistics on Investment in Fixed Assets of China 1995–2000 and from the Statistical Yearbook of the Chinese Investment in Fixed Assets for 2002–2017. There was no edition of the Statistical Yearbook of the Chinese Investment in Fixed Assets for 2001 and 2002. The figure for 2001 is from the China Rural Statistical Yearbook [13]. The data on investment in residential buildings of peasant households for 1983–2000 are from the Statistics on Investment in Fixed Assets of China 1995–2000 [16], and the data for 2003–2017 are from the Statistical Yearbook of the Chinese Investment in Fixed Assets 1950–1995 [18]. The figures for 1981 and 1982 are from the Statistical Yearbook of the Chinese Fixed Asset Investment 1950–1995 [18]. There is no Statistical Yearbook of the Chinese Investment in Fixed Assets for 2001 and 2002. The figures for 2000–2002 are from the China Statistical Yearbook [9]. The data on the purchase of productive fixed assets investments by peasant households for 1982–1995 are from the Statistical Yearbook of the Chinese Investment in Fixed Assets 1950–1995 [18], from the China Statistical Yearbook [9] for 1996–1998, and from the China Rural Statistical Yearbook for 1999–2017. The figure for 1981 is from the Statistics on Investment in Fixed Assets of China 1950–2000 [17]. The figures for other fixed asset investments of peasant households were calculated by subtracting the amount of investment in residential buildings and the purchase of productive fixed asset investments from the total amount of fixed asset investment of peasant households. Please refer to **Appendix B** for the calculation of the agricultural proportion of the original value of fixed assets of peasant households. Data on the agricultural fixed assets investments of peasant households from 1999 to 2001 are taken from the China Rural Statistical Yearbook [13]. Data on the agricultural fixed assets investments by peasant households from 2002 to 2017 are taken from the Statistical Yearbook of the Chinese Investment in Fixed Assets [18]. There was no 2014 edition of the Statistical Yearbook of the Chinese Investment in Fixed Assets. Hence, there is no official figure for the agricultural fixed assets investment of peasant households for 2013. However, I obtained the figure by subtracting the figure of agricultural fixed assets investment in all types of agriculture from the figure of agricultural fixed assets investment in all types of agriculture. The relevant data can be found in the Statistical Yearbook of the Chinese Investment in Fixed Assets [18] for 2015.

4.4. Agricultural Investment by Economic Type

Apart from the three major economic types of agriculture, some other forms have emerged since the economic reforms, including associate agriculture; joint-stock agriculture; foreign-invested agriculture; and Hong Kong, Macao, and Taiwan-invested agriculture. The official data for these types were first published in 2001. Regarding missing values, I assumed that the figures before 1983 were zero and adopted the increase in the original value of agricultural fixed assets in the new rural household association for 1984–1988. For the period 1989–2000, I assumed an arithmetic sequence and estimated the missing values.

The data on total fixed assets investment in agriculture from 1952 to 2017 are the aggregate figures of fixed assets investments in state-owned agriculture, collective-owned agriculture, peasant household agriculture, and other types of agriculture. Thus far, we have obtained a complete dataset of agricultural investments by economic type in China for the period from 1952 to 2017.

For comparison, **Table 10** reports the estimated results for agricultural fixed assets from other studies. For 1952–1957, the figures for agricultural fixed assets estimated by Cheng [6] are much larger than my estimation results, perhaps because the source data they adopted included investments in water and weather conservation facilities. However, since the 1970s, China's official statistics have excluded investments in water and weather conservation facilities from agricultural fixed assets investment. For data consistency, I adopted official figures, but excluding water and weather conservancy investments. For 1981–2007, we can see that Wu's [8] estimation results are larger than mine for 1981–1986 but smaller than mine for 1987–1997. The reason for the former is that Wu's [8] method considers all funds spent on the purchase of productive fixed assets as agricultural investments. The explanation for the latter is that his method ignored other types of agriculture that have increased since the mid-1980s; thus, his estimation results became smaller than mine since 1987. Li's [7] estimation results are far below mine. As mentioned earlier, his method assumes, unrealistically, that the percentage of agriculture in the total investment is fixed. There was a large gap in the series between 2002 and 2003. The figures he presents for 2003 are also taken from official statistics and are the same as ours.

Table 10. Fixed assets investment in China's agriculture at current prices (100 million yuan).

Year	Fixed Assets Investment in Agriculture	Fixed Assets Investment in State-Owned Agriculture	Fixed Assets Investment in Collective-Owned Agriculture	Fixed Assets Investment in Peasant Household Agriculture	Fixed Assets Investment in Other-Type Agriculture	Cheng's Estimates on Fixed Assets Investment in Agriculture	Wu's Estimates on Fixed Assets Investment in Agriculture	Li's Estimates on Fixed Assets Investment in Agriculture
1952–1956	7.84	2.58	2.57	2.68	0.00	23.89		
1957–1961	20.18	7.87	7.44	4.87	0.00	23.20		
1962–1966	21.72	9.06	7.81	4.85	0.00			
1967–1971	27.94	8.69	11.93	7.32	0.00			
1972–1976	46.01	13.71	21.38	10.92	0.00			
1977–1981	70.31	20.05	33.28	16.98	0.00		82.44	
1982–1986	135.80	22.80	31.83	79.06	2.12		149.86	38.05
1987–1991	223.48	36.27	54.58	121.26	11.37		221.66	61.64
1992–1996	503.95	85.52	136.29	244.35	37.78		455.90	158.93
1997–2001	1,077.72	289.08	317.35	405.95	65.34		761.10	484.39
2002–2006	2,020.76	520.38	362.45	835.72	302.21			1,901.93
2007–2011	6,408.77	1,850.27	556.74	1,392.74	2,609.03			3,403.50
2012–2016	14,857.30	2,606.75	711.73	2,072.20	9,466.59			
2017	22,962.00	3,720.45	602.43	2,069.66	16,569.50			

Source: (i) Data on total fixed assets investment in agriculture from 1952 to 2000 were obtained by summarizing the fixed assets investments in state-owned agriculture, collective-owned agriculture, peasant agriculture, and other-type agriculture. Data from 2001 to 2017 are from the Statistical Yearbook of Chinese Investment in Fixed Assets [17]. (ii) Data on fixed assets investment in other types of agriculture are the figures for the increase in the original value of agricultural fixed assets in the new rural household association for 1984–1988. Relevant data were obtained from the China Rural Statistical Yearbook [13]. The data on fixed assets investments in other types of agriculture are the aggregate figures of agricultural fixed assets in types besides the three primary types and taken from the Statistical Yearbook of Chinese Investment in Fixed Assets [17]. The data on total fixed assets investment in agriculture from 1952 to 2017 are the aggregate figures of fixed assets investment in state-owned agriculture, collective-owned agriculture, peasant household agriculture, and other types of agriculture. The data after 2001 were published in the Statistical Yearbook of Chinese Investment in Fixed Assets [17].

From **Table 10**, we calculated the annual growth rate and share of total agricultural fixed assets investment by economic type, as shown in **Figure 1**. During 1952–1960, China attached great importance to state-owned agriculture, especially in the years before collectively owned agriculture blossomed. Hence, the growth

in fixed assets investments in state-owned agriculture was significant during this period, and the share of total agricultural fixed assets investments was large. Subsequently, along with the rise in collectively owned agriculture, the share of state-owned agriculture declined, and this trend continued until the late 1990s.

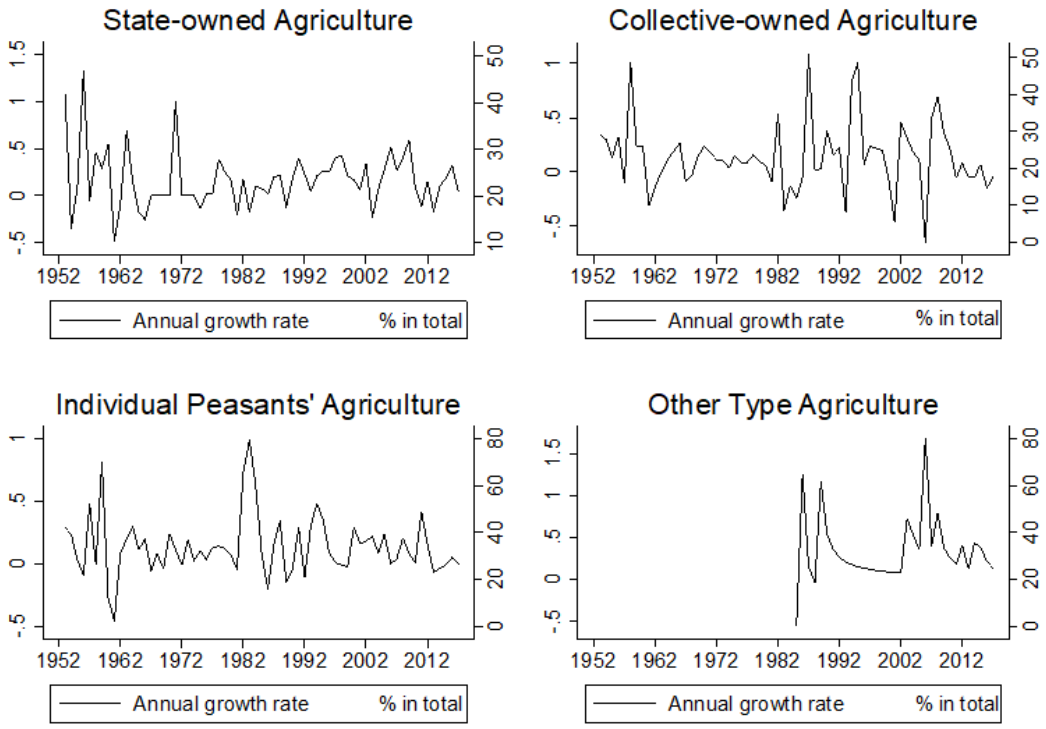

Figure 1. Annual growth rate and percentage in total agricultural fixed assets investment by economic type.

Figure 1 shows that, from 1952 to 1982, collectively owned agriculture accounted for the majority of agricultural fixed assets investment in China. In the 1980s, along with the spread of the household responsibility system, the growth rate of fixed assets investment in collectively owned agriculture and its percentage of total agricultural fixed assets investment began to fluctuate wildly. Since the 2000s, this share has decreased further.

Interestingly, during the early years (1952–1956), investment in peasant household agriculture increased rapidly. Along with the collectivization of agriculture in China, investments in fixed assets in peasant household agriculture were stagnant in the 1960s and the 1970s. Nevertheless, as the household responsibility system spread, investment in peasant households' agriculture began to increase rapidly, and its share in total agricultural fixed assets investments began to rise. However, since the 2000s, with the rise of other types of agriculture in China, the percentage of peasant household agriculture in total agricultural fixed assets investment has been declining. This is due to a low willingness among farmers to invest in agriculture, stemming from labor migration and low profit margins in agricultural operations. Consequently, many farmers prefer to engage in agricultural production through leasing services, resulting in a significant portion of agricultural investments being made by related agricultural service companies. Regardless of the form, it is evident that the growth rate of agricultural investment has slowed down.

5. Sources of Agricultural Investment

This section clarifies the sources of agricultural investment in China. However, China's official statistics on the sources of agricultural fixed assets investment can

be traced only since 2003. The Statistical Yearbook of the Chinese Investment in Fixed Assets [17] reports the sources of fixed assets investment by the state-owned economy for 1952–2000, and the sources of fixed asset investment of the collective-owned economy for 1982–2000. However, these figures show the sources of aggregate fixed assets investment, including not only agricultural but also non-agricultural investment.

For the state-owned economy, which mainly engages in non-agricultural production, I had to adjust the official figures. The details are provided in **Appendix C**. The estimated results are presented in **Table 11**. The majority of agricultural investments in state-owned agriculture came from state budgetary appropriation. Since the 1960s, with the increase in the surplus of state-owned agriculture, the share of agricultural investments from self-owned and self-collected funds has increased. Since the late 1970s, the percentage of agricultural investment sourced from domestic loans has increased with the building and development of the banking system in China. However, this share is far below that of other sources.

Table 11. Sources of agricultural fixed assets investment in state-owned agriculture and collectively owned agriculture: 1952–2000.

Year	State-Owned Agriculture			Rural Collectively Owned Agriculture		
	State Budgetary Appropriation	Domestic Loans	Self-Owned and Self-Collected Funds and Others	Domestic Loans	State Budgetary Appropriation	Self-Owned and Self-Collected Funds and Others
1952–1956	93.69	0.00	6.31	52.77	4.11	43.12
1957–1961	86.43	0.00	13.57	14.74	21.52	63.74
1962–1966	92.06	0.09	7.85	12.10	16.79	71.10
1967–1971	86.07	0.09	13.84	3.09	12.74	84.17
1972–1976	81.96	0.14	17.90	5.82	19.35	74.83
1977–1981	77.77	0.79	21.45	10.18	20.56	69.26
1982–1986	70.08	2.23	27.70	27.62	72.38	
1987–1991	64.38	2.95	32.68	29.18	70.82	
1992–1996	60.16	3.12	36.72	27.70	72.30	
1997–2000	60.56	2.93	36.06	13.30	86.70	
1982–1986	70.08	2.23	27.70	27.62	72.38	
1987–1991	64.38	2.95	32.68	29.18	70.82	
1992–1996	60.16	3.12	36.72	27.70	72.30	
1997-2000	60.56	2.93	36.06	13.30	86.70	

Source: The data on state-owned agriculture from 1953 to 2000 are estimated by the author based on data from the Statistical Yearbook of Chinese Investment in Fixed Assets 1950–1995 [18]. **Appendix C** presents the details of the estimation. Data on collectively owned agriculture from 1953 to 1981 were estimated by the author using data from the Statistics of China Supply and Marketing Cooperatives [19]. **Appendix D** presents the details of the estimation. The data on collectively owned agriculture from 1982 to 2000 are taken from the Statistical Yearbook of Chinese Investment in Fixed Assets 1995–2000 [16].

Considering that the collective-owned economy primarily refers to those in rural areas and engages in agricultural production, I assume that the aggregate fixed assets investment in collective-owned agriculture is approximately equal to agricultural fixed assets investment. Thus, I adopt the figures for the collective-owned economy without any adjustment for 1982–2000. For 1953–1981, I estimate the percentage of funds from each source based on the financial data on rural production brigades. The details are shown in **Appendix D**. **Table 11** shows that during 1953–1956, the majority of investments in collectively owned agriculture came from domestic loans. China's banking system was not well developed in this period, and the loans were likely financial loans primarily. However, with the development of collectively owned agriculture, the share of funds coming from loans declined, and the share of funds that were self-owned or self-collected grew. Since the late 1970s, the development of China's banking system has led to an increase in domestic loan funding. However, these figures fell with the decline in collectively owned agriculture after the mid-1990s.

Table 12 reports the official statistics of the sources of agricultural fixed assets investment for 2003–2017. For agriculture of all types, excluding peasant households' agriculture, the main sources of investment are self-owned and self-collected funds, and their shares rose during this period. By contrast, the share of the agricultural investment coming from state budgetary appropriation declined. In peasant households' agriculture,

the majority of the agricultural investment comes from self-owned and self-collected funds, suggesting that it is still difficult for peasant households to obtain loans from banks.

Table 12. Sources of agricultural fixed assets investment: 2003–2017.

Year	Agriculture Excluding Peasant Households' Agriculture			Peasant Households' Agriculture	
	State Budgetary Appropriation	Domestic Loans	Self-Owned and Self-Collected Funds and Others	Domestic Loans	Self-Owned and Self-Collected Funds and Others
2003	26.34	6.05	63.65	3.92	96.08
2004	19.81	7.66	69.40	2.67	97.33
2005	21.22	4.01	72.58	2.76	97.24
2006	21.40	4.65	72.58	2.94	97.06
2007	18.34	4.25	75.68	3.14	96.86
2008	15.25	4.49	78.64	3.23	96.77
2009	16.97	4.82	77.25	4.58	95.42
2010	14.52	5.12	79.67	3.27	96.73
2011	10.18	4.78	84.14	3.41	96.59
2012	9.80	4.77	84.89	3.06	96.94
2013	9.87	4.98	84.75	-	-
2014	8.57	5.16	85.99	6.59	93.41
2015	7.81	4.23	87.80	2.86	97.14
2016	8.00	4.03	87.78	4.35	95.65
2017	7.44	4.50	87.80	3.00	97.00

Source: The data are from the Statistical Yearbook of the Chinese Investment in Fixed Assets [18].

Figure 2 shows loan interest rates for agriculture and funds toward agriculture. Loan interest rate 1 refers to the loan interest rate for equipment in rural production brigades. Loan interest rate 2 pertains to the rate for peasant households. Loan interest rate 3 refers to the rate for fixed assets investment. Note that the loan interest rate for peasant households consists of the long-term loan rate (primarily for agricultural fixed assets investments) as well as the short-term loan rate (primarily for agricultural production materials). During the 1950s, loan interest rates for agricultural investment were high. Based on available data, the loan interest rate was higher for peasant households than for rural production brigades, confirming that peasant households find it more difficult to borrow money from banks. Furthermore, since the mid-1990s, loan interest rates on fixed assets investments have declined. This may be attributed to the abundance of investable funds resulting from the increase in production surplus and the development of China's banking system.

Let us consider the balance of agricultural loans in China's financial institutions and state financial expenditures on agriculture. While both include funds for non-fixed-assets-investments, they still reflect funds toward agricultural investments from financial institutions and national finances.

Agricultural loans rapidly increased from 1952 to 1959. This corresponds, first, to a growing share of domestic loans in the agricultural fixed assets investment by rural collectively owned agriculture during this period (**Table 11**). Second, a rapid increase in agricultural loans occurred in the 1980s and 1990s. With the development of China's banking system, access to agricultural loans increased, especially for collectively owned agriculture. As shown in **Table 11**, the share of domestic loans for fixed assets investment in rural collectively owned agriculture was high during this period. Since the 2000s, the increase in agricultural loans has slowed.

State financial expenditure on agriculture rose quickly in the 1950s. This corresponds to a large percentage of state budgetary appropriations of agricultural fixed assets investment in state-owned and rural collectively owned agriculture during this period. In the early days of the Republic, self-accumulation was very low, and thus, a considerable part of agricultural investment was accomplished through government funds. In the 1980s and 1990s, the increase in state financial expenditure on agriculture was steady, and began to accelerate in the 2000s.

Additionally, since China opened its market to foreign investors, a considerable amount of foreign investment has flowed into the agricultural sector. **Figure 2**

shows that foreign direct investment in agriculture increased rapidly during the 1980s and 1990s. This is also an important reason for the diversity in China's agricultural production and organizational forms.

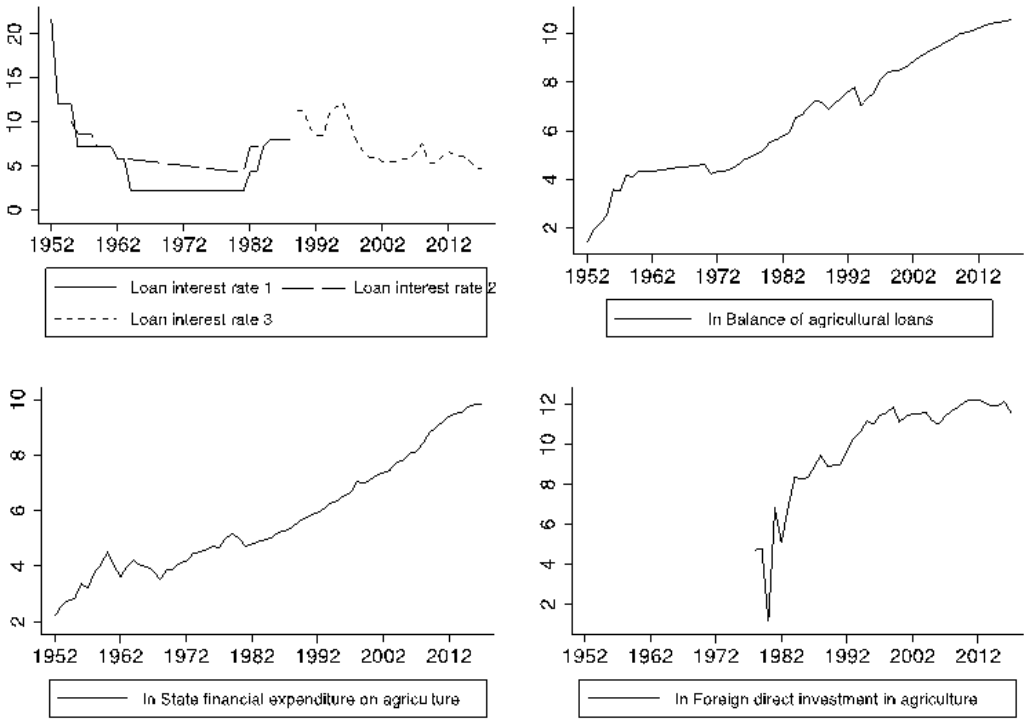

Figure 2. Agricultural loan interest rates and funds toward agriculture at current prices.

Note: Data on loan interest rates and the balance of agricultural loans are from the Almanac of China's Finance and Banking [21], data on state financial expenditures on agriculture, from the Finance Yearbook of China [22], and data on foreign direct investment in agriculture, from the China Trade and External Economic Statistical Yearbook [23].

6. Conclusion

The contributions of labor and labor productivity to agriculture have been exhaustively analyzed since Lewis's famous theory was proposed and developed [24–26]. Comparatively, the issues of agricultural investment and capital accumulation have yet to attract the attention they deserve. The scarcity of studies in this field is largely due to a lack of relevant data on agricultural investment and capital accumulation, especially in developing countries.

Measuring agricultural investment and capital in China presents significant challenges due to the complexity of its statistical system and frequent changes in official data criteria and standards. This issue is particularly pronounced for agricultural investment before 1978, for which reference materials are extremely limited. The lack of reliable data has hindered accurate assessments of agricultural production efficiency and the sector's contribution to China's industrial transformation. To address this gap, this study constructs a comprehensive dataset on agricultural investment in China, covering all agricultural sectors, including state-owned, collectively owned, and peasant household agriculture, from 1952 to 2017.

By outlining this data construction process, the study examines the evolution of agricultural investment and its sources over this period. The analysis reveals that, while collective farming was the dominant production model before 1978, a significant share of agricultural investment was concentrated in state-owned agriculture. From 1962 to 1966, state-owned agriculture accounted for nearly half of total national agricultural investment, despite occupying only 3% of the country's arable land. Investment sources further indicate that state-owned agriculture was primarily funded through state budgetary appropriations, whereas collective agriculture relied largely on self-accumulation. Interestingly, agricultural investment by peasant households

before collectivization was sizable—contrary to expectations, but reasonable given the surge in investment enthusiasm following land reforms[27,28]. Although exact figures on agricultural machinery owned by peasant households are unavailable, it can be inferred that their fixed assets primarily consisted of livestock and traditional agricultural tools. Historical estimates by Minami and Makino[29] on agricultural capital stock in Manchuria from 1932 to 1944 further support this perspective, showing higher-than-expected levels of investment and capital stock in the early years, aligning with this study's findings.

Following the reform and opening-up period, the introduction of the household responsibility system led to a rapid increase in household agricultural investment, with approximately 90% of this investment still stemming from self-accumulation. This stands in stark contrast to other agricultural entities, which had a self-accumulation ratio of around 60%. However, after 2010, the share of government budgetary appropriations and agricultural loans began to decline, while investment by non-household agricultural entities grew substantially. By 2010, these entities accounted for 50% of total agricultural investment. This shift largely reflects the declining agricultural labor force in peasant households, as farmers increasingly opt to engage in agricultural production through service providers rather than investing directly in agriculture. Consequently, household agricultural investment has declined, while investment by service-oriented agricultural enterprises has risen.

Overall, our calculations indicate that investment in China's agricultural sector exhibits significant cyclical patterns. As shown in **Figure 3**, when analyzed in five-year intervals, the trends in agricultural investment become more apparent. During China's closed economy period, agricultural investment growth remained low. This can be attributed to two key factors: low production efficiency leading to slow agricultural capital accumulation, and the substantial transfer of agricultural surplus to the industrial sector. In other words, from the founding of the People's Republic to the beginning of economic reforms, China's development strategy centered on increasing food production and accumulating capital for industrialization within a closed economic system. Agricultural collectivization was implemented to optimize scarce resources and reduce surplus retention among peasants. While this policy came at the expense of rural livelihoods, it facilitated rapid and sizable capital accumulation in the agricultural sector under a closed economy[1,30].

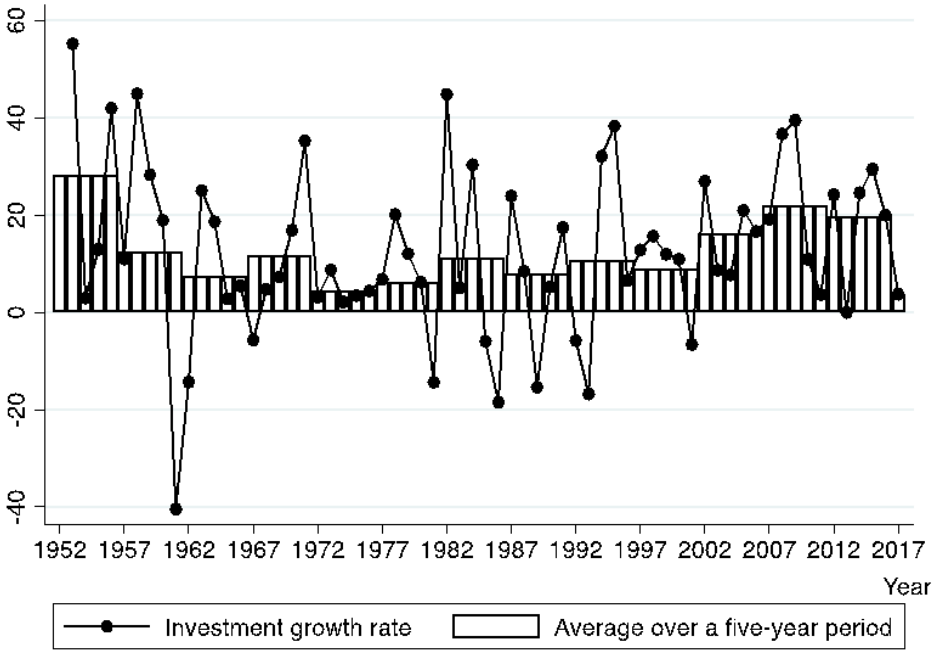

Figure 3. Agricultural investment growth rate and five-year average at constant prices (1952 = 100).

With economic reforms, labor migration from agriculture to non-agricultural industries, along with rising labor productivity, allowed peasant household agricultural surpluses to grow, making more funds available for reinvestment. Additionally, foreign investment inflows reduced the need to transfer agricultural surplus to other sectors, leading to a significant rise in agricultural investment. However, after 2010, as China's overall economic growth slowed, investment growth in the agricultural sector also decelerated. Given the ongoing decline in agricultural labor and China's recent challenges in maintaining food self-sufficiency, reassessing the level of agricultural investment is crucial. In light of these economic shifts, increasing investment in agriculture has become an urgent priority for ensuring sustainable development.

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Institutional Review Board Statement

Not applicable.

Informed Consent Statement

Not applicable.

Data Availability Statement

All data supporting the reported results are included in the Appendix of this article, so that other researchers can readily use them. The calculation methods are fully documented in the main text with appropriate references. No additional datasets were generated or analyzed during the current study.

Conflicts of Interest

The author declares no conflict of interest.

Appendix A. Machinery and Equipment in Chinese Agriculture and in State-Owned Farms

Table A1. Machinery and equipment in Chinese agricultural and state-owned farms.

Year	Arable Land (Ten Thousand Mu)	Arable Land in State-Owned Farms (Ten Thousand Mu)	Large And Medium-Sized Agricultural Tractors (Unit)	Large and Medium-Sized Agricultural Tractors in State-Owned Farms (Unit)	Small-Sized Agricultural Tractors (Unit)	Small-Sized Agricultural Tractors in State-Owned Farms (Unit)	Combine Harvesters (Unit)	Combine Harvesters in State-Owned Farms (Unit)
1952	161,878	565	1,307	1,176	-	-	284	276
1953	162,793	-	1,582	-	-	-	429	-
1954	164,032	-	2,945	-	-	-	591	-
1955	165,235	-	4,767	-	-	-	943	-
1956	167,737	-	11,267	-	-	-	1,451	-
1957	167,745	1,581	14,674	4,815	-	-	1,789	1,406
1958	160,351	-	26,396	-	-	-	3,452	-
1959	156,869	-	33,289	-	-	-	4,908	-
1960	157,292	-	45,536	-	-	-	5,857	-
1961	154,966	-	52,239	-	-	-	6,245	-
1962	154,355	4,372	54,938	-	919	-	5,906	-
1963	154,090	-	59,235	-	992	-	6,001	-
1964	154,968	-	65,868	-	1,294	-	6,176	-
1965	155,391	5,002	72,599	18,668	3,956	-	6,704	5,411
1966	154,437	-	-	-	-	-	-	-
1967	153,846	-	-	-	-	-	-	-
1968	152,330	-	-	-	-	-	-	-
1969	152,190	-	-	-	-	-	-	-
1970	151,702	4,932	125,498	-	78,309	-	8,002	-
1971	151,049	-	150,179	-	133,550	-	8,685	-
1972	150,922	-	189,944	-	207,731	-	9,399	-
1973	150,319	-	234,078	-	302,177	-	9,164	-
1974	149,868	-	280,676	-	421,223	-	10,901	-
1975	149,562	5,979	345,000	-	598,533	-	12,551	-
1976	149,082	-	397,000	-	825,000	-	14,233	-

Table A1. *Cont.*

Year	Arable Land (Ten Thousand Mu)	Arable Land in State-Owned Farms (Ten Thousand Mu)	Large And Medium-Sized Agricultural Tractors (Unit)	Large and Medium-Sized Agricultural Tractors in State-Owned Farms (Unit)	Small-Sized Agricultural Tractors (Unit)	Small-Sized Agricultural Tractors in State-Owned Farms (Unit)	Combine Harvesters (Unit)	Combine Harvesters in State-Owned Farms (Unit)
1977	148,871	-	467,000	-	1,091,000	-	15,732	-
1978	149,084	6,426	557,358	51,005	1,373,000	21,000	18,987	13,587
1979	149,247	6,536	666,823	-	1,671,000	23,000	23,026	15,000
1980	148,958	6,684	744,865	-	1,874,000	27,000	27,045	16,000
1981	148,556	6,613	792,032	53,085	2,037,000	28,000	31,268	16,873
1982	147,909	6,651	812,447	58,825	2,287,000	29,000	33,904	17,922
1983	147,539	6,645	840,776	59,317	2,750,000	32,000	35,728	18,838
1984	146,781	6,128	853,914	56,172	3,298,000	44,000	35,861	17,609
1985	145,269	5,973	852,357	64,183	3,824,000	54,000	34,573	17,361
1986	144,345	6,531	866,463	67,312	4,526,000	63,000	30,945	18,945
1987	143,833	6,528	880,952	67,731	5,300,000	73,000	33,802	18,193
1988	143,583	6,977	870,187	68,802	5,958,000	95,327	35,004	19,319
1989	143,484	6,993	848,220	69,990	6,543,000	108,240	36,582	18,182
1990	143,509	7,059	813,521	68,993	6,981,000	110,050	38,719	17,445
1991	143,480	6,696	784,466	64,825	7,304,000	108,800	43,996	15,427
1992	143,139	6,776	758,904	64,512	7,507,000	110,672	51,075	15,340
1993	142,652	6,723	721,216	63,457	7,883,400	126,800	56,304	15,037
1994	142,360	6,737	693,154	62,730	8,236,687	144,966	63,918	14,652
1995	142,456	6,840	671,846	60,853	8,646,356	143,403	75,351	14,584
1996	195,059	7,050	670,848	60,600	9,189,200	184,000	96,378	14,900
1997	195,059	7,146	689,051	60,445	10,484,813	194,908	141,312	14,142
1998	195,059	7,226	725,215	63,044	11,220,551	194,616	182,629	14,544
1999	195,059	7,254	784,216	65,566	12,002,509	208,000	226,036	14,000
2000	195,059	7,202	974,547	66,562	12,643,696	214,000	262,578	15,000
2001	195,059	7,223	829,900	67,302	13,050,840	216,000	282,871	15,000
2002	195,059	7,112	911,670	72,000	13,393,884	232,000	310,147	16,300
2003	195,059	7,035	980,560	70,000	13,777,056	245,000	365,041	18,000
2004	195,059	7,230	1,118,636	73,800	14,549,279	263,500	410,520	19,000
2005	195,059	7,557	1,395,981	80,000	15,268,916	270,000	480,378	20,000
2006	182,603	7,781	1,718,247	90,300	15,678,995	286,000	565,578	23,000
2007	182,603	7,962	2,062,731	103,600	16,191,147	301,100	633,784	25,900
2008	182,574	8,249	2,995,214	117,200	17,224,101	315,000	743,474	29,000
2009	203,077	8,397	3,515,757	131,900	17,509,031	323,600	858,372	32,000
2010	202,902	8,984	3,921,723	146,000	17,857,921	330,000	992,062	39,000
2011	202,858	9,174	4,406,471	161,700	18,112,663	347,000	1,113,708	40,000
2012	202,738	9,186	4,852,400	174,000	17,972,300	328,000	1,278,821	46,000
2013	202,745	9,317	5,270,200	176,800	17,522,800	333,000	1,421,000	48,400
2014	202,586	9,365	5,679,500	193,000	17,297,700	321,000	1,584,600	53,000
2015	202,498	9,488	6,072,900	197,000	17,030,400	309,000	1,739,000	57,000
2016	202,381	9,671	6,453,546	216,000	16,716,149	268,000	1,902,008	94,000
2017	202,322	9,684	6,700,800	222,000	16,342,400	301,000	1,985,400	64,000

Source: Data on national cultivated land from 1952 to 2008 are from the China Compendium of Statistics 1949–2008; data for 2009–2017 are from the China Statistical Yearbook; and data on the cultivated land of state-owned farms for 1952–2008 are from the China Compendium of Agricultural Statistics 1949–2008 and China Statistical Yearbook for 2009–2017. Data for small-sized agricultural tractors owned by state-owned farms from 1978 to 1987 and those for combine harvesters owned by state-owned farms in 1979 and 1980 are from the China Compendium of Agricultural Statistics 1949–2008. The other data are from the China Statistical Yearbook.

Appendix B. Proportion of Agriculture in the Original Value of the Fixed Assets of Peasant Households

The production fixed assets in rural households consist of agricultural production fixed assets (Column C), non-agricultural production fixed assets (Column G), production premises (Column J), and others (Column K), as shown in **Table A2**. There are no disaggregated data on agricultural and non-agricultural production premises. Hence, I assumed that the proportions of the original value of production premises (Column J) and others (Column K) between agricultural production and non-agricultural production are consistent with those between the original value of agricultural fixed assets (Column C) and non-agricultural fixed assets (Column G). Under this assumption, to obtain the agricultural proportion in the original value of fixed assets of peasant households, I calculated the percentage of the original value of agricultural production fixed assets (Column C) as the sum of the percentage of the original value of agricultural production fixed assets (Column C) and the original value of non-agricultural production fixed assets (Column G), as shown in Column B.

Note that there are no relative data for 1981–1984. Hence, I assigned a percentage of one in 1981, implying that there were no non-agricultural production activities in peasant households in that year, and then made up the remaining figures for 1982–1984.

Table A2. Relative data on the original value of production fixed assets in rural households.

Year	Original Value of Production Fixed Assets Per Rural Household	Agricultural Proportion in the Original Value of Fixed Assets of Peasant Households	Original Value of Agricultural Production Fixed Assets	Of Which, Draft Animals and Product Animals	Of Which, Large, Medium and Small Iron and Wood Farm Tools	Of Which, Farming, Forestry, Animal Husbandry, and Fishery Machinery	Original Value of Non-Agricultural Production Fixed Assets	Of Which, Industrial Machinery	Of Which, Transport Machinery	Production Premises	Others
	A=C+G+J+K	B=C/(C+D)	C=D+E+F	D	E	F	G=H+I	H	I	J	K
1981	-	1.00	-	-	-	-	-	-	-	-	-
1982	-	0.93	-	-	-	-	-	-	-	-	-
1983	-	0.88	-	-	-	-	-	-	-	-	-
1984	-	0.83	-	-	-	-	-	-	-	-	-
1985	792.53	0.78	455.16	339.01	48.50	67.65	128.97	16.13	112.84	174.33	34.07
1986	850.78	0.75	470.08	-	-	-	155.23	-	-	-	-
1987	909.03	0.73	485.00	338.49	51.37	95.14	181.49	26.40	155.09	197.52	45.02
1988	1,033.04	0.71	548.41	365.33	58.50	124.58	218.80	32.84	185.96	212.67	53.16
1989	1,126.07	0.72	604.17	385.97	61.15	157.05	235.94	37.72	198.22	230.99	54.97
1990	1,258.06	0.72	669.75	402.36	70.32	197.07	257.94	42.12	215.82	269.92	60.45
1991	1,497.09	0.74	779.46	424.63	87.50	267.33	280.32	45.16	235.16	360.43	76.88
1992	1,643.95	0.72	838.79	443.97	95.23	299.59	327.93	52.40	275.53	388.68	88.55
1993	1,950.31	0.72	991.19	521.11	120.18	349.90	384.63	67.22	317.41	517.29	57.20
1994	2,347.63	0.74	1,242.95	687.19	136.07	419.69	440.40	81.13	359.27	585.32	78.96
1995	2,774.27	0.74	1,517.02	839.21	153.89	523.92	526.66	81.93	444.73	672.01	58.58
1996	3,605.07	0.72	1,873.61	905.05	200.31	768.25	721.79	113.36	608.43	899.87	109.80
1997	3,896.56	0.72	1,935.62	850.01	207.33	878.28	752.52	115.92	636.60	982.06	226.36
1998	3,970.81	0.74	2,018.08	771.06	213.27	1,033.75	695.17	125.81	569.36	1,000.80	256.77
1999	4,045.48	0.73	2,034.32	730.76	190.85	1,112.71	756.97	118.95	638.02	1,036.67	217.53

Source: The data are from the China Rural Statistical Yearbook. (i) As no relevant data were available for 1981–1984, I set up figures for these four years. (ii) As no relevant data were available for 1986, I replaced the missing values for 1986 with the averages of the figures for 1985 and 1987.

Appendix C. Sources of Agricultural Fixed Assets Investment in State-Owned Agriculture for 1952–2000

There are no official data available on the percentages of each source of agricultural fixed asset investments in state-owned agriculture for 1952–2000, but information is available on the sources of aggregate fixed asset investments in the state-owned economy for this period.

To estimate the percentages of each source of agricultural fixed assets investment in state-owned agriculture for 1952–2000, I first assumed that the percentages of each source of agricultural fixed assets investment in state-owned agriculture in 2000 are equal to those in 2002, which are available in the Statistical Yearbook of Chinese Investment in Fixed Assets 2003. There is no Statistical Yearbook of the Chinese Investment in Fixed Assets for 2001 and 2002. This assumption is acceptable because the percentage of each source of agricultural fixed asset investment is usually not expected to change dramatically.

Second, using the data of the percentages of each source of fixed assets investment in the state-owned economy, I can obtain a percentage index of each source through diving the figure of the previous year by the figure of the current year. Here, I calculated the percentage indexes for domestic loans and for self-owned and self-collected funds, and others only.

Third, by multiplying the calculated "percentage index" of the previous year by the figure of the current figure, we can obtain the figure of the percentage of the previous year. Because we already have figures for 2000, those for the remaining period of 1953–1999 can be estimated by backward calculation.

Finally, the percentage of agricultural fixed assets investment coming from state budgetary appropriation can be calculated by subtracting the figures of domestic loans, the figures of self-owned and self-collected funds, and others from 100. The relative data and estimation results for the percentages of each source of agricultural fixed asset investment in state-owned agriculture are shown in **Table A3**.

According to my estimation, the percentages of agricultural fixed assets investment from domestic loans (Column R), self-owned and self-collected funds, and others (Column S) are lower than the aggregate figures (Columns M and N), respectively. Moreover, the percentages of agricultural fixed assets investment from state budgetary appropriations (Column Q) are higher than those from the aggregate figures (Column L). This is reasonable considering that self-accumulation in agricultural production was much less than that in non-agricultural production, and access to loans for agriculture was much less as well. Thus,

even state-owned agriculture depended much more on budgetary appropriations.

Table A3. Calculation of the sources of agricultural fixed assets investment in state-owned agriculture.

Year	State-Owned Economy			Percentage Index of Domestic Loans	Percentage Index of Self-Owned and Self-Collected Funds and Others	State-Owned Agriculture		
	State Budgetary Appropriation	Domestic Loans	Self-Owned and Self-Collected Funds and Others			State Budgetary Appropriation	Domestic Loans	Self-Owned and Self-Collected Funds and Others
	L	M	N	$O_{t-1} = M_{t-1}/M_t$	$P_{t-1} = N_{t-1}/N_t$	$Q=100-R-S$	$R_{t-1} = O^* R_t$	$S_{t-1} = P^*S_t$
1952	-	-	-	-	-	-	-	-
1953	83.7	0.0	16.3	-	0.98	91.32	0.00	8.68
1954	83.4	0.0	16.6	-	2.13	91.16	0.00	8.84
1955	92.2	0.0	7.8	-	1.16	95.85	0.00	4.15
1956	93.3	0.0	6.7	-	0.59	96.43	0.00	3.57
1957	88.6	0.0	11.4	-	0.51	93.93	0.00	6.07
1958	77.6	0.0	22.4	-	0.86	88.07	0.00	11.93
1959	73.9	0.0	26.1	-	0.95	86.10	0.00	13.90
1960	72.4	0.0	27.6	-	0.69	85.31	0.00	14.69
1961	60.1	0.0	39.9	-	2.40	78.76	0.00	21.24
1962	83.4	0.0	16.6	-	1.11	91.16	0.00	8.84
1963	85.0	0.0	15.0	0.00	0.96	92.01	0.00	7.99
1964	84.1	0.2	15.7	0.15	1.22	91.62	0.02	8.36
1965	85.8	1.3	12.9	0.59	0.96	92.97	0.16	6.87
1966	84.3	2.2	13.5	3.14	0.49	92.55	0.27	7.19
1967	72.0	0.7	27.3	0.64	1.04	85.38	0.09	14.53
1968	72.7	1.1	26.2	1.57	1.11	85.92	0.13	13.95
1969	75.5	0.7	23.7	0.88	0.99	87.30	0.09	12.62
1970	75.3	0.8	23.9	2.00	0.83	87.18	0.10	12.72
1971	70.7	0.4	28.9	0.80	0.88	84.57	0.05	15.39
1972	66.7	0.5	32.8	0.50	1.03	82.48	0.06	17.46
1973	67.2	1.0	31.8	0.91	0.95	82.95	0.12	16.93
1974	65.6	1.1	33.3	0.69	0.98	82.14	0.13	17.73
1975	64.4	1.6	34.0	0.89	0.94	81.70	0.19	18.10
1976	62.0	1.8	36.2	1.06	0.90	80.51	0.22	19.27
1977	57.9	1.7	40.4	1.00	1.12	78.28	0.21	21.51
1978	62.2	1.7	36.1	0.47	1.08	80.57	0.21	19.22
1979	63.0	3.6	33.4	0.31	0.76	81.78	0.44	17.78
1980	44.7	11.7	43.7	0.86	0.91	75.31	1.42	23.27
1981	38.6	13.6	47.8	0.84	0.91	72.90	1.65	25.45
1982	31.4	16.2	52.4	1.13	1.04	70.13	1.97	27.90
1983	35.4	14.3	50.3	0.93	1.02	71.48	1.74	26.78
1984	35.3	15.4	49.3	0.67	0.93	71.88	1.87	26.25
1985	24.0	23.0	53.0	1.01	0.96	68.99	2.79	28.22
1986	22.2	22.7	55.1	0.92	1.00	67.91	2.76	29.34
1987	20.5	24.6	54.9	1.02	0.90	67.78	2.99	29.23
1988	14.6	24.1	61.3	1.15	0.93	64.44	2.93	32.64
1989	13.3	20.9	65.8	0.89	1.04	62.43	2.54	35.03
1990	13.2	23.6	63.2	0.84	1.02	63.49	2.87	33.65
1991	10.2	28.1	61.7	0.92	0.97	63.74	3.41	32.85
1992	6.3	30.4	63.3	1.20	0.92	62.61	3.69	33.70
1993	6.0	25.4	68.6	0.99	0.99	60.39	3.09	36.52
1994	4.9	25.6	69.5	1.09	0.97	59.89	3.11	37.00
1995	4.9	23.4	71.7	0.99	1.00	58.98	2.84	38.17
1996	4.6	23.6	71.8	1.03	0.99	58.91	2.87	38.23
1997	4.7	23.0	72.3	0.98	1.04	58.71	2.79	38.49
1998	7.1	23.5	69.5	0.98	1.05	60.14	2.85	37.00
1999	10.0	24.0	66.0	0.92	1.05	61.95	2.92	35.14
2000	10.8	26.1	63.1			61.44	3.17	33.59

Source: Data on state-owned agriculture from 1953 to 2000 are taken from the Statistics on Investment in Fixed Assets of China 1950–2000.

Appendix D. Sources of Agricultural Fixed Assets Investment in Rural Collectively Owned Agriculture for 1952–1981

There are no data on the sources of agricultural fixed assets investment in rural collectively owned agriculture for 1952–1981. Instead, I collected the data on revenue from fiscal year, increase in agricultural loans and advance payments, and the balance of rural production brigades for that period. Then, by calculating their respective percentages in the total (sum of the three), I obtain the percentages of budgetary appropriation, domestic loans, self-owned and self-collected funds, and others in the total agricultural fixed assets investment, as shown in **Table A4**.

Table A4. Relative financial data of rural production brigades (%).

Year	Revenue From Fiscal	Increase in Agricultural Loans and Advance Payments	Balance of Rural Production Brigades	Percentage of Budgetary Appropriation	Percentage of Domestic Loans	Percentages of Self-Owned And Self-Collected Funds and Others
	T	U	V	O=T/(T+U+V)	P=U/(T+U+V)	Q=V/(T+U+V)
1952	0.1	1.7	-	-	-	-
1953	0.1	2.6	1.0	2.70	70.27	27.03
1954	0.2	1.1	2.8	4.88	26.83	68.29
1955	0.4	2.3	3.5	6.45	37.10	56.45
1956	0.6	19.3	5.2	2.39	76.89	20.72
1957	0.7	-	13.3	5.00	0.00	95.00
1958	0.4	11.2	12.2	1.68	47.06	51.26
1959	10.8	0.9	33.4	23.95	2.00	74.06
1960	23.0	17.5	41.2	28.15	21.42	50.43
1961	48.4	3.2	47.5	48.84	3.23	47.93
1962	5.7	6.0	28.5	14.18	14.93	70.90
1963	9.4	10.1	30.5	18.80	20.20	61.00
1964	8.5	3.9	40.7	16.01	7.34	76.65
1965	8.7	6.5	43.5	14.82	11.07	74.11
1966	15.3	5.3	55.3	20.16	6.98	72.86
1967	10.8	3.7	62.2	14.08	4.82	81.10
1968	9.3	-	75.3	10.99	0.00	89.01
1969	9.2	3.1	71.5	10.98	3.70	85.32
1970	11.6	1.5	73.4	13.41	1.73	84.86
1971	14.5	5.3	82.0	14.24	5.21	80.55
1972	17.6	6.3	77.5	17.36	6.21	76.43
1973	24.4	2.9	87.0	21.35	2.54	76.12
1974	25.6	4.9	99.9	19.63	3.76	76.61
1975	26.8	9.3	109.3	18.43	6.40	75.17
1976	32.9	16.8	115.1	19.96	10.19	69.84
1977	32.5	8.0	111.4	21.40	5.27	73.34
1978	40.0	16.5	114.6	23.38	9.64	66.98
1979	35.6	20.9	108.0	21.64	12.71	65.65
1980	38.0	36.5	135.4	18.10	17.39	64.51
1981	35.5	11.4	147.2	18.29	5.87	75.84
1982	34.2	20.8	147.0	16.93	10.30	72.77
1983	36.2	26.4	115.0	20.38	14.86	64.75
1984	41.2	127.2	116.4	14.47	44.66	40.87
1985	37.1	21.0	99.7	23.51	13.31	63.18

Source: Statistics of China Supply and Marketing Cooperative.

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