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# Commercialization as exogenous shocks: The effect of the soybean trade and migration in Manchurian villages, 1895–1934☆

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ABSTRACT

The effects of commercialization and migration in traditional agrarian economies such as China's during the nineteenth and twentieth centuries have been a subject of ferocious debate. Using data from Manchuria on soybean cultivation and exports, we employ difference-in-differences and instrumental variable approaches to demonstrate a significantly positive relationship between growing soybeans for export and the returns to migration. Those who migrated to Manchuria in response to high market prices, and to villages more suitable for cultivating soy prospered most; they owned approximately two-thirds more of the arable land and one-third more of houses than those who failed to do so. Evidence suggests that the positive welfare effect of commercialization-cum-migration was confined not only to the rich, who seek to relieve the "land constraint" at home, but possibly also to the poor.



## 1. Introduction

For some time now, economic historians have recognized that mass long-distance migrations that have occurred since around the mid-nineteenth century—much of which were global in nature—have been an important part of world history. Referring primarily to migration in the Transatlantic, Hatton and Williamson (1998), for example, consider their consequences on wages, living standards, and industrial production across nations to be of epic proportions. Yet, some migrations have been given greater analytical attention than others; in particular, migration to the frontiers of Manchuria and the rice fields and rubber plantations of Southeast Asia, for instance, has received scant analytical attention in comparison with migration to the Americas, even though in terms of magnitude the former clearly was one of the "three main circuits of long-distance migration from 1846 to 1940" (Mckeown, 2004: 155–156).[1]

Migration to Manchuria is important because it represents a part of the global expansion and demographic transition whose significance is comparable to that of European settler colonies, without which "Manchuria might not be a part of China at all today" (Mckeown, 2004: 182; see also Lattimore, 1962). More importantly, the fact that migration to Manchuria occurred at a time that coincided with soybean commercialization or specifically the cultivation and export of China's major cash crop provides us with an invaluable opportunity for examining the economic consequences of an essentially exogenous shock on migration or specifically

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[1] According to Gottschang (1987), the magnitude of the migration to Manchuria was no smaller than the westward movement in the United States between 1880 and 1950, and was twice as large as the great nineteenth-century migration from Ireland.

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the welfare of migrants; an issue that has been much debated within the Chinese context but which has little empirical evidence to bear upon (Brandt, 1989; Feuerwerker, 1990; Huang, 1985; Myers, 1970; Rawski, 1989; among others).[2] By employing a unique dataset based on a farm survey in Manchuria in the 1930s, which also contains a rich history of the migration of the surveyed farm households, we attempt to fill this gap.

The economic significance of commercialization in the context of migration cannot be better illustrated by the Manchurian experience. While migration to Manchuria began around the 1860s—when the Qing government removed the restrictions henceforth imposed upon the Han Chinese from freely settling there, it was not until around the turn of the twentieth century (circa 1895) that migration increased substantially (Gottschang, 1987; Gottschang and Lary, 2000). This sudden surge in migration was presumably due to an intensified process of soybean commercialization, thanks to the rise in world demand for this cash crop. In fact, this commercialization process in Manchuria proceeded so rapidly that by the early twentieth century it accounted for approximately 60–70% of China's soybean export to the world at a time when China produced about 80% of the world's soybean output (Perkins, 1969). For China as a whole, the importance of soybean increased after the First World War (circa 1915), replacing tea and sericulture and, by the 1920s became the number one export accounting for more than 20% of China's overall export earnings (Lei, 1981; You, 1934).

Difference-in-differences (DID) and instrumental variable approaches were applied to identify the causal relationship between commercialization and the economic welfare of migrants from a unique farm survey conducted in Manchuria in the 1930s.[3] There are two important findings. The first is that those who migrated after soybean became the single-most important cash crop in Manchuria, and settled in those villages whose biological and climatic characteristics were best suited for soybean cultivation, had benefited the most from it. This result holds robustly regardless of how economic welfare was measured—be it in terms of socioeconomic status or ownership of arable land and housing properties. The foregoing conclusion regarding the positive effects of soybean commercialization on household economic welfare remains basically unchanged even when North and South Manchuria are analyzed separately.

The second key finding is that households that migrated before soybean commercialization (circa 1907) differed significantly in socioeconomic characteristics from those that came after the commercialization. Compared to their predecessors—which primarily comprised landlords and owner-cultivators, those who came after soybean became a major export crop were of a distinctly lower socioeconomic status—predominantly tenant farmers and wage laborers. This finding is strikingly similar to the international experience of earlier European immigrants to the New World led by farmers and artisans from rural areas intending to relieve the "land constraint" (see Pomeranz, 2000), in contradistinction to their distinctly poorer successors, who came primarily to take advantage of the employment opportunities created by the early immigrants (Cohn, 1992; Hatton and Williamson, 1998).

These two findings combined have an important implication for Chinese economic history. Unlike previous studies on agricultural commercialization, which have relied on "patching" survey data together and such aggregative statistics as the size of the nonagricultural population and area sown to cash crops (Sicular, 1991: 1779), our work provides solid empirical evidence, at the household level, on how agricultural commercialization in China had actually contributed to the growing economic welfare and upward social mobility of the Chinese farmers who had taken advantage of this opportunity.[4] The Manchurian experience clearly suggests that, without the benign effects conferred by commercialization on the migrants, and perhaps equally important the redistributive effects of highly active factor markets, the less privileged social groups would not have been able to experience the economic improvements that we have documented.

The remainder of this paper is organized as follows. In Section 2, we provide a narrative of the history of the development process in Manchuria, with a special emphasis on migration and land reclamation, and the importance of soybean cultivation and export for the Manchurian economy since around the 1860s. This is followed, in Section 3, by an introduction of both the survey data and the variables employed in the analysis, whereas we spell out our empirical strategy and discuss the pertinent estimation issues in Section 4. The empirical results are discussed in Section 5, followed by a brief conclusion in Section 6.

## 2. Mass migration and commercialization in Manchuria

### *2.1. Migration and land augmentation in Manchuria*

In the mid-nineteenth century, the Qing (ethnic Manchu) government of China removed the restrictions which previously restrained ethnic Han from settling in Manchuria's vast territory. The opportunity to migrate into Manchuria not only served as a "vent" for surplus rural labor in the North China plain (modern day Hebei, Henan and Shandong), but, more importantly, allowed

[2] We define commercialization as essentially a process of how economic actors respond to an external stimulus or shock in terms of reallocating their resources in order to take advantage of the new economic opportunities presented to them. See Kung et al. (2011).

[3] Initially employed to evaluate the relationship between policy and social programs (e.g. Card and Krueger, 1994), the difference-in-differences method has increasingly been extended to encompass the identification of a variety of relationships beyond those of social programs—many historical (e.g. Acemoglu et al., 2005).

[4] The view that commercialization did confer beneficial economic effects on the farmers in China in terms of rising labor productivity and incomes, is championed by Brandt (1989), Faure (1989), Myers (1970), and Rawski (1989), among others.

many—especially those without capital of their own—to take advantage of the commercial opportunities offered by soybean cultivation and export.

*2.1.1. Migration*

Until the mid-nineteenth century Manchuria was sparsely populated. The inhabitants were mostly ethnic minorities (the Manchu, the Mongol, and Chinese people of Korean descent) who relied primarily on fishing and raising livestock for a living, and, with approximately one million people they constituted less than 1% of the population of China at the time (Cao, 1997).[5] After the Qing government moved its capital to Beijing, the region where the majority of the various ethnic groups resided—Fengtian in the eastern part of Liaoning Province—became depopulated.[6] To encourage the Han Chinese to take up the slack, the Qing government relaxed its migration policy and allowed them to move to this frontier economy during the period 1644 to 1668.[7] But the effect of this policy was limited for two reasons. First, earlier migrants had very limited economic freedom; officially, they were obliged to register with a military-cum-civilian organization known as the "Eight Banners" under which they would be allocated some (non-transferrable) "banner land" (*qidi*) for subsistence farming (Kong, 1986). As the Manchu and the Mongol Bannerman assumed a more prominent military role defending the frontier, these Chinese migrants took up the slack in farming.

Second, what rendered this restrictive policy even more ineffective is that it was reversed after its brief existence—a mere 24 years (circa 1668). Thanks to the increase in migration of the ethnic Han to Manchuria,[8] and the economic threat which they allegedly posed to native inhabitants, the Qing government tightened migration by blocking the three major ports of entry (the Shanhai Pass, Gubeikou, and Sifengkou).[9] In addition, the Qing government implemented essentially an apartheid policy (circa 1670–1681) under which the Manchu, the Mongol and the Han were made to live separately from each other. Moreover, those (illegal migrants) who failed to register under the Eight Banner administration were eventually repatriated to their village of origins (Ding et al., 2004; Fan, 2007; Yi and Diao, 1994). More restrictive measures were to follow afterwards. By 1740 (the fifth year of the Qianlong Reign), for example, it became explicit that only the ethnic Manchu were allowed to cultivate the fallow banner land (Ding et al., 2004; Qinggaozong Shilu, 1985, p. 864; Yi and Diao, 1994). This marked the end of the short-lived attempt of the Qing government to develop Manchuria via opening up its borders, and further development on a much larger scale had to wait until around the mid-1800s.

At the end of the Second Opium War in 1858, the Treaty of Tien-Tsin required the Qing government to open up Niuzhuang, a village strategically located in the Liaodong Peninsula, to be the region's "treaty port".[10] At about the same time, the Qing government was obliged to cede more than 1,000,000 $km^2$ of land in Manchuria to Russia.[11] This cession made defense of the frontier much more difficult, so to counteract this adverse situation, the Qing government permitted Han Chinese to migrate to Manchuria.[12] The construction of railroads in the 1890s further facilitated migration (Lee, 1970). The result was the largest migration in the history of China. Gottschang (1987) estimates that total net population transfer between North China and Manchuria by the early twentieth century was over eight million, a migration comparable in size to the westward movement in the United States between 1880 and 1950 and twice as large as the great nineteenth-century emigration from Ireland.[13]

In the seventeenth century, the largest city on the Liaotung peninsula, Fengtien, had a population of about 10,000 (Sun, 1973). Jinan, the capital of Shandong on the North China plain had half a million people at that time. In fact, even the smaller counties in Shandong, such as Licheng or Jining, had a population of more than 20,000 each (Cao, 2001). After Manchuria was opened up for migration, its population increased from three million in 1850 to 5.2 million in 1887—an increase of 73% in 37 years. By 1940, the total population had reached 40 million—an eighth-fold increase in a little over just half a century. Two-thirds of the total increase was due to migration (Eckstein et al., 1974). Fig. 1 shows that migration to Manchuria increased steadily after the late 1800s, reaching twelve million people in 1927. Natural disasters in Manchuria and the calamities of war and world economic depression after the 1920s slowed the migration process, but annual average migration still stood at more than seven million in that period.

[5] Although attempts had been made in the past to encourage migration (from, for example, the tenth year of the Shunzhi reign (1653) to the seventh year of the Kangxi reign (1668)), these were short-lived (ending in that case in 1670).

[6] Fengtian was thus the first Manchurian region where prefectures and counties were established (Yi and Diao, 1994).

[7] For further details on the migration policy of this period, see Qingchao Tongzhi (2000, p. 233), *Daqing Huidian Shili* (1764, p. 1109), and Shengjing Tongzhi (1736, p. 23).

[8] From 1661 to 1724 the number of Han migrants increased by 200,000 to a total population of approximately 300,000 (Lu, 1987).

[9] The Imperial decree *Liaodong Zhaomin Shouguan Yongzhu Tingzhiling* (The Edict of Regulating Migration and Settlement in Liaodong Peninsula) was issued in 1668 (the seventh year of the Kangxi Reign).

[10] Niuzhuang is at the mouth of the Liaoning River, which flows through the most fertile and populated region of Manchuria. In addition, its port has the longest frost-free period in this region (8 months), so disruptions to trade due to extreme cold weather could be kept to a minimum (Bank of Chosen, 1920, pp. 16–17; see also Mckeown, 2004).

[11] As a result of signing the Sino-Russian Treaty of Aihui and the Sino-Russian Convention of Peking, 600,000 $km^2$ of land north of the Amur River and south of Xing'an Mountain and more than 400,000 $km^2$ of land elsewhere were ceded to Russia.

[12] The earliest regions opened up by the Qing government included the Hulan district in modern Heilongjiang and the Lalin District in today's Jilin Province (Eckstein et al., 1974; Kong, 1986). In fact, inspired by the desire to "forestall territorial encroachment" by the Qing government, the Russian government had similarly encouraged settlement "with homesteading policies in the 1880s" (Mckeown, 2004).

[13] This great migration was known in Chinese as the "chuang guan dong" (meaning "trying to make a living in Manchuria").

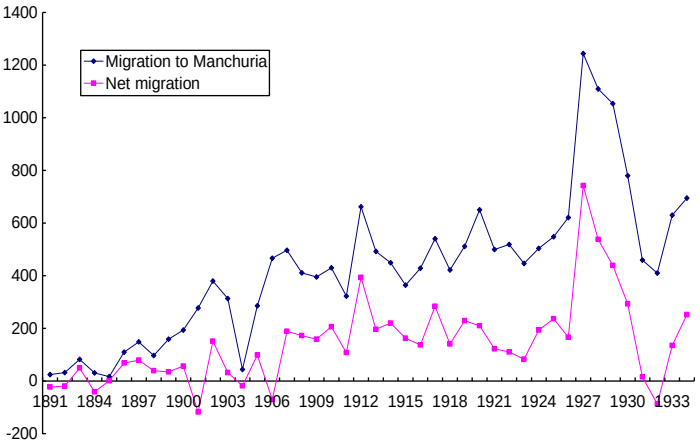


**Fig. 1.** Annual migration to Manchuria, 1891 to 1934 (*in thousands*).
*Source*: Gottschang, "Economic Change," pp. 461–69.

Migration to Manchuria may be regarded as largely a response to the "land constraint" on the North China Plains (modern day Hebei, Henan and Shandong). Rapid population growth since the late Ming caused per capita arable land to drop precipitously from 15 *mu* (1 mu = 0.0667 ha) to 3 mu in the 1930s, making it difficult for the so-called peasants to adequately feed themselves. In particular, the population in North China was, by the 1930s, seven times higher than in the late Ming. In addition, migration from the North China plain was impelled by the destruction wrought by several natural disasters and social upheavals ranging from the Taiping Rebellion and Boxer Uprising to wars fought among the Warlords and foreign military aggressions. Manchuria promised an alternative to those hoping to improve their livelihoods.

Of the three provinces on the North China Plain Shandong accounted for the lion's share, 71%, of the migrant population in Manchuria, followed by Hebei (17%) and Henan (11%) (Wu, 1941; see also Cao, 1997; Fan, 2007). The estimates provided by the Manchurian survey are strikingly similar: 71% from Shandong Province, 13.8% from Hebei, 15.2% from Henan, Shanxi, Jiangxi and Yunnan altogether. Consistent with the aforementioned historical account, the Manchurian survey clearly shows that mass migration to the northeast did not begin in earnest until the 1860s (see Appendix 1, Table A1.1 for the distribution of migration over time).

It should be stressed that, although the restriction of settlement in Manchuria was removed after 1860, the Qing government did not open up all of Manchuria with one edict. Its strategy, apparently, was to open up the south initially, and only the regions served by road networks. This resulted in differences in the timing of development between North and South Manchuria; in particular, it explains why development in North Manchuria during the initial phase (circa 1860) was confined to banner land only while settlement in the south was already well underway, so much so that by the Republican era, the entire Jilin Province (the bulk of which was in the south) was more or less fully settled, whereas settlement in the inland of Heilongjiang Province (entirely in the north) had only just begun.[14]

### *2.1.2. Land reclamation and soybean culture*

The most formidable task confronting migrants to Manchuria was to develop the wasteland so that it could be cropped to produce an output high enough to sustain the cultivators and their families. Soy was the migrants' primary crop, not because it had exceptional commercial value, but rather because it was expected to improve the soil's fertility.[15] This was considered essential, as much of the land had not been cultivated before and as such lacked the nutrients required for good harvests.[16]

While soy was new to Manchuria,[17] the natural conditions there were near perfect for its cultivation.[18] Soy's oil content depends on the latitude where it is grown. Manchuria's latitude from 38°40′ to 53°30′ north is optimal for growing good soybeans (Lu et al., 1981). In addition, Manchuria normally receives suitable amounts of both sunshine and rainfall for a healthy crop.[19] And

[14] The Republican government also followed a similar development strategy. For details on the process of land reclamation in Manchuria, see Kong (1986). For details on the regional distribution of the settlement of migrants, see Chao (1979).

[15] The root of the soy plant contains rhizobia, soil bacteria which fix nitrogen (diazotrophy) after becoming established inside the root nodules. So when soy roots rot away in the soil, they function as nitrogenous fertilizer and enrich the soil's fertility.

[16] This soil-enhancing property of soybean is evident from the Gazetteer of Zhu-he County (1929, p. 427), which states that: "farmers in Zhu-he County liked to plant soybean to reclaim land. The sown acreage of other crops accounted for only one to two percent of the entire portfolio… The best crop to be planted at the beginning of the land reclamation was soybean, as the quantity of output on such virgin land was equal to that of the arable land".

[17] It is suggested that the crop was brought into Manchuria by migrants from North China in Ming and Qing times (Lei, 1981). There is no settled, conclusive account with regard to the crop's actual origin. While some Chinese scholars suggest that it was first cropped in the Yangzi region, Japanese scholars believe that Manchuria is the true origin (Wang, 1982).

[18] Historical records suggest that soy is one of the oldest crops still being planted in China. Its cultivation can be dated back to as early as the Spring-and-Autumn period (circa 771–403 BC).

[19] Annual average rainfall there amounts to 500 ml, with a frost-free period of nearly 150 days, and the average water temperature in July is about 24 °C. All of these characteristics are conducive to soybean cultivation (Sun, 1956; Zhu, 1964).

indeed, Manchuria's rich, black soil even today produces soybeans of distinctly high quality, and its productivity exceeds that of Japan at the latter's peak.[20]

### 2.2. International soybean trade

Before Manchuria emerged as a major exporter of soy, the Qing government had tightly controlled the trade in soybeans (Isett, 2006; Settai and Ito, 1920). It was only after the first Sino-Japanese War, when the Japanese government became acutely aware of the potential profits from soybean exports that China began to promote soybean exports in earnest. But the real turning point came only after the Russo-Japanese War. With Russian merchants interested in buying Manchurian soybeans, the Japanese government introduced the crop to various European oil mills in 1908 (Lei, 1981; Manshikai, 1988). Demand from the European market increased soybean exports tremendously, and between 1908 and 1931 Manchuria accounted for approximately 60 to 70% of China's total exports of soy.[21]

Although soybean exports generally rose from 1908 to 1931, the volume varied. In response to the initial stimulus from Europe, soybean exports increased sharply from 1908 to 1915. This initial growth spurt was disrupted from 1916 to 1920 by the First World War. The ensuing decade (1921 to 1931) saw a sharp recovery in soybean exports from Manchuria, but the world economy then suffered the deep and long Great Depression. Severe flooding in North Manchuria in 1932 and conflict with China after the Mukden incident of 1931 further injured Manchurian economy.[22] Soybean exports were no exception.

Fig. 2 depicts the entire process of soybean commercialization in Manchuria. The blue line (in the upper quadrant) represents an index of Manchurian soybean exports, and the pink line a soybean price index. It can be clearly seen that soybean exports rose sharply after 1895. By 1908 they had increased three-fold relative to the level in 1872. Exports increased substantially during the 1920s, but declined precipitously in the next decade. The price index parallels that of the export volume, rising until the late 1920s, then dropping precipitously. On the whole, Manchuria experienced a clear trend of rising soybean exports and export prices from 1895 to 1929.

#### 2.2.1. Hypothesis

We hypothesize that the cash cropping opportunities brought about by the international trade in soybeans benefited those households that migrated after soybean became a major export crop of Manchuria and settled in villages whose natural endowments—soil and climate characteristics—were most suitable for soybean cultivation.

## 3. Data and definition of variables

### 3.1. The Manchurian survey data

This study relied on data from a unique farm survey conducted in the 1930s and used it to examine the impact of commercialization during the late nineteenth and early twentieth centuries on the economic welfare of migrant farm households. The survey was conducted by the Provisional Industrial Investigation Bureau organized under the auspices of the Ministry of Enterprises of the National Affairs Yuan of Manchukuo in the mid-1930s. The ministry's overriding objective was to raise agricultural output.[23] The survey was conducted in two waves. The first was conducted in 17 villages chosen from 16 counties in North Manchuria[24] in the late February of 1935.[25] The second survey took place 1 year later, in late February of 1936, in 22 villages chosen from 21 counties. The results were published in December of 1936.[26] The majority of the villages covered in the second

[20] The provinces of Heilongjiang, Jilin and Liaoning were ranked the top three according to oil content among a total of sixteen Chinese provinces (Institute of Agricultural Science of Jilin Province, 1960). In terms of productivity, the estimates for Manchuria were 0.954 dan per tingbu (1 dan = 120 catties; 1 tingbu = 16 mu) during 1925 to 1927, which exceeded the Japanese record of 0.87 dan per tingbu during its "golden age" in the 1919 to 1923 period (East Asian Economies Research Bureau, 1927, cited in Lei, 1981).

[21] China alone accounted for 80% of the world's output, according to Perkins' (1969) estimates. The rise of soybean in China's exports altered the structure of China's international trade (Sun, 1956). This was especially the case after the First World War, when soybeans replaced tea and sericulture and became the number one export item, earning more than 20% of the national income from export (You, 1934).

[22] The Mukden incident of September 18, 1931(also known as the Jiuyiba shijian in Chinese) occurred in South Manchuria when a section of the Japanese-owned South Manchurian Railway near Mukden was dynamited. The imperial Japanese Army accused Chinese dissidents of this act, and on this pretext they invaded Manchuria. The incident presaged the Second Sino-Japanese War, although it was 1937 before it fully erupted.

[23] Although the Manchurian government drew up the Manchurian Agricultural Development Five Year Plan in 1932, they were acutely aware that they knew little about rural economic conditions, a limitation which led to their conducting the survey in question.

[24] The exact demarcation of North and South Manchuria was not clear though, as the boundaries shifted back and forth according to claims and negotiations between the Russians, who occupied the north, and the Japanese, who occupied the south. Nevertheless, it is commonly accepted that South Manchuria included those regions served by the South Manchurian Railway, whereas North Manchuria covered regions served by the Chinese Eastern Railway. See Bank of Chosen (1920) for an example of the north-south geographical demarcation.

[25] Guowuyuan shiyebu linshi chanye diaochabu, *Kotoku Gannendo noson jittai chosa* (A Survey of the Actual Village Conditions in 1934) (Changchun: Manzhouguo shiye bu linshi chanye diaocha bu, 1936) 3 vols (henceforth referred to as N. J. C. 1934).

[26] Guowuyuan shiyebu linshi chanye diaochabu, *Kotoku Gannendo noson jittai chosa* (A Survey of the Actual Village Conditions in 1934) (Changchun: Manzhouguo shiye bu linshi chanye diaocha bu, 1936) 4 volumes (henceforth referred to as N. J. C. 1936).

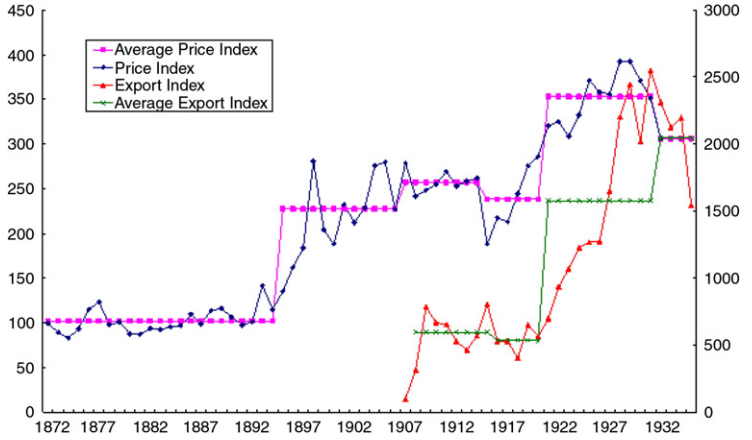


**Fig. 2.** Chinese soybean export and price indices, 1872–1935.
*Source*: The price data from 1872 to 1901 were collected from the *Anural Report of the New Chwang Customs;* from 1902 to 1932 they come from *China's Foreign Trade Statistics, 1864–1949*, pp. 80–81, 96. The export data from 1907 to 1919 and from 1925 to 1931 are from the *Anural Customs Report*. The data from 1920 to 1924 are from *South Manchurian Railway Survey Monthly* 5, no. 5, pp. 33–34; from 1932 to 1935 they are from *East Asian Industrial and Merchant Economy* 1, no. 4, pp. 49, 72, and 66.

survey were in South Manchuria, with only few from the north.[27] Altogether, the two surveys covered some 1776 farm households in 41 villages located in 37 counties, (Fig. 3).[28] Myers (1976) provides a preliminary analysis of the socioeconomic change in these Manchurian villages.

Summarized in Table 1, the two surveys enumerated a wide array of socioeconomic characteristics of the farm households. They include household size, occupational and demographic characteristics, migration and settlement history (in terms of frequency and location), farm production characteristics (sown acreage, cropping patterns and output), and engagement in factor market transactions (land, labor and credit markets). Importantly, the surveys also enumerated household wealth, ranging from housing property and land ownership to productive assets such as farm implements and livestock. In addition, the surveys give historical overviews of the village economies in which the farm households were located. Included in this summary information are the ages of the surveyed villages, the incidence of natural disasters and even social conflicts.

The data explain differences among the villages surveyed as well as the broader differences in the development process between North and South Manchuria. On the whole, the percentage of the four designated socioeconomic status in the sample in Manchuria was landlords: 16.02%, owner-cultivators 35.04%, tenant families 21.67% and landless laborers 20.73% (Table A1.2 of Appendix 1).[29] However, this distribution conceals the vast regional difference between North and South Manchuria. For instance, whereas owner-cultivators accounted for almost half of the social class in South Manchuria (47.14%), the figure in the North was less than 22% (21.74%). Given the lack of difference in land inequality between the two regions (as measured by the Gini coefficient), the much higher social class equality found in South Manchuria may be due to the relatively greater importance of non-agricultural income—38.1%—as opposed to 28.3% in the North. Such a magnitude is comparable in importance to that of the highly commercialized Lower Yangzi basin, where farm households in the 1930s obtained more than one-third of their income from a variety of off-farm sources.[30]

Although the surveyed households in South Manchuria owned more land and houses than their counterparts in North Manchuria (e.g. 3.1 *shang* versus 2.2 *shang* in terms of land),[31] more land was owned by landlord in North Manchuria than that in South Manchuria.[32] Moreover, given that up to 20% of the crops on the farms of households in North Manchuria were sown with soybeans, compared with 14.6% in the south (Table A1.3, Appendix 1), soybean commercialization would most likely have a bigger impact on the welfare of the farm households in North Manchuria (more on this below).

[27] The five villages in North Manchuria were Aihui, Taonan, Huachuan, Fujin, and Yushu, all of which were located outside of the Songnen plain.
[28] The questionnaire had been fine tuned after the first survey. In particular, a new section on education was added, whereas the one on factor markets was streamlined. While we are not the first to study the economy of Northeast China using these farm surveys, by combining and using the results of both surveys our coverage of the whole of Manchuria is the most comprehensive (Benjamin and Brandt (1997), for example, relied exclusively on the second survey in their analysis).
[29] In this survey, the households were divided into sixteen categories of socioeconomic status. In simplicity, we sorted them as Myers' (1976) classification scheme into landlords, owner-cultivators, tenant families and landless laborers.
[30] The estimate is about 35% according to Kung et al. (2011). The Lower Yangzi region is also regarded as highly commercialized already by the early nineteenth century (Pomeranz, 2000).
[31] Shang is the unit of land used in Manchuria, 1 shang = 15 mu (1 mu = 0.0667 ha).
[32] The average land owned by landlord in North Manchuria was 28.9 shang or 434 mu, while in South Manchuria, it was only 15.4 shang or 231.6 mu.

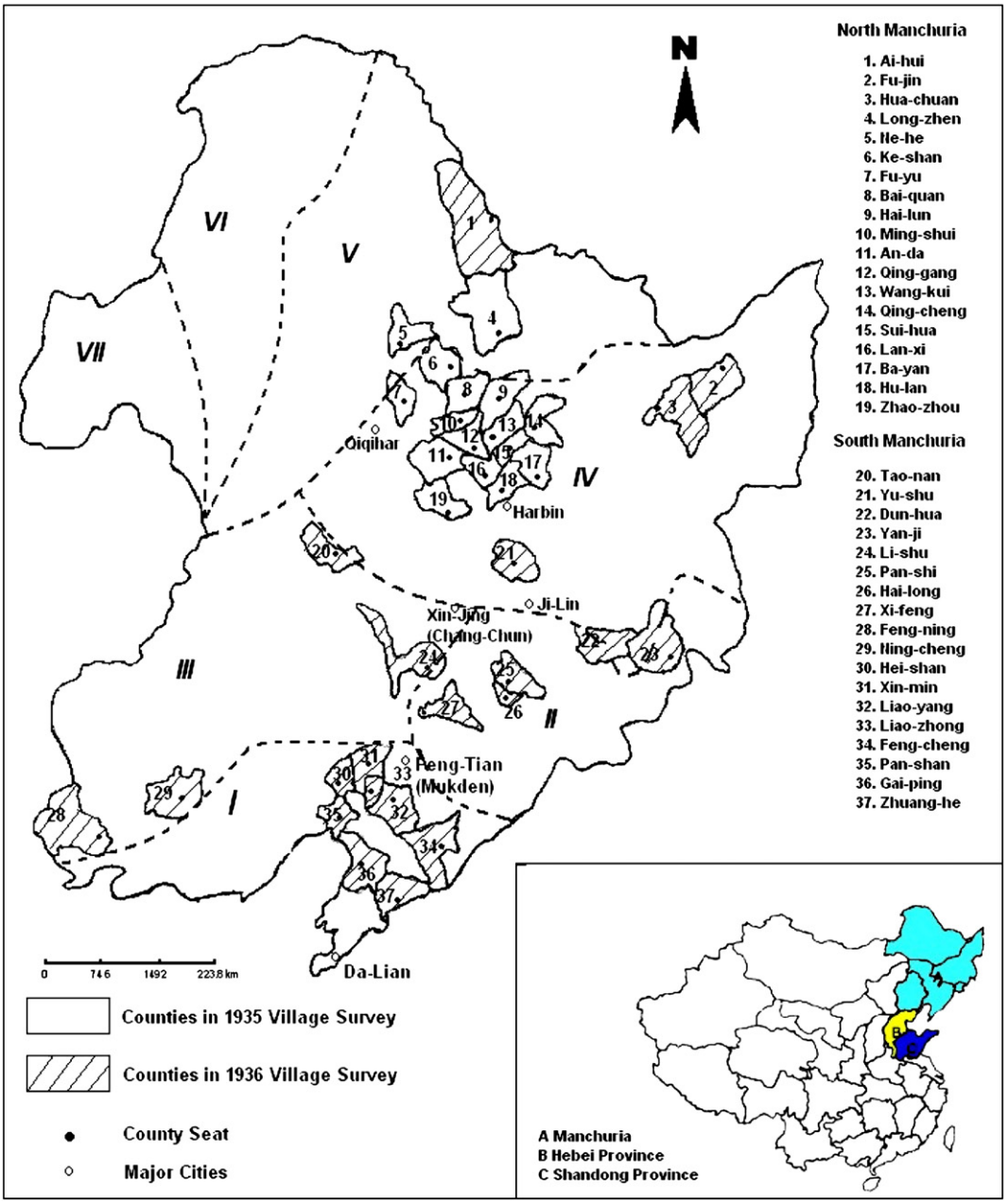


**Fig. 3.** Location of villages in the 1935–1936 Manchurian village survey, by agricultural region.
*Source*: Location of observation is from *Manchuria Village Surveys in the 1930s* and information of seven broad agricultural regions is from Guomin Zhengfu Dongbei Ziyuan Weiyuanhui, *Dongbei*.

Although the surveyed villages were not randomly selected, their wide spatial dispersion renders the surveys geographically representative.[33] For instance, whereas the first survey covered primarily villages close to Qiqihar and Harbin, the second survey covered a good number of counties near Mukden. All three of these cities were major economic centers—hence likely to be much affected by the forces of commercialization. Another positive feature about this survey is that, since all of the surveyed villages were located within 20 km of a county seat, their responses to international trading opportunities were thus likely to be fairly uniform.

[33] However, as Fig. 3 shows, the number of households covered in the Manchurian survey varied from one region to another. For instance, no households in regions 6 and 7 were surveyed.

**Table 1**
Summary of Manchurian survey variables available for use in analysis.

| Code in survey | Variables employed in the regressions | Units |
|---|---|---|
| Table 1 Summary of farm households | Socioeconomic status (in the 1930s) | *Social class*[1] |
| | Population | *Person* |
| | Male | *Person* |
| | Female | *Person* |
| Table 2 Kinship and family history | Kinship (whether or not have relatives?) | |
| | Place of birth | *Province*[2] |
| | Socioeconomic status of ancestors | *Social class*[1] |
| | Length of stay in Manchuria | *Years* |
| | Reasons for migration | *Various*[3] |
| | Socioeconomic status upon arrival in this village | *Social class*[1] |
| | Reasons for settling in this village | *Various*[3] |
| | Time of settlement in this village | *Years* |
| Table 3 Population | Age structure of family member | *Years* |
| | Off-farm laborer | *Person* |
| Table 6 Summary of land types | Cultivated land | *Shang* |
| | Total arable land | *Shang* |
| | Total wasteland | *Shang* |
| | Total uncultivated land | *Shang* |
| | Other types of land (e.g. forest, cemetery, etc.) | *Shang* |
| | Total land | *Shang* |
| Table 7 Housing and production tools | Number of houses | *Number* |
| | Number of farmhouses | *Number* |
| Table 12 Sown acreage and crops output | Total sown area | *Shang* |
| | Total unharvested area | *Shang* |
| | Sown area of soy | *Shang* |
| | Unharvested area of soy | *Shang* |
| | Output of soybeans | *Dan* |

*Note*:
1. Social class includes: landlord; owner-cultivator; tenant farmer; and laborer.
2. Provinces include: Shandong, Hebei, Henan, Shanxi, Jiangxi, Inner Mongolia, Heilongjiang, Jilin, Liaoning, Yunnan, and Shanghai.
3. Reasons for migration include a combination of the followings: to escape economic hardships/to improve living standards by seeking help from relatives; hired to work as farm laborers; and others (such as better educational opportunities for children and debt avoidance).
*Source*: All tables are from *Manchuria Villages Survey*.

### 3.2. Independent variables

#### 3.2.1. Migration

Ideally, a panel dataset would be best for estimating households' responses to soybean prices. Although the survey data is cross-sectional in nature, we were able to match the different phases of soybean export with the detailed migration histories of the surveyed households to create pseudo-panel data, with each phase or period indicating a differing degree of commercialization. Constructed to be 1 only in the time period of arrival and 0 otherwise, this variable allows us to test the exogenous effect of commercialization on household welfare using household migration history as the pertinent proxy. The details of these constructions are provided in Table A1.1 of Appendix 1.

#### 3.2.2. Suitability of soybean cultivation

The extent to which farm households respond to price changes should depend on resource endowment—specifically, the suitability of their land for soybean cultivation, which is likely to vary from one region to another. It was thus necessary to control for this effect. Indeed, Table A1.4 (Appendix 1), which summarizes the proportion of land sown with soybeans as a fraction of total arable land, clearly reveals a substantial difference between North and South Manchuria. While the average in the south was 14.62%, the comparable figure was almost seven percentage points higher in the north, at 21.61%, suggesting that villages in North Manchuria were more likely affected by commercialization, specifically the international soybean trade, than those in the south.[34] In addition to the broad regional differences, substantial differences are also apparent among villages within the same region. Whereas counties such as Aihui and Zhaozhou in North Manchuria had more than 30% of their arable land sown with soybeans, for instance, Bayan and Qingcheng were hardly involved in soybean cultivation (Table A1.3, Appendix 1). The same sharp contrast can be found in South Manchuria.

[34] Using only the second wave of the survey data would thus underestimate the effect of commercialization.

### 3.3. Dependent variables

One dependent variable was socioeconomic status (*Jingji shenfen*) or social class in the 1930s. While income would be the ideal measure of household economic welfare, the data are incomplete; the survey enumerated only incomes obtained from the sale of major crops such as soy, sorghum, corn and wheat, while ignoring the output of a variety of minor crops such as barnyard grass, sesame and fruits, and non-farm income—the latter an important income source for some households.[35] The Japanese investigators divided the surveyed households into sixteen categories of socioeconomic status or social class, which is too refined for our purpose. To facilitate the analysis, we followed Myers' (1976) classification scheme and sorted them into landlords, owner-cultivators, tenant families, and landless laborers. Given the over-riding importance of land in a large agrarian economy such as Manchuria's, these categories probably provide a reliable indicator of household economic well being.

The amount of arable land and housing each family owned were employed as two additional measures of household wealth. In an agrarian economy with a low standard of living, land and housing are the major forms of wealth in which relatively affluent households can invest. It is thus reasonable to expect that the more land and housing a household controls, the greater the economic welfare. To check on this reasoning, we calculated correlation among the three dependent variables and found significant relationships among them (Table A1.5, Appendix 1). The correlation coefficients between social status on the one hand, and land owned or housing owned on the other were 0.69 and 0.56, and the correlation coefficient between land owned and housing owned was 0.72. All are significant at the 1% level. According to this survey, the amount of land owned by a "representative" household was 3.39 shang or 50.85 mu, which was nearly four times larger than their counterparts in the North China plain. In addition, most households owned two houses.

### 3.4. Control variables

Variations in households' responsiveness to price changes might be affected by a broad range of household and village characteristics. At the household level, it is important that we control for, first and foremost the age of the head of household, given that age has a direct effect on wealth accumulation through life-cycle saving (Ando and Modigliani, 1963; Chayanov, 1986). Our second control is household size. A concern may be raised, however, as to whether some households in our sample may be overrepresented due to the unique Chinese practice of household division, whereby a household would be divided into several smaller units headed by the male heirs of the succeeding generation.[36] While we are unable to gage which households in our sample are overrepresented, the unusually larger size of households in our sample than those in the rest of China suggests that household division in Manchuria must have been conducted much less frequently than in the rest of China.[37]

There are two important considerations why this may be the case. Foremost is that, as a new settlement Manchuria had more land relative to labor, and hence it would be in the interest of big, wealthy families to postpone divvying up their land. Indeed, it is not uncommon to find Manchurian families with four or five successive generations living together, and that some of the largest families may have well over a hundred members (Hulan prefecture gazetteer, 1929, p. 427). Also, wealthy families postponed divvying up their land because that would enable them to enjoy economies of scale in defending against the bandits, which were rampant during the decline of the Qing dynasty (Campbell and Lee, 2000; Zhao, 2007, 2008).

Third, given that the surveys were conducted in villages located in close proximity to the three big cities in Manchuria—Shenyang, Harbin and Qiqihar, it is likely that some families had taken advantage of non-farm opportunities. To control for the wealth effect resulting from these possible opportunities, we control for both the ratio of off-farm labor to population in a household and a household's location of residence. We employ a dummy variable and assign a value of 1 to it if a household was located in an industrialized area and 0 otherwise.[38] Other village controls include a village's distance to the nearest county seat and its endowment (land per household in a village).

Finally, given that the timing of migration affected the economic returns to a household, we control for the differences in the time a household had lived in a village when the survey was conducted. Table 2 summarizes the descriptive statistics on all of the variables available for use in the regression analyses.

[35] Even in less industrialized North Manchuria, non-farm income accounted for 28.1% of overall household income. In more industrialized South Manchuria, this ratio was much higher—more than 35%. The first survey is especially deficient in this respect, as non-farm income was not enumerated.

[36] Partible inheritance or *fenjia* had been an important social institution in China (Myers, 1970). It required that the properties of a household including arable land, housing properties etc., were divided equally among the male heirs (brothers) in a family when parents became either too old to assume overall management of an extended household or had recently deceased.

[37] Compared to roughly four persons in a representative household in the southeast Lower Yangzi region and five in North China (see Huang, 1985, 1990; Myers, 1970), South Manchuria had 6.3 whereas North Manchuria 7.3 according to the Manchurian survey.

[38] Industrialization in Manchuria was the combined result of migration, foreign investment and international trade. By 1934, the non-agricultural sector already accounted for nearly two-thirds of the economy's total output (63.8%)—a ratio higher than the national average. But industrialization was rather uneven in Manchuria, with a heavy concentration in big cities such as Harbin, Mukden and Changchun.

**Table 2**
Summary statistics for the variables employed in the regression analysis.

| Variables | Obs. | Mean | Std. dev. | Min. | Max. |
|---|---|---|---|---|---|
| Socioeconomic Status (in the 1930s) (landlord = 4; cultivator = 3; tenant = 2; laborer = 1) | 1516 | 2.49 | 1.02 | 1 | 4 |
| Land owned (unit: *shang*) | 1511 | 20.15 | 84.47 | 0 | 1760 |
| Houses owned (unit: *number*) | 1516 | 2.65 | 5.52 | 0 | 88 |
| Cohort dummy 1860–1894 | 1516 | 0.09 | 0.29 | 0 | 1 |
| Cohort dummy 1895–1907 | 1516 | 0.03 | 0.18 | 0 | 1 |
| Cohort dummy 1908–1915 | 1516 | 0.03 | 0.17 | 0 | 1 |
| Cohort dummy 1916–1920 | 1516 | 0.05 | 0.21 | 0 | 1 |
| Cohort dummy 1921–1931 | 1516 | 0.11 | 0.31 | 0 | 1 |
| Cohort dummy 1932–1934 | 1516 | 0.12 | 0.31 | 0 | 1 |
| Regional soybean cultivation dummy (suitable for planting soybeans = 1) | 1516 | 0.41 | 0.49 | 0 | 1 |
| Family size (unit: *person*) | 1516 | 6.80 | 5.01 | 1 | 68 |
| Time living in village (unit: *year*) | 1515 | 49.27 | 71.71 | 1 | 285 |
| Ratio of off-farm labor to population | 1516 | 0.05 | 0.11 | 0 | 1 |
| Age of household head | 1516 | 48.71 | 14.41 | 25 | 75 |
| Land per household in village (unit: *shang per household*) | 1516 | 12.97 | 15.89 | 1.43 | 88.19 |
| Age of village (unit: *year*) | 1516 | 110.18 | 86.47 | 5 | 285 |
| Distance to the county seat (unit: *li*[1]) | 1516 | 31.52 | 27.65 | 8 | 167 |
| Industrialization dummy (industrialized area = 1) | 1516 | 0.53 | 0.50 | 0 | 1 |
| Region dummy (South Manchuria = 1) | 1516 | 0.51 | 0.50 | 0 | 1 |

*Note*: 1. *Li* is the unit of length used in China, one *li* = 0.311 mile.

## 4. Empirical strategy

### 4.1. Model choice

The difference-in-differences (DID) model is ideal for identifying the causal effect of commercialization on household welfare because of the differences in the inherent suitability among villages in soybean cultivation. As befits this kind of model, which is designed to examine the difference in impact of an exogenous shock between the "treated" group and the "untreated" or control group, in our context we first divided the commercialization process into several phases based on the indices of soybean prices and exports, followed by the construction of migration cohorts that corresponded to the various phases of commercialization. The household cohorts were then divided into a "treatment" group of those who migrated to villages with a greater proportion of acreage sown in soy throughout the period of commercialization, and a "control" group who migrated into villages with a smaller-than-average proportion of their acreage sown in soy. Any difference between the treatment group and control group would then be a measure of the varying effects of soybean trade on the economic welfare of the surveyed households. Our estimation equation thus assumed the following specification:

$$y_{itr} = \beta_0 + \beta_1 \sum_{period\,2}^{period\,7} mig_{it} + \beta_2 village_{ir} + \sum_{period\,2}^{period\,7} \delta_t (mig_{it} \times village_{ir}) + \gamma X + \varepsilon_{itr} \quad (1)$$

where $y_{itr}$ is the social status or economic welfare of farm household $i$ who migrated to village $r$ at time $t$, $mig_{it}$ is a dummy variable indicating the migration status of household $i$ in period $t$ (and is thus a measure of the effect of the varying degrees of commercialization), and $village_{ir}$ is a dummy variable indicating the degree of commercialization of a village. We assigned the value of 1 to a region if the proportion of acreage sown to soybeans was higher than the mean and a value of 0 if the proportion was lower. In Eq. (1), $\delta$ is the estimator of the difference-in-differences that examines the effects due to soybean commercialization on household economic welfare, $X$ is a vector of control variables, and $\varepsilon$ is the random error term.

### 4.2. Estimation issues

Although we have controlled for the suitability of a region for soybean cultivation and household characteristics, there are still a number of estimation issues of concern. First, our estimation would be biased if migration to different villages was not random. This would be especially the case if some households consciously elected to settle in villages because they were well suited for soybean cultivation. It is fortunate that, in the process of opening up Manchuria the Qing government chose to open up the south initially and only the regions served by road networks; this had severely limited the freedom of the physical movements of migrants—at least initially. Moreover, since most of the land in Manchuria had not previously been cultivated, settlement was a gradual process that easily required more than an entire decade to complete. By controlling the issuance of land titles, the Manchurian government indeed exercised tight control over the process of opening up this frontier land, which effectively restricted the choice of migration destinations.

The choice of migration destination was also limited by the predominant migration strategy that families had adopted; which was to send one member to Manchuria initially to establish a base and to ensure that it was economically prudent for the remaining members to join (Gottschang and Lary, 2000).[39] Indeed, our Manchurian survey shows that for more than one-third of the migrants, the choice of destination was fundamentally dictated by where their relatives and friends had settled—which did not necessarily coincide with opportunities for cash cropping soybeans.[40]

Second, we are similarly concerned with the issue of return migration. Fortunately, evidence suggests that once settled down, migrants seldom returned home on a permanent basis (Gottschang and Lary, 2000; Ho, 1959). In contrast, settlement rate in Manchuria had increased over time (Amano, 1932; Trade Bureau of the Japanese Ministry of Foreign Affairs, 1918).

Third, the concern that selective migration to cities and mining towns would similarly bias the composition of the households being surveyed is alleviated by another survey finding that an overwhelming majority of the migrants, 84%, worked in agriculture (MMTKK, 1929). This was especially the case in the more agrarian north, where soybean cultivation and export were far more pervasive (Soichi, 1927). Additionally, we have controlled for the differences in the extent to which households had members specializing in off-farm activities that take place in the big cities in close proximity to the surveyed villages. Finally, onward migration to other rural communities that should form part of the sampling frame is less of a problem because that should net out with migration from other villages into the sampled communities. Table A1.6 (Appendix 1), for instance, finds no significant statistical differences in the socioeconomic characteristics of three different groups of households—those who migrated directly to South Manchuria and to North Manchuria, and those who resettled indirectly from south to north Manchuria, presumably in response to the booming soybean trade in the latter since the 1920s. Thus, although we cannot completely eliminate the possibility of selective migration, chances of that occurring were slim.

The fourth estimation issue arises from the timing of migration. Given that the level of migration to Manchuria increased with the price of soybean, the socioeconomic profiles of migrants may have changed accordingly. We found, from Table A1.7 (Appendix 1), that those who came before 1915 belonged overwhelmingly to the more affluent classes of landlords and owner-cultivators, whereas the proportions of tenant farmers and farm wage workers increased sharply after 1915—presumably in response to the employment and income opportunities associated with soybean commercialization. Table A1.8 (Appendix 1), which shows the *t-test* results among the seven periods of migration, confirms that differences in socioeconomic status among our migrant households existed only between the two broad periods with 1915 as the dividing line but not among the various sub-periods in either of them. Given that we are concerned primarily with the welfare effect of soybean commercialization, this finding importantly reaffirms that the socioeconomic profiles of those who came *after* commercialization commenced (in 1907) did not differ significantly.

The foregoing finding suggests that the increase in the demand for wage labor in Manchuria had likely spiked up wages, thereby allowing migrants without capital of their own to find a job. Evidence does suggest that farm wages in Manchuria after the first decade of the twentieth century were indeed several times higher (Li, 1957; Suleski, 1978; Zhao, 1989). By the same token, the lower rents in Manchuria relative to those in North China would have the similar effect of attracting more tenant farmers to migrate to this frontier economy. If this conjecture closely approximates the reality, the two factor markets—land and labor—should be active. Indeed, our calculations, based on the survey, do reveal that as much as 36.1% ($[0.368+0.358]/2=0.361$) of the arable land was rented, and 36.3% ($[0.290+0.436]/2=0.363$) of the households were involved in labor hiring (panels C and D, Table A1.2, Appendix 1).[41] Moreover, the higher incidence of labor hiring in the agrarian north further suggests that North Manchuria was likely more responsive to the cash cropping opportunities than the south.

Finally, although by using the DID estimation we have attempted to establish the causal relationship between commercialization and household welfare, we still need to deal with the possible problems of omitted variable bias and errors associated with measuring the degree of commercialization.[42] For instance, the omitted variable of soil quality is a good case in point, for it affects not only household welfare (via the returns to soybean cultivation), but it is also correlated with the suitability of soybean cultivation directly. In addition to requiring an optimal pH balance of the soil (of neither excessively acidic nor alkaline), a good harvest of this early-ripening spring crop requires also abundant sunshine and stable temperature as well as an optimal dose of water (excessive rainfall could seriously reduce output). In short, whether a village is suitable for cultivating soybean depends crucially on a set of biological characteristics, viz. temperature, rainfall, and the pH balance of the soil (Sun, 1956;

[39] As Mckeown (2004: 178) explains, that "(migration) decisions are made in the context of information and assistance obtained from relatives and village members ..... (whereby) these networks are also institutionalized as mutual aid societies, labor recruitment enterprises, and dense commercial linkages".

[40] Of course, what we cannot rule out is the possibility that those who initially migrated chose to go to villages where the conditions for growing soybeans were more conducive. However, the possibility of selective migration in response to the potential economic opportunities offered by soybean commercialization was unlikely, in light of the fact that the average age of our surveyed villages was well over 100 years by the time the survey was conducted (in the 1930s). Even for the villages in North Manchuria, where the economic opportunities of soybean commercialization were greater than those in the south, migration had commenced well before soybean export became important.

[41] While land distribution was very uneven in this part of China (the Gini coefficient of land was 0.784, which was distinctly higher than that in either North China (0.18) or the Yangzi delta (0.61) (Kung et al., 2010)), the activeness of factor markets suggests that those lacking capital were also able to capture part of the gains from soybean commercialization, if indirectly, through participation in either of these factor markets. See Fan (2007) and Xu (1925) on the welfare effects of factor markets in the Chinese context.

[42] That is because our choice of commercialization measure was limited by the cross-sectional nature of our dataset, which forced us to use the percentage of overall acreage sown with soy as the pertinent proxy.

Wang, 1982). As these biological considerations are correlated with our proxies of the suitability of soybean cultivation (the regional dummy variables) but otherwise have no direct bearing on household economic welfare (except through their effects on the endogenous independent variable), we employ these related biological characteristics—average temperature, average rainfall, and the pH balance of the soil[43]—as our instrumental variables to correct for the possible endogenous nature of our DID estimation.[44]

## 5. Soybean commercialization and household economic welfare

### 5.1. Baseline estimates

Table 3 reports our baseline estimates of the predictive power of commercialization for household economic welfare using the whole sample. With the exception of socioeconomic characteristics, which was estimated using an ordinal Probit model (in which the dependent variable is categorical with an ascending order of importance), the remaining regressions were all estimated using the ordinary least squares (OLS) method. The table reports the coefficients generated in six regressions, with the three dependent variables each accounting for two sets of results—one with and the other without a set of control variables. Of the six periods of migration, the difference-in-differences estimator is significant and positive across all six regressions only in the period 1921–1931. This suggests that households which migrated into villages suitable for soybean cultivation during this period tended to improve significantly in economic welfare compared to their counterparts who migrated into villages ill-suited for cultivating this cash crop. Those who had migrated at the right time and to the right place owned approximately two-thirds more of the arable land (64.4%) and one-third more of houses (32.2%) than those who failed to do so.[45]

### 5.2. Instrumental evidence

Table 4 presents the regression results with the instrumented evidence included. Panel A shows the first-stage results of regressing whether a village was suited for soybean cultivation against the three instrumental variables. All of the relationships are significant at the 1% level, regardless of whether or not the control variables are included, suggesting that the instruments are valid. The signs are also in accordance with expectations. The positive coefficient of the temperature variable suggests that stable, warmer weather is better for soybean production in Manchuria, whereas too much water and alkalinity are, as expected, bad for the crop.[46]

In panel B, the first-stage regression results have been substituted into the second-stage of the TSLS regression in which the three measures of household welfare were regressed against the DID estimators. As with the estimation results in Table 3, ordinal Probit models were evaluated to estimate socioeconomic status (columns 1 and 2) and OLS models were used for the other two measures. Comparing the results with the baseline estimates in Table 4, the larger coefficients estimated in Table 4 suggest that the previous estimates were likely biased downwards. More important though is the finding that the difference-in-differences estimators in the IV-TSLS formulations were significantly positive not only for the period 1921–1931, but also for 1908–1915. This estimation result is reasonable, as China had already begun to export soybeans to Europe by the early 1900s. In terms of the welfare effect of commercialization, the significantly positive DID estimators indicate that those who specialized in the cultivation of soybeans had greater potential for upward mobility in terms of owning more arable land and houses.

### 5.3. Robustness checks

We performed three robustness checks. The first checks for possible measurement error in classifying the villages into those suitable for soybean cultivation and those not suitable, given the clustering around the sample mean. To ensure that our classification was robust, we repeated the regressions using a smaller sample. Specifically, we excluded from the analysis the top 25 and the bottom 25 percentiles of the households. Second, to ensure that our estimations are not sensitive to our choice of periodization, we re-estimate our regressions with a sample that excludes all migrants who arrived before 1895—the year that marked the genesis of soybean export. Reported in Tables A2.1 and A2.2 of Appendix 2, respectively, the

[43] The Institute of Soil and Fertilizer (Turang yu Feiliao Yanjiusuo), Academy of Agricultural Science, Heilongjiang Province collected and tested some soil samples from four Manchurian counties and found pH values larger than seven (see Zhu (1983), Table 14–15).

[44] Information on the three instruments is available in a report of the Northeast China Resources Committee (*Guomin Zhengfu Dongbei Ziyuan Weiyuanhui, 1971*), which, as a key research institute was established in 1932, with many famous Chinese scholars playing a key role in formulating its policies (Wu, 1986). According to this report, Manchuria can be divided into seven broad agricultural regions based on climate, soil, and environmental characteristics (refer again to Fig. 3).

[45] To follow the common practice of calculating the average effect of treatment on the treated group in DID analysis, we compute the average of DID estimators in periods where the effect of commercialization on the two welfare gauges is significant. For instance, in the case of arable land the average effect is 64.4% ($[0.767+0.521]/2=0.644$).

[46] We report the validity of our instrumental variables in Table A1.9 of Appendix 1. To test the validity of our instruments, we employed another set of instruments, namely, the forest-free period and the average evaporation during the growing season as instruments for our endogenous explanatory variables, while controlling for average rainfall, average temperature and soil pH. We found that none of the original instruments were then significant, which means that they are not significantly correlated with our dependent variables.

**Table 3**
Soybean commercialization and household welfare, baseline estimates.

| Dependent variable | Socio-economic status | Socio-economic status | Land owned (log) | Land owned (log) | Housing property (log) | Housing property (log) |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *DID estimators (sown area of soy × migration)* | | | | | | |
| 1860–1894 | −0.399 | −0.541[a] | −0.392 | −0.849[b] | −0.199 | −0.276 |
| | (0.277) | (0.262) | (0.307) | (0.310) | (0.200) | (0.207) |
| 1895–1907 | 0.163 | 0.045 | 0.724[a] | 0.299 | 0.484[a] | 0.337 |
| | (0.290) | (0.262) | (0.353) | (0.340) | (0.224) | (0.231) |
| 1908–1915 | −0.122 | −0.304 | 0.001 | −0.394 | 0.219 | 0.116 |
| | (0.321) | (0.278) | (0.388) | (0.349) | (0.227) | (0.229) |
| 1916–1920 | 0.005 | −0.091 | 1.091[b] | 0.767[b] | 0.346[c] | 0.262 |
| | (0.279) | (0.257) | (0.324) | (0.307) | (0.197) | (0.196) |
| 1921–1931 | 0.458[a] | 0.430[a] | 0.886[b] | 0.521[b] | 0.391[b] | 0.322[a] |
| | (0.240) | (0.220) | (0.264) | (0.248) | (0.165) | (0.167) |
| 1932–1934 | 0.222 | 0.108 | 0.668[b] | 0.234 | 0.349[a] | 0.238 |
| | (0.232) | (0.219) | (0.245) | (0.235) | (0.156) | (0.160) |
| *Control variables* | | | | | | |
| Characteristics of households, villages and counties | *No* | *Yes* | *No* | *Yes* | *No* | *Yes* |
| Number of obs. | 1419 | 1418 | 1511 | 1510 | 1556 | 1515 |
| LR chi-squared/F-statistic | 89.82 | 251.11 | 9.34 | 22.76 | 8.92 | 20.46 |
| Adj. R-squared/pseudo R-squared | 0.025 | 0.066 | 0.074 | 0.258 | 0.072 | 0.201 |

*Notes*:
1. Columns (1) and (2) are Ordinal Probit models; columns (3), (4), (5) and (6) are OLS models.
2. Control variables include family size, the ratio of off-farm labor to population in a household, the number of years lived in village, age of household head, village endowment measured by the ratio of land to the number of households, age of village settlement, distance to the county seat, an industrialization dummy variable and a regional dummy variable.
3. Constant terms are not reported.
Robust standard error in parentheses.
[a] Significant at the 5% level.
[b] Significant at the 1% level.
[c] Significant at the 10% level.

results are trivially different from those of Table 3 and panel B of Table 4, suggesting that measurement error is not a serious issue.

Third, owing to differences in the level of development and particularly industrialization between North and South Manchuria, estimates based on the whole sample may conceal the differential effect of soybean commercialization on the two regions. To ascertain whether our results are driven by the effects in North Manchuria vis-à-vis its southern counterpart, we also generate estimates using the two sub-samples. The pertinent OLS estimates are presented in Table 5, whereas the IV-TSLS estimation results are presented in Table 6.

The OLS estimates suggest that, in South Manchuria, 1908–1915 represented the "golden age" of soybean commercialization, whereas in the north it was from 1916 onwards all the way to 1934—a result that appears to be consistent with history—as it was the south that developed earlier.[47] Indeed, it was not until the opening of the South Manchurian Railway in the early twentieth century that the north did begin to develop in earnest, with an increasing number of migrants arriving from both South Manchuria and the North China plain in search of new income opportunities.[48] That the impetus of soybean commercialization shifted from the south to the north was most likely attributable to the fact that North Manchuria was especially well suited for soybean cultivation in terms of both soil and climate characteristics.[49] For instance, a study has found that today's Heilongjiang and Jilin provinces—both in North Manchuria—produce the beans with the highest oil content (21%) among the 16 provinces where soybeans are grown (Wang, 1982). This may explain why more than 60% of the output of soybean from Manchuria during the early twentieth century actually came from the north (Lei, 1981).

[47] The other issue raised earlier pertains to the lesser reliance of the farm households on soybean commercialization in South Manchuria because of its more industrial economic structure. We now have empirical evidence to substantiate that conjecture. Reported in Table A2.3 of Appendix 2, the interaction term between region and soy sown acreage is negative and significant at the 1% level for South Manchuria, suggesting that the various gauges of economic welfare resulting from soybean commercialization were indeed less pronounced for those residing in the South.

[48] The completion of the South Manchurian Railway (from Changchun to Dalian) in 1903, which linked up with Chinese Eastern Railway (connecting with Chita, a city in the Russian Far East), facilitated migration and helped integrate the markets in Manchuria (Ginsburg, 1949). With the eventual opening up of the rest of North Manchuria and specifically the market for land in 1911, North Manchuria developed rapidly (Kong, 1986).

[49] As mentioned earlier, the oil content of soybeans depends to a large extent on the latitude at which they are grown. According to Lu et al. (1981) the optimal range is about 45–52° north, which is exactly where North Manchuria is located.

**Table 4**
Soybean commercialization and household welfare, instrumental evidence.

| Panel A: first stage regression | | |
|---|---|---|
| Dependent variable | *Is the village fit for planting soy?* (*yes* = 1) | |
| | (1) | (2) |
| *Independent variables* | | |
| Average temperature during production cycle (log) | 41.187[a] | 145.971[a] |
| | (1.994) | (38.243) |
| Average rain fall during production cycle (log) | −26.309[a] | −109.744[a] |
| | (0.942) | (29.443) |
| pH value of the soil | −20.874[a] | −81.093[a] |
| | (0.749) | (21.028) |
| *Control variables* | | |
| Characteristics of villages and counties | *No* | *Yes* |
| Number of obs. | 1618 | 1618 |
| Wald's chi-squared | 1350.16(3) | 364.72(8) |
| Pseudo R-squared | 0.3299 | 0.3946 |

| Panel B: second stage regression | | | | | | |
|---|---|---|---|---|---|---|
| Dependent variable | Socio-economic status | Socio-economic status | Land owned (log) | Land owned (log) | Housing property (log) | Housing property (log) |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *DID estimators (sown area of soy × migration)* | | | | | | |
| 1860–1894 | 0.139 | −0.024 | 0.433 | −0.262 | 0.141 | −0.043 |
| | (0.306) | (0.281) | (0.480) | (0.369) | (0.274) | (0.239) |
| 1895–1907 | 0.964[a] | 0.949[a] | 0.972[b] | 0.535 | 0.853[a] | 0.701[c] |
| | (0.342) | (0.339) | (0.540) | (0.378) | (0.308) | (0.289) |
| 1908–1915 | 1.505[a] | 1.265[a] | 1.716[a] | 1.045[c] | 1.046[a] | 0.690[c] |
| | (0.403) | (0.354) | (0.637) | (0.526) | (0.362) | (0.314) |
| 1916–1920 | 0.355 | 0.271 | 1.238[c] | 0.646 | 0.749[c] | 0.709[c] |
| | (0.389) | (0.376) | (0.628) | (0.526) | (0.359) | (0.298) |
| 1921–1931 | 0.754[a] | 0.661[a] | 1.137[c] | 0.841[c] | 0.749[a] | 0.716[a] |
| | (0.316) | (0.297) | (0.503) | (0.383) | (0.287) | (0.246) |
| 1932–1934 | 0.638[c] | 0.573[c] | 0.661 | 0.397 | 0.534[c] | 0.530[c] |
| | (0.292) | (0.271) | (0.456) | (0.284) | (0.265) | (0.219) |
| *Control variables* | | | | | | |
| Characteristics of households, villages and counties | *No* | *Yes* | *No* | *Yes* | *No* | *Yes* |
| Number of obs. | 1419 | 1418 | 1511 | 1510 | 1516 | 1515 |
| LR chi-squared/F-statistic | 7.72 | 18.60 | 7.96 | 22.87 | 9.13 | 21.78 |
| Adj. R-squared/pseudo R-squared | 0.029 | 0.141 | 0.041 | 0.242 | 0.053 | 0.193 |

*Notes*:
1. In panel A, columns (1) and (2) are Probit models; control variables include the endowment of the village measured by ratio of land to household, its age, the distance to the county seat, an industrialization dummy and a regional dummy.
2. In panel B, columns (1) and (2) are Ordinal Probit models; columns (3), (4), (5) and (6) are OLS models; Control variables include a broad range of households, villages and counties characteristics, variables are same as Table 3.
3. Constant terms in panels A and B are not reported.
Robust standard errors in parentheses.
[a] Significant at the 1% level.
[b] Significant at the 10% level.
[c] Significant at the 5% level.

Table 6, which reports the IV-TSLS estimation results, finds that, in the case of North Manchuria, the difference-in-differences estimators are significant and positive for 1908–1915 as well as 1921–1931 across all three measures of the dependent variable. That 1908–1915 is significant in the IV estimates but insignificant in the earlier OLS estimates suggests that the previous estimates were probably biased. This can readily be explained by history. After losing control of Dalian's port (in South Manchuria) and the South Manchurian Railway to the Japanese after the Russian-Japanese War, the Russians attempted to divert exports away from Dalian by offering tax concessions on goods shipped from the north via Vladivostok while imposing tariffs on goods going south.[50] These measures proved effective, and North Manchuria benefited from them, which explains why soybean exports in North Manchuria soared even during 1908–1915.

[50] The tariff amounted to 7–8 *yuan* per ton of goods, which was equivalent to about one-third of the cost of production (Beiman Zhongdong Tielu Huoyun Zhengce, 1937).

**Table 5**
Soybean commercialization and household welfare in north and south Manchuria, baseline estimates.

| Dependent variable | North Manchuria | | | South Manchuria | | |
|---|---|---|---|---|---|---|
| | Socio-economic status | Land owned (log) | Housing property (log) | Socio-economic status | Land owned (log) | Housing property (log) |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *DID estimators (sown area of soy × migration)* | | | | | | |
| 1860–1894 | – | – | – | 0.110 | −0.686 | −0.133 |
| | – | – | – | (0.345) | (0.450) | (0.253) |
| 1895–1907 | 0.502 | 1.291[a] | 0.496 | 0.454 | 0.620 | 0.398 |
| | (0.463) | (0.504) | (0.301) | (0.418) | (0.436) | (0.316) |
| 1908–1915 | 0.223 | 0.777[b] | 0.400 | 1.161[c] | 0.826[a] | 0.508[a] |
| | (0.487) | (0.481) | (0.298) | (0.474) | (0.464) | (0.303) |
| 1916–1920 | 1.132[c] | 2.701[c] | 0.685[a] | 0.487 | 0.814[a] | 0.533[a] |
| | (0.436) | (0.428) | (0.276) | (0.512) | (0.433) | (0.287) |
| 1921–1931 | 1.836[c] | 2.556[c] | 0.951[c] | 0.451 | 0.242 | 0.190 |
| | (0.415) | (0.362) | (0.261) | (0.333) | (0.320) | (0.221) |
| 1932–1934 | 1.237[c] | 2.136[c] | 0.756[c] | 0.769[c] | 0.483 | 0.456[a] |
| | (0.403) | (0.362) | (0.258) | (0.327) | (0.295) | (0.193) |
| *Control variables* | | | | | | |
| Characteristics of households, villages and counties | *Yes* | *Yes* | *Yes* | *Yes* | *Yes* | *Yes* |
| Number of obs. | 659 | 734 | 739 | 759 | 776 | 776 |
| LR chi-squared/F-statistic | 196.00 | 26.64 | 14.21 | 100.63 | 14.78 | 11.80 |
| Adj. R-squared/pseudo R-squared | 0.108 | 0.339 | 0.254 | 0.048 | 0.300 | 0.207 |

*Notes*:
1. Columns (1) and (4) are Ordinal Probit models; columns (2), (3), (5) and (6) are OLS models;
2. Control variables include family size, the ratio of off-farm labor to population in a household, the number of years lived in village, age of household head, village endowment measured by the ratio of land to the number of households, age of village settlement, distance to the county seat, an industrialization dummy variable and a regional dummy variable.
3. Constant terms are not reported.
Robust standard error in parentheses.
[a] Significant at the 5% level.
[b] Significant at the 10% level.
[c] Significant at the 1% level.

With regard to South Manchuria, the periods in which all three welfare measures are significant are 1916–1920 and 1932–1935. The significance of 1916–1920 in the IV estimates for South Manchuria can be explained by the historical fact that the Chinese Eastern Railway became severely congested during the First World War and Russia's October Revolution. As a result, the South Manchurian Railway took up the slack and transported a disproportionate amount of goods to Dalian for export (Haiguan Nianbao, 1920). The significance of 1932–1935 can equally be accounted for by history. We know that prior to 1931 it was North Manchuria that was the center of soybean cultivation, accounting for approximately 80% of Manchuria's soybean exports. The north then suffered several major floods and an increased incidence of banditry, and soybean cultivation in the north was negatively impacted, whereas the south was largely spared these difficulties (Beiman Youfang Gongye Xianzhuang, 1936). This may explain why commercialization had a significant and positive effect on the welfare of farm households in South Manchuria during 1931–1935—a period after the north had taken over as the primary region of soybean commercialization. In short, using 1907 as the year benchmarking soybean exports, the effect of commercialization was firmly positive and significant for Manchuria as a whole, although it varied spatially among the various sub-periods.

## 6. Conclusions

For a long time, the economic consequences of the opening up of China in general and the frontier economy of the Northeast in particular (circa 1840s to 1930s) have been a subject of intense debate but of which solid empirical evidence has been sorely lacking. In this article we examine, with micro-level empirical evidence the effect of commercialization-cum-migration on the peasant economy of China during the late nineteenth–early twentieth century. By analyzing a unique household dataset using difference-in-differences and instrumental variable approaches, our work is the first to provide solid empirical evidence on the causal relationship of how commercialization, when combined with migration, positively impacted farmers' welfare. Specifically, those who migrated to Manchuria after soybean commercialization, and those who settled in villages whose biological and climatic characteristics were best suited for soybean cultivation, owned approximately two-thirds more of the arable land and one-third more of houses than those who failed to do so.

**Table 6**
Soybean commercialization and household welfare, separate for north and south Manchuria, instrumented evidence.

| Dependent variable | North Manchuria | | | South Manchuria | | |
|---|---|---|---|---|---|---|
| | Socio-economic status | Land owned (log) | Housing property (log) | Socio-economic status | Land owned (log) | Housing property (log) |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *DID estimators (sown area of soy × migration)* | | | | | | |
| 1860–1894 | – | – | – | 0.626[a] | −0.624 | 0.087 |
| | – | – | – | (0.301) | (0.458) | (0.295) |
| 1895–1907 | 1.933* | 1.501 | 1.031 | 1.323[b] | 0.853 | 0.847[a] |
| | (0.995) | (1.075) | (0.784) | (0.372) | (0.560) | (0.361) |
| 1908–1915 | 2.863[a] | 2.847[c] | 1.698[c] | 1.638[b] | 1.154[a] | 0.829[a] |
| | (1.300) | (1.771) | (1.045) | (0.363) | (0.554) | (0.357) |
| 1916–1920 | 1.813 | 2.727[a] | 1.163 | 1.203[b] | 1.001[a] | 1.201[a] |
| | (1.109) | (1.338) | (0.858) | (0.317) | (0.623) | (0.401) |
| 1921–1931 | 3.187[b] | 3.984[b] | 1.398[a] | 1.190[b] | 0.607 | 1.058[b] |
| | (1.030) | (1.215) | (0.804) | (0.317) | (0.472) | (0.304) |
| 1932–1934 | 2.065[c] | 2.857[b] | 1.144 | 1.434[b] | 0.809[a] | 1.074[b] |
| | (1.012) | (1.037) | (0.784) | (0.279) | (0.422) | (0.272) |
| *Control variables* | | | | | | |
| Characteristics of households, villages and counties | *Yes* | *Yes* | *Yes* | *Yes* | *Yes* | *Yes* |
| Number of obs. | 659 | 734 | 739 | 759 | 776 | 776 |
| LR chi-squared/F-statistic | 9.04 | 19.77 | 13.36 | 6.81 | 15.01 | 11.17 |
| Adj. R-squared/pseudo R-squared | 0.152 | 0.308 | 0.238 | 0.089 | 0.306 | 0.153 |

*Notes*:
1. Columns (1) and (4) are Ordinal Probit models; columns (2), (3), (5) and (6) are OLS models.
2. Control variables include family size, the ratio of off-farm labor to population in a household, the number of years lived in village, age of household head, village endowment measured by the ratio of land to the number of households, age of village settlement, distance to the county seat, an industrialization dummy variable and a regional dummy variable.
3. Constant terms are not reported.
4. Average rainfall, average temperature and the pH of the soil were employed as instrumental variables.
Robust standard errors in parentheses.
[a] Significant at the 5% level.
[b] Significant at the 1% level.
[c] Significant at the 10% level.

A more important finding perhaps is that this golden opportunity was by no means confined to only those attempting to relieve the "land constraint" in their home villages on the North China plain. Our analysis suggests that commercialization had possibly benefited the poor more than the rich, as those who came after the Manchurian economy became distinctly more commercialized were the ones who did not possess the required capital—predominantly tenant farmers and wage laborers—yet they were just as able to take advantage of this golden opportunity. In short, commercialization in Manchuria had likely produced a "trickle-down" effect on a wider spectrum of the society as development spread gradually from the south to the north in tandem with the process of commercialization. While China on the whole may have failed to register impressive economic growth during the period in question, one cannot point to commercialization as the primary culprit.

## Appendix 1

**Table A1.1**
Migration periods.

| Period of migration | Sample size | Percentage |
|---|---|---|
| Period 1: before 1860 | 284 | 18.73% |
| Period 2: 1860–1894 | 144 | 9.50% |
| Period 3: 1895–1907 | 154 | 10.16% |
| Period 4: 1908–1915 | 122 | 8.05% |
| Period 5: 1916–1920 | 161 | 10.62% |
| Period 6: 1921–1931 | 298 | 19.66% |
| Period 7: 1932–1934 | 353 | 23.28% |

*Note*: The periods were defined based on development trends in Manchuria's soybean trade.

**Table A1.2**
Labor and land markets in Manchuria in the 1930s.

| | Manchuria | | |
|---|---|---|---|
| | Overall | North | South |
| *Panel A: socioeconomic status* | | | |
| Landlord | 16.02% | 18.27% | 13.80% |
| Owner-cultivator | 35.04% | 21.74% | 47.14% |
| Tenant | 21.67% | 26.42% | 18.01% |
| Laborers | 20.73% | 28.11% | 13.45% |
| *Panel B: land owned and housing property and Gini coefficient of land ownership* | | | |
| Land (*unit: shang*) | 2.6 | 2.2 | 3.1 |
| Land Gini | 0.768 | 0.793 | 0.741 |
| Housing | 2.62 | 2.36 | 2.84 |
| *Panel C: labor market (hired laborers as a percentage of total labor force)* | | | |
| Hired-in | 29.00% | 34.84% | 20.41% |
| Hired-out | 43.60% | 43.05% | 41.10% |
| *Panel D: land market (land rented as a percentage of total cultivated land)* | | | |
| Rent-in | 36.80% | 41.67% | 31.30% |
| Rent-out | 35.80% | 26.63% | 45.10% |

Source: All tables are from Manchuria Villages Survey.

**Table A1.3**
The proportion of acreage sown to soybean in different regions of Manchuria.

| Regions (NM) | Proportion of the area in soybean | Regions (SM) | Proportion of the area in soybean |
|---|---|---|---|
| Aihui | 31.7% | Taonan | 25.4% |
| Huachuan | 26.8% | Dunhua | 17.6% |
| Fujin | 17.6% | Panshi | 37.9% |
| Hailun | 29.5% | Yushu | 32.4% |
| Wangkui | 22.2% | Yanji (1) | 17.1% |
| Siuhua | 32.6% | Yanji (2) | 5.1% |
| Qingcheng | 1.7% | Zhuanghe | 0.3% |
| Hulan | 8.2% | Fengcheng | 0.0% |
| Bayan | 0.2% | Liaoyang | 15.0% |
| Qinggang | 6.5% | Liaozhong | 16.4% |
| Lanxi | 24.7% | Gaiping | 2.1% |
| Anda | 32.8% | Xinmin | 8.5% |
| Zhaozhou | 41.0% | Lishu | 27.0% |
| Fuyu (1) | 14.8% | Xifeng | 20.4% |
| Fuyu (2) | 2.3% | Hailong | 36.9% |
| Nehe | 37.0% | Heishan | 3.9% |
| Baiquan | 30.1% | Panshan | 5.8% |
| Mingshui | 27.9% | Fengning | 0.0% |
| Keshan (1) | 25.7% | Ningcheng | 6.0% |
| Keshan (2) | 15.8% | – | – |
| Keshan (3) | 30.3% | – | – |
| Longzhen | 16.0% | – | – |

*Note*: The proportion of the sown area under soy equals the sown area with soybeans divided by total sown area. NM = North Manchuria; SM = South Manchuria. The average proportion in North Manchuria is 21.6% (standard deviation 0.12); the average proportion in South Manchuria is 14.6% (standard deviation 0.13); and the overall average proportion is 18.4% (standard deviation 0.13). The number in parenthesis indicates that a different village from the same county was being surveyed.

**Table A1.4**
Cropping patterns in north and south Manchuria in the 1930s.

| Categories of crops | North Manchuria | South Manchuria |
|---|---|---|
| Soybean | 21.80% | 14.62% |
| Gaoliang (Sorghum) | 9.30% | 28.28% |
| Corn | 10.30% | 8.09% |
| Wheat | 10.70% | 0.97% |
| Millet (Su) | 14.60% | 0.23% |
| Tares | 1.70% | 0.06% |
| Flax | 0.07% | 0.11% |
| Vegetable | 3.94% | 4.02% |
| Buckwheat | 1.90% | 0.82% |
| Millet (Mizi) | 0.34% | 1.42% |
| Millet (Guzi) | 5.10% | 0.04% |
| Rice | 0.85% | 2.33% |
| Barley | 3.34% | 0.57% |
| Others crops | 16.06% | 38.44% |

*Note*: Other crops include opium, fruits, cotton, tobacco and so on. Most of them were a part of sidelines.

**Table A1.5**
Correlations among the dependent variables.

| | Socioeconomic status | Land owned | Housing property |
|---|---|---|---|
| Socioeconomic status | 1.000 | | |
| Land owned | 0.695[a] | 1.000 | |
| Housing property | 0.562[a] | 0.715[a] | 1.000 |

[a] Significant at the 1% level.

**Table A1.6**
T-tests of households' characteristics among different groups of migrants.

| | | Group 1 | Group 2 | Group 3 |
|---|---|---|---|---|
| | | (SM) | (SM–NM) | (NM) |
| *Panel A: socioeconomic status* | | | | |
| Group 1 | (SM) | | −0.219 | −0.976 |
| Group 2 | (SM–NM) | −0.219 | | −1.004 |
| Group 3 | (NM) | −0.976 | −1.004 | |
| *Panel B: land* | | | | |
| Group 1 | (SM) | | −0.767 | −0.335 |
| Group 2 | (SM–NM) | −0.767 | | −0.188 |
| Group 3 | (NM) | −0.335 | −0.188 | |
| *Panel C: houses* | | | | |
| Group 1 | (SM) | | −1.236 | 0.074 |
| Group 2 | (SM–NM) | −1.236 | | −1.195 |
| Group 3 | (NM) | 0.074 | −1.195 | |

*Notes*: "SM" denotes direct migration to South Manchuria; "NM" denotes direct migration to North Manchuria; "SM–NM" denotes migration from South to North Manchuria.

**Table A1.7**
Distribution of migrants' socioeconomic categories at time of arrival, by periods of migration.

| | Landlord | Owner-cultivator | Tenant farmer | Wage laborer |
|---|---|---|---|---|
| Before 1860 | 14.90% | 34.13% | 12.02% | 38.94% |
| 1860–1894 | 20.00% | 25.38% | 16.15% | 38.46% |
| 1895–1907 | 12.69% | 41.04% | 12.69% | 33.58% |
| 1908–1915 | 13.39% | 38.39% | 16.96% | 31.25% |
| 1916–1920 | 7.69% | 24.48% | 20.28% | 47.55% |
| 1921–1932 | 7.04% | 20.00% | 28.89% | 44.07% |
| 1932–1934 | 6.73% | 15.06% | 37.82% | 40.38% |

**Table A1.8**
Results of t-tests among different socioeconomic categories of migrants, by periods of migration.

| | Before 1860 | 1860–1894 | 1895–1907 | 1908–1915 | 1916–1920 | 1921–1931 | 1932–1934 |
|---|---|---|---|---|---|---|---|
| Before 1860 | | −0.15 | −0.639 | −0.689 | 2.779[a] | 3.667[a] | 4.127[a] |
| 1860–1894 | −0.15 | | −0.427 | −0.484 | 2.613[a] | 3.351[a] | 3.757[a] |
| 1895–1907 | −0.639 | −0.427 | | −0.079 | 3.228[a] | 4.064[a] | 4.524[a] |
| 1908–1915 | −0.689 | −0.484 | −0.079 | | 3.185[a] | 3.953[a] | 3.393[a] |
| 1916–1920 | 2.779[a] | 2.613[a] | 3.228[a] | 3.185[a] | | 0.228 | 0.439 |
| 1921–1931 | 3.667[a] | 3.351[a] | 4.064[a] | 3.953[a] | 0.228 | | 0.241 |
| 1932–1934 | 4.127[a] | 3.757[a] | 4.524[a] | 3.393[a] | 0.439 | 0.241 | |

[a] Significant at the 1% level.

**Table A1.9**
Regression of the dependent variables on various instrumental variables.

| Dependent variables | Socio-economic Status | Land owned (log) | Housing property (log) |
|---|---|---|---|
| | (1) | (2) | (3) |
| *Panel A: baseline estimation* | | | |
| Independent variables | | | |
| Average temperature during production cycle (log) | −1.900 | −3.856 | −1.628 |
| | (2.485) | (2.446) | (1.503) |
| Average rainfall during production cycle (log) | 1.039 | 1.321 | 0.493 |
| | (1.404) | (1.232) | (0.736) |
| pH of the soil | 1.413 | −0.199 | −0.080 |
| | (1.051) | (0.977) | (0.604) |
| Control variables | | | |
| Characteristics of households, villages and counties | *Yes* | *Yes* | *Yes* |
| Number of obs. | 1418 | 1510 | 1515 |
| LR chi-squared/F-statistic | 203.24 | 29.19 | 29.37 |
| Adj. *R-squared*/pseudo *R-squared* | 0.055 | 0.175 | 0.184 |
| *Panel B: two-stage least squares with IV* | | | |
| Independent variables | | | |
| Average temperature during production cycle (log) | −2.446 | −2.206 | −2.238 |
| | (2.772) | (3.249) | (1.807) |
| Average rainfall during production cycle (log) | 1.289 | 0.642 | 0.909 |
| | (1.648) | (1.740) | (0.989) |
| pH of the soil | 1.529 | −1.024 | 0.284 |
| | (1.397) | (1.418) | (0.829) |
| Control variables | | | |
| Characteristics of households, villages and counties | *Yes* | *Yes* | *Yes* |
| Number of obs. | 1418 | 1510 | 1515 |
| LR chi-squared/F-statistic | 20.54 | 31.56 | 29.17 |
| Adj. *R-squared*/pseudo *R-squared* | 0.143 | 0.219 | 0.182 |

*Notes*:
1. Column (1) is an Ordinal Probit model; columns (2) and (3) are OLS models.
2. Control variables include family size, the ratio of off-farm labor to population in a household, age of household head, the number of years lived in village, village endowment measured by the ratio of land to household, age of village settlement, distance to the county seat, an industrialization dummy variable and a regional dummy variable.
3. In panel B, frost-free period and average evaporation were instrumental variables to identify the relationship between the IVs (average rainfall, average temperature and soil pH) and the socioeconomic dependent variables.
4. Constant terms in panels A and B are not reported.
Robust standard errors in parentheses.
[a] Significant at the 10% level.
[b] Significant at the 5% level.
[c] Significant at the 1% level.

Notes to Table A2.2:
1. Baseline estimations in columns (1) to (3) and estimations using instrumental variables in columns (4) to (6).
2. Columns (1) and (4) are ordinal Probit models; columns (2), (3), (5) and (6) are OLS models.
3. Control variables include family size, the ratio of off-farm labor to population in a household, the number of years lived in village, age of household head, village endowment measured by the ratio of land to the number of households, age of village settlement, distance to the county seat, an industrialization dummy variable and a regional dummy variable.
4. Average rainfall, average temperature and soil pH were employed as the instrumental variables.
5. Constant terms are not reported.
Robust standard errors in parentheses.
[a] Significant at the 1% level.
[b] Significant at the 5% level.
[c] Significant at the 10% level.

## Appendix 2

**Table A2.1**
Soybean commercialization and household welfare, baseline estimates and instrumental evidence (small sample to check robustness).

| Dependent variable | Socio-economic status | Land owned (log) | Housing property (log) | Socio-economic status-IV | Land owned (log)-IV | Housing property (log)-IV |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *DID estimators (sown area of soy × migration)* | | | | | | |
| 1860–1894 | −0.664[a] | −0.639[a] | −0.272 | 0.119 | 0.386 | 0.027 |
| | (0.316) | (0.321) | (0.232) | (0.314) | (0.397) | (0.268) |
| 1895–1907 | 0.178 | −0.026 | 0.011 | 1.497[b] | 0.276 | 0.590 |
| | (0.345) | (0.389) | (0.261) | (0.407) | (0.550) | (0.356) |
| 1908–1915 | 0.019 | −0.307 | 0.157 | 2.158[b] | 2.082[b] | 1.319[b] |
| | (0.345) | (0.457) | (0.285) | (0.556) | (0.645) | (0.491) |
| 1916–1920 | 0.363 | 1.183[b] | 0.404 | 0.611 | 0.702 | 1.497[b] |
| | (0.322) | (0.430) | (0.187) | (0.564) | (0.842) | (0.566) |
| 1921–1931 | 0.681[b] | 0.695[b] | 0.404[a] | 0.943[b] | 1.301[b] | 1.042[b] |
| | (0.259) | (0.287) | (0.187) | (0.337) | (0.479) | (0.294) |
| 1932–1934 | 0.385 | 0.242 | 0.135 | 0.905[b] | 0.508 | 0.557[c] |
| | (0.253) | (0.274) | (0.176) | (0.310) | (0.380) | (0.245) |
| *Control variables* | | | | | | |
| Characteristics of households, villages and counties | *Yes* | *Yes* | *Yes* | *Yes* | *Yes* | *Yes* |
| Number of obs. | 897 | 951 | 956 | 897 | 951 | 956 |
| LR chi-squared/F-statistic | 176.23 | 21.86 | 23.25 | 13.5 | 20.7 | 16.1 |
| Adj. R-squared/pseudo R-squared | 0.075 | 0.327 | 0.289 | 0.129 | 0.291 | 0.216 |

*Notes*:
1. Baseline estimations in columns (1) to (3) and estimations using instrumental variables in columns (4) to (6).
2. Columns (1) and (4) are ordinal Probit models; columns (2), (3), (5) and (6) are OLS models.
3. Control variables include family size, the ratio of off-farm labor to population in a household, the number of years lived in village, age of household head, village endowment measured by the ratio of land to the number of households, age of village settlement, distance to the county seat, an industrialization dummy variable and a regional dummy variable.
4. Average rainfall, average temperature and soil pH were employed as the instrumental variables.
5. Constant terms are not reported.
Robust standard errors in parentheses.
[a] Significant at the 5% level.
[b] Significant at the 1% level.
[c] Significant at the 10% level.

**Table A2.2**
Soybean commercialization and household welfare, baseline estimates and instrumental evidence (sample using only migrants arriving after 1895 to check robustness).

| Dependent variable | Socio-economic status | Land owned (log) | Housing property (log) | Socio-economic status-IV | Land owned (log)-IV | Housing property (log)-IV |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *DID estimators (sown area of soy × migration)* | | | | | | |
| 1908–1915 | −0.013 | −0.230 | 0.293 | 1.594[a] | 1.613[b] | 0.975[b] |
| | (0.346) | (0.399) | (0.262) | (0.470) | (0.656) | (0.426) |
| 1916–1920 | 0.398 | 1.139[a] | 0.305 | 0.101 | 0.703 | 0.7417[c] |
| | (0.294) | (0.365) | (0.223) | (0.449) | (0.668) | (0.439) |
| 1921–1931 | 0.839[a] | 0.753[a] | 0.331[b] | 0.577[b] | 0.958[b] | 0.559[b] |
| | (0.218) | (0.252) | (0.156) | (0.257) | (0.423) | (0.251) |
| 1932–1934 | 0.587[a] | 0.439[c] | 0.181 | 0.533[b] | 0.422 | 0.296 |
| | (0.209) | (0.235) | (0.144) | (0.257) | (0.346) | (0.224) |
| *Control variables* | | | | | | |
| Characteristics of households, villages and counties | *Yes* | *Yes* | *Yes* | *Yes* | *Yes* | *Yes* |
| Number of obs. | 996 | 1050 | 1055 | 669 | 1050 | 1055 |
| LR chi-squared/F-statistic | 186.59 | 23.06 | 21.44 | 13.17 | 22.35 | 22.41 |
| Adj. R-squared/pseudo R-squared | 0.068 | 0.297 | 0.247 | 0.117 | 0.255 | 0.227 |

**Table A2.3**
Soybean commercialization and household welfare, regional differences.

| Dependent variables | Socioeconomic status | Land owned (log) | Housing property (log) |
|---|---|---|---|
| *Independent variables* | | | |
| Sown area of soy × region | −1.911(0.410)[a] | −4.195(0.858)[a] | −1.985(0.579)[a] |
| Sown area of soy (%) | 1.490(0.331)[a] | 2.777(0.616)[a] | 0.766(0.415)[b] |
| Region dummy (South Manchuria = 1) | 0.229(0.127)[b] | −0.515(0.259)[c] | −0.233(0.175) |
| *Control variables* | | | |
| Household size (log) | 0.110(0.021)[a] | 1.055(0.117)[a] | 0.600(0.078)[a] |
| Time of resettling in village (log) | 0.110(0.021)[a] | 0.318(0.047)[a] | 0.202(0.031)[a] |
| Land per household in villages | 0.003(0.001)[c] | 0.024(0.003)[a] | 0.005(0.002)[b] |
| Age of village (log) | 0.083(0.043)[c] | 0.312(0.101) | 0.067(0.066) |
| Distance to county (log) | 0.231(0.052)[a] | −0.103(0.107) | 0.073(0.071) |
| Industrialization dummy (yes = 1) | 0.156(0.102) | 0.992(0.229)[a] | 0.819(0.155)[a] |
| Number of obs. | 1212 | 1261 | 1262 |
| LR chi-squared/F-statistic | 134.71 | 34.26 | 28.43 |
| Adj. R-squared/pseudo R-squared | 0.05 | 0.212 | 0.151 |

*Note*: Constant terms are not reported.
Robust standard errors in parentheses.
[a] Significant at the 1% level.
[b] Significant at the 10% level.
[c] Significant at the 5% level.

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