Commercialization as Exogenous Shocks: The Effect of the Soybean Trade in Manchurian Villages, 1895-1934*

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ABSTRACT

The role played by commercialization in traditional agrarian economies such as China's in the 19th century has been ferociously debated, but it remains unclear because of a lack of robust empirical evidence. Using data from Manchuria on soybean cultivation and exports, a difference-in-differences approach was applied to demonstrate a significantly positive relationship between participation in growing soybeans for export and a number of socioeconomic gauges of rural prosperity. Those who migrated to Manchuria in periods when high world market prices prevailed, and to villages where the climate and soil characteristics were more suitable for cultivating soy prospered most: specifically, they owned approximately two-thirds more of the arable land and one-third more of houses than those who failed to do so. This strong result survives a number of robustness checks, which include the use of temperature, rainfall and soil characteristics as instruments and sub-samples that divide Manchuria into north and south.

Keywords: Commercialization, Soybean Trade, Involution, Rural Prosperity, Manchuria

JEL Classifications*: N35, N55, O15*

I. INTRODUCTION

For a long time, the role of commercialization in China's long-term development has been a subject of intense intellectual debate in which a consensus remains lacking.[1] One view sees commercialization in China during the nineteenth century as having primarily the desirable effects of promoting export growth and integrating previously fragmented markets (rural and urban, for instance),[2] thereby promoting greater specialization and sharply increasing household income[3]. Such a view is consistent with the classical thinking of Smith and Marx in regard to the progressive role of commercialization.[4] The opposing view, however, sees commercialization as having a basically negative, or at best a negligible effect on the Chinese peasant economy. While commercialization may have come as a "shock" to China's traditional economy, its effect was negligible because any effect was confined largely to the treaty ports.[5] For those who, forced by population pressure, responded excessively to cash cropping opportunities but at a time when world prices of these crops had begun to fall, commercialization resulted in social differentiation. The growth in the popularity of Communism in the early twentieth century was seen by those taking this position as an outcome of "involutionary growth" or "growth without development", a process whereby output produced was just enough to feed a growing

[1] Brandt, *Commercialization*; Huang, *Peasant Economy, Peasant Family*; Perkins, *Agricultural Development*; Rawski, *Economic Growth*, among others. 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.

[2] Myers, "Agrarian System," pp. 250-51, finds, for instance, that during 1890-1905 staple crop export increased by 300 percent and cash crops export by 600 percent.

[3] Brandt, *Commercialization*, "Farm Household"; Myers, *Chinese Peasant,* "Agrarian System," "Resource Allocation"; Rawski, *Economic Growth;* Wiens, "The Microeconomics"; Zhang, *Dongnan Yanhai*; Lin, "*Kouan Maoyi*"; Eastman, *Families*.

[4] Their ideological differences notwithstanding, both Smith, *An Inquiry*, and Marx, *Capital*, subscribed to the view that commercialization will lead to the collapse of a small peasant economy, thereby promoting the emergence of capitalism.

[5] Hou, "Economic Dualism" and Murphey, "Treaty Ports," estimate that economic activities conducted through China's treaty ports contributed no more than 10 percent of the national income, with virtually no effect on the traditional or "subsistence" sector. Combined, the overall effects of commercialization were thus negligible.

population.[6]

The Japanese conducted a unique farm survey in the 1930s during their occupation of Manchuria. In this study, we set out to use data from that survey to estimate the impact of commercialization on the rural economy of northeast China. There are two important reasons for this particular geographical choice. The first is that Manchuria had since 1895 experienced rapid commercialization of its soybean cultivation and export; a process comparable in importance to what took place in the lower Yangzi region in the late nineteenth century.[7] The Japanese data provide an invaluable opportunity to test empirically the welfare effect of commercialization on those exposed to this exogenous stimulus. A recent study using these same data has disputed the commonly assumed lack of social mobility in China, but it failed to establish a causal link between soybean production and export, on the one hand, and socioeconomic change on the other.[8] Quantifying this link is our primary goal.

Its close proximity to north China rendered Manchuria a popular destination to which many Chinese villagers migrated in search of alternative work and income opportunities.[9] A thorough examination of these migration opportunities may help shed light on whether, and if so to what extent "involution" was significant on the North China plain.[10] The importance of involution depends heavily on the extent to

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[6] Huang, *Peasant Economy*; Zhang, *Zhongguo Jindai, Mingqing*, Li, Wei and Jing, *Mingqing Shidai,* and Xue, "Zhongguo," See also Elvin, *Pattern*, "The High-Level."

[7] Kung, Bai and Lee, "Human Capital", examines the effect of off-farm migrant work opportunities on household income in the most commercialized region in China, the lower Yangzi.

[8] Myers, "Socioeconomic."

[9] Migration to Manchuria has remained the largest in the history of China, Kong, *Dongbei, Xinbian Zhongguo*; Gottschang, "Economic Change", *Swallows*; Zhao, "1920-30 *Niandai*," "*Yimin*," "*Dongsansheng*," "*Jindai Dongsansheng*."

[10] Huang, *Peasant Economy*, defines involution as the application of more labor effort than was *optimally* necessary, "at the costs of sharply diminished marginal returns" (*emphasis added*). In particular, "poor peasant family farms demonstrate this pattern most clearly, both in the sense of excessive labor input per crop and in the sense of excessive reliance on a single cash crop", p. 155.

which a causal relationship can be established between migration and social mobility—the latter measured specifically in terms of socioeconomic status and land-and-housing ownership. Any beneficial effects of migration would presumably stem from alleviating population pressure—the underlying cause of involution.

In an attempt to identify any causal relationship between commercialization and the economic welfare of migrants, we exploited the variations in soybean cultivation reported in response to the sharp rise in soybean exports from Manchuria to the rest of the world during the period from roughly 1895 to 1934 using a difference-in-differences (DID) approach.[11] While the dataset we employed is essentially cross-sectional in nature, we were able to assign the surveyed households into a panel of cohorts based on their migration history (specifically when they migrated to Manchuria) that corresponded to different phases of commercialization. Moreover, we also had information on the villages in which migrants settled and their suitability (in terms of climate and soil characteristics) for soybean cultivation, so we were able to estimate the effect of commercialization on household economic welfare.

Our overriding hypothesis is straightforward: Households that migrated to villages suitable for soybean cultivation (where) in periods when the beans fetched high market prices (when) were able to benefit from commercialization. Stated in terms of the difference-in-differences framework, the "treated" group in our experimental design comprised those who migrated to villages with a greater proportion of acreage sown with soybeans, whereas the "control" group comprised those migrating to villages with a smaller-than-average proportion of acreage sown with soy.[12] The impact of the soybean trade on the economic welfare of farm

[11] Initially employed to evaluate the relationship between policy and social programs (Card and Krueger, "Minimum Wages," "Minimum Wages: Reply"; Duflo, "Schooling and Labor"), 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 (see, e.g., Acemoglu, "Rise of Europe"; Chen and Zhou, "Long-term Health"; Qian, "Missing Women", among others).

[12] Under the rationality assumption, we used variations in the acreage sown with soybeans as an indication of a village's suitability in terms of climate and soil characteristics.

households can be identified in the differences between the treatment and control groups. Additionally, in order to ensure that our DID estimation did not suffer from any estimation bias caused by an omitted variable or errors in measuring the degree of commercialization, we adopted an instrumental variable approach using average temperature and rainfall and the pH balance of the soil as the pertinent instruments.

Our analysis reveals that the soybean trade had a significant positive effect on the economic welfare of those who actively engaged in soybean cultivation and export in periods of high market prices, particularly from 1921 to 1931. Specifically, those who migrated at the right time and to the right place owned approximately two-thirds more arable land and houses than those who failed to do so. While we found a difference in the significance of timing between north and south Manchuria, the difference is attributable largely to differences in the stage of economic development or specifically the economic structure and endowment characteristics of the two regions, so the disparity does not fundamentally alter our conclusions. In addition to establishing a causal link between the commercialization of cash cropping and economic welfare, our results also help elucidate the role of agricultural involution in a context where surplus rural labor is thought to have been an acute problem.

The remainder of this paper is organized as follows. In Section II, 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 III, 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 IV. The empirical results are discussed in Section V, followed by a brief conclusion in Section VI.

II. Historical Background

II.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 subsequently served as a "vent" for surplus rural labor in the North China plain (modern day Hebei, Henan and Shandong), which helped to alleviate the pressure of involution.

II.1.1 Migration

In the late seventeenth century (1670), Manchuria had only one million people, which was less than one percent of the population of China at the time.[13] They relied primarily on fishing and raising livestock for a living, so most of this vast territory had not yet been brought under cultivation. 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".[14] At about the same time, the Qing government was obliged to cede more than one million square kilometers of land in Manchuria to Russia.[15] This cession made defense of the frontier much more difficult, so to counteract this adverse situation, the

[13] Cao, *Zhongguo Yiminshi*, p. 29. Although attempts had been made in the past to encourage migration (from, for example, the tenth year of the Shunzhi reign (顺治十年，1653) to the seventh year of the Kangxi reign (康熙七年, 1668), these were short-lived (ending in that case in 1670).

[14] 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 (eight months), so disruptions to trade due to extreme cold weather could be kept to a minimum (Bank of Chosen, *Economic*, pp. 16-17).

[15] As a result of signing the Sino-Russian Treaty of Aihui and the Sino-Russian Convention of Peking, six hundred thousand square kilometers of land north of the Amur River and south of Xing'an Mountain and more than four hundred thousand square kilometers of land elsewhere were ceded to Russia.

Qing government permitted Han Chinese to migrate to Manchuria.[16] The result was the largest migration in the history of China. Gottschang, for example, estimates that total migration between North China and Manchuria by the early twentieth century was around five 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.[17]

In the seventeenth century, the largest city on the Liaotung peninsula, Fengtien, had a population of about 10,000.[18] 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.[19] 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 percent 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.[20] Figure 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.

Agricultural involution, according to Huang, was caused primarily by growing population pressure.[21] Rapid population growth since the late Ming caused per capita arable land to drop precipitously from 15 *mu* (1 *mu*=0.0667 hectares) to 3 *mu* in the

[16] 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, Chao, and Chang, "Economic Development," p. 241; Kong, *Dongbei, Xinbian Zhongguo*).

[17] Gottschang, "Economic Change," p. 461. This great migration was known in Chinese as the "*chuang guan dong*" (meaning "trying to make a living in Manchuria").

[18] Sun, *Economic Development*, p. 6.

[19] Cao, *Zhongguo Renkou*, p. 365, 369.

[20] Eckstein, Chao and Chang, "Economic Development," p. 246.

[21] Huang, *Peasant Economy and Social Change*.

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 plains 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.

> *Figure 1 about here* <

II.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.[22] This was considered essential, as much of the land had not been cultivated before and as such lacked the nutrients required for good harvests.[23]

While soy was new to Manchuria,[24] the natural conditions there were near perfect for its cultivation.[25] Soy's oil content depends on the latitude where it is grown.

[22] 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 functions as nitrogenous fertilizer and enrich the soil's fertility.

[23] This soil-enhancing property of soybean is evident from the *The Gazetteer of Zhu-he County* (1929), 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".

[24] It is suggested that the crop was brought into Manchuria by migrants from North China in Ming and Qing times (Lei, *Dongbei*, pp. 37-38). 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, *Dadou*, pp. 10-11).

[25] 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.

Manchuria's latitude from 38°40' to 53°30' north is optimal for growing good soybeans.[26] In addition, Manchuria normally receives suitable amounts of both sunshine and rainfall for a healthy crop.[27] And 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.[28]

II.2 *International Soybean Trade*

Before Manchuria emerged as a major exporter of soy, the Qing government had tightly controlled the trade in soybeans.[29] 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.[30] Demand from the European market increased soybean exports tremendously, and between 1908 and 1931 Manchuria accounted for approximately 60 to 70 percent of China's total exports of soy.[31]

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[26] Lu, Cheng, and Cheng, "Woguo Dadou."

[27] Annual average rainfall there amounts to 500ml, with a frost-free period of nearly 150 days, and the average water temperature in July is about 24 degrees Celsius. All of these characteristics are conducive to soybean cultivation (Zhu, "Zhongguo Dongbei," pp. 446-74; Sun, *Dadou*, p. 34).

[28] 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 ("Zai Manzhou," p.28, cited in Lei, *Dongbei*.)

[29] Shigeshi, *Shina*; Seiji, *Study*; Settai and Ito, *Manchurian*; and Isett, *State*, Chapter 8, pp. 211-38.

[30] Manshikai, *Manshū*, p. 550; Lei, *Dongbei*, p. 4.

[31] China alone accounted for 80 percent of the world's output, according to Perkins', *Agricultural Development*, estimates. The rise of soybean in China's exports altered the structure of China's international trade (Sun, *Dadou*, p. 7). 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 percent of the national income from export (You, *Zhongguo*, pp. 29-30).

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.[32] Soybean exports were no exception.

Figure 2 depicts the entire process of soybean commercialization in Manchuria. The blue line 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.

Hypothesis. The "underdevelopment" or "involution" thesis argues that commercialization—the result of China's integration into the world economic system—brought no positive effects to China's small peasant economy. We hypothesize instead that the cash cropping opportunities brought about by the international trade in soybeans benefited some households, provided that they migrated at the right time (during 1908-1915 or 1921-1931) and to the right place (to villages whose natural endowments are suitable for soybean cultivation).

[32] The Mukden incident of September 18, 1931 occurred in South Manchuria when a section of the Japanese-owned South Manchuria 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. For the Chinese, the Mukden incident is also known as the September 18 Incident (*Jiayiba shijian*), or the Manchurian Incident from the Japanese standpoint.

> Figure 2 about here <

III. Data and Variable Definitions

III.1 The Manchurian Survey Data

This study relied 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.[33] The survey was conducted in two waves. The first was conducted in 17 villages chosen from 16 counties in North Manchuria[34] in the late February of 1935.[35] The second survey took place one year later, in late February of 1936, in 22 villages chosen from 21 counties. The results were published in December of 1936.[36] The majority of the villages covered in the second survey were in south Manchuria, with only few from the north.[37] Altogether, the two surveys covered some

[33] 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.

[34] 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. See Bank of Chosen, *Economic*, pp. 11-12, for an example of the north-south geographical demarcation. Generally, it is commonly accepted that South Manchuria included those regions served by the South Manchuria Railway, whereas North Manchuria covered regions served by the Chinese Eastern Railway.

[35] 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).

[36] 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 vols (henceforth referred to as N. J. C. 1936).

[37] The five villages in North Manchuria were Aihui, Taonan, Huachuan, Fujin, and Yushu, all of which were located outside of the Songnen plain.

1,776 farm households in 41 villages located in 37 counties, (Figure 3).[38] Myers provides a preliminary analysis of the socioeconomic change in these Manchurian villages.[39]

>*Figure3 about here*<

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.

Although the surveyed villages were not randomly selected, their wide spatial dispersion renders the surveys geographically representative.[40] 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. Moreover, since all of the surveyed villages were located within

[38] 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, "Land", for example, relied exclusively on the second survey in their analysis).

[39] Myers, "Socioeconomic."

[40] However, as Figure 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.

20 kilometers of a county seat, their responses to international trading opportunities were also likely to be fairly uniform.

III. 2. Independent Variables

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. This allowed 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 Appendix 2 (Table A1).

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 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 percent, the comparable figure was almost seven percentage points higher in the north, at 21.61 percent, suggesting that villages in north Manchuria may have been more affected by commercialization, specifically the international soybean trade, than those in the south.[41] 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 percent of their arable land sown with soybeans, for instance, Bayan and

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

Qingcheng were hardly involved in soybean cultivation. The same sharp contrast can be found in South Manchuria.

> *Table 1 about here* <

III.3 Dependent Variables

One dependent variable was socioeconomic status (*Jingji shenfen*) or social class. 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, non-farming income, an important income source for some households.[42] The Japanese investigators divided the surveyed households into sixteen categories of socioeconomic status or social class, which is too refined for our purpose.[43] To facilitate the analysis, we followed Myers' classification scheme and sorted them into landlords, owner-cultivators, tenant families, and landless laborers.[44] 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 percentage of the four designated social classes in the sample was landlords 17.14%, owner-cultivators 37.49%, tenant families 23.19% and landless laborers 22.18%.

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

[42] Even in less industrialized North Manchuria, non-farm income accounted for 14 percent of overall household income. In more industrialized South Manchuria, this ratio was much higher—more than 30 percent. The first survey is especially deficient in this respect, as non-farm income was not enumerated.
[43] The 16 categories as enumerated by the Japanese researchers are: *Landlord* (Landlord, Landlord-owner cultivator, Landlord-owner cultivator-tenant, Landlord-tenant, Landlord-owner cultivator-tenant-laborer, Landlord-tenant-laborer, Landlord-hired laborer); *Owner-cultivator* (Owner-cultivator, Owner-cultivator-tenant, Owner-cultivator-tenant-laborer, Owner-cultivator-laborer); *Tenant* (Tenant, Tenant-laborer); *Laborer* (Laborer); *Other* (Miscellaneous occupation) (See, Myers, "Socioeconomic").
[44] Myers, "Socioeconomic."

affluent households can invest. It is thus reasonable to expect that the more land and housing a household controls, the greater its economic welfare. To check on this reasoning, we calculated correlation among the three dependent variables and found no significant relationships (Appendix 2, Table A2). 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 one-percent level. According to this survey, the amount of land owned by a "representative" household was 3.63 *shang* or 54.45 *mu*,[45] which was nearly four times larger than their counterparts in the North China plain. In addition, most households owned two houses.

III.4 Control Variables

Variations in households' responsiveness to price changes might be affected by a broad range of household and village characteristics. Examples might include a family's size and settlement history in Manchuria, an area's population density, the distance to the nearest county seat, and so on. Moreover, it is probably also necessary to control for regional differences in light of the greater industrialization in Manchuria during the period of the surveys.[46] Table 2 summarizes statistics on all of the variables employed in the regression analyses (Appendix 1).

> *Table 2 about here* <

IV. EMPIRICAL STRATEGY

[45] *Shang* is the unit of land used in Manchuria, 1 *shang* =15 *mu* (1 mu=0.0667 hectare).

[46] 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. In light of this huge intra-regional variation in industrialization, we employed a dummy variable to indicate whether a village was located in an industrialized county to control for the possible effect of industrialization on household economic welfare.

IV.1 Model Choice

The diversity in soybean cultivation among the villages provides an excellent opportunity for using difference-in-differences (DID) model to help identify the causal inference between commercialization and its consequences for household welfare. In our DID model, we first divided the commercialization process into several phases based on the indices of soybean prices and exports, on which basis we constructed 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 had the following specification:

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

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 degree 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.[47] In Equation (1), δ is the estimator of the difference-in-

[47] Owing to the cross-sectional nature of our data, we can only employ the proportion of acreage sown with soy as the pertinent proxy for the effect of commercialization.

differences that examines the effects due to soybean commercialization on household economic welfare, X is a vector of control variables, and ε is the random error term.

IV. 2 Estimation issues

Although we have controlled for the suitability of a region for soybean cultivation and household characteristics, an issue remains as to whether farm households differentially endowed—most notably with land but also in terms of other socioeconomic and demographic characteristics—might be differentially affected by the same exogenous variable. In particular, given the highly unequal distribution of land in Manchuria at the time, might land-deficit households be especially ill-equipped to take advantage of the international trade in soybeans? Table 3 summarizes the relationship between farm size and the proportion of arable acreage sown with soy. The data relieve such concerns to some extent. While the positive relationship between soybean cultivation and farm size suggests that larger farm households were more responsive to this commercial opportunity, the activeness of both the land (rental) and labor markets suggests that those with under-sized farms were also likely able to capture part of the gains (from trade), if indirectly, through participation in either of these factor markets.[48] In fact, as the survey clearly reveals, as much as 36 percent of the arable land was rented, and 35 percent of the households surveyed were involved in labor hiring as either workers or employers. Moreover, the higher incidence of labor hiring in the north further suggests that North Manchuria, which was more agricultural in its economic structure, was probably more responsive to the cash cropping opportunities than the south (Appendix 2, Table A3).

[48] It should be pointed out that land distribution was very uneven in this part of China. To the extent that later migrants were more likely to be driven by land shortages in their village of origin, they drove up land prices in Manchuria (Gottschang, *Swallow*). Moreover, the Qing government's policy of selectively selling land to only those who possessed a complete set of farm implements further limited land acquisition. That helps to explain why the Gini coefficient was exceptionally high in these Manchurian villages. At 0.784, it was distinctly higher than the coefficient in either North China (0.18) or the Yangzi delta (0.61) (calculated from Kung, Wu, and Wu, "Class Formation," Table 1).

>Table 3 about here<

Another source of selection bias might be the possibility that migration to different villages was not random. This would be especially important if some households consciously elected to settle in villages because they were well suited for soybean cultivation.[49] To some extent this concern can be alleviated by the fact that, first of all, the Qing government did not open up all of Manchuria with one edict. South Manchuria was opened up in the 1860s, but settlement in the north was confined initially to banner land only.[50] Then, since most of the land in Manchuria had not previously been cultivated, settlement was a gradual process that required several phases of land reclamation—a process that easily took more than an entire decade to complete. The Manchurian survey reveals precisely that. By controlling the issuance of land titles, the Manchurian government indeed exercised tight control over the process of opening up this frontier land, in a manner that effectively restricted the choice of migration destinations. Moreover, the data also show 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 may or may not have coincided with opportunities for cash cropping soybeans. Together, these factors reduced the possibility of migrants settling freely in villages whose endowments were more suitable for soybean cultivation.

Although we have attempted to establish the relationship between commercialization and household welfare, our DID estimation still fails to deal with the possible problems of omitted variable bias and errors associated with measuring

[49] See, for example, Banerjee and Duflo, "Experimental Approach."

[50] As administrative divisions into which all Manchu families were placed, the "Eight Banners" provided the basic framework for Manchu military organization. Banner land (*qidi*) was allocated by the Qing governor to Banner households for maintaining their subsistence, and it could not be freely transferred. See also Kong, *Dongbei, Xinbian Zhongguo*.

the degree of commercialization.[51] Soil quality is an obvious case in point, for it affects not only the returns to soybean cultivation and hence household welfare, but it is also correlated with the suitability of soybean cultivation directly. It is thus necessary to find a set of instrumental variables that correlate with the regional dummy variables that proxy for the suitability of soybean cultivation but otherwise have no direct bearing on household economic welfare. We looked to the biological characteristics of soybean production for these.

V. SOYBEAN COMMERCIALIZATION AND HOUSEHOLD ECONOMIC WELFARE

V.1 Baseline Estimates

Table 4 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

[51] 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.

(67.5 percent) and one-third more of houses (35 percent) than those who failed to do so. [52]

> Table 4 about here<

V.2 Instrumental Evidence

Soy is an early-ripening spring crop, the harvest of which depends crucially on three natural elements.[53] The first is temperature. Abundant sunshine and stable temperature are absolutely crucial for the crop to bear fruit. Water is of course essential for this crop, but excessive rainfall seriously reduces output. And soy is most suitably grown on land with an optimal pH, neither excessively acidic nor alkaline. While the pH of the soil in Northeast China is typically sub-optimal, the extent to which it exceeds the optimal pH varies from one region to another.[54] Based on these biological considerations, average temperature, average rainfall, and the pH balance of the soil were employed as instrumental variables in the analysis to correct for the endogenous nature of the regional dummy variable which was used to proxy for the suitability for soybean cultivation. These instruments seem unlikely to be correlated with the economic welfare of farm households except through their effects on endogenous independent variable.

Information on the three instruments is available in a report of the Northeast China Resources Committee (*Guomin Zhengfu Dongbei Ziyuan Weiyuanhui*) in the

[52] 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 67.5 percent ([0.793+0.557]/2=0.675), whereas that for houses is 34.5 percent ([0.347+0.343]/2=0.345].

[53] Hymowitz, "On the Domestication"; Sun, *Dadou*; Xu, "China"; and Wang, *Daodou*.

[54] 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, *Turang*, table 14-5, p. 321).

1930s.[55] According to this report, Manchuria can be divided into seven broad agricultural regions based on climate, soil, and environmental characteristics (please refer again to Figure 3).

Table 5 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 one percent 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. [56]

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 4, 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 5 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 ad already begun to

[55] Established in 1932, the Northeast China Resources Committee (*Guomin Zhengfu Dongbei Ziyuan Weiyuanhui*) was established as a key research institute with many famous Chinese scholars playing a key role in formulating its policies. For more details of the function of this committee, see Wu, "Guomindang."

[56] We report the validity of our instrumental variables in Table A4 of Appendix 2. 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.

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 soybeans had greater potential for upward mobility in terms of owning more arable land and houses.

> *Table 5 about here* <

V. 3 Robustness Checks

We performed two robustness checks. The first checked 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. The results reported in tables A5 and A6 of Appendix 3 show little change from those of Table 4 and Panel B of Table 5, suggesting that measurement error is not a serious concern.

Owing to differences in the level of development and particularly industrialization between north and south Manchuria, we also generated estimates using the two sub-samples. The pertinent OLS estimates are presented in Table 6. What the estimates of the whole sample fail to reveal is that the effect of soybean commercialization were very different in the two regions. 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.

Is this reasonable? We think so. As mentioned earlier, it was the south that developed earlier. Not until the opening of the South Manchurian Railway in the early twentieth century did the north 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.[57] In fact, North Manchuria was especially well suited for soybean cultivation in terms of both soil and climate characteristics.[58] 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 percent) among the 16 provinces where soybean are grown.[59] This may explain why more than 60 percent of the output of soybean from Manchuria during the early twentieth century actually came from the north.[60]

> *Table 6 about here* <

Table 7 reports the IV-TSLS estimation results using separate samples representing north and south Manchuria. In the case of North Manchuria, the difference-in-differences estimators are significant and positive for 1908-1915 and 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.[61] These measures proved effective, and North Manchuria benefited from them, which explains

[57] 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, "Manchurian Railway"; Wang, *Zhongguo Dongbei*, p. 147-48). With the eventual opening up of the rest of North Manchuria and specifically the market for land in 1911, North Manchuria developed rapidly (Kong, *Dongbei, Xinbian Zhongguo*).

[58] The oil content of soybeans depends to a large extent on the latitude at which they are grown. According to Lu, Cheng, and Cheng, "Woguo Dadou," the optimal range is about 45-52 degrees north, which is exactly where North Manchuria is located.

[59] Wang, *Dadou*, pp. 78-79.

[60] Lei, *Dongbei*, pp. 38-39.

[61] "Beiman Zhongdong Tielu." The tariff amounted to 7-8 *yuan* per ton of goods, which was equivalent to about one-third of the cost of production.

why soybean exports in North Manchuria soared during 1908-1915—our IV-TSLS result.

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.[62] 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 percent 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.[63] This may explain why commercialization had a significant and positive effect on the welfare of farm households in South Manchuria during 1931-1935.

> *Table 7 about here* <

VI. Conclusions

The role played by commercialization in the development of the Chinese economy before World War II has been a subject of intense intellectual debate, but one about which, owing to a lack of solid empirical evidence, there is still no consensus. By employing data from a farm survey conducted in Manchuria in the 1930s, we have identified a strong relationship between cash cropping soybeans and the economic welfare of Manchurian farmers in this period. Specifically, by using the difference-in-

[62] *Haiguan Nianbao*.

[63] "Beiman Youfang."

differences approach, we have been able to explain variations in soybean cultivation as a response to the sharp rise in soybean exports from Manchuria to the rest of the world roughly from 1895 to 1934.

Our primary finding is that, depending on when and to where one migrated, commercialization did have a significant positive effect on farmers' welfare measured in terms of various socioeconomic gauges. Those who had migrated at the right time and to the right place owned approximately two-thirds more of the arable land and one-third more of houses than those who failed to do so. This undermines the agricultural involution thesis, which argues that the small peasant holders of the North China plains suffered a secular decline in their farm sizes on the one hand, and a lack of alternative income opportunities on the other. While many may indeed have suffered from the problem of undersized farms, the opportunity to migrate to a frontier economy with relatively abundant land did offer at least some of them an outlet for their otherwise surplus labor, thereby avoiding the diminishing marginal returns to their increased effort which would have otherwise suffered in the absence of such opportunities.

While these empirical results basically support the view that commercialization was related with rising prosperity in the Chinese countryside, there are a couple of important qualifications. The results do not imply that commercialization benefited everyone regardless of when and to where they migrated. The beneficiaries were mostly those who actively pursued the cultivation and export of soybean in times of high market prices (mostly 1908-1915 and 1921-1931), and those in villages where the soil and climate were especially conducive to growing soy. In other words, while commercialization presented an unprecedented and precious opportunity for improving one's economic welfare, the opportunities varied according to the dictates of demand and supply in the world economy, as well as the specific location to which one migrated. Lacking either would not do.

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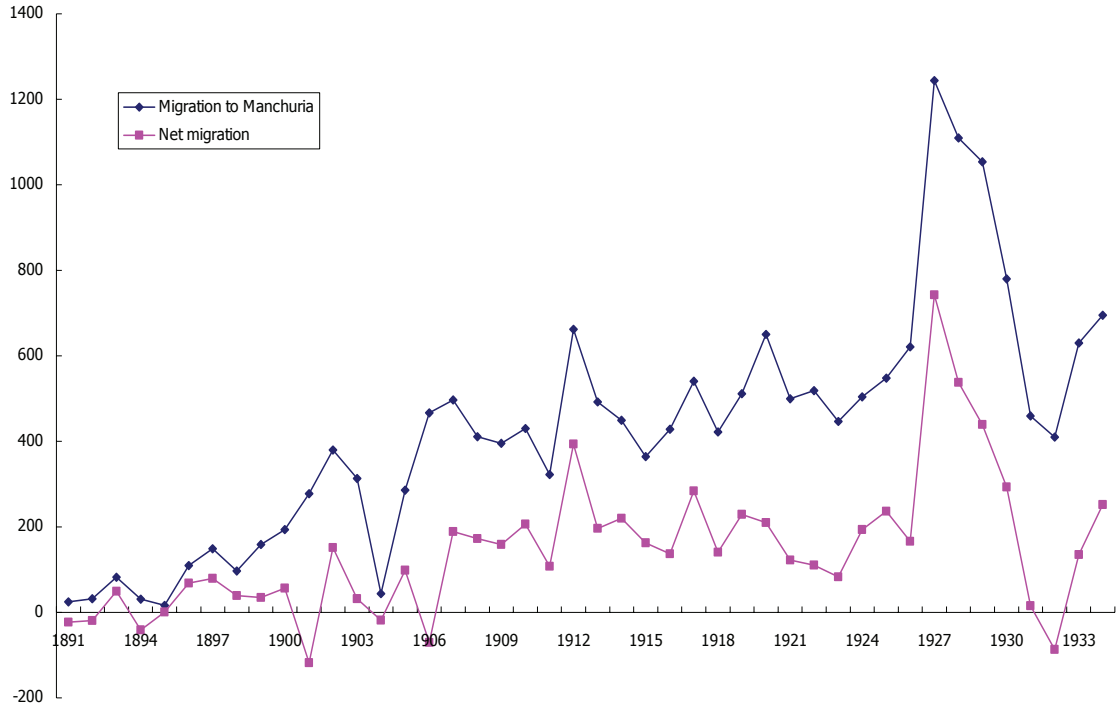
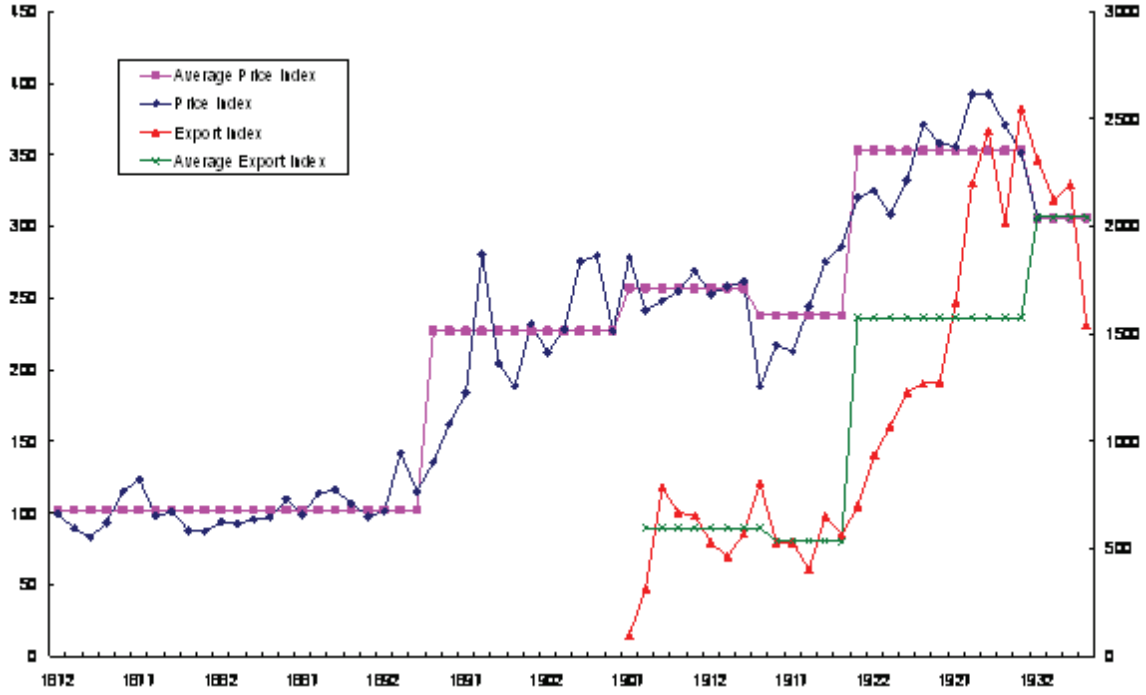
FIGURE 1
ANNUAL MIGRATION TO MANCHURIA, 1891 TO 1934



Source: Gottschang, "Economic Change," pp. 461-69.

FIGURE 2

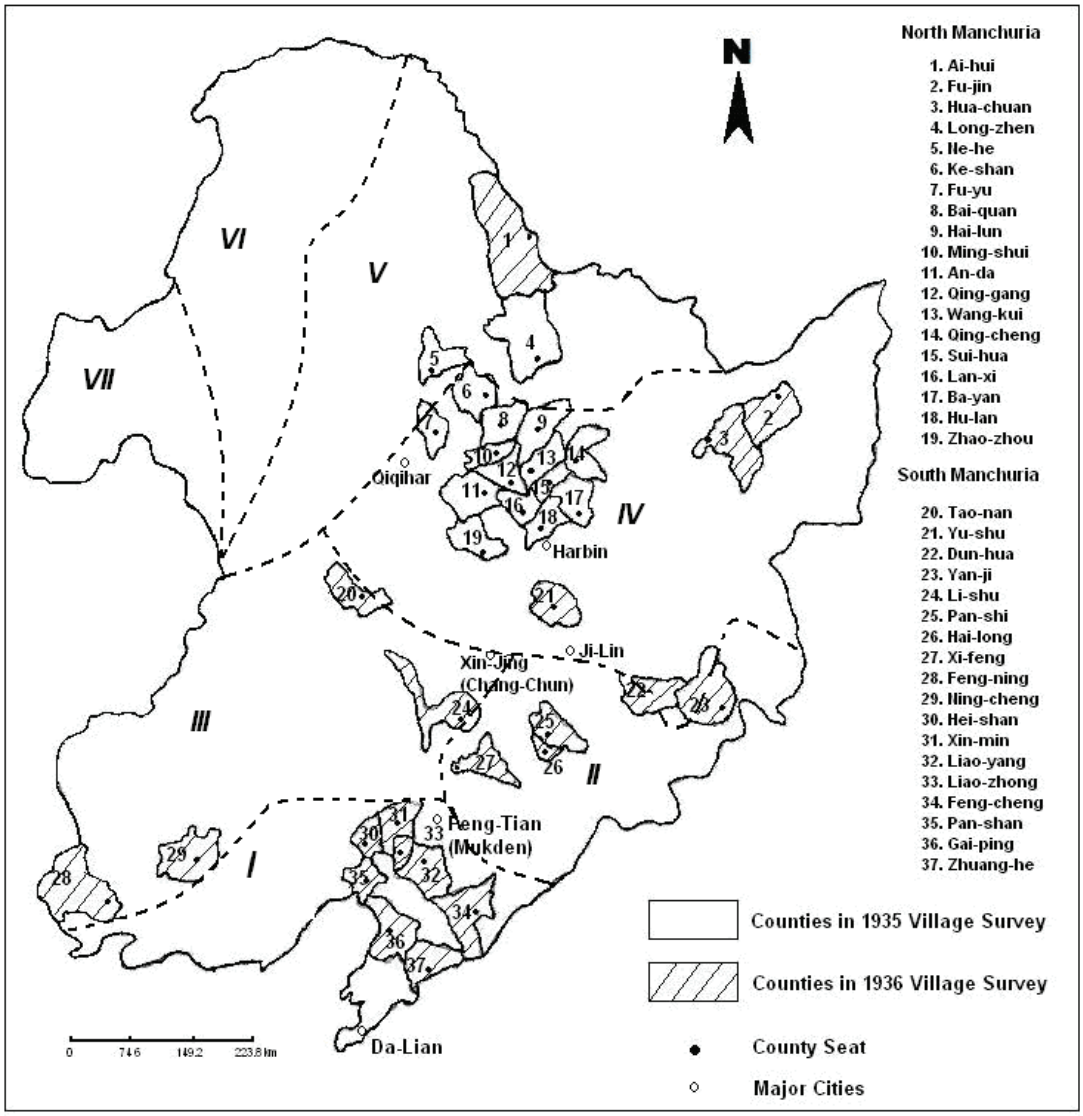
CHINESE SOYBEAN EXPORT AND PRICE INDICES, 1872 – 1935



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.

FIGURE 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*.

TABLE 1

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	31.72%	Taonan	25.40%
Huachuan	26.78%	Dunhua	17.60%
Fujin	17.58%	Panshi	37.90%
Hailun	29.51%	Yushu	32.40%
Wangkui	22.24%	Yanji (1)	17.10%
Siuhua	32.57%	Yanji (2)	5.10%
Qingcheng	1.71%	Zhuanghe	0.30%
Hulan	8.17%	Fengcheng	0.00%
Bayan	0.15%	Liaoyang	15.00%
Qinggang	6.45%	Liaozhong	16.40%
Lanxi	24.65%	Gaiping	2.10%
Anda	32.82%	Xinmin	8.50%
Zhaozhou	41.01%	Lishu	27.00%
Fuyu (1)	14.83%	Xifeng	20.40%
Fuyu (2)	2.34%	Hailong	36.90%
Nehe	37.03%	Heishan	3.90%
Baiquan	30.07%	Panshan	5.80%
Mingshui	27.92%	Fengning	0.00%
Keshan (1)	25.73%	Ningcheng	6.00%
Keshan (2)	15.80%	-	-
Keshan (3)	30.30%	-	-
Longzhen	16.00%	-	-

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 21.61% (standard deviation 0.12); the average proportion in South Manchuria is 14.62% (standard deviation 0.13); and the overall average proportion is 18.37% (standard deviation 0.13).

TABLE 2

SUMMARY STATISTICS FOR THE VARIABLES EMPLOYED IN THE REGRESSION ANALYSIS

Variables	Obs.	Mean	Std. Dev.	Min.	Max.
Socioeconomic Status (landlord=4; cultivator=3; tenant=2; laborer=1)	1516	2.49	1.02	1	4
Logarithm of land owned (unit: *shang*)	1612	1.30	1.60	0	7.47
Logarithm of houses owned	1618	0.78	0.92	0	4.49
Cohort dummy 1860-1895	1618	0.09	0.29	0	1
Cohort dummy 1895-1907	1516	0.10	0.30	0	1
Cohort dummy 1907-1915	1516	0.08	0.27	0	1
Cohort dummy 1915-1921	1516	0.11	0.31	0	1
Cohort dummy 1921-1931	1516	0.20	0.40	0	1
Cohort dummy 1932-1935	1516	0.23	0.42	0	1
Regional soybean cultivation dummy (suitable for planting soybeans=1)	1618	0.40	0.49	0	1
Logarithm of farm population (unit: *person*)	1618	1.73	0.60	0	4.22
Logarithm of time living in village (unit: *year*)	1515	2.79	1.64	0	5.86
Land per household in village (unit: *shang per household*)	1618	13.32	16.27	1.43	88.19
Logarithm of age of village (unit: *year*)	1618	4.39	0.88	1.61	5.65
Logarithm of distance to the county seat (unit: *li*)	1618	3.21	0.63	2.08	5.12
Industrialization dummy (industrialized area =1)	1618	0.54	0.50	0	1
Region dummy (South Manchuria=1)	1618	0.53	0.50	0	1

TABLE 3

PROPORTION OF ACREAGE SOWN WITH SOYBEAN BY DIFFERENT FARM SIZES IN MANCHURIA IN THE 1930S

Farm Area (unit: *mu*)		Manchuria	South Manchuria	North Manchuria
0~1.5		41	28	13
	mean	0.0%	0.0%	0.0%
	sd.	0.000	0.000	0.000
1.5~3		72	20	52
	mean	0.0%	0.0%	0.0%
	sd.	0.000	0.000	0.000
3~15		203	81	122
	mean	1.8%	2.9%	1.0%
	sd.	0.103	0.135	0.076
15~45		337	216	121
	mean	6.8%	7.4%	5.8%
	sd.	0.161	0.164	0.157
45~180		389	252	137
	mean	13.1%	11.2%	16.6%
	sd.	0.175	0.168	0.181
180~525		211	113	98
	mean	16.1%	10.3%	22.8%
	sd.	0.158	0.137	0.153
525~900		77	31	46
	mean	16.7%	13.1%	19.1%
	sd.	0.141	0.151	0.131
>900		75	36	39
	mean	19.4%	13.8%	24.5%
	sd.	0.135	0.103	0.141
Total		1405	777	628
	mean	9.9%	8.7%	11.4%
	sd.	0.160	0.154	0.165

Source: Manchuria Village Surveys in the 1930s.

TABLE 4

SOYBEAN COMMERCIALIZATION AND HOUSEHOLD WELFARE, BASELINE ESTIMATES

Dependent Variable	Socio-economic Status (1)	Socio-economic Status (2)	Owned land (log) (3)	Owned land (log) (4)	Housing (log) (5)	Housing (log) (6)
DID estimators						
Sown area of soy× migration (1860-1894)	-0.399	-0.500*	-0.392	-0.818**	-0.199	-0.260
	(0.277)	(0.303)	(0.307)	(0.311)	(0.200)	(0.208)
Sown area of soy× migration (1895-1907)	0.163	0.048	0.724**	0.313	0.484**	0.347*
	(0.290)	(0.310)	(0.353)	(0.341)	(0.224)	(0.233)
Sown area of soy× migration (1908-1915)	-0.122	-0.320	0.001	-0.395	0.219	0.108
	(0.321)	(0.340)	(0.388)	(0.353)	(0.227)	(0.230)
Sown area of soy× migration (1916-1920)	0.005	-0.080	1.091***	0.793**	0.346*	0.283
	(0.279)	(0.295)	(0.324)	(0.307)	(0.197)	(0.196)
Sown area of soy× migration (1921-1931)	0.458**	0.447**	0.886***	0.557**	0.391***	0.343**
	(0.240)	(0.260)	(0.264)	(0.249)	(0.165)	(0.166)
Sown area of soy× migration (1932-1934)	0.222	0.137	0.668***	0.265	0.349**	0.257
	(0.232)	(0.253)	(0.245)	(0.235)	(0.156)	(0.158)
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	218.68	9.34	24.87	8.92	17.25
Adj. R-squared / Pseudo R-squared	0.025	0.057	0.074	0.2404	0.072	0.1876

Notes: 1. Columns (1) and (2) are Ordinal Probit models; columns (3), (4), (5) and (6) are OLS models. 2. Control variables include the endowment of each village measured by the ratio of land to population, the age of the village, the distance of to the county town, an industrialization dummy variable and a regional dummy variable. 3. Constant terms are not reported.

Robust standard error in parentheses.

** Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.*

TABLE 5

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***	145.971***
	(1.994)	(38.243)
Average rain fall during production cycle (log)	-26.309***	-109.744***
	(0.942)	(29.443)
pH value of the soil	-20.874***	-81.093***
	(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 (1)	Socio-economic Status (2)	Owned land (log) (3)	Owned land (log) (4)	Housing (log) (5)	Housing (log) (6)
DID estimators						
Sown area of soy× migration (1860-1894)	0.139	0.058	0.433	-0.325	0.141	-0.054
	(0.306)	(0.283)	(0.480)	(0.389)	(0.274)	(0.235)
Sown area of soy× migration (1895-1907)	0.964***	0.976***	0.972*	0.442	0.853***	0.745***
	(0.342)	(0.344)	(0.540)	(0.448)	(0.308)	(0.285)
Sown area of soy× migration (1908-1915)	1.505***	1.198***	1.716***	0.899*	1.046***	0.673**
	(0.403)	(0.382)	(0.637)	(0.507)	(0.362)	(0.315)
Sown area of soy× migration (1916-1920)	0.355	0.340	1.238**	0.486	0.749**	0.607**
	(0.389)	(0.377)	(0.628)	(0.503)	(0.359)	(0.304)
Sown area of soy× migration (1921-1931)	0.754***	0.720***	1.137**	0.566**	0.749***	0.695***
	(0.316)	(0.306)	(0.503)	(0.428)	(0.287)	(0.246)
Sown area of soy× migration (1932-1934)	0.638**	0.582**	0.661	0.274	0.534**	0.493**
	(0.292)	(0.275)	(0.456)	(0.331)	(0.265)	(0.218)
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	15.94	7.96	22.67	9.13	20.96
Adj. *R-squared* / Pseudo *R-squared*	0.0293	0.1248	0.041	0.2313	0.053	0.1827

Notes: 1. In panel A, models (1) and (2) are Probit models; control variables include the endowment of the village measured by ratio of land to population, its age, the distance to the county town, 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 the village's endowment as in panel A. 3. Constant terms in panels A and B are not reported.

Robust standard errors in parentheses

** Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.*

TABLE 6
SOYBEAN COMMERCIALIZATION AND HOUSEHOLD WELFARE IN NORTH AND SOUTH MANCHURIA, BASELINE ESTIMATES

Dependent Variable	*North Manchuria*			*South Manchuria*		
	Socio-economic Status (1)	Owned land (log) (2)	Housing (log) (3)	Socio-economic Status (4)	Owned land(log) (5)	Housing (log) (6)
DID estimators						
Sown area of soy× migration	-	-	-	0.112	-0.680*	-0.152
(1860-1894)	-	-	-	(0.342)	(0.412)	(0.259)
Sown area of soy× migration	0.685	1.476***	0.592*	0.450	0.621	0.389
(1895-1907)	(0.462)	(0.506)	(0.340)	(0.357)	(0.422)	(0.265)
Sown area of soy× migration	0.313	0.885*	0.451	1.152***	0.817**	0.521**
(1908-1915)	(0.496)	(0.488)	(0.339)	(0.405)	(0.482)	(0.303)
Sown area of soy× migration	1.221***	2.884***	0.775***	0.473	0.800*	0.529**
(1916-1920)	(0.443)	(0.431)	(0.300)	(0.428)	(0.487)	(0.306)
Sown area of soy× migration	1.928***	2.744***	1.046***	0.444	0.260	0.187
(1921-1931)	(0.422)	(0.374)	(0.264)	(0.314)	(0.363)	(0.228)
Sown area of soy× migration	1.333***	2.330***	0.851***	0.776***	0.492	0.452**
(1932-1934)	(0.414)	(0.362)	(0.256)	(0.287)	(0.335)	(0.211)
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	169.19	27.44	17.43	86.73	16.99	10.43
Adj. *R-squared* / Pseudo *R-squared*	0.093	0.325	0.261	0.046	0.281	0.187

Notes: 1. Columns (1) and (4) are Ordinal Probit models; columns (2), (3), (5) and (6) are OLS models; 2. Control variables include the endowment of each village measured by the ratio of land to population, the age of the village, the distance of to the county town and an industrialization dummy variable. 3. Constant terms are not reported. *Robust standard error in parentheses.*

** Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.*

TABLE 7

SOYBEAN COMMERCIALIZATION AND HOUSEHOLD WELFARE, SEPARATE FOR NORTH AND SOUTH MANCHURIA, INSTRUMENTED EVIDENCE

Dependent Variable	*North Manchuria*			*South Manchuria*		
	Socio-economic Status (1)	Owned land (log) (2)	Housing (log) (3)	Socio-economic Status (4)	Owned land (log) (5)	Housing (log) (6)
DID estimators						
Sown area of soy× migration	-	-	-	0.731**	-0.522	0.130
(1860-1894)	-	-	-	(0.304)	(0.459)	(0.298)
Sown area of soy× migration	2.383**	2.000	1.296	1.281***	0.818	0.797**
(1895-1907)	(1.013)	(1.395)	(0.790)	(0.376)	(0.562)	(0.365)
Sown area of soy× migration	3.284**	3.265*	1.839*	1.562***	1.086**	0.783**
(1908-1915)	(1.338)	(1.930)	(1.060)	(0.367)	(0.555)	(0.361)
Sown area of soy× migration	2.017	2.860*	1.250	1.248***	1.047*	0.863**
(1916-1920)	(1.138)	(1.528)	(0.866)	(0.440)	(0.625)	(0.406)
Sown area of soy× migration	3.581***	4.314***	1.593**	1.212***	0.637	1.190***
(1921-1931)	(1.048)	(1.423)	(0.807)	(0.321)	(0.473)	(0.308)
Sown area of soy× migration	2.316**	2.999**	1.230	1.452***	0.831**	1.062***
(1932-1934)	(1.032)	(1.406)	(0.788)	(0.282)	(0.423)	(0.275)
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	8.36	16.35	13.47	6.17	17.04	11.16
Adj. *R-squared* / Pseudo *R-squared*	0.098	0.278	0.213	0.0647	0.2801	0.1301

Notes: 1. Columns (1) and (4) are Ordinal Probit models; columns (2), (3), (5) and (6) are OLS models. 2. Control variables include the size of the household, the time living in Manchuria, the endowment of the village measured by the ratio of land to population, its age, the distance to the county town and an industrialization 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

** Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.*

Appendix 1

SUMMARY OF MANCHURIAN SURVEY VARIABLES EMPLOYED IN THE REGRESSIONS

	Variables	Units
Table 1.	***Summary of Farm Households***	
	Socio-economic status	
	Population	*person*
	Male	*person*
	Female	*person*
Table 2.	***Kinship and Family History***	
	Kinship	
	Place of birth	
	Class status of ancestors	
	Time to Manchuria	*years*
	Reasons for migration	
	Class status in village	
	Reasons for settling in village	
	Time of settlement in village	*years*
Table 6.	***Summary of Lands***	
	Cultivated land	*shang*
	Total arable land	*shang*
	Total wasteland	*shang*
	Total uncultivated land	*shang*
	Other land	*shang*
	Total land	*shang*
Table 7.	***Housing and Production Tools***	
	Kind of housing	
	Number of houses	
	Number of farmhouses	
Table 12.	***Sown Area and Output of Products***	
	Total sown area	*shang*
	Total unharvested area	*shang*
	Sown area of soy	*shang*
	Unharvested area of soy	*shang*
	Output of soybeans	*dan*

Source: All tables from *Manchuria Villages Survey*.

Appendix 2

TABLE A2.1

MIGRATION PERIODS

Period of migration	Sample size	Percentage
period 1: before 1860	321	19.70%
period 2: 1860-1894	175	10.70%
period 3: 1895-1907	162	9.90%
period 4: 1908-1915	107	6.60%
period 5: 1916-1920	156	9.60%
period 6: 1921-1931	347	21.30%
period 7: 1932-1935	363	22.30%

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

TABLE A2.2

CORRELATIONS AMONG THE DEPENDENT VARIABLES

	Socio-economic Status	Owned land	Housing property
Socio-economic status	1.000		
Owned land	0.695***	1.000	
Housing	0.562***	0.715***	1.000

**** Significant at the 1% level.*

TABLE A2.3

LABOR AND LAND MARKETS IN MANCHURIA IN THE 1930S

		North Manchuria	South Manchuria	Manchuria
Panel A	*Labor Market (hired laborers as a percentage of total labor force)*			
	Hired-in	34.84%	20.41%	29.00%
		(0.163)	(0.208)	（0.212）
	Hired-out	43.05%	41.10%	43.60%
		(0.180)	(0.338)	(0.244)
Panel B	*Land Market (rent land as a percentage of total cultivable land)*			
	Rent-in	41.67%	31.30%	36.80%
		(0.352)	(0.273)	(0.321)
	Rent-out	26.63%	45.10%	35.80%
		(0.183)	(0.329)	(0.278)

Note: Standard deviations in parentheses.

TABLE A2. 4

REGRESSION OF THE DEPENDENT VARIABLES ON VARIOUS INSTRUMENTAL VARIABLES

Dependent Variables	Socio-economic Status (1)	Owned land (log) (2)	Housing (log) (3)
Panel A: Baseline Estimation			
Independent Variables			
Average temperature during production cycle (log)	-0.862	-6.463**	-1.133
	(1.989)	(2.461)	(1.480)
Average rainfall during production cycle (log)	0.331	2.722*	0.353
	(0.972)	(1.167)	(0.723)
pH of the soil	0.723	0.761	-0.143
	(0.753)	(0.908)	(0.586)
Control variables			
Characteristics of households, villages and counties	yes	yes	yes
Number of Obs.	1418	1510	1515
LR chi-squared / F-statistic	203.62	33.65	32.03
Adj. *R-squared* / Pseudo *R-squared*	0.05	0.23	0.17
Panel B: Two-Stage Least Squares with IV			
Independent Variables			
Average temperature during production cycle (log)	-3.559	-5.029	-2.925
	(2.761)	(3.159)	(1.802)
Average rainfall during production cycle (log)	2.024	1.540	1.468
	(1.629)	(1.679)	(0.967)
pH of the soil	2.144	-0.296	0.791
	(1.374)	(1.356)	(0.805)
Control variables			
Characteristics of households, villages and counties	yes	yes	yes
Number of Obs.	1418	1510	1515
LR chi-squared / F-statistic	20.74	34.37	31.18
Adj. *R-squared* / Pseudo *R-squared*	0.118	0.219	0.163

Notes: 1. Model (1) is an Ordinal Probit model; models (2) and (3) are OLS models. 2. The control variables included the endowments of each village measured by the ratio of land to population, its age, distance to the county town, an industrialization dummy variable and a region dummy variable. 3. Constant terms are not reported. 4. 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. *Robust standard errors in parentheses*

** Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.*

Appendix 3

TABLE A3.1

SOYBEAN COMMERCIALIZATION AND HOUSEHOLD WELFARE, BASELINE ESTIMATES (Small Sample Robustness)

Dependent Variable	Socio-economic Status (1)	Socio-economic Status (2)	Owned land (log) (3)	Owned land (log) (4)	Housing (log) (5)	Housing (log) (6)
DID estimators						
Sown area of soy× migration (1860-1894)	-0.717	-0.641	-0.694	-0.618	-0.407	-0.258
	(0.312)	(0.316)	(0.444)	(0.393)	(0.233)	(0.231)
Sown area of soy× migration (1895-1907)	0.295	0.185	0.579	-0.004	0.238	0.021
	(0.326)	(0.334)	(0.470)	(0.421)	(0.276)	(0.248)
Sown area of soy× migration (1908-1915)	0.054	0.070	0.004	-0.237	0.249	0.198
	(0.340)	(0.347)	(0.487)	(0.436)	(0.282)	(0.256)
Sown area of soy× migration (1916-1920)	0.473	0.406	1.817***	1.274***	0.604**	0.416*
	(0.316)	(0.326)	(0.444)	(0.402)	(0.267)	(0.237)
Sown area of soy× migration (1921-1931)	0.641***	0.725***	1.159***	0.790***	0.504***	0.462**
	(0.258)	(0.265)	(0.365)	(0.328)	(0.198)	(0.193)
Sown area of soy× migration (1932-1934)	0.406	0.415	0.729**	0.313	0.286	0.177
	(0.249)	(0.257)	(0.352)	(0.319)	(0.176)	(0.187)
Control Variables						
Characteristics of households, villages and counties	*no*	*yes*	*no*	*yes*	*no*	*yes*
Number of Obs.	898	897	952	951	957	956
LR chi-squared / F-statistic	87.62	158.22	8.32	21.3	8.55	17.6
Adj. *R-squared* / Pseudo *R-squared*	0.037	0.0671	0.103	0.300	0.094	0.258

Notes: 1. Columns (1) and (2) are ordinal Probit models; columns (3), (4), (5) and (6) are OLS models. 2. Control variables include the endowment of the villages measured by the ratio of land to population, the age of the village, the distance to the county town, and industrialization dummy variable and a region dummy variable. 3. Constant terms are not reported.
Robust standard error in parentheses.

** Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.*

TABLE A3.2
SOYBEAN COMMERCIALIZATION AND HOUSEHOLD WELFARE, INSTRUMENTAL EVIDENCE (Small Sample Robustness)

Dependent Variable	Socio-economic Status (1)	Socio-economic Status (2)	Owned land (log) (3)	Owned land (log) (4)	Housing (log) (5)	Housing (log) (6)
DID estimators						
Sown area of soy× migration (1860-1894)	0.139	0.116	0.380	0.499	0.012	0.039
	(0.306)	(0.317)	(0.480)	(0.505)	(0.333)	(0.264)
Sown area of soy× migration (1895-1907)	1.369***	1.527***	1.082	0.095	0.833**	0.632
	(0.428)	(0.421)	(0.641)	(0.651)	(0.407)	(0.368)
Sown area of soy× migration (1908-1915)	2.059***	2.180***	2.306**	2.294***	1.349***	1.354***
	(0.580)	(0.573)	(0.776)	(0.841)	(0.545)	(0.491)
Sown area of soy× migration (1916-1920)	0.488	0.612	1.440	1.297	1.287**	1.492***
	(0.608)	(0.546)	(0.881)	(0.892)	(0.601)	(0.567)
Sown area of soy× migration (1921-1931)	1.055***	0.967***	1.463**	1.490***	1.045***	1.078***
	(0.372)	(0.341)	(0.574)	(0.538)	(0.346)	(0.295)
Sown area of soy× migration (1932-1934)	0.749**	0.855***	0.375	0.600	0.300	0.533*
	(0.342)	(0.312)	(0.424)	(0.477)	(0.317)	(0.244)
Control Variables						
Characteristics of households, villages and counties	*No*	***Yes***	*No*	***Yes***	*No*	***Yes***
Number of Obs.	898	897	952	951	957	956
LR chi-squared / F-statistic	7.5	12.7	6.9	19.7	9.7	21.1
Adj. *R-squared* / Pseudo *R-squared*	0.027	0.112	0.038	0.254	0.066	0.223

Notes: 1. Models (1) and (2) are Ordinal Probit models; the control variables included the endowment of each village measured by the ratio of land to population, the age of the village, its distance to the county town, an industrialization dummy variable and a region dummy. 2. Average rainfall, average temperature and soil pH were employed as the instrumental variables; 3. Constant terms are not reported.
Robust standard errors in parentheses

** Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.*