LUND UNIVERSITY

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New Evidence of Deliberate Fertility Control in Colonial Taiwan: Dajia 1906-1942

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Abstract

This paper deals with the disputable issue of the existence of Malthus' Preventive Check in Chinese population. With the help of a newly established historical database (Demographic Database of Colonial Taiwan, DDCT), which currently including the individual level data regarding to the socio-demographic backgrounds of the registered population in fifteen townships in North and Western Taiwan, we thus are allowed to learn about the birth histories of colonial Taiwan. In combination with the fluctuations of monthly food prices of the North and Western Taiwan, we are capable of detecting the fertility response to the short term economic stress for Taiwan's population, one branch of the Chinese population, in the past. In our research area (Dajia), we find an obvious fertility response for families with lower social statuses shortly after price change for our entire study period. It thus had provided us an implication that Chinese population had practiced deliberate birth control in pre-transitional period. We believe the constraints of population growth were, however, dictated not only by a set of factors, composed by poverty-induced spouse separation, malnutrition and prolonged breast feeding, but also by deliberate fertility control.

Keywords: deliberate fertility control, colonial Taiwan, Malthusian paradigm, Cox PH model.

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Chapter 1

Introduction

Aim and scope

One of the most controversial issues in historical demography is whether childbearing behaviors of Chinese people were deliberately controlled. The famous demographer Thomas Robert Malthus has indicated that the force constraining the Chinese population is mainly driven by the positive checks, which are infanticides, starvation, illness, and deaths etc. It might be true during the time of his observation, but it doesn't mean that the habit of thinking and the norm of childbearing behaviors for Chinese population will not evolve when time passed by, especially after parents witnessing several of their children die because of the illness or die in their hands (infanticide) without doing anything to stop the miseries. For this reason, we wonder when people began to know the method to avoid the unwanted child, said by temporary abstinence or any other methods of deliberate birth control before 1954 (the time the family planning program has implemented in Taiwan officially).

In this paper, we measure the presence of deliberate fertility control of the population in central Western Taiwan by the fertility response to short-term economic stress. The topic is interesting of studying for several reasons. First is that the Taiwan's historical population can act as a substitute research site for researchers who are interested in the Chinese population, for very little demographic data was available in Mainland China before 1953.[1] Furthermore, the understanding of the birth histories in Taiwan will enhance our knowledge about the issues of fertility patterns in Chinese population, where very little effort has been done toward a systematic study of this topic. A third reason for studying fertility control is that it renders us a chance to have a deeper knowledge of the heterogeneous fertility patterns of the population with different socio-economic status (SES). So far, the similar researches with micro level analysis have been studied basing on a genealogical database featured by the Qing nobilities lived in North-Eastern China (Bengtsson and Dribe 2010; Wang and Campbell et al. 2010; Campbell and Lee 2005; Wang and Lee et al. 1995).

More specifically, the aim of this work is to clarify which kind of constraints (preventive check or positive check) that was dominated in the colonial Taiwan.[2] Besides providing a picture of how people with various socio-demographic backgrounds will be

[1] The earliest census published in Mainland China was in 1953

[2] Taiwan had been colonized by Japan for fifty years, which is from 1895 to 1945.

analyzed multivariately, using a longitudinal micro level dataset for the town Dajia located in Taiwan.

Within this more general framework, this paper is aiming to detect the deliberate control, if any, in Taiwan between 1906 and 1942. Data from the colonial household registration records, together with both the community-wide and national-wide grain price, a multivariate analysis will be applied in this study. Thus it will not be a study of aggregated level where the general fertility rates of the year are compared with the differences of the food price, but instead focus on the fertility responses from a household point of view. The analytical framework outline in Chapter five will demonstrate the connection between natural disasters and grain price fluctuation, and the deliberate birth control was actually practiced before the change of grain price. This conceptual idea is the most important framework in this paper, which was first introduced by the researchers in Lund University in Southern Sweden (Bengtsson and Dribe, 2006). The same method has also been applied to the topic study in six German towns (Dribe and Scalone, 2010). Although, this study is not the first paper seeking to find the clues of how the childbearing attitude of the Chinese families was formed (Wang and Lee et al. 1995) , but it is the first paper that is capable of detecting the connection of fertility control to the short term economic crisis, which would render us a great chance to end the continuous debates of which population check that was dominated in China, during the pre-transitional and transitional period,[3] which dated from 1906 to 1920, and 1921 to 1942. Special concern of this paper will also emphasize on indentifying the Taiwanese fertility from three different categories, which are “natural population,” “parity-specific controlled,” and “sex-specific controlled.” By understanding this, we thus could control for other forces that interplay in the decision making process of childbearing. The types of marriages are also important to be controlled and distinguished, for they also reflect the married couples’ attitude toward childbearing in a broader Chinese social context. A careful explanation about the marriages types and fertility patterns in Taiwan will be presented in Chapter 4. The empirical analysis will be made on a sample of two communities in a populated town Dajia in Middle Western Taiwan, for the period from 1906 to 1942. The places were chosen because the households live in the center of Dajia township are with a wide variety of occupational statuses, that our analysis in SES would not be too concentrated in only one side of the spectrum. The 1942 was chosen as the closing year of our study period is because the limit of grain price data.

The remainder of this chapter will be devoted to a brief sketch of the Malthusian assumption about population check in China and an overview of the previous topic researches. Later this paper will follow by Chapter 2, and it will provide a general

[3] The transitional period mentioned here indicate the “first demographic transition,” when the level of mortality started to decline, and the fertility had remained at a high level (see Appendix 1).

background of our research area over time and space, as well as the data and methods that will be used in this study. In Chapter 3, we will picture the path of the social and economic development of the research area over the period of time we are studied. Chapter 4 depict the specific social norms and settings in Chinese society that contribute to the formation of different types of marriages, and in each type of marriage, the timing and the level of fertility will thus be expected to perform in a different way compared to the others. Then in Chapter 5, a theoretical framework will be outlined. Chapter 6 portrait the features of weather, harvest outcome and grain price, followed by the empirical results corresponding to our research question shown in Chapter 7. Finally, the concluding remark will be present in the end of this paper.

Previous research on fertility patterns in historical China (before 1945)

While the limit of available demographic data about China has stunted the demographers who are interested in contemporary Chinese demography, the data problems probably are even more troublesome for historic demographers who want to look further back in the history. But fortunately, lineage genealogies datasets and slave registers records left from the last imperial period (Qing dynasty 1644-1911) were discovered, which put in new data source for analyzing Chinese historical demography. Demographers focused on China are thus capable of exercising the technique of 'family reconstitution' and establish the genealogical archive of those Qing nobilities. Wang, Lee and Campbell et al. 1995, were first used their genealogical archive of Qing nobilities for a pioneering study of detecting the deliberate fertility control of Chinese population. They had claimed, *late start, spacing and early stopping,* were the three main reasons that had led China's fertility level to be much lower than that of the European level between seventieth to twentieth century (Wang, Lee and Campbell 1995, table1, p.385). They also claimed that the Chinese population is very unlikely to be a natural population, because in their findings, those noble families are rational and risk averse and will intentionally regulate the timing of child birth on the grounds of the number of sons they already had, the livelihood of their previous child, and other sorts of gender preference factors (Wang, Lee and Campbell 1995). In other words, their study proclaims the Qing nobilities' attitudes toward childbearing are gender-selective (preference on sons) and were limited by parity-specific variables. Their results were striking and very quickly drawn attention from other scholars, as well as critics. Arthur P. Wolf (2001, 2006) had not only once debated with the revisionists' view of parity-specific limitation in China. In general, he totally disagree with the revisionists' three main arguments and believe the late start is very natural, 'for Chinese's tradition of early marriage, the young woman very often began her married life in a strange and often forbidding environment that may inhibit her sexual intercourse for couples weeks, but there is no way to believe anything would inhibited the Chinese sexuality' (Wolf 2001, p.144). His objected

view in long spacing is mainly laid in whether or not the longer interval is determined by calculus of conscious. His view of longer birth interval (compared with Northern and Western European countries) in China is not because of the deliberately reduced coital frequency, but due to some combination of uncontrollable factors as poor health, inadequate nutrition, heavy labor, and poverty-induced spousal separation (Wolf 2001, p.142). For his objection in regard to *late stopping*, the aggregated data of age at last birth from Zhao's study (Zhao 1997, pp.745-6) was extracted to buttress his point of view for no conscious birth planning in China. Therefore, he claimed the Qing nobilities was an extraordinary population and lack of representativeness to the whole Chinese population (Wolf 2001, p.148).

In Lee and Campbell 2005's article (adopted in Allen and Bengtsson et al. 2005, pp.403-27), had used another archive which based on the Chinese Bannermen's registration records compiled in Liaoning, for measuring the level of living standard in North-Eastern China. Under the comparative framework of Eurasia Project (EAP), the basic hypothesis of this paper was that Chinese population will be regulated by the economic situation and will respond accordingly to cost of living, as it already proven in European context (Galloway 1988; Bengtsson and Dribe 2004, Chapter 6). In Lee and Campbell's paper, they do find the fertilities in several communities in Liaoning respond negatively to the grain prices. However, as Lee and Campbell themselves mentioned in the article, for those children who died in their early infancy and most of the daughters were omitted in the lineage genealogy (Lee and Campbell 2005, p.409), that made the genealogical archive for Han Banner Army not a good data source for analyzing Chinese fertility, which has once again reflected the limit of reliable population data in studying Chinese demography and, meanwhile call for new data to settle the debate between revisionists and their opponents.

The archive of Taiwan's household registers data compiled by Japanese colonial government has served as excellent demographic data, not only for it contains abundant social demographic information about the registered population, but also for its exceptional accuracy among the current existed historical material of Chinese population. For those economic historians who are familiar with the micro data analysis, the archive of Taiwan's household registers database will offer them a chance to employ risk comparing model to assist them indentifying the determinants for different demographic performances among different SES groups over different time and space. Until now, three books had published based on the data this registers archive (Engelen and Wolf et al. 2005; Chung, Engelen and Wolf et al. 2006; Engelen and Hsieh 2007). The purpose of this set of publishers is to compare the demographic patterns across two sides of the continent, between East Asian countries and West European states (19th to early 20th centuries), where a large part of their empirical results had pointed out the length of birth interval is indifferent among the various social groups, nor does it has any different among couples with different family

compositions (Chapter 9 of Chung and Engelen et al. 2006, p.228, 234). On the ground of these findings, their conclusions regarding to Chinese population are consistent with the Wolf's arguments for there is no conscious spacing among Chinese married couples, and Chinese population is thus most likely to be a natural population. But, one perhaps the most serious deficiency of all the works mentioned above are more interested in answering "what mattered?" rather than "why mattered?" Because of that, their authors had devoted all their efforts to examine the socio-demographic variables that could possibly result to the prolonged birth interval, but fail to use the equivalent space for discussing the driving force of birth control (both conscious and unconscious). We believe the motivation of birth control, is intrinsic, crucial and worth more of our concerns when studying historical population.

A newly publish book (Tsuya, Wang, Alter and Lee et al. 2010) had endeavored to study the driving force that regulate the reproduction, by constructing multivariate models with inclusive of food price information and birth profile. A cross comparing framework thereafter, was established to detect the deliberate control in Northeastern China, Northern Japan, and their European counterparts in Southern Sweden, Belgium and Italy (Bengtsson and Dribe 2010, *Chapter 5* in *Prudence and Pressure*). However, since the birth profile in Chinese banner men's genealogies is not very complete, it is not allowed to detect the timing of fertility response in detail (for example, in a monthly or Seasonal basis) and is very difficult to distinguish among the effects of both the proactive and passive fertility controls. Because of this reason, our efforts in this paper will be mainly dedicated to make up for this deficiency by using a new data source in colonial Taiwan.

Chapter 2

Area and data

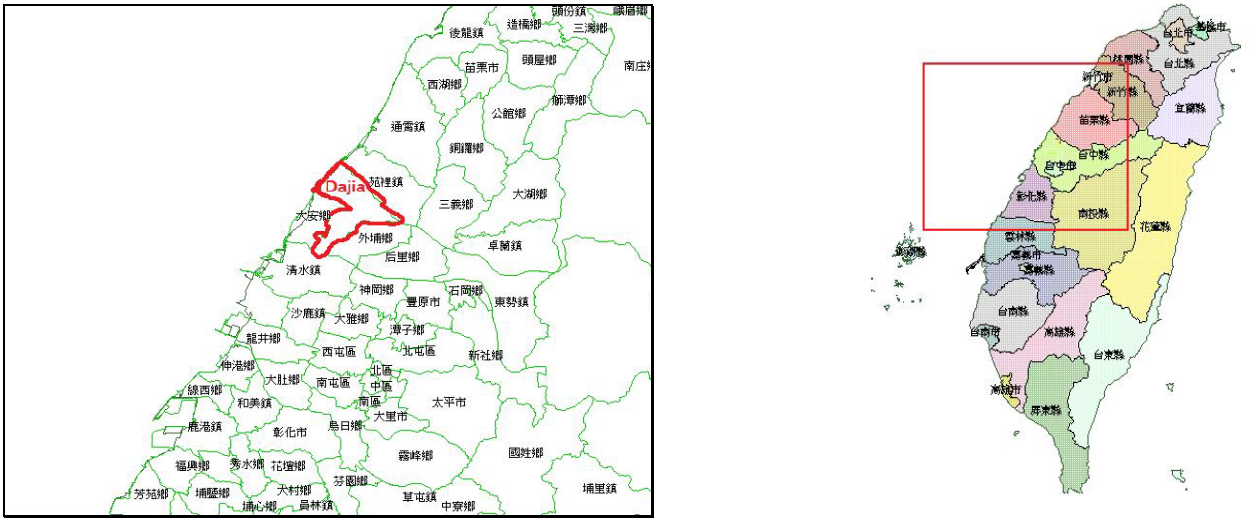
The area under study

Dajia is located in Taichung *hsien*, a county in the Western coast of Taiwan Island, and is one of the oldest towns in Taiwan. With abundant fertile soil and good weather condition, it began to draw Chinese migrants from Fujian province to settle in Dajia since 1669. During the early Qing dynasty, Dajia is already a populated and prosperous township, and also the religious and spiritual center of central Western Taiwan after the Dajia Mazu temple was

finished in 1730. [4] The average temperature of Dajia is 24 degree, which extends the growing season, allowing the cultivation of two and often more crops per year on a single piece of land.[5] In Qing dynasty, the types of agriculture products are mainly concentrated in growing both sugar cane and rice (Wang 1994),[6] for the farming knowledge and habits of agricultural cultivation in Dajia were inherited from their ancestors in Mainland China. Later under the governance of Japanese government, the composition of agriculture wasn't changed much. However, since the growth of population and economy, the center of Dajia had to expand several times to meet the need of better social and economic life.

The reasons why we choose Dajia as our research area have already self explained by the description above. Other than the abundant socio-demographic information we could acquire and learn from Dajia's population, the attainment of information for country level grain price is very crucial in our study, which we have to put extra consideration into. Since Dajia alone accounted for 3.6% of the total rice production in Taiwan in 1941, the large scale of farming yields, agricultural production and the attainable local-level rice price altogether lead to our final decision of "Dajia."

Figure 2.1 Administration boundary of Dajia (2010)



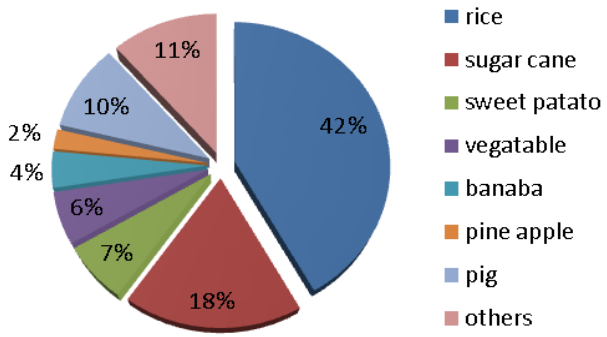
Source: GIS output of THCTS system (Taiwan History and culture in Time and space), Academia Sinica, Taiwan.

[4] This temple has made Dajia become the spiritual and religious center for central Taiwan in 1730, since then altogether 53 townships consider themselves to be part of this circle.

[5] Not include wheat, since Japanese had failed to grow different types of wheat in winter period, while the experiments in growing sweet potatoes were quite successful. (Bank of Taiwan 1957, p.59)

[6] The type of cultivation is mainly depends on the will of farmers. The rice farmers would change to grow sugar cane next year if they expect the price of sugar will rise in the next year.

Figure 2.2 Agriculture Production, 1944, Taiwan



Source: Taiwan's Grain Statistics Book (1942)

Data

The data in this study were obtained from the Demographic Database of Colonial Taiwan, DDCT)[7], where consist of the household registers data of nineteen townships in colonial Taiwan (1905-1945). Each township usually can be further divided into, more or less, a dozen villages. Our Dajia data were composed by households who inhibited in two villages located in the center of the town where just next to the railway station, and not very far from the Dajia Mazu temple. It is because the computerization is very time consuming that the research team in Academia Sinica has yet been able to take care of the households lived in the rural area. But, the households in downtown Dajia is already provided us sufficient sample to undergo micro level analysis (see Table 2.1).

Table 2.1 Registered based dataset in downtown Dajia (1906-1945).

	Numbers of population	Numbers of population (born after 1906)	Number of births (born after 1906) [8]	Number of births (born in downtown Dajia after 1906)
Total population	11562	7513	6089	5219
Men	5206	3418	3165	2725
Women	6356	4095	2924	2494

Source: Elaborated from the dataset used in this study.

Before starting data management, we would like to make several tests to see if the data in household registers is trustworthy. There are two reasons that could cause to

[7] Research Unit "Program for Historical Demography" (PHD) is established and annexed to the research institution Academia Sinica in 2003. And now, PHD is responsible the data computerization and other academic activities related.

[8] This figure includes the births that were not born in downtown Dajia. They probably migrate to downtown Dajia with accompany by their biological parents and their birth profiles thus appear in our registered dataset.

underestimation of child births. One is because of some parents practiced infanticide and therefore didn't report their childbirths intentionally.[9] Second, it could due to some families live too far from the township and their children had died before they report to the police office. Those parents very often choose not to report the Child birth (Wolf and Huang 1980). The infanticide is very limited in Dajia, since the sex ratio at birth is 109 boys to 100 girls in Dajia, which is not very far from the secondary sex ratio that usually assumed as 105, see Table 2.1. By checking the mortality rates of individuals in our dataset, thus could examine whether or not the mothers reported the deaths of their infant children to the Japanese police. Other data problem, such as gender selection effect can also be examined by the same method. In Figure 2.3, we found that the infant mortality rate are quite high among new born babies, and there is no clear difference between both gender in their first two years of age, which had served as the evidence that the registered based dataset for downtown Dajia is reliable for no clear sign of infanticide and thus free from the problem of underestimation. Second, we found the risk of dying is somewhat different after the infant child turn to the age of four. The boys seem to have more chance of staying alive compared with girls. And, we rather think this phenomenon was due to the parents treat boys and girls differently when rearing them, than to think it's a sign of infanticide. Because infanticide usually happens shortly after the child was born, and an elevated female mortality rate is however appeared after age of two (see Figure 2.3). Nevertheless, we would rather leave the detail reasoning to the future study because this is not the core question we are going to discuss in this paper.

The way how the dataset constructed in DDCT is very similar to SDD (Scanian Demographic Database) that arranged by the parish records, for it also contains the vital life events, such as position in a household (household head, mother, father, wife, husband, employee etc.), personal events (birth, death, marriage, adoption, enter family, exit family, cohabitation, criminal, etc.), the event date in the format of "year-month-day," and occupation titles etc. Besides, the registers also include the detail address information of where the family members moved from and moved to, ethnicity, marriage type, bound-feet,[10] and drug addiction etc,[11] so we could clearly portrait the way of living for the population we are investigated. It is a bit easier for us to put together all the information that reconstructing a whole family would required, in comparison to those built on the parish records (Dribe 2000, pp.23-5), because all above mentioned information was recorded in the

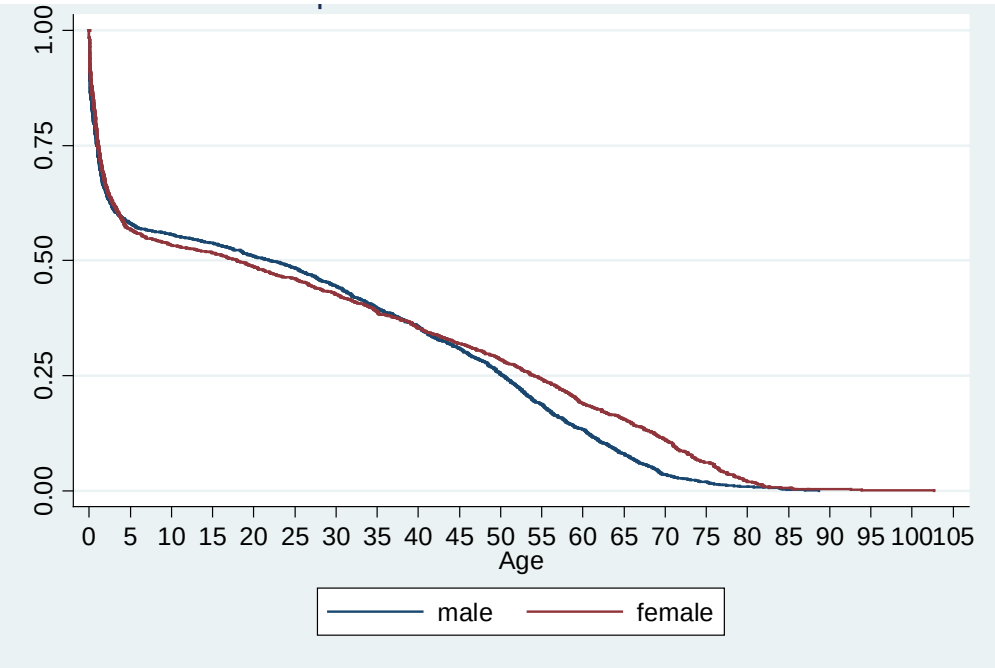
[9] The community-wide household registers records are maintained by local Japanese police office in each village during the colonial period.

[10] To be looked more attractive, traditional Chinese women were very often been forced to have their feet bound, but this tradition has been prohibited by Japanese colonial administration since 1911. (Chung and Wolf 1994, p.104)

[11] The import of Opium can't be completely banned in Qing dynasty. During colonial period, those who are already addicted to the drug can buy opium, but need to be registered. (Wang, 1994, pp.415-475)

household registers. Even so, our dataset still need to be managed to fulfill the need of this study.

Figure 2.3 Kaplan-Meier survival estimates for both sex, Dajia, birth year 1810-1945



Source: Elaborated from the dataset used in this study.

In order to connect the socio-demographic background of the each mother to each of their child birth, we create the birth profile for each mother by annexing the birth information (sex of child, date of birth and death, parity order) to the basic information of their biological mothers (date of birth, marriage, death, and occupation). For the SES backgrounds of their husbands are even more decisive to the choice of childbearing, therefore, we include them to the mothers' birth profile as well (Chen 2009).

Figure 2.4 The Episodes Created for Analyzing Birth Events, with No Return Migration.

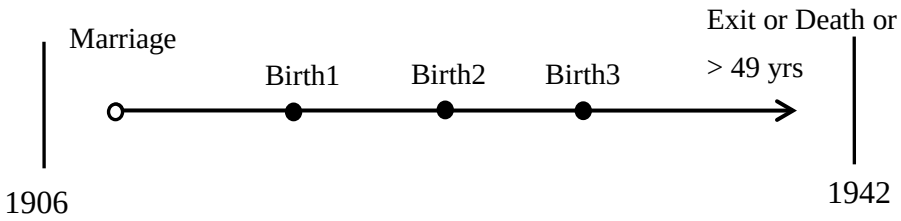
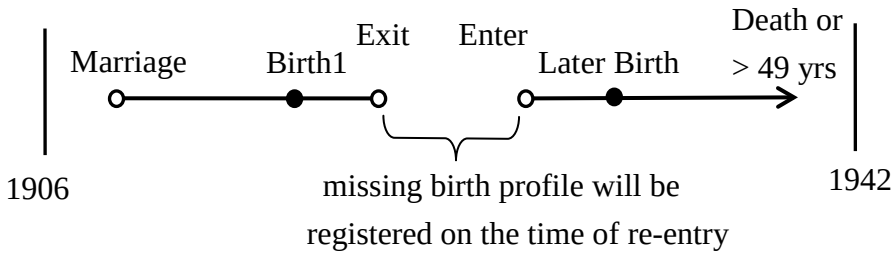


Figure 2.5 The Episodes Created for Analyzing Birth Events, with Return Migration.



For we are preparing for an event-history analysis, we have created several episodes for those mothers who have more than one child (see Fig 2.4). For some households, they migrated out of the research area and thereafter return. We use a different method to split the episodes (see Figure 2.5). For those women with no return migration, the first episode begins by the date of marriage to the date of their first birth. Second episode stems from the date of first birth to that of the second birth, and the same logic for the forthcoming child births. Three episodes will be generated if one mother has three children. And in the end, a specific date "end_date" will be created by four criterions to specify the time when a mother no longer fertile, out-migrated, or died before the upper limit of our study period. First, if a mother died before her fertile age (49 yrs), the "end_date" will be referred to the date of death. Second, if a mother out migrated before her fertile age, the "end_date" will be referred to the date of out-migration. Third, if a mother died after her reached to her fertile age, the "end_date" will be referred to her 49th birth date. Fourth, a mother neither died or reached her fertile age before 1942, we restrict the "end_date" to 31th of September in 1942, for our price index (with one year of lag) was extended from 1906 to 1942.[12] The further explanation about the rice price index will be shown in Chapter 6. Alternatively, for those women return to the research area some time after out-migration (see Figure 2.5). We still consider the women in the period of out-migration are exposed to the risk of childbearing, for many cases in Dajia, the women returned usually accompanied with their children. For these women, the birth file during out-migration period, very often, could be restored. In Table 2.1, there are more than 800 migrants whose was born from other villages, and migrate to downtown Dajia with their biological parents, during 1906-1945.

We also split the study period into two sub-periods, one from 1906 to 1920, and the other from 1921 to 1942, for the reason that 1920 is the turning point of first demographic transition in Taiwan (see Appendix 1). By doing so, we could distinguish the fertility patterns of the time prior to and during transitional period. Besides, we exclude those

[12] We are not sure about why the colonial administration didn't publish the regional price index for period 1943-1945. The possible reason could be because of the outbreak of Asian Pacific War.

women who have their first child birth before they had married, the so called illegitimate births, for we only concern the fertility within the marriage. However, since the illegitimate births is uncommon in our study period (Engelen and Hsieh 2007, p.83 & 90), there are only 46 out of 6356 women been excluded from this study.

It might be suggested that in some cases, the women we are censored are pregnant but not able to give births eventually, for they experienced fetal deaths. For we have no information to identify the specific events as fetal births. We thus restrict our study to consider the women experienced fetal deaths, are under the risk of childbearing.

Chapter 3

Social and economic background

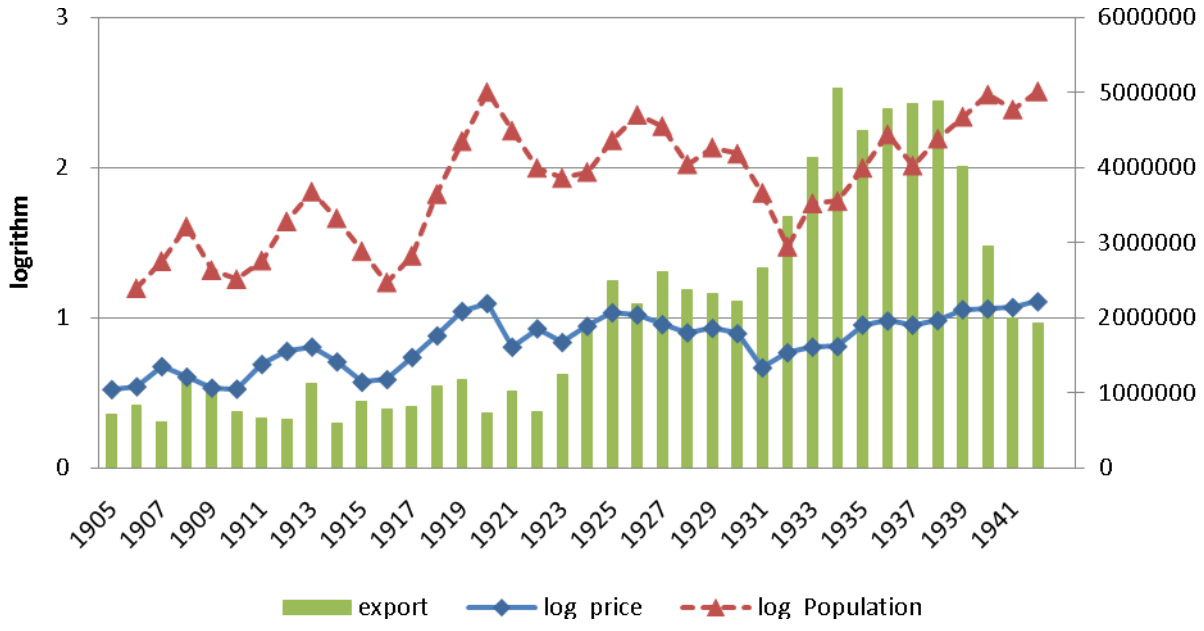
Economic development in Taiwan 1906-1942

The population of Taiwan in 1906 is about 3 million people (3,075,375). From the earlier colonial period of 1906-1920, the increase level of population is rather high but not very stable Taiwan through the first half of the colonial period, which was vibrated between 1.1 and 2.5 each year in logarithmic scale (see Fig.3.1). However, in the second half of the colonial period of 1921-1942, the growth of population is getting more stable and even faster than the previous period, by around 2.5 each year. At the same time, rice prices increased rapidly as well. But it's largely due to a gradual increase of rice exports to Japan production through the colonial period (See Fig.3.1). The rice exports before 1920 was relatively low compared to that of after 1920, which is because the taste of Taiwanese native rice is quite different from that of in Japan. It took quite many efforts for the colonial authority, about 30 years to find the suitable type of rice that would be welcome in Japan, and at the same time, could also adapted to Taiwan's climate. Ponlai rice (Japónica type) was successfully cultivated in Taiwan in 1925. It hence had conquered the butterflies in Japanese stomach soon after and gradually replaced the importance of native rice. But, while the rice exports boomed after 1925, the native workers' wage level didn't seem to be improved much and is highly influenced by the fluctuation of rice price (see Figure 3.1). Nevertheless, about forty years of high population growth without a constant decline in real wages, was made possible only by a remarkable economic growth and improvement of technologies in agricultural sectors, as well as industrial sectors; especially when during 1926-1935, both

population growth and real wage were maintained at its highest level among the entire colonial period.

The development path of economic growth during colonial period can roughly be divided into three periods (Bank of Taiwan 1969, pp.2-10). First period is from 1895 to 1905, when colonial government had tried to introduce many systems which is not existed in former Qing Empire's rules, such as unified the units of measurement to be accorded with standard of Japan, reorganized monetary system (set up bank system), reformed land system (property right, cadastral survey, land registration and land rent unification, etc.), and established the essential laws and regulations to secure the full implementation of capitalist market would function well in Taiwan. Furthermore, in second episodes 1906-1925, the main development plan of colonial government is to make Taiwan become one of the major suppliers for Japanese food market and commercialize the agricultural products, such as rice and sugar, by introducing modernized irrigation facilities, modifying the methods of production. During this time period, the productivity in agricultural sector had increased remarkably. During the third period from 1926 to 1935, it is the time to reap the harvest of the earlier polices implemented. The population in 1926 to 1935 had increased around one million people (from 4010485 to 4990131),[13] which was mainly due to both the increase of child births and the fast speed of mortality decline (see Appendix 1) driven by the economic growth and the improvement of public hygiene.

Figure 3.1 Log of Population, Log of Rice Price and Rice Exports in Taiwan, 1905-1942

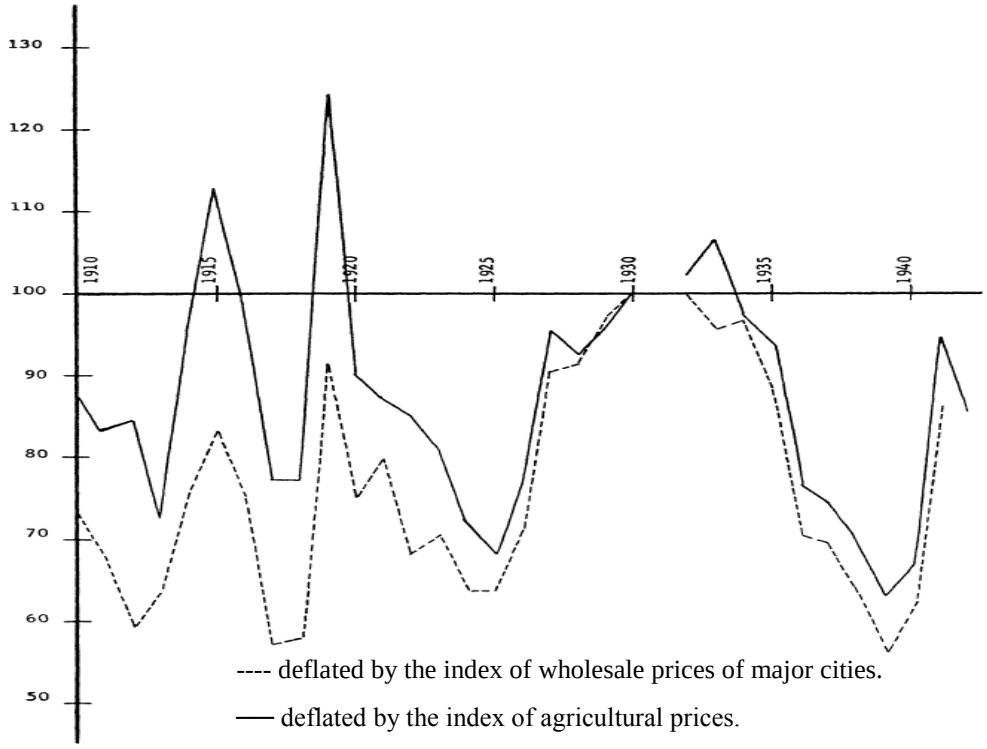


Source: Population Studies of Taiwan (1951), Production Department (1943) and Taiwan

[13] The figures are extracted from the book "Statistical Abstract of Taiwan Province for the Past 51 Years," which do not include the Koreans, Japanese and newly coming Chinese migrants.

(1943).

Figure 3.2 Index of Agricultural Real Wage, 1910-1941 (price of 1930=100).



Source: Ho (1968), p.334

The dynamic of economic growth in the colonial period was mainly come from the increase of agricultural production. In late 1930's, the agricultural sector alone had directly provided employment to nearly 70 percent of the Taiwanese male labor force and contributed over 50 percent of the island's production of goods by value (Ho 1968, p.313). The agricultural transformation in colonial Taiwan can be attributed to technology changes that had begun since the very beginning of the colonization in 1898 (Bank of Taiwan 1969, pp.11-29). The first achievement of colonial government is the introduction of basic infrastructure in agriculture, such as the modern irrigation facilities and services, which had increased the irrigated covered ratio from 28.17% in 1903 to 63.13% in 1941 (Bank of Taiwan 1958, p.30). The second achievement is the innovation of labor-using technologies, such as double cropping, crops rotation schemes, chemical fertilizers, and better seed preparation (Ho 1967, p.320). All these innovative ways of farming were carefully experimented and examined before introduced.[14] Lastly and perhaps the most important achievement of the colonial government contributed to institution change, that had ensured the findings of agricultural

[14] The Japanese colonial government has pay extraordinary concerns in agricultural scientific research, and as early as in 1899 that the research fund was allocated for setting up the agricultural experimental station. And later in 1903 to 1925, the agricultural improvement stations were established in strategic districts in Northern and Western coastal Taiwan. (Ho 1967, p.327)

science would be properly introduced, widely disseminated, extensively adopted, and correctly applied (Andersson 2003, p.75; Ho 1967, p.327).

Social structure in preindustrial Taiwan

The data on social structure in Taiwan is far from perfect. The differences between various occupational titles are very unclear, especially for those who worked as farmers. Since the majority population in Taiwan was contributed by farmers along the entire colonial period (see Appendix.3), it is worthwhile for us to put efforts to distinguish and understand the differences between different occupational categories and hierarchies. As we had mentioned before, that the colonial government had undertaken a huge cadastral survey project to make sure all the arable land to be monitored and taxed. In 1899, the investigation of the entire island had finished, which means the size and ownership of each piece of arable lands had been carefully measured and registered. Meanwhile, land tax had been reformed revolutionarily, that the shared ownership which existed in Qing's rules was totally been abolished,[15] that the concept of private property right had not only been reinforced, but also been regulated by colonial institutions and laws. Because of this reason, the social structure of Taiwan can be roughly divided into three categories followed by freeholders, crofters (semi-landless) and tenants. For freeholders, they are those who owned lands which were large enough to sustain their families. As for crofters, they are those smallholders who are not able to sustain their families by their owned lands. And, people in social group have to rent another plot of land to sustain their families. Tenants are the largest group among three (see appendix 4), who had to rent a farm land from freeholders to be able to cover their subsistence.

Along the second half of the colonial period, at least the second half of the colonization, the social structure among the agricultural population didn't have any remarkable change (Appendix 4.). But something we have to keep in mind, that the reallocation of human resources was actually functioned quietly during this time. Though in a slow pace, but actually the share of agricultural population was decreasing from 64% to 53% in 1906 and 1942 (see Appendix 3.). It therefore served as an evidence that the commercialization and industrialization policies carried out by the colonial government had not only led to economic growth but also indirectly driven people lived in the rural area to move to the urban area, such as the downtown of larger villages or towns, where had more economic activities taken place and factories situated. For example, in our research area in downtown Dajia, the farmers are actually minorities. In Table 3.1, the occupations found in Dajia were classified based on the social class scheme used in HISCO.[16] Excluding those whose

[15] The land tax system in Qing dynasty is very complex and hierechical that make one piece of land may shared by two or several owners.

[16] HISCO is an occupational classification system that is both international and historical links to existing

occupation titles are missing,[17] the largest social groups in Dajia were followed by lower managers, unskilled workers and higher managers. And unsurprisingly, farmers were among the second smallest social group, and were only higher than the unemployed, for our datasets are from "downtown" Dajia.

Table 3.1 Social Structures in Downtown Dajia, 1906-1945.

Social Groups	Freq.	Percent
Non-manual		
Higher Managers	259	17.7
Lower Managers	418	28.6
Skilled Workers	87	5.9
Manual		
Medium Skilled Workers	83	5.7
Farmers	65	4.4
Lower Skilled Workers	172	11.7
Unskilled Workers	374	25.5
No occupation	6	0.4
Total	1464	100.0

Source: Elaborated from the dataset used in this study.

In addition, the occupation information in our registered database is not crystal clear. Especially for those who were working in the farms, for them, could be registered as "Farm owner", "Tenants", "Bamboo Farmer", "Tea Farmer", and "Farmer" etc. Among those who termed as "Farmer," it is very hard to tell how much land they have, and almost impossible to identify their social statuses by merely judging by their job titles. Reconstructing the social status for the farmers is possible by combining with the tax-poll registers information. However, before the tax-poll records to be computerized,[18] the best we can do is instead of intuitively judging by experiences, but singling out a social class "Farmers" tentatively.

Chapter 4

Marriages and Fertility

classifications used for present day purposes; however, we merged some subdivisions that we think is too narrow, and singled out "Farmers" which we concerned especially here. See also, History of Work.

[17] About sixty eight percent of the population studied here were not entitled with occupational status. In most cases, the occupational status was entitled only to the household head.

[18] The tax-poll registers begun recorded nearly the same time as household registers and had covered the detailed information on the ownership, location, and taxable value of all registered lands. But, so far those tax registers are stored in the local land offices and only two villages in Northern Taiwan, named Hai-Shan and San-hsia, had been computerized (Wolf & Huang 1980).

Marriages Pattern

The marriage pattern in Taiwan is not so different from that of in mainland China, which is characterized by early and universal marriages (Wolf and Huang 1980; Chuang, Engelen and Wolf et al. 2006). In other words, before the demography transition period, the Chinese marriage pattern is quite different from that of "Northwest European patterns," characterized by a relatively high age at first marriage and a high proportion of people never marry (Hajnal 1965). In Table 4.1, it shows the mean age of first marriage in Dajia. We found the mean age for women is about 19 years old, while that of men is about 24 years old. One might noticed the peculiar phenomenon that some people married at the age far too young, 12 years old for women and 9 years old for men in 1895-1925 (see minimum age in Table 4.1). This can be explained by the several specific marriage types that formed merely in Chinese joint household systems, which Hajnal (1982) couldn't be able to depict well in his article. In "Minor marriage," a girl was adopted at a very early age and was reared in her future husband's household before she reached the fertile age. The women born long before the 1905, when the household registers start recording, might be more conservative and believed that the date she was adopted could be counted as the marriage date. It thus formed the peculiar marriage pattern in our population studied. Alternatively, "Uxorilocal marriage" usually occur when the groom couldn't afford the costly bride price[19] or the expense for a wedding, he thus agree to provide one of his children to his wife's parents (very often the boy will be named after wife's father name), by doing this, they usually in return for a reduced bride price (Wolf and Huang 1980, p.95). These two types of marriage mentioned above, were found common in several villages in Northern and Central Taiwan (Wolf and Huang 1980; Engelen and Hsieh 2007), while the same pattern was also found very common in Fukien province and some villages in Yangtze Delta (Wolf and Huang 1980). Several evidences (Wolf 1995; Wolf and Huang 1980, Chapter 10, 12) had buttressed the hypothesis that the differences of fertility patterns were dictated by forms of marriage indirectly through psychological reasons, which the sexual attractiveness among couples married in minor marriages would diminish by the length of their childhood association.

[19] Bride price, also known as bride wealth, is an amount of money or property or wealth paid by the groom or his family to the parents of a woman upon the marriage of their daughter to the groom.

Table 4.1 Ages at first marriage, all married Men and Women in Dajia.

	Mean	Min	Max	Obs
Women				
1895-1925	19.3	12.2	32.7	796
1926-1945	19.5	13.6	33.0	542
Men				
1895-1925	24.7	9.3	68.5	360
1926-1945	23.7	15.4	49.6	125

Source: Elaborated from Dajia datasets

Note: Excluding extreme value, we ignored those women who married after years of 35, who were accounted less than 1% of all women.

In Table 4.2, the distribution of the different forms of marriages was presented. Among those people who lived in Dajia, the "Major marriage"[20] is contributed to 58% of all forms of marriage, which was the most common form of marriage in Dajia. It was followed by widowed, uxorilocal, divorced, and minor marriage. Besides, there are few people who were polygamous (2.1%), for whom the marital relationship is denoted as "concubine marriage."

Table 4.2 Forms of marriages in Dajia

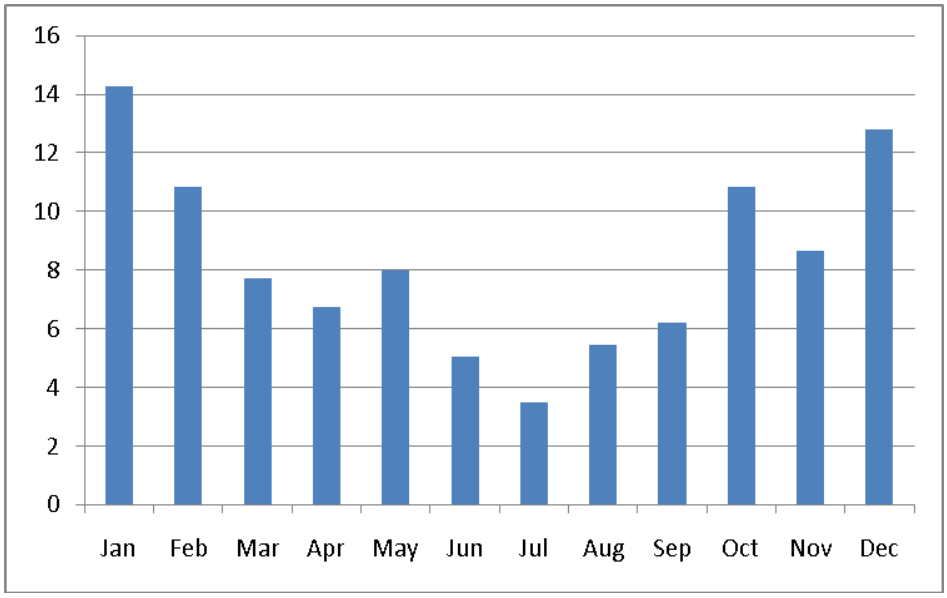
Marriage Types	Freq.	Percent
Major marriage	1853	58.1%
Minor marriage	76	2.4%
Special minor marriage	3	0.1%
Uxorilocal marriage	234	7.3%
In-house marriage	1	0.0%
Concubine marriage	68	2.1%
Widowed	673	21.1%
Divorced	119	3.7%
Relationship terminated	157	4.9%
Concubinage terminated	4	0.1%
Marriage type unkown	12	0.4%
Total	3188	100.0%

Source: Elaborated from Dajia datasets

[20] Major marriage is the most common marriage type in Chinese, its formation rules characterized by joint household systems had been proposed in Hajnal's article (1982).

Considering the timing of marriage, the people in colonial Taiwan seems prefer to marry in winter (December and January), which is slightly before the Chinese new year; and less likely to marry in mid summer (June and July), see Figure 4.1. However, this pattern found in Dajia seems had just reflected the annual harvest cycle, when during mid summer (June and July) the farmers are extremely busy and working hard in processing the harvest of first rice crop (dried, husked, packed, and stored) and planting the second rice crop right after that.[21] And in winter, the Farmers are slack and have more free time to prepare for the wedding. [22] This pattern was also found another village (Lugang) in central Taiwan as well (Engelen & Hsieh 2007, pp.76-8). Besides, the month of July in lunar calendar (between July and August) is the so called "Ghost Month," when Chinese people tend to avoid any celebrating activities, such as wedding, for fear of bringing bad luck, during that period. Therefore, we believe the possible reasons for the specific seasonal distribution in Dajia could be attributed to the annual agricultural cycle, as well as the traditional norms and culture in Taiwan.

Figure 4.1 Seasonal Distribution of Marriages



Source: Demographic Database of Colonial Taiwan

[21] The first harvest period is from early of January to mid of June, while second harvest period is from early of July to late November (Bank of Taiwan 1957, p.57).

[22] We believe this point is especially true after 1920s, when double cropping had become popular in Taiwan.

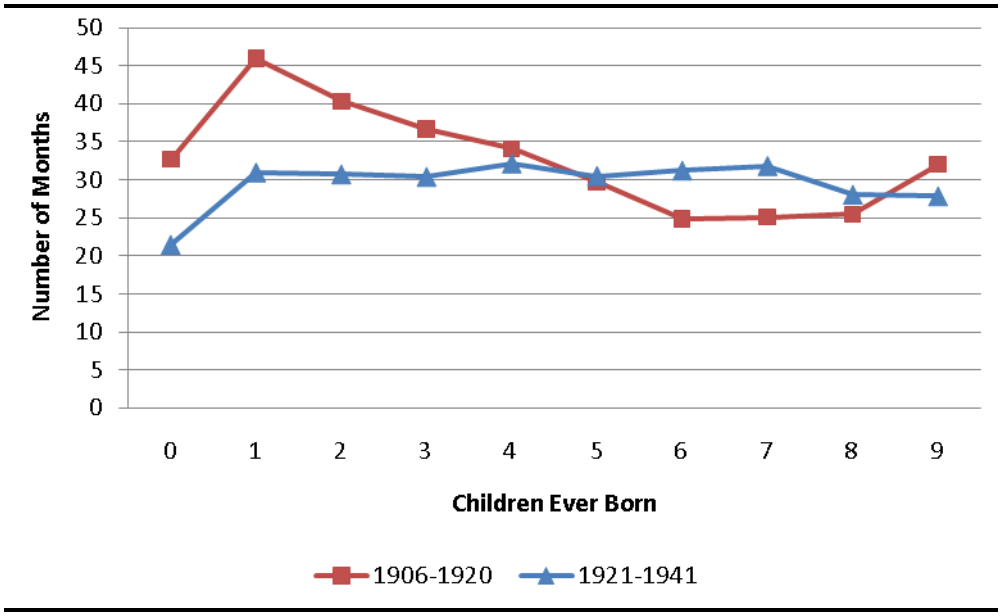
Fertility Pattern

Figure 4.2 presents the average birth intervals of women in Dajia, by the number of children even born. Apart from the intervals between marriage to first birth (0-1st) and first birth to the second (1st-2nd), the duration of the interbirth were rather stable and varied between 24-45 months in pre-transitional period, and 27-32 months in transitional period. There has no clear sign of any prolong birth interval for those who have large number of children ever born, which render little foundation supporting the point that parity-specific -birth control is existed in Chinese society. However, in pre-transitional period, it took longer time for couples in to bear their first two children, compared with those counterparts in Northwest Europe (Bengtsson and Dribe 2006, Figure 2, p.732). While the bridal marriages were common in pre-transitional Europe and very often have shorter interval between first marriages to the first child births, the illegitimate birth or bridal pregnancy was very rare in pre-transitional Taiwan, which could be attributed to the specific forms of marriage that mentioned previously (Marriage patterns, Chapter 4 in this study). For those couples married in the form of minor marriage, the reproductive intercourse would suggest to begin some weeks after marriage, for them might feel awkward and embarrassed to have sex with someone they grew up together with, in the early period of marriage (Wolf and Huang 1980, Chapter 6, pp.91-2; Engelen and Hsieh 2007, p.166). Even for those couples married in the form of "major" or "Uxorilocal" marriage, a large percentage of their marriage were arranged by the wills of their parents, which would make them uneasy to sleep next a stranger and would suggest to decrease the frequency of intercourses, at least in their early stage of marriage (Engelen and Hsieh 2007, p.166). Nevertheless, the birth interval between first marriage and first birth is still shorter compared to the second birth intervals (see Figure 4.2).

In spite of the child birth interval of the first two parities are different between the two sides of the continent, the fertility pattern of the third and the higher births are, by and large, assimilated. On the ground of this reason, we believe the Chinese population is a "natural population".[23]

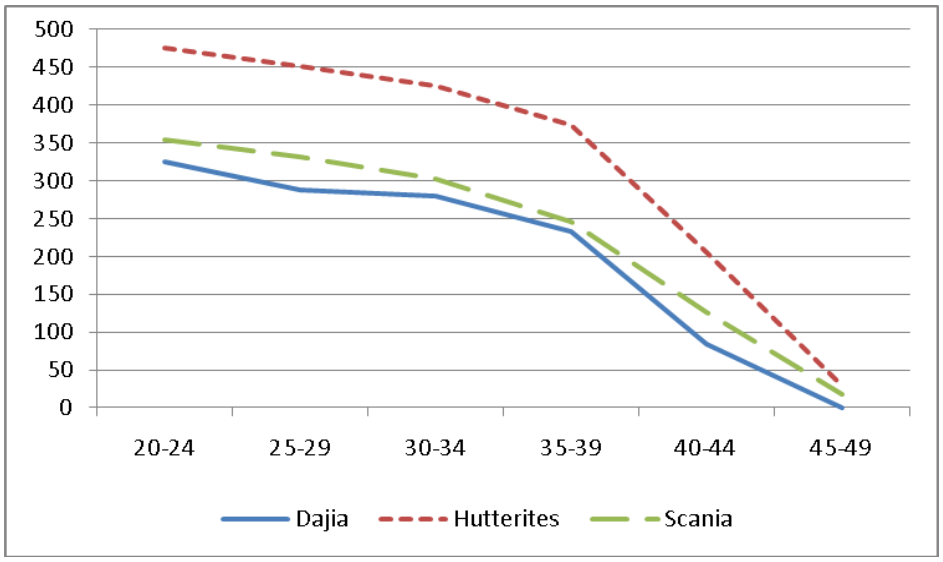
[23] Natural population indicates a population whose fertility exists or has existed in the absence of deliberate birth control. However, the social factor, such as sexual taboos during the lactation was not thought to be a form of birth control. "Control can be said to exist when the behavior of the couple is bound to the number of children already born and is modified when this number reaches the maximum which the couple does not want to exceed." (Henry 1961, p.81)

Figure 4.2 Interbirth Intervals, by Previous Children Born in Dajia, Both Sub-periods (1906-1920 and 1921-1942)



Note: All socioeconomic groups. Include only women who were married in the research area. First interval is from marriage to the first birth.

Figure 4.3 Age Specific Marital Fertility, Dajia (Major Marriage, 1908) and Four Parishes in Southern Sweden



Note: The ASMF indices of Scania was calculated from Coale-trussell measurement[24] extracted from Bengtsson and Dribe (2006)

Source: Demographic Database of Colonial Taiwan;, Bengtsson and Dribe (2006) and Henry (1961)

[24] See article by Coale and Trussell (1978).

Due to debates between revisionists and Malthusians' supporters was largely because lack of detail and reliable data,[25] further tackling the burdensome question of "whether the Chinese population is a natural population before the transitional period," more reliable and quality data are required. From Figure 4.3, ASMF indices for population in Dajia,[26] Southern Sweden (Hamstad, Hög, Kävlinge, Kågeröd, and Sireköpinge), and Hutterites, [27] had illustrated that the fertility rate of people in Dajia is not very far from Hutterites, and only slightly lower than that of the level in Southern Sweden. This in turn has explained that the population in Taiwan is quite probably a "natural population." Though the evidence found here suggest that people in pre-transitional Taiwan is probably a natural population, we should not conclude generally that the Chinese population practiced no birth control in pre-transitional period. This plausible conclusion had been made by Princeton University's European Fertility Project in the 1960s and 1970s and later been inspected to be flawed (Bengtsson and Dribe 2000, p.727). For this reason, we believe it required careful examinations before we make any firm conclusion, in regard to issue of deliberate birth control in Chinese population. Before testing by multivariate analyses, we had noticed that monthly pattern of fertility could render us some clues. In Figure 4.4, the propensity of conception in Dajia is relatively low between early of spring to mid summer, when April and May are two lowest months in a year. It is very unlikely to be dictated by coincidence, for it had widely been found in the studies done by Japanese administration during the colonial time and also in Wolf's research area, Hai-Shan (Bank of Taiwan 1951, p.42; Wolf and Huang 1980, pp.46-8). Social norms, economic cycles or various other parity-independent variables are the possible candidates for explaining the specific fertility pattern proposed by the previous studies. In Wolf's book (1980), he suggested it was mainly caused by the specific farming cycle in Taiwan. But it doesn't make sense, for the farmers were hard working during the summer (May, June and July) and then should had the lowest fertility level nine months after that period (which are January, February and March). Obviously, it is not the case here. However, in a recent paper of Wolf and Engelen opposed to revisionists' view (Chuang and Engelen et al. 2006, p.257), they had claimed the slightly lower marital fertility of Chinese population might determined by a long period of lactational amenorrhea due to some combination of malnourishment and prolonged breast-feeding. Though their

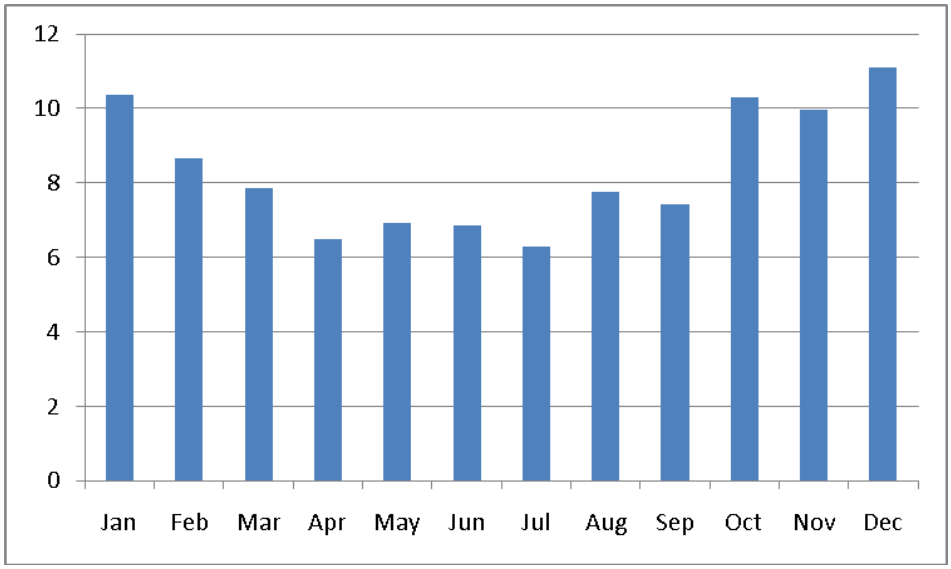
[25] The revisionists claimed that in early twenty century, TFR in mainland China is 6, which is 'low' and 'moderate' compared to that of European counterparts, based on indirect estimation proposed by Princeton University's fertility survey in rural China (Barclay, Coale and Stoto et.al. 1976). A cross-continental comparison of age specific marital fertility (ASMF) had demonstrated in Wang and Lee et al.'s article (1995, p.385).

[26] The ASMF is elaborated based on the method used by Tuan (1958).

[27] Hutterites, an Anabaptist North-American population who aiming at maximizing their fertility. The fertility data of Hutterites was extracted from Henry's article (1961).

argument is probable, but it is not convincing enough for it is incapable of explaining the mechanism why it would lead to a lower fertility level between early spring and mid summer. To make up for this discrepancy, a theoretical framework will accordingly be introduced in next section.

Figure 4.4 Seasonal Distributions of Births



Source: Demographic Database of Colonial Taiwan

Chapter 5

Theoretical background

Theories

The debates of revisionists' and Malthusian supporters' views on deliberate control in pre-transitional China can be described as a zero-sum game, while Malthusian supporters claim there is no parity-specific control in a natural population, their opponents believed the Chinese population is determined by parity-specific variables, such as child ever born, gender of the last child, and number of sons they have had etc. It seems like they are standing on the two extremes of the spectrum and would never find anything in common. Meanwhile, the topic issue in pre-transitional Europe had also drawn lots of concerns from

many scholars, but the main argument in Europe lies on "whether a non-parity-specific deliberate control existed in a natural population." In European revisionists views, they believed that even in a natural population, the people would still practice birth control, but very often in a non-parity-specific way. The evidence had been found in Southern Sweden between 1766 and 1865, for a longitudinal database was used in this study, that the SES background and various parity independent variable can thus be controlled and examined in a risk comparing model. The basic idea of their model is to find out the interrelatedness between fertility and the short term economic stress, for the time before transition period, people are uncertain about the supply of food, and food price had played a very important role in regulating individuals' demographic outcomes (Bengtsson, Campbell and Lee et al. 2004). By simply detecting the fertility response to the short term food price fluctuation, however, couldn't rule out other parity independent effects, such as breast feeding, out-migration, and malnourishment etc. We need a more exquisite model that could combine the price of food and individual level births information in a monthly basis (Bengtsson and Dribe 2006). Incorporating with the local farming cycle and the timing of market price fluctuation, a clear picture of deliberate control could be painted. The great detail of the conceptual framework will be explained in the following part of this chapter.

Assumptions and expected results

The theoretic framework and methodology applied in this paper are mainly based on the article written by Bengtsson and Dribe (2006), which focus on examining the deliberate birth control of pretransitional population in Southern Sweden. The method used in their article had quite successful to distinguish various parity independent effects and single out the deliberate control in Southern Sweden, for the farmer in the pre-industrial had already known to forecast the results of the following harvest to alleviate the possible economic crisis, which could cause to starvation and famine. The same method had been also applied to several villages in Germany (Dribe and Scalone 2010). And in both regions, they had found that the population with lower social classes, who are more vulnerable to the short term economic crisis, had more intensity to practice a postponement strategy and thus avoid conception in the months where the food prices are at its peak.

Since so far the existing study deal with the issue of deliberate control in Chinese population had relied on the Banner men's genealogical database from Northeastern China, detecting the response of childbearing to cost of living has several limitations we had mentioned in the previous section (Chapter 1). For we have more complete information about the weather condition, harvest cycle, food price and individuals' birth profile, we are allowed to present a analytical framework that could reveal the mechanisms for both proactive and passive birth control. To make sure this theoretical framework could also be applied properly and closely in line with the background in pretransitional Taiwan, we

would like to make some clarifications.

First, we assume the farmers in Taiwan know both the reasons behind the economic cycle and the weather patterns very well and could thus plan their childbearing accordingly by their forecast on the coming harvest. This assumption was made on the grounds of three: **I.** the main food price in quite uncertain and would strongly strike real wage when the food price fly to the sky, as we can see from the year of 1920 and 1925 (Figure 3.2 & 3.3). **II.** the rise of food price is usually caused by bad weather conditions, especially Typhoon (Wang 1994, p.81-91). And Typhoon had visit Taiwan regularly between July and September each year. **III.** from the Qing's rice price index collected by Wang (1994), we had found the price of rice is very often soar in November and December (shortly before the Lunar New Year) and the toughest time was usually occurred in February, March and April (shortly before the harvest in next year). For these reasons, we could construct an assumption framework characterized by Dribe and Scalone (2010, Figure1.), basing on the region-specific information in Taiwan. In Figure 5.1, we had summarized the information such as, the farming cycle of the colonial Taiwan, the months that Typhoons had usually visited, and the most probable time for a short-term food price change. All information concerned in this figure, had allowed us to make an extrapolation that Taiwan's farmers would possibly delay their births in the early period of the Typhoon season, if any. Because, not until the Typhoon season had ended, the farmers are uncertain about which direction food price will change toward. Typhoon season ended around late September,[28] farmers would thereafter have some general ideas of how the rice price would change in next year by evaluating the damages caused by Typhoon.[29] Hence, the effect of deliberate fertility control, if any, would probably be seen at least nine months after that (from April to July). It is quite interesting that our first hypothetic assumption proposed here is actually fitted well with the seasonal distribution of fertility in Figure 4.4, where the depressed fertility was found from April to July.

Second, since the individuals we have in our sample population are those who inhibited in downtown Dajia, and those titled as "farmers" are not the majority in this district (only 4.4 %; see Table 3.1), one might doubt about the representativeness of our sample population, and would probably suggest that the people whose occupations other than farmers might have limited knowledge about the farming cycle and might in turn have no capability to forecast the coming harvest. However, we believed that even though both the crude death rate and the number of agricultural population had apparently declined since 1920s (see Appendix 1 and 3), the structure of the agricultural society in Dajia had yet been

[28] There are some exceptions, in the historical records, Typhoon had ever visit Taiwan in November.

[29] Chinese Farmers can probably have general idea of the forthcoming harvest outcome in autumn equinox, dated on 23rd of September in Chinese solar term calendar (http://www.tachia.org.tw/).

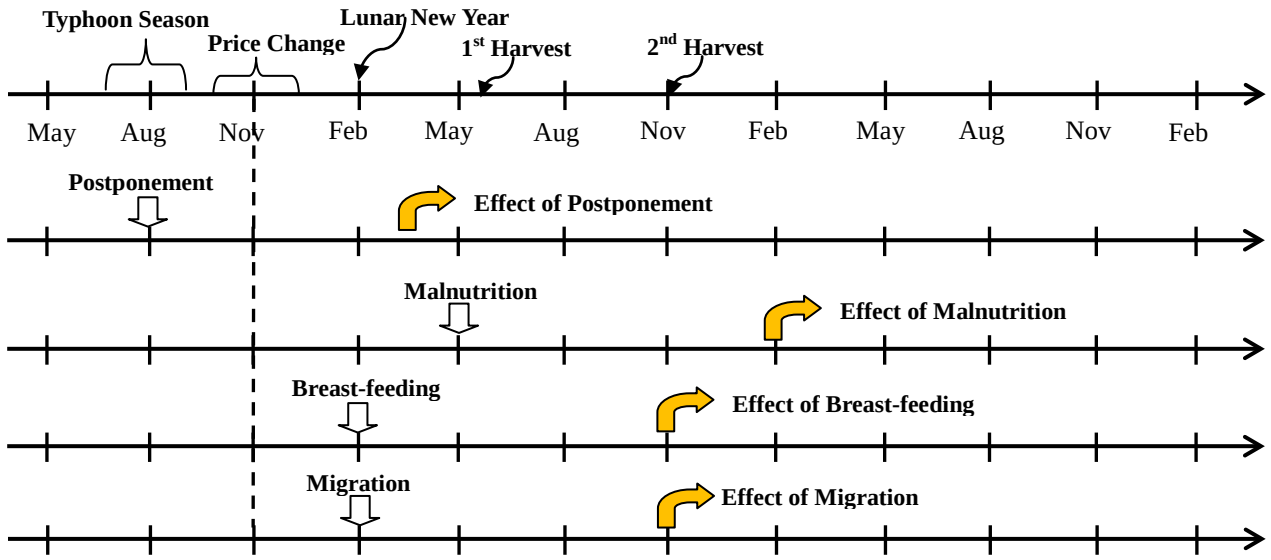
changed drastically, for the reason that Japanese colonial administration had no intention to convert an agricultural-centered Dajia into a city of heavy industry.[30] We thus believe that a large number of the unskilled or lower skilled labors lived in downtown were grown up from the near villages in rural Dajia and migrated to downtown Dajia when they had entered into their adulthood. The people of this group would then suggest knowing the fundamental knowledge of farming, such as farming cycle, and would practice a birth control accordingly to the outcome of harvest. The merchants and store managers, and middle skilled workers in downtown would also have some basic knowledge about the farming, for the short-term business cycle was connected to the food price as well. Consequently, it is reasonable to assume those who lived in the town center couldn't live unaffectedly, but on the contrary, their life were remained strongly connecting to the rural Dajia. But, those who are not farmers would expected be slightly less responsive to the food price, for they wouldn't inspect the damages of rice crops as farmers would usually do after the strikes of Typhoon.

Third, one would suspect the link between change of rice price and the outcome of the harvest on the grounds of two reasons: **I.** Rice could somehow be stored and took out when necessary; **II.** There must be some alternative source of food supply other than rice that people could eat during the economic hardship when rice price tower to the sky high. In regard to the first point, it very unlikely, for the weather in Taiwan is warm and humid that the rice couldn't hold for long (two months at most) in the ordinary condition. Preserving the crops for a longer period of time, granaries were required. However, large granary is uncommon before 1937. Before 1923, only small private ones could be found in some bigger villages and towns (Lee 2009, p.72). Not until the 1933, that the colonial administration passed a law to encourage local wholesalers to organize a corporate body aiming to manage and build the large rice granaries, and support them with financial aid, the number of sizable granaries was thus accelerated. In 1937, there were fifty four of such corporates were formed in Taiwan (Lee 2009, p.73). For the second point, notwithstanding the sweet potato was the important substitution food source beside rice,[31] the amount of sweet potato apparently was not sufficient to feed the entire population in Taiwan (see Figure 2.2) and would probably become scarce and hard to be attained during the economic hardship.

[30] The manual industry was well developed in downtown Dajia though. Manufactures as sleeping mats and straw hats were quite competitive in the global market during the colonial period.

[31] In the old time, sweet potatoes have widely been seen as the food for the poor.

Firgure 5.1 Illustration of the timing of fertility response to the change of rice prices.



Source: Revised from Dribe and Scalone (2010), section 2. analytical framework.

Fourth, we suggest there were also other parity-independent variables, apart from the effect of postponement, which would also result to a depressed fertility: **I.** malnutrition; **II**. breast-feeding; and **III.** migration. For the first and second variables, malnutrition and breastfeeding, they are two most discussed variables that would slow down the birth spacing of Chinese population. In order to distinguish these two effects, we assume that the time of breast feeding and malnutrition would at least happen, respectively, in twelve and fifteen months after the price change. Our assumption for malnutrition is based on the historical experiences that the economic hardship was usually occurring in late winter/ early spring, when the rice storage was low (Wang 1994, p.79 & 84-91). On the ground of this reason, we believe the month of May was the hardest time in a year and the vulnerable groups[32] will suffered the most at this time.[33] As for the effect of breast feeding, assuming it was a conscious way of contraception, it would play a less important role in the fertility responsive mechanism (Bengtsson and Dribe 2006, p.736). The main reason is that we don't have enough information of how women in Taiwan would actually respond (by either prolonged or shorten) at the time of economic crisis. Thus, the depressed fertility that occurred at least one year after the price changed would be expected as an effect of breast feeding.

[32] For we have large percentage of the studied population are non-agricultural group, vulnerable and less vulnerable group in this paper is not distinguished by whether a household is a net producer or a net consumer (Tsuya, Wang, Alter and Lee et al. 2010, p.103), but by the hierarchy of social status presented in previous section (chapter 3).

[33] The rice storage had reached the lowest level right before the next harvest. We believed it is some time around May.

Regarding to the link between migration and the economic stress, in several interview based on studies carried out in Mainland China and Taiwan in 1980-81 (Wolf 2001, p.142), it had summarized the reasons why a woman have to separate with her husbands, several of them are directed to the separation of spouse which includes: away from home begging, husband in the army, husband away from home working. This had rendered us the evidences that when under an extreme economic condition, male household heads in vulnerable group would choose to leave the village they lived to other villages where they have more chance to get employed. In the meanwhile, we assume the male labors among the vulnerable groups in downtown Dajia would most likely to become jobless shortly before the Lunar New Year when the grain crops had been harvested, and then left their partners shortly after the Lunar New Year in some time around February, seeking for a job.

Chapter 6

Short-term economic fluctuations: grain prices

The connection between weather, harvest outcome and grain prices

The short-term economic fluctuation is the most important factor to determine people's demographic response, such as childbearing, mortality and migration etc. The logic of the demographic responsive mechanism can be extended from the impacts of price fluctuations on the level of consumption, wages, revenues, and demand of labor etc. Nevertheless, the impacts of price fluctuation is not that straightforward, if we look the entire population as a whole without considering the technological improvement, change of market condition and the forms of land rent and tax etc. (Dribe 2000, p.146). The previous study with aggregate level data allowed us neither to stratify the socio-economic status nor to indentify the timing of demographic events (Galloway 1988). Having a closer look at the mechanism of demographic responsive process, individual level data with combination to multivariate statistical tools had widely been used for systematic researches, such as a cross-continental project which aim to examine the demographic response on both sides of the Euro-Asia continent (Bengtsson and Dribe 2005). Even so, the similar study is not available in Taiwan yet, which is why we want to make an effort to this topic study.

As we had mentioned before (chapter 2), that we believe the rice price will serve as a

good indicator of economic fluctuations. For the rice as a commodity, its price level was determined directly via the harvest outcome and indirectly via the weather conditions in a year. According to the prices histories in Qing Taiwan (1644-1895) collected from the local chronicles, that the weather condition is the primary factor had led to a drastic rise of grain price during Qing Taiwan (Wang 1994). The unwelcoming weather conditions include heavy storm or Typhoon, drought, and frost.[34] Besides, the excessive rice export to mainland was also an important candidate for price fluctuations. In 1711, the head of the Qing administration thought the problem of trade deficit in grain production was too serious and hence announced a rice embargo.[35] The heads of the municipality were then responsible to make sure the harvest in sufficient for local's subsistent level before permitting of the export of local grain production (Wang 1994, pp.101-119). With the experiences concluded from Qing's Taiwan, we believe that the commodity market of rice had been well developed in Qing's time. The price of rice was mainly determined by the harvest outcomes. Harvest failures usually followed by the one or several serious Typhoon damages. Mainland was the main trade partner during that time, the inventory of rice storage in Taiwan would determined by the amount of rice exported to mainland. Later until the Japanese colonial time, the logic of price fluctuation is more or less the same, since the rice is one of important strategic commodities for Japanese colonial government, especially during the war period (Lee 2009, pp.67-70). However, the exception was the time between 1939 and 1942, the grain regulating system under the Japanese Imperial had changed dramatically in 1939 due to a higher food demand during second Sino-Japanese war and the harvest failure in Korea,[36] and since then consumption price had been highly regulated at a relatively high level (Lee 2009, pp.93-4).

Notwithstanding the weather conditions, harvest outcomes, and amount of rice exports had determined the rice price respectively through a direct and indirect way, none of them could reflect the economic fluctuation as completely as the price index published by local official institutes. Fortunately, the colonial administration did have published the local-level price index (Taichung *hsien*) regularly from 1927 to 1942. For the price index from 1905 to 1926, we used the national level index that calculated from the export records of Keelung harbor,[37] where the exported rice was largely come from Taichung, Tainan, and Kaohsiung (Taiwan 1943).

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[34] From 1926 to 1935, the damages caused by natural disasters: 12 times of serious Typhoon strikes, 32 times of draughts (mainly in Southern Taiwan), 3 times frosts (Bank of Taiwan 1957, pp.52-4)

[35] The rice embargo had been lift several times. Since the harvest outcomes were uncertain from year to year, there were no policies that could effectively stabilize the rice prices during that time.

[36] The harvest failure in 1939 was caused by drought and there were 4708 people had died in famine in that year in Korea (Lee 2009, p.95).

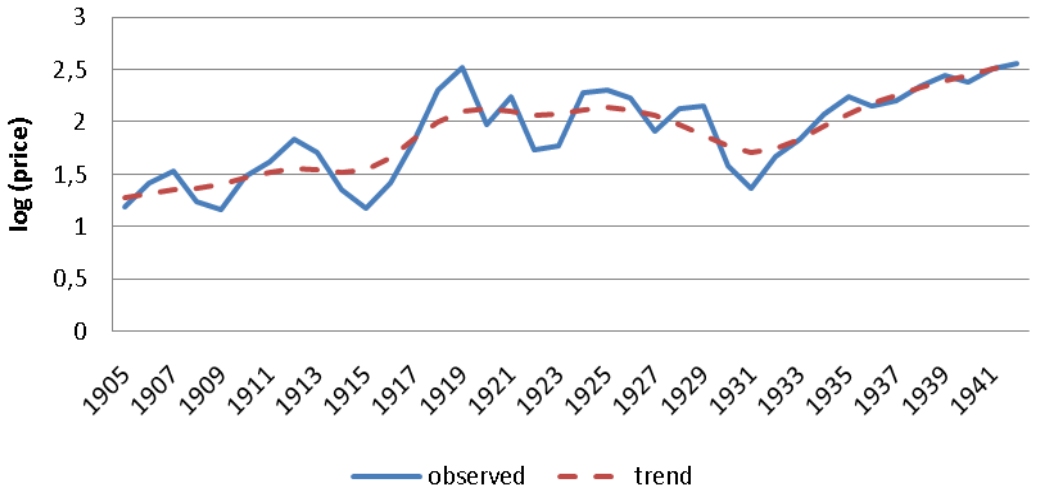
[37] The major export harbor in Northern Taiwan.

Measures of economic fluctuations: grain prices index

The "*observed value*" presented in the Figure 6.1 was calculated from the monthly basis administrative records collected from Keelung harbor (price index from 1905-1926) and local official institute (price index from 1927-1942). However, since the food price of the harvest year are greatly determined by the second harvest in fall, we used the price of the month "October" to represent the entire harvest year for the period from 1st of October to 30th of September. In order to measure the short-term economic stress, we first adjusted the price index of harvest year (price of October in each year) with logarithm, for obtaining the growth rate of price each year, which we denoted as "*observed value*". Second, we obtained "*trend value*," by using Hodrick-Prescott filter,[38] a smooth parameter was set to 100, which is common for yearly data. And then, as a proxy index of short-term economic fluctuations, the price deviations were thus obtained by deducting *observed value* with *trend value.*

Someone might notice that the change rate of price are more cyclical in the first half of the study period (1906-1921), compared with the second half of the study period (1921-1942). It might probably due to two reasons. First, the technology change induced by Japanese colonial government, had effectively controlled the factors that were unfavorable to a long term economic growth, such as drought, tropical storm, and ethnic conflicts etc., in the second half of the study period.[39] Second, the grain regulation system had introduced since 1931, it had functioned quite well to meet the purpose of colonial administration, since then the long term trend of price growth was rather stable.

Figure 6.1 Change Rate of Rice Price (log price), 1905-1942 in Dajia, Taiwan



[38] The Hodrick-Prescott (HP) filter a smooth curve is fitted through a time series, rather than a deterministic trend of moving average, which both of them would produce undesirable effects (Dribe 2000, p.154)

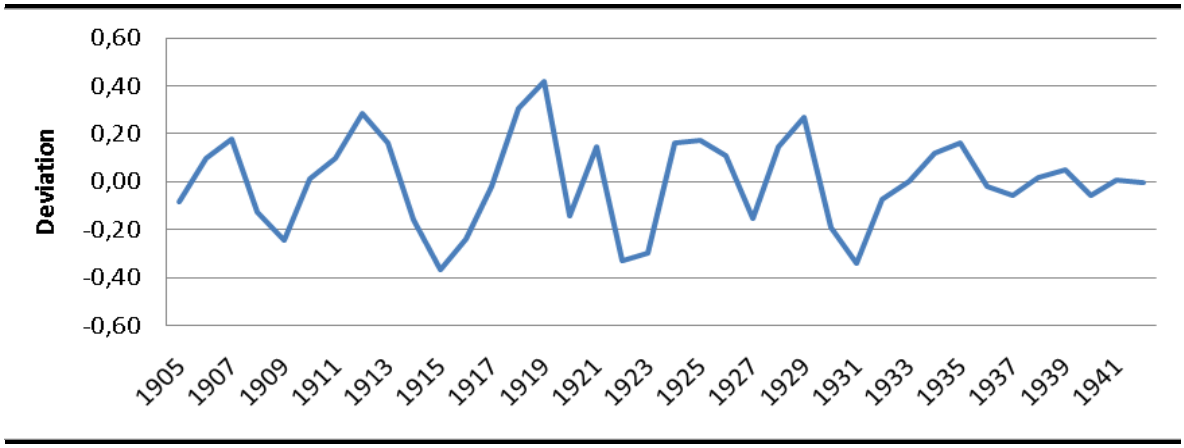
[39] The output of rice was less affected by droughts, for an improvement of irrigation facilities. The forest was planted surround the farm purposely, on the side face to the sea, to reduce the crops damages caused by tropical storm.

Note: Hodrick-Prescott Trend was calculated using a smoothing parameter of 100

Source: Production Department (1943)

Although the long term change rate of food price had revealed an increasing government invention on grain price, but the colonial administration was unable to eliminate the short-term price shock completely. In Figure 6.2 had demonstrated the deviations between *observed* and *trend* value, where in the second half of our study period, there were at least five years had its price deviations greater than twenty percent. However, since the grain regulating system had been reformed and a fixed price system was enforced, the deviation after 1939 was thus very limited.

Figure 6.2 Rice Price Deviations from Hodrick-Prescott Trend 1905-1942 in Dajia, Taiwan



Soure: Elaberation from price index shown in Figure 6.1

Chapter 7.

Deliberate birth control in times of economic stresses

In this chapter, we are going to present the empirical results of our findings in Dajia. In our analyses, a sets of models will be analyzed; first one is aiming to portrait the baisc relationships among socio-demographic background and price; the second is to inscribe the fertility responses of our study period (include two sub-periods); the third is to detect the threshold effects for fertility response. However, before turning to empirical evidence on deliberate birth control, the statistical method used in the empirical analysis will be

discussed.

Statatistical Method: Event-History Analysis

As we pointed out earlier in Chapter 2, our micro level data used in this study was prepared for an event history analysis. And since the deliberate birth control is the main issue we are discussing here, the birth event will be considered as a right-censoring. Individuals entering into the marriages will be left-truncated. The study period was limited from 1st of January in 1906 to 31st of December in 1942.[40] Besides to create the spells for each birth intervals and limit the duration of study, one most crucial task in this study is to construct a model that could present the timing of fertility response. The method used in this study is followed by the manner outlined by Bengtsson and Dribe (2006, pp.736-7). We estimate the martial fertility by using Cox PH model that not only control for socio-demographic covariates, but also the rice price deviations at birth. With bearing in mind that we are studying the fertility response, thus we are interested in births rather than the conceptions. Detecting the subsequent response for one year after the price changed, we also control the price deviations of one year lagged. More specifically, our model can be presented in the following form:

$$\ln h_{ij}(a,t) = \ln h_0(a) + \beta X_{ij}$$

where:

$h_{ij}(a,t)$ is the individual hazard of married women (j) of observed parity (i) at duration time a at calendar time t;

$h_0(a)$ is the baseline hazard, when an individual having the value zero on all covariates;

β is the vector of parameters for the covariates estimated;

X_{ij} is the vector of covariates for married women (j);

There are two limits for our empirical models. We first limit our study to focus only on second and higher-order births. That is because the first parity birth is seemingly dependent on the marriage, for the married women in Dajia usually have shorter birth intervals between their first marriage and first order birth (Figure 4.2, p.24 in this paper). Second, we assume the vectors of β are equal among each parities (>2), for the sample number of higher order births is too little to be analysed separately.

The impact of socio-demographic background on marital fertility

The results shown in Table 7.1 had illustrated the basic interrelatedness among price,

[40] The upper limit of the time period was set on 31st of September in 1942 is due to the one year lagged price information can only be valid until then.

socio-demographic and marital fertility, where two separate models were estimated. The difference between these two models is that, the first model includes two parity-dependent variables, which are *sex of previous child* and *the sons ever born*, while the second one does not include them. The result in first model had shown a decreasing fecundity among those older age groups when we control for all other determinants in the model. The relative risks of childbearing differ among different social groups, and while the higher fertility was found for higher social status in non-manual labors, it doesn't hold true for the manual workers, for the unkilled labors are more fecund than lower-skilled. The life Status of previous child had shown those women whose previous child had died young (<2), they had higher intensity of having another child.

Table 7.1 Cox Proportional Hazards Estimates of Marital Fertility, and Fertility Response to 10% Change in Food Prices, in Dajia, 1906-1942, for All Women, Second and Higher-Order Births

		Model I		Model II	
Covariates	Mean	RR	%	RR	%
Age					
15-19	0.09	1.38 (0.03)		0.35 (0.01)	
20-24	0.29	1.19 (0.01)		0.93 (0.14)	
25-29 (ref.)	0.26	1.00		1.00	
30-34	0.19	0.90 (0.03)		0.94 (0.24)	
35-39	0.11	0.81 (0.01)		0.84 (0.01)	
40-44	0.04	0.68 (0.01)		0.73 (0.01)	
45-49	0.01	0.33 (0.02)		0.34 (0.02)	
SES of women's husbands					
Non-manual:					
Higher managers, professionals, Sales	0.13	1.00 (ref.)		1.00 (ref.)	
Lower managers, professionals and sales	0.13	0.97 (0.68)		0.92 (0.29)	
Skilled workers	0.03	0.86 (0.15)		0.86 (0.15)	
Manual:					
Medium workers	0.03	0.96 (0.79)		1.00 (0.46)	
Farmers	0.03	0.93 (0.56)		0.91 (0.44)	
Lower-skilled workers	0.02	0.82 (0.16)		0.80 (0.12)	
Unskilled workers	0.11	0.94 (0.43)		0.90 (0.14)	
Unknown [b]	0.52	0.86 (0.01)		0.81 (0.01)	
Life Status of Previous Child					
Alive	0.81	1.00 (ref.)		1.00 (ref.)	
Dead and < 2 years since previous birth	0.11	1.35 (0.01)		1.64 (0.01)	
Dead and >2 years since previous birth	0.08	1.08 (0.21)		1.35 (0.01)	

Table 7.1. *contin.*

		Model I		Model II	
Covariates	Mean	RR	% [a]	RR	%
Sex of Previous Child					
Male (ref.)	0.53	1.00 (ref.)			
Female	0.47	1.06 (0.24)			
Sons among Previous Births					
Yes (ref.)	0.30	1.00 (ref.)			
No	0.70	0.98 (0.68)			
Marriage type					
Major marriage (ref.)	0.49	1.00 (ref.)		1.00 (ref.)	
Minor marriage	0.04	0.89 (0.25)		0.92 (0.40)	
Special minor marriage	<0.01	0.83 (0.60)		0.88 (0.72)	
Uxorilocal marriage	0.12	1.09 (0.12)		1.10 (0.08)	
In-House marriage	<0.01	0.65 (0.54)		0.61 (0.50)	
Unknown	<0.01	0.87 (0.68)		0.78 (0.48)	
Concubine marriage	<0.01	0.83 (0.54)		0.69 (0.24)	
Widowed [c]	0.29	1.13 (0.02)		1.14 (0.01)	
Divorced [d]	0.02	0.92 (0.76)		0.92 (0.50)	
Relationship terminated [e]	0.03	0.89 (0.14)		1.02 (0.91)	
SES*price(t) [f]					
Higher managers, professionals, Sales			19.18 (0.01)		19.18 (0.03)
Lower managers, professionals and sales			-1.84 (0.68)		-0.93 (0.85)
Skilled works			-10.10 (0.10)		-10.00 (0.13)
Medium skilled workers			6.22 (0.49)		7.59 (0.43)
Farmers			-3.00 (0.70)		-2.73 (0.74)
Lower-skilled workers			-3.32 (0.72)		-2.55 (0.80)
Unskilled workers			4.70 (0.33)		5.92 (0.26)
Unknown			0.96 (0.80)		1.19 (0.77)
SES*price(t-1) [g]					
Higher managers, professionals, sales			9.84 (0.03)		9.84 (0.02)
Lower managers, professionals and sales			1.37 (0.58)		1.20 (0.66)
Skilled works			3.55 (0.31)		5.06 (0.20)
Medium skilled workers			-3.67 (0.42)		-4.38 (0.37)
Farmers			1.02 (0.81)		1.39 (0.77)
Lower-skilled workers			-0.70 (0.89)		-0.48 (0.93)
Unskilled workers			-1.95 (0.44)		-3.10 (0.27)
Unknown			-0.70 (0.73)		-0.58 (0.80)
Liklihood ratio test		3372.09		34717.68	

Births	3075	3043

Note: (a) For each category % present the percentage of fertility response to a 10% change in food prices. Thus the effect for reference categories are the base effects of prics from the estimated models (i.e, in Model I, base hazard for higher manager*p(t)=1*3.91. To present in percentage, we re-calculated it with formula $100*(e^{blog(1.1)}-1)$.) The other effects, meanwhile, are the combined base and ineraction effects (ie. Lower mangers, 1.38*0.31). For reference categories p-value refer to the base effects of prices in the model estimation, while other p-value refer to interaction effects.

(b) Among these women, 51% of their husbands are not entitled with occupation. In our registers, only household head are enetiled with occupation, however, in a joint household system, it is very common to have several famlies live in the same household. Thus, it our dataset, there are about 51% of women's husband are not entitled with occupation, probabely because their father still economic active and been entitled as household head. Besides, they could also employees who did't have their own houses and lived in employers' household. The detail information required a further study.

(c) (d) (e) Since our registers started recording on 1st of January 1906 and ended on 31st of December 1945, the widowed and divored and relationship terminated are the status last reigstered, which doesn't mean their marital status at birth. We therefore shouldn't exclude them from our estimated model.

(f) We use prices by harvest year (October-September) for price at time *t.* For exmple, the price for 1908 fall (1st of October) covered the analysing period 1st of October, 1908 to 30th of September, 1909. By doing so, there is a built-in lag for current price used.

(g) We use prices lagged by one harvest year for price at time *t-1*. In this way, the price 1907 fall covered the analysing period 1st of October, 1908 to 30th of September, 1909.

Source: Elaborated from the Demographic Database of Colonial Taiwan

The parity-specific factors, such as *sex of previous child* and *sons ever born* that had been argued to be decisive for birth spacing among Chinese population, in the previous studies (Wang, Lee and Campbell 1995). Those factors had only minor effects and are apparently not significant in our first model, which had again provided the evidence indicating Chinese population is a natrual population before transitional period (second stage) had completed.

To check the model specification, we use the graphcal method to plot an estimate of $-\ln\left[-\ln\left\{\hat{S}(t)\right\}\right]$ versus ln(t) for each level of the covariate in question, where $\hat{S}(t)$ is the Kaplan-Meier estimate of the survivor function. For proportional hazards, $h(t \mid x) = h_0(t)\exp(x\beta_x)$, and thus $S(t \mid x) = S_0(t)^{\exp(x\beta_x)}$, which can be implied as

$$-\ln\left[-\ln\left\{S(t \mid x)\right\}\right] = -\ln\left[-\ln\left\{S_0(t)\right\}\right] - x\beta_x$$

Thus, under the proportional hazards assumption, the plotted curves should be parallel (Cleves, Gould, and Gutierrez 2004). The results for proportional hazards assumption test were presented in Appendix 5-9 in this paper. All covariates used in our estimated models had provided evidences in favor of the proportional hazard assumption.

The impact of short-term economic fluctuations of different time periods

Table 7.2 had shown the price response by three-month periods, with controls for the same socio-demogarphic factors that had applied in Model I of Table 7.1 with no inclusive of the monthly price effects for each SES groups (interaction terms). For those women oberved in this model belong to a relatively vulnerable group, for their husbands' social statuses were either farmers, unskilled workers, or unknown.[41] We first check the effect of postponement, where a lowered fertility response would expected to appear between April to July, if there is any. It is not surprising, that we had found a strong lowered fertility response six months after the price changed along the entire study period 1906-1942 and the two sub-periods in pre-transitional (1906-1920) and transitional (1921-1942), which render us clear evidences pointing toward a deliberate birth control during the period we studied. Then, we hence examine the effects for the passive birth control. The effects of passive fertility control, such as prolong breast-feeding, migration, and malnutrition are not very clear for the entire study period. But if we look two sub-periods separately, the passively fertility control is very strong in the pre-transitional period. During this period, the depressed fertility responses were found for twelve months after the price changes (February to April in second year) and also for fifteen months after the price changed (May to July in second year), which suggest us that all three assuming effects were all at work in the pre-transitional period. On the contrary, we could hardly find any evidence for passive birth control in the transistional period (see our findings in Table 7.2).

[41] We include the "occupation unknown" in vulnerable group, for we reasonably believe that they are either young (yet inherit the business, or land property from their fathers) or possibly the landless migrant workers from other villages (see *Note b* Figure 7.1).

Table 7.2 Fertility Response to a 10% Increase in Food Prices (compared to the normal price level, trend value) by Quarter-Year Among the women in Vulnerable Group in Dajia, 1906-1942, for All Married Women.

	1906-1942		1906-1920		1921-1942	
	%	p	%	p	%	p
Quarter *Price(t)						
Nov-Jan	15.07	0.03	-35.14	0.01	42.18	0.01
Feb-Apr	3.45	0.73	-66.36	0.07	15.72	0.61
May-Jul	-40.00	0.01	-99.88	0.01	-79.02	0.01
Aug-Oct	-5.18	0.70	-77.97	0.02	-63.09	0.04
Quarter*Price(t-1)						
Nov-Jan	-6.61	0.40	-21.77	0.02	14.31	0.03
Feb-Apr	-6.25	0.20	-66.27	0.01	9.52	0.43
May-Jul	-13.24	0.13	-99.20	0.01	2.04	0.92
Aug-Oct	-3.68	0.51	-49.06	0.07	-6.32	0.63
Births	1959		513		1446	

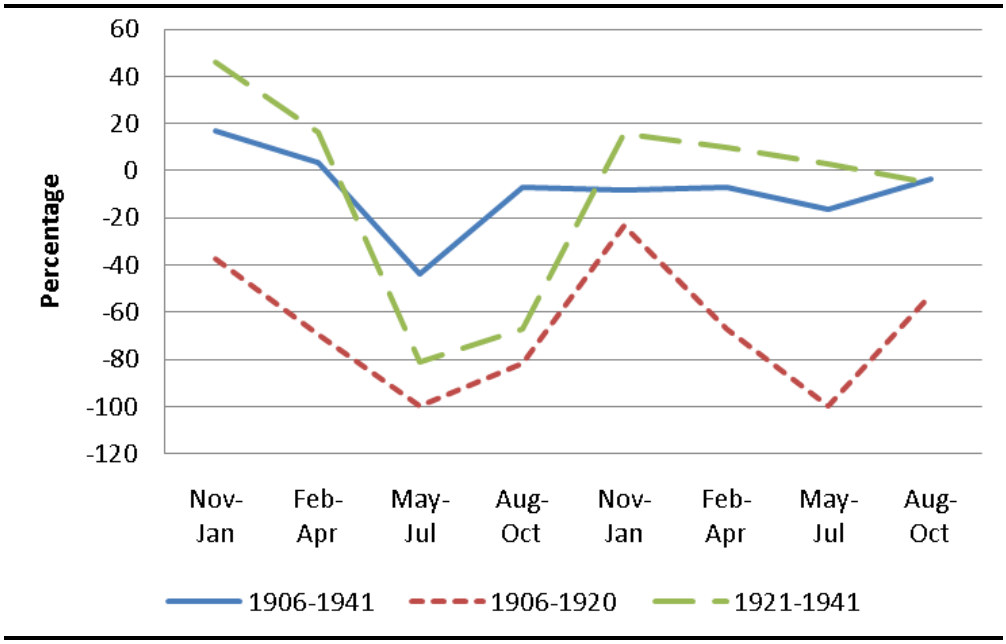
Note: The model also includes age, husbands' SES, life status of previous child, sex of previous child, and sons among previous births.

Source: Demographic Database of Colonial Taiwan.

Our results of deliberate fertility control in Chinese population are quite similar to its counterparts in Northwest Europe, at least in the pre-transitional period, which had implicated that the Chinese population in pre-transtitional period is not merely determined by positive checks, but also be regulated by preventive check. This is not fully consistent with the view point of Malthus and his supporters, who claimed the poor health, inadequate nutrition, heavy labor, and poverty-induced spousal separation are the main reasons for explaining the lowered fertility among Chinese universal and early marriages (Malthus 1989, pp.121-133, Wolf 2001, p.142).

From Figure 7.1 (elaborated based on the estimates presented in Table 7.2), we instead of finding obvious passive effect in transitioanl period, but in pre-transitional period. It would in turn render us evidence that the living standard was improved in transitional period (Bengtsson and Campbell 2004).

Figure 7.1 Fertility Response to a 10% Increase in Rice Prices (compared to the normal price level, trend value) over the Next Two Years, Among the Women in Vulnerable Groups, by Different Periods in Dajia, Taiwan



Source: Based on model estimations in Table 7.2.

Threshold effects in the fertility response to economic stress

For those households in vulnerable group, a large number of them are either farmers or farm workers, and the food production is the main activity in their daily life. The very low (or low) food price were generally beieved to be advantageous for the net food buyers, as those worked as farm workers; while at the same time, the low food price would be thought to be harmful for the farmers, the net food sellers. However, the adverse effect for net food sellers during the low food price period could in turn lead to reduced demand for labors and services from net food buyers households (Dribe and Scalone 2010, Aksoy and Isik-Dikmelik 2008, pp.3-4) and turn out to hurt the net food buyers via this indirect way. In this section, we examine the fertility response for married women in the vulnerable group to different levels of economic stresses, by classifying the food price levels into five categories, “very low,” “low,” “normal,” “high,” and “very high” (Bengtsson and Dribe 2006, Dribe and Scalone 2010). By doing so, we can detect the linearity for the fertility response to the food price fluctuations. In Table 7.3, it shows the fertility responses of married women to each categorized prices. It is not surprisingly that our results show a negative linear relationship between high (very high) price and the fertility response, when the higher the rice price, the lower the fertility response is. However, the negative linear relationship was also found for low and very low price, which means the vulnerable households are not always benefited from the the low food price. Along the time of low price period, the net food buyers’ income might be wore off due to the shortage of labor demand, and the net food sellers’ income

would be damaged by lower profit on return.

Table 7.3 Fertility Response to a 10% Increase in Food Prices (compared to the normal price level, trend value) by Quarter-Year Among Vulnerable Group in Dajia, 1906-1942, for All Married Women.

	Farmer, lower skilled/ Unskilled	
	RR	p
Rice price		
Very Low	0.07	0.02
Low	0.32	0.36
Normal	1.00	Ref.
High	0.28	0.06
Very High	0.04	0.01
Births	2231	

Note: The model also includes age, husbands' SES, life status of previous child, sex of previous child, and sons among previous births.

Source: Demographic Database of Colonial Taiwan.

Chapter 8.

Summary and conclusions

This paper is aiming to understand the changing attitude of Chinese population toward childbearing behaviors in pre-transitional period and the transitional period. The main contribution of this paper is to answer the two important demographic issues: **I.** Is Chinese population a natural population before the transitional period? **II.** Is Chinese population been dominated by Malthusian's view of positive check? By means of looking at a branch of Chinese population in colonial Taiwan, we had overcome the problem of data limitation for Chinese demography, especially in pre-transitional period. Taking advantages from using a micro-level data, we are able to control for the socio-demographic information of each individual in our research area (Dajia), in combination to the regional level grain price index, we were allowed to make a set of multivariate analyses in answering these two research questions.

For answering our first research question, the evidences from the length of birth interval and age specific fertility had marked the characteristics of a natural population. This view point had also been further confirmed by non-parity-specific characteristics found in our multivariate analyses. With the supports of these features that had convinced us the Chinese population a natural population both before and during the first demographic transition. As for our second question, our empirical results show that, in spite of Chinese farmers are widely capable of forecasting the harvest outcome before price change in late September, the deliberate control of practicing postponement couldn't be confirmed until entering into the transitional period, when the mortality start declining. The passive fertility control appeared fifteen months after the actual change of grain price, implicated a positive check was at work through a combined effect of malnutrition, poor-induced spouse separation, and prolong breast feeding. The controversial view that Malthusians' followers believe, the Chinese population had been regulated "only" by positive checks, is now being denied by the results shown in this paper.

Conclusively, our empirical results had indicated that the attitude toward childbearing among Chinese is quite similar to that of Northwest Europeans, at least in the pre-transitional period. While the populations in both sides of the continent had equal wisdoms in forecasting harvest outcomes before transitional period, both populations choose planning their child births accordingly to their forecast in food price fluctuations. The ways of how people harmonize their economic life during the economic hardship is actually not very different on both sides of the continent.

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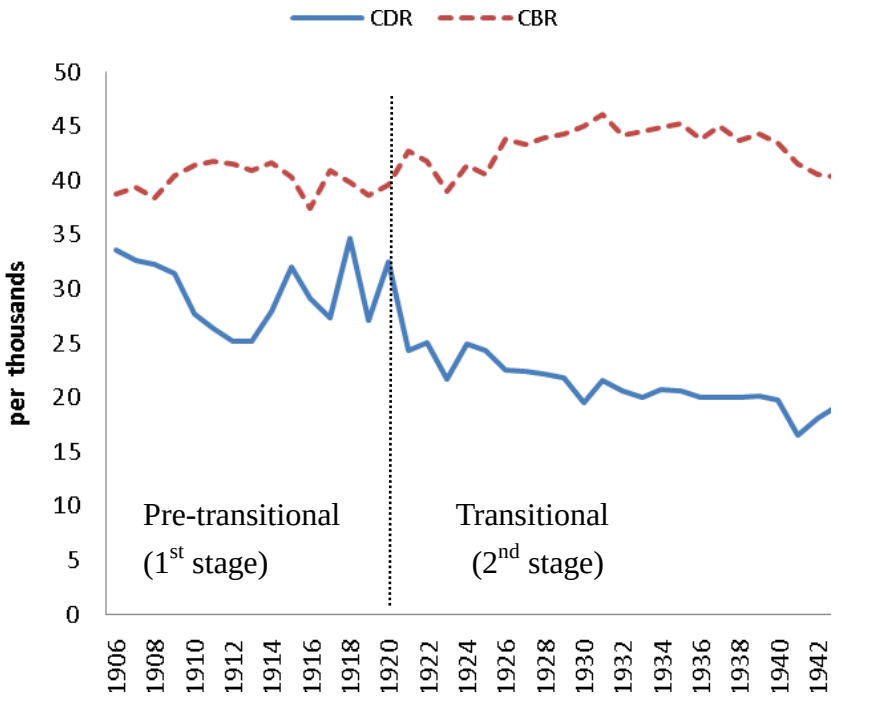
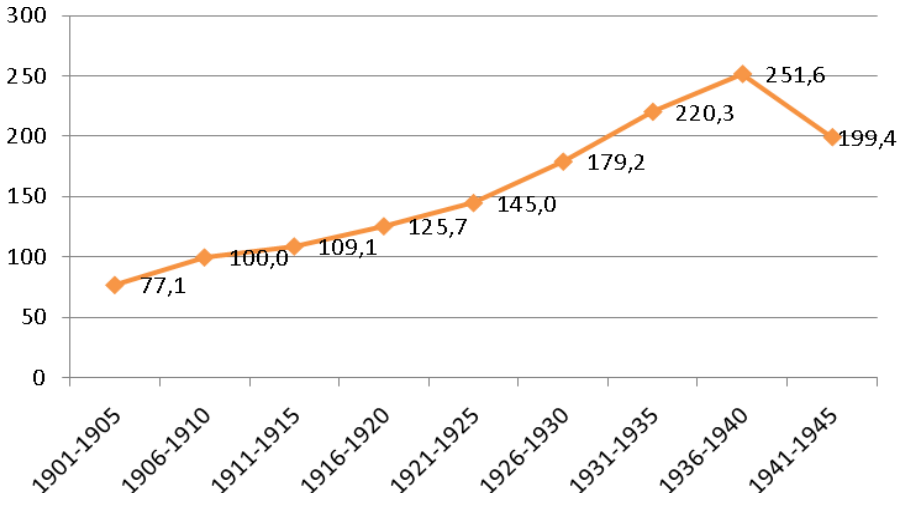
Appendix

Appendix 1. Mortality and Fertility, Colonial Taiwan, 1906-1942



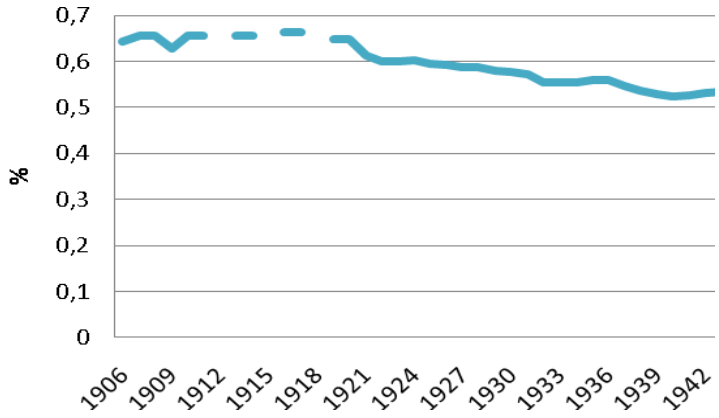
Source: Taiwan Executive Office (1946)

Appendix 2. Inex of Agricultural Gross Output in Colonial Taiwan, 1901-1945. (index 1906-1910=100)



Source: Ho (1968), table1, p.315.

Appedix 3. Percentage of Agricultural Population, Taiwan, 1906-1942



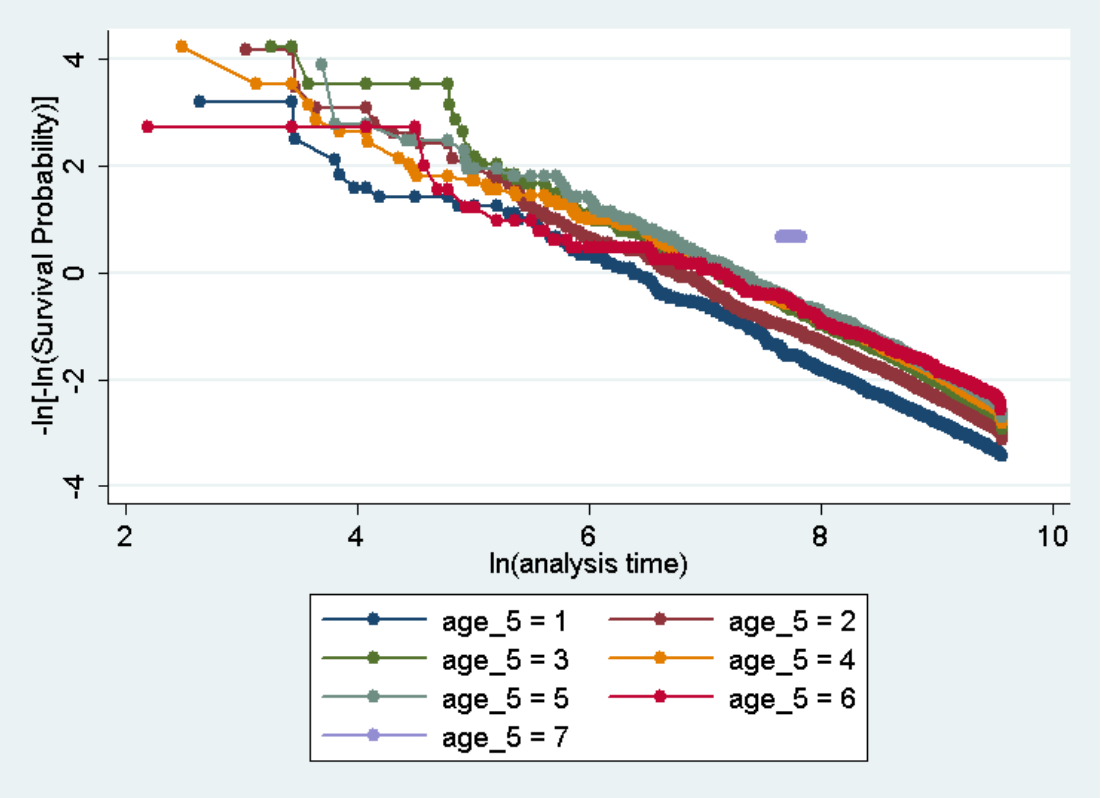
Source: Eleborated fromTaiwan Executive Office (1946).

Appendix 4. Social Structuer in Taiwan. (% in total numbers of agricultural households)

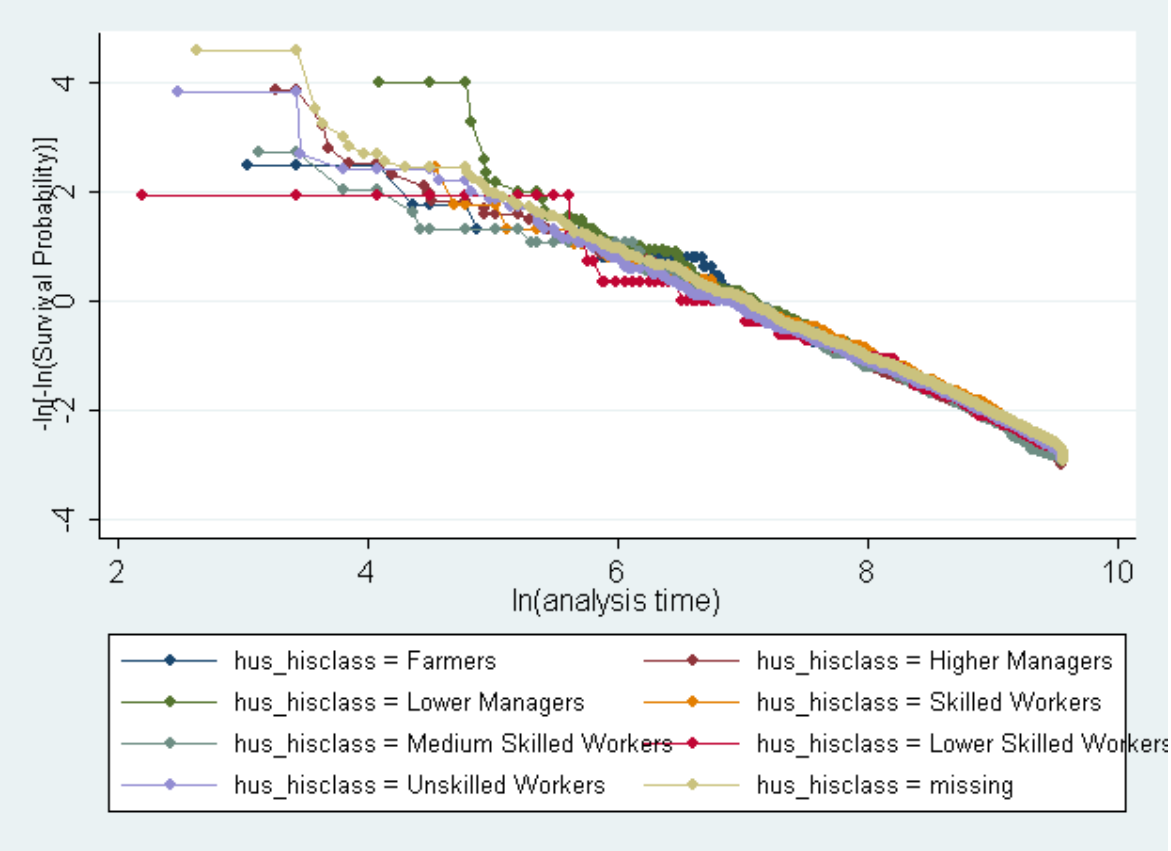
Year	Freeholder	Semi-landless	Tenants
1922	30.3	28.9	40.8
1923	29.2	29.9	41.0
1924	29.3	29.8	40.9
1925	29.0	30.1	40.9
1926	29.0	30.1	40.9
1927	29.3	28.1	40.1
1928	29.2	30.7	40.1
1929	29.0	30.9	40.2
1930	29.1	30.7	40.2
1931	28.7	30.8	40.5
1932	32.7	29.5	37.7
1933	29.0	27.3	34.7
1934	31.6	30.3	38.1
1935	31.5	30.6	38.0
1936	30.9	31.3	37.8
1937	30.7	31.5	37.8
1938	30.7	31.9	37.4
1939	32.7	31.3	36.0
1940	32.0	31.2	36.8
1941	31.2	31.4	37.4
1942	30.9	31.2	37.9
1943	31.0	28.0	38.8
1944	31.0	29.9	39.1
1945	29.8	29.5	40.7

Source: Elaborated from Taiwan Executive Office (1946)

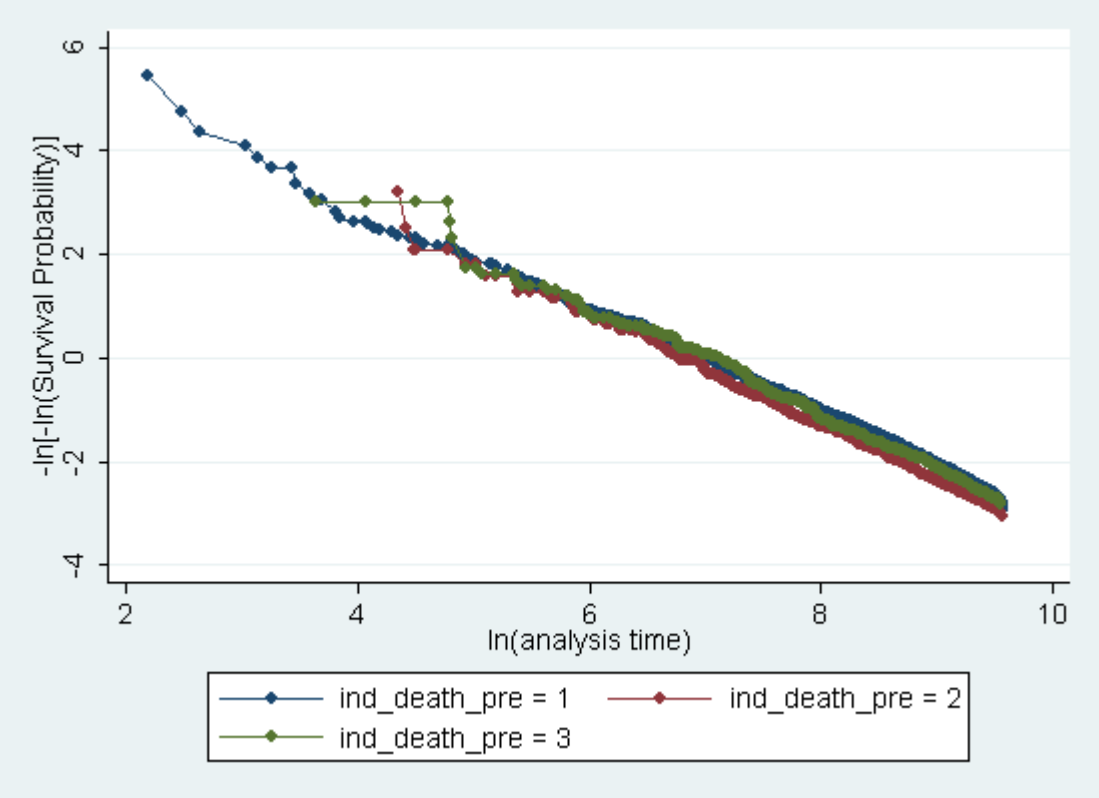
Appendix 5 Test of proportional hazards assumption for **age of mother at birth**, with control for husbands' SES, types of marriages, and life status of previous child.



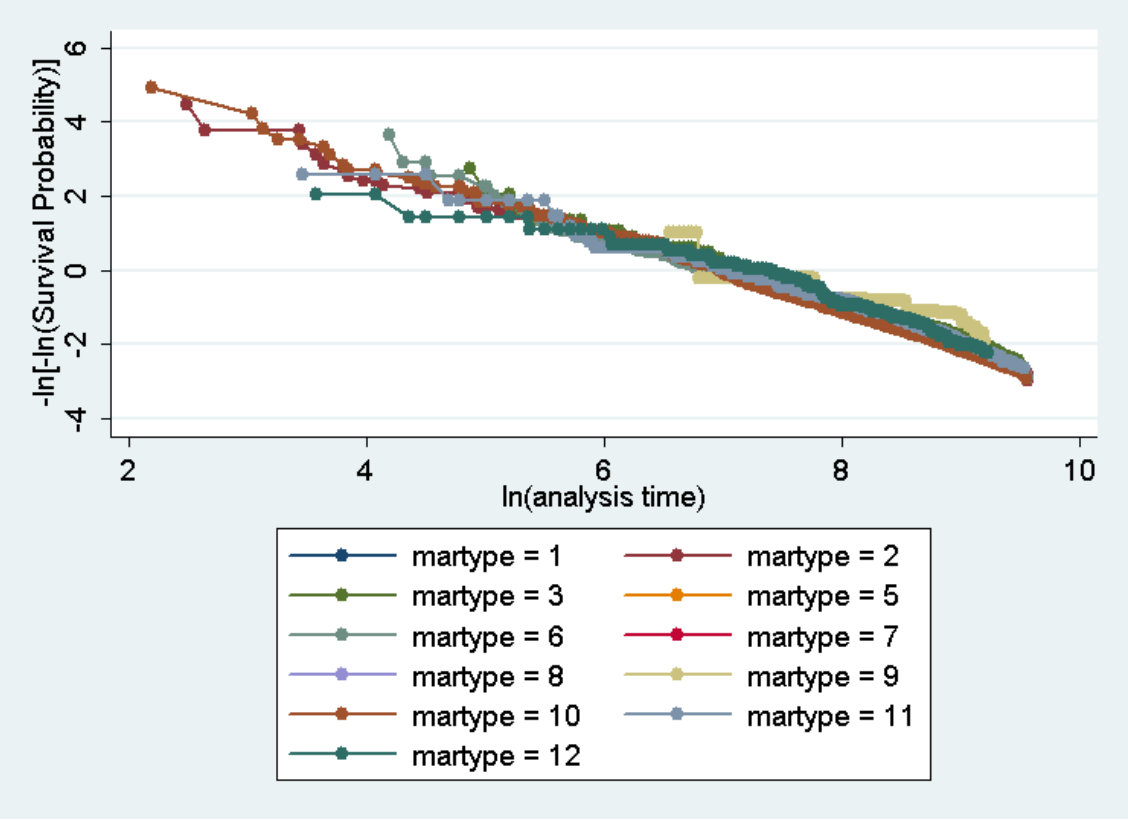
Appendix 6 Test of proportional hazards assumption for **type of marriages**, with control for age of mother, husbands' SES, life status of previous child.



Appendix 7 Test of proportional hazards assumption for **life status of previous child**, with control for age of mother, types of marriages, and husbands' SES.



Appendix 8 Test of proportional hazards assumption for **type of marriages**, with control for age of mother, husbands' SES, life status of previous child.



Appendix 9 Test of proportional hazards assumption for **Quarter period**, with control for age of mother, husbands' SES, types of marriages and life status of previous child.