Two cities, one life
Marriage and fertility in
Lugang and Nijmegen

Theo Engelen &
Hsieh Ying-Hui

Life at the Extremes Volume III

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Two cities, one life
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in Lugang and Nijmegen
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Preface

Every book has its history. The history of the present volume began in 1996 when Arthur P. Wolf (Stanford University), Chuang Ying-chang (Academia Sinica, Taiwan) and Theo Engelen (Radboud University Nijmegen, the Netherlands) started a comparative research program on the demographic history of Taiwan and the Netherlands, called Population and Society in Taiwan and the Netherlands. It is a collaboration of Taiwanese, US and Dutch historians and anthropologists studying the differences in family formation and demography in two countries considered prototypical for the European and the Asian population regimes. The comparison of these regimes itself has a long history from Thomas Malthus\(^1\) via John Hajnal\(^2\) to James Lee\(^3\). Originally, the core of the comparison was the classical dichotomy of the world into a Western-European and a Chinese demographic pattern, the first characterized by late marriage and a high incidence of celibacy, the other by young and universal marriage. The resulting implicit assumption was that, in the Malthusian terminology, the European population was regulated through preventive checks, the Chinese through positive checks. According to James Lee et al. this typology does not do justice to Chinese society. They refer to the Malthusian vision as mythology and are convinced that Chinese actors have displayed a so called proactive behavior throughout the 19th and 20th centuries.

In Population and Society in Taiwan and the Netherlands the participants have refrained from indulging in sweeping generalisations. Instead, they collected large databases on both sides of the Eurasian continent and tried through empirical research on the micro level to let the data speak. This third volume of Life at the Extremes. The demography of China and Europe presents the results of a comparison between two provincial towns, Lugang in Taiwan and Nijmegen in the Netherlands. These results are also evaluated within the larger discussion mentioned.

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University Nijmegen and the Program for Historical Demography of the Academia Sinica, Taiwan. A grant from the Taiwanese National Science Organization enabled Theo Engelen to spend the academic year 2004-2005 at the Institute of Ethnology of the Academia Sinica. For one year Hsieh Ying-hui and Theo Engelen could devote most of their time to comparing the population of Nijmegen and Lugang. Before this specific period, during the research and afterwards, the authors benefited from discussions and comments by many colleagues. In this way Arthur Wolf, Chuang Ying-chang and Hill Gates contributed to the book, as did Yang Wenshan, Yu Guang-hong, Pan Ing-hai, John Shepherd and Melissa Brown. We also gratefully mention Jan Kok who has been of great value for the program in general and this book in particular. Hill Gates was kind enough to read and comment on the text written by two non-native speakers. As always, however, the responsibility for the chapters you are about to read rests with the authors.

Nijmegen/Taipei, January 2007,

Theo Engelen and Hsieh Ying-Hui
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I

Two cities, one life

Introduction
The history of mankind is characterized by a constant struggle to feed an increasing number of human beings. As a result, population growth has been very slow until well into the 19th century. Moderate levels of labor and soil productivity simply did not allow an increase comparable to that begun after the agricultural and industrial revolutions. The historically unknown growth of population and of the standard of living since then, however, was mainly limited to the western part of the world. For many regions in Asia and Africa the threat of hunger and starvation have remained a living reality until today. Pessimists even predict that at the global level the unbalanced growth of population and resources inevitably is heading towards disaster. One of the crucial issues in historical demography, if not in history, is the way societies in the past handled the constant threat of overpopulation.

We address this central issue too. Our approach, however, is not the analysis of developments and interactions of the dynamics determining the growth of population and production at the macro level. Rather, we focus on two towns and the individuals living in these towns. The background of this choice is easy to understand. Obviously, the development of the size of populations of nations or continents was not directed at the national or continental level. It was the result of conscious and unconscious decisions regarding marriage and fertility made by individual historical actors. The intellectual horizon of most of these actors was limited to circumstances in their own family, village, town or region. They had no idea of the macro effects of their behavior. Our knowledge of these individual decisions and the perceptions underlying them is still very limited. To be sure, the general growth of the number of inhabitants is known for most parts of the world, as are its economic, social and cultural covariates. Still, we have only begun to understand the mechanism that guided individual level actions to reach this macro level result.

When Thomas Malthus published the first edition of his *Essay on Population* in 1798, he distinguished two possible strategies for historical actors. The first was to limit population growth by marriage restriction. In western Europe, he stated, we find people in all layers of society who know what the consequences are of a young and reckless marriage. Therefore, they postpone marriage or remain celibate. Those who do not live up to this preventive check pay a high price. Their children boost the infant mortality rates and their standard of living is appalling. Malthus also pointed at populations that did not practice marriage restriction at all: China was his principal case. There, the positive checks of poverty, famine and epidemics corrected the fast growing population with a red pencil. We will deal in more detail with the ideas of Malthus and his followers in the next

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chapter. Suffice it to say here that the division of the world into a ‘preventive’ and a ‘positive’ part induced us to compare the reproductive behavior of populations living under the two regimes.

This book is part of the research program *Population and Society in Taiwan and the Netherlands* started in 1997 by Chuang Ying-Chang (Academia Sinica, Taiwan), Arthur P. Wolf (Stanford University, U.S.A.) and Theo Engelen (Radboud University Nijmegen, the Netherlands). The evidence presented here follows the general characteristics and purposes of this program. What are they? The program is geared toward the comparison of the demography of a western-European and a ‘Chinese’ society. The two countries chosen, situated at opposite ends of the Eurasian continent, are archetypical representatives of the two demographic patterns described by Malthus. This division goes beyond demographic differences only. It starts with an observation by John Hajnal that until recently the European demographic regime was “unique or almost unique in the world”. He proceeds by stating that because of the difference in marriage systems, Europe was richer and life less precarious there than in the rest of the world. Thus, this line of thinking also attributes differential economic development to population processes.

The project *Population and Society in Taiwan and the Netherlands* is the result of ongoing interest in the dichotomy of the world as outlined here. The participants can evaluate this distinction because they have a set of remarkably similar sources at their disposal. In both countries we find carefully kept and reliable household registers that contain almost exactly the same information. A detailed comparison of the lives represented in these registers has, in our view, implications extending far beyond the national boundaries of Taiwan and the Netherlands. It provides an opportunity to evaluate and, if need be, revise the models that now dominate our perception of the demographic history of the world.

The first empirical goal of the project is to compare a small number of selected communities in terms of the standard demographic rates of marriage, fertility and mortality. Do the Taiwanese and Dutch rates differ as predicted by the neo-Malthusian models? Do they indicate that population growth in Taiwan was regulated by mortality, while growth in the Netherlands was governed by fertility? There is ample evidence that marriage was earlier and more nearly universal in Taiwan than in the Netherlands, but this does not necessarily mean that Taiwanese fertility was unregulated and insensitive to economic opportunity.5 All

5. In fact, recently published evidence suggests that the Ch’ing nobility practiced some form of birth control (though there is not as yet evidence of fertility control among commoners). See Wang Feng, James Lee, and Cameron Campbell, ‘Marital fertility control among the Qing nobility: Implications for two types of preventative check,’ *Population Studies* 49 (1995) 383-400.
the evidence now available says that marital fertility was lower in China than in pre-industrial Europe. This could be due to such positive checks as infecundity or fetal loss due to poor maternal health, but it could also mean that Chinese fertility was regulated within marriage rather than by delay of marriage.

The great advantages of the evidence from the household registers, as compared with aggregated evidence, is that one can determine the exact timing of births and the extent to which the length of the intervals is influenced by such variables as the mother’s age and social position, the number of her surviving children, and the fate of her last-born child. Careful examination of such evidence will allow us to determine whether Taiwanese fertility was regulated by positive or preventive checks. With regard to mortality, the Malthusian argument is that mortality was much higher in China than in Europe because population was ‘forced’ and ‘wretchedness’ was its consequence. Was wretchedness induced by over-population a more important cause of mortality in China than in Europe? Or were the differences, if there were in fact differences, largely due to endemic diseases that had little to with poverty? The household registers are sufficiently detailed to answer these questions for our sample of Taiwanese and Dutch communities.

The next goal of the project is to determine what comparisons between China and Europe look like when one takes account of regional, class, and occupational variation. An important failing of Hajnal’s contrast between European and non-European is that it is largely based on national averages. This is a serious problem because it may have the effect of making China and Europe look more unlike one another than they actually are. It could be that people living in similar settings, working at similar jobs, and commanding similar resources behave in similar ways regardless of whether they are Taiwanese or Dutch. This possibility is investigated by classifying all of the people included in our study by locality, by occupation, and by social class. In short, the participants of the program begin with real human beings and then determine whether or not their being Taiwanese or Dutch matters.

When we compare Lugang and Nijmegen in this book we pursue the same strategy. We will calculate and compare the standard demographic rates of nuptiality, fertility and mortality, and in this way test the Malthusian predictions. Next, we will try to disentangle the individual rationality behind aggregated measures in order to find out whether the one life each inhabitant of the two towns had was indeed used in a different way. In the rest of this first chapter we will

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introduce the two towns selected. Are they comparable and if so, what periods can best be compared? Finally, the sources that make the comparison possible are described.

The two towns
Nijmegen in the Netherlands and Lugang in Taiwan are the towns taken as examples of the two demographic regimes said to rule Europe and China. Studying them provides us with the opportunity to zoom in on particular circumstances, and, thus, look both at general characteristics of the countries they are situated in and at local peculiarities. The cities resembled each other as much as two cities at the both ends of the Eurasian continent could. Both were medium sized provincial towns with a regional function, both were once flourishing ports and both were, in the period studied, suffering from an economic crisis. We will first describe the two towns and then provide a statistical comparison of the major characteristics.

Lugang is located on the west coast of central Taiwan. See Map 1 (page 14). Until 1850, it was Taiwan’s second largest city, a situation which is captured in the saying “Yi Fu, er Lu, san Mengjia” (First Tai-nan, second Lugang, and third Tai-bei). This position was the result of being the main seaport connecting central Taiwan with southern Fukien, across the strait of Taiwan. Although Lugang had to struggle constantly against silting and blockage, for a long time there was no better way to transport goods from or to the Changhua plain than through its port. DeGlopper described the city in its period of bloom as follows: “Lugang had official yamens, granaries, warehouses, temples, and academies, and was the site of magnificent annual festivals and conspicuous displays of wealth. But it produced practically nothing for itself, and depended on the trade that exchanged the rice and agricultural products of central Taiwan for the cloth and manufactured articles of Southern Fukien.”

This one-sided orientation backfired in the second half of the 19th century. The development of the northern part of the island was responsible for a declining relative position of Lugang, but the city also witnessed an absolute decline. More and more, rice was not exported to the mainland, but was consumed by the growing population of Taiwan itself. Fukien province managed to buy rice in Indochina and transported it more cheaply by way of large steamships. The final blows came in 1905 when the Japanese finished Taiwan’s north-south railway, connecting Changhua and Kaohsiung, and, in 1908, Changhua and the north. The newly developed seaports of Keelung and Kaohsiung could host modern

ships, and took over almost all transport. Lugang remained a port visited by small junks only. The following figures are indicative: in 1896 1051 ships came to the city, in 1937 only 8.

In 1899, a native of the city was appointed as the head of a Chinese state licensed salt monopoly, resulting in a short period of salt production. Still, this could not restore the former wealth derived from shipping and trading. Further, environmental deficiencies created so many difficulties that from 1918 on, the salt fields were gradually closed down and converted to rice fields. Many inhabitants of Lugang reacted to the new situation by moving away to the new economic centers of the island. In most cases, however, their families remained in Lugang,
living on remittances from the emigrants. In the Japanese period, there was hardly any industrialization in Lugang. The glorious past was replaced by 20th century reality, a rural town which hosted only the proverbial rice and flour mills, oil presses, and soy sauce works. The rest lived on rents and remittances.

As always, however, the past left its traces in Lugang, even in the years when the economic situation deteriorated. Its appearance remained very distinctive: according to some, the best example of Chinese domestic architecture in Taiwan. Until 1934, the city was characterized by very narrow streets, covered with timber roofs that shielded the inhabitants from rain and sun. This is the origin of Lugang’s fame as “the city where you can’t see the sky”. The Japanese colonial government changed this in 1934 by building a few wide streets though the city. Even after the urban renewal project, however, one could find the traditional Ch’ing merchant houses behind the new facades of the main street. The ancient architecture is until the present a major characteristic of the town.

For the inhabitants of Lugang the memory of former wealth lingered. They considered themselves as special in Taiwan. Next to the architectural heritage, the local accent was cause for pride. It is said to demonstrate the cultivated nature of the city. The self-image of the city mirrored this. Having been established as a city for many centuries in itself was an admirable quality. Having been for many years the biggest harbor in Taiwan and the second largest city are engraved in the collective memory. Many legends (especially those about visits of emperors to the city) are cherished even when no historic evidence substantiates them. The three centuries’ old Matsu Temple was and is a centerpiece of Lugang’s claim to superiority. In Lugang nobody doubted that it was the oldest Matsu temple in the country and the root for all other Taiwanese Matsu temples. The rich past thus was used as a way to define the city.

When comparing themselves to dwellers in the surrounding countryside, inhabitants of Lugang made a strong distinction: the farmers clearly were not as cultivated and educated as themselves. Nor could big cities like Taipei compete with Lugang’s position. Although the economic prosperity Taipei could not be denied, in the Lugang view this went hand in hand with overpopulation, dirt, chaos, vice and crime. All this amounts to the feeling that being “Lugang people” was a special quality. Although social divisions within the city were recognized, they were of minor importance when compared to the fact that they all were inhabitants of this superior city.

How many people could call themselves inhabitants of this superior city? Graph 1.1 (page 16) shows that during the first half of the colonial period Lugang only witnessed a very slow population growth. Until 1925 about 30,000 men and women lived there. After that year a significant growth spurt started, bringing the population to 40,000 in 1940. If we treat the growth of the Lugang population as
indicative of the socio-economic situation, the conclusion must be that the city was clearly more prosperous in the second half of the Japanese colonial period.

At the other end of the Eurasian continent we find Nijmegen, a medium-sized provincial town located, on the north-south scale, in the middle of the Netherlands, close to the eastern border. See Map 2. The city was founded along the river Waal that connected the western part of the Netherlands with Germany. This geographic position made the city a thriving river port for centuries. The Waal and the trade it generated between several parts of Europe formed the core of Nijmegen’s economic activities from the Middle Ages on. Time and again, however, the vulnerability of the river trade was revealed by the succession of wars that characterized the European history of the early modern era. Political change resulted in traffic and trade barriers. The occupation of the country by the French at the end of the 18th century dealt a final blow to Nijmegen’s trade, simply because the border with Germany was closed. Also, when the French army approached the city in October 1794, many members of the Protestant elite fled the city and found refuge in Holland, leaving Nijmegen without the traditional ruling class.

This was only one reason for the decline. Nijmegen also became the victim of the structural transformation of interregional transport routes. Larger cities,

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like Rotterdam in the Netherlands, and Köln and Düsseldorf in Germany, took over the position of the traditional towns along the rivers Waal, Maas and Rijn, leaving them only a small part of the total trade. The effect of the financial catastrophe following the French invasion was visible during a large part of the 19th century. Nijmegen entrepreneurs had become very cautious. Investments in new products and production processes were scarce. The number of rentiers who chose to buy land and obligations rose. Even the city government emphasized the crisis by a very conservative spending pattern.

No wonder, then, that in this period the city is described as a backward outpost in the eastern Netherlands. A German observer, for instance, noticed in
1818 that Nijmegen was nothing more than a collection of “curved, dark streets with small and ugly houses”.\textsuperscript{10} Contemporary descriptions of the living conditions within the walls reflect the situation. Keywords are: Neglected, unpaved streets, an open sewer system, overpopulation, alcoholism, lack of hygiene, and pauperism resulting in crime. By the middle of the century 21,000 inhabitants were living on a surface area that by the standards of the time could accommodate only 16,000 people at most. As a result the average house contained between 6 and 8 inhabitants, often in only one room. The overpopulation was the result of the garrison status of the city. From 1591 on, Nijmegen was the easternmost Dutch garrison, a status that required the preservation of the medieval walls. As time went on, these walls became a suffocating harness for a population that could hardly grow.

The Nijmegen historian Paul Klep recently reconstructed the standard of living in the city. He found that for most of the inhabitants of Nijmegen the 19th century was an era of poverty and insecurity. The nominal day wages stayed at the 18th century level until the economic resurrection in the last quarter of the 19th century. A relatively large proportion of the citizens of Nijmegen was too poor to cope. Klep’s calculations show that 13% of the population received poor relief in the 1820’s, rising to 18% in the 1840’s. Illiteracy is another measure for underdevelopment. Of all marriages contracted in the years between 1812 and 1821 20% of the men and 45% of the women were illiterate. The corresponding percentages for the marriage period 1840-1849 were 15 and 30. Illiteracy was declining, we may conclude, but at a very slow pace.

In sum, then, we may conclude that, until 1875, the economy of Nijmegen had all the characteristics of a traditional, pre-industrial society, always on the edge of poverty and with no immediate prospects for future improvement. For centuries the quantitative division of the labor population remained the same. Agriculture was a relatively large sector and industry remained an underdeveloped part of the economy. An army of day laborers moved along with the fluctuations in demand, working one day in transport, another in agriculture or building. It is not surprising then that in a city like this the use of steam engines, until the last quarter of the century, was restricted to shipping and some mills.

In the 1870’s things changed. The most important incentive for this change was launched by the Royal Decree of April 18, 1874, that ended Nijmegen’s position as a military stronghold. When the walls were demolished, building activity on the newly gained surface area was unprecedented. Between 1870 and 1900, total production and income in Nijmegen increased to five times the previous level, and the standard of living doubled.

As always, the number of inhabitants mirrored the development of the economic situation. During the first decades of the 19th century Nijmegen harbored about 13,000 inhabitants. The increase to a population of approximately 21,000 in 1840 could only be maintained by the growth of the garrison. But then the growth stopped. Between 1840 and 1870, the number of ‘Nijmegenaren’ remained about the same. The city walls precluded further expansion and the stagnating economy resulted in an invariable demand for labor. The dramatic change during and after the 1870’s is plain to see. Within thirty years the economic revival resulted in a population of 44,000 in 1900.

**The period of comparison**

The aim of this research is to find the similarities and discrepancies in the demographic behavior of the inhabitants of Nijmegen and Lugang. The comparison is made difficult, however, because the two towns had a different pace of development until the 1970’s. What periods can we reasonably compare? Since the detailed individual level data available for Taiwan cover the years of the Japanese colonial period between 1895 and 1945, we had to select a period in Dutch history that was similar with regard to economic and demographic change. An analysis of relevant indicators showed that for Nijmegen the years between approximately 1840 and 1890 resembled Lugang in the period 1895-1945.

In these time segments, the two cities had approximately the same number of inhabitants. Nijmegen witnessed an increase from 21,000 inhabitants in
For the city of Lugang, the population in 1895 was approximately 17,000, and in 1945 it was 29,000. Both cities also had a market function for the surrounding countryside. When we look at their respective demographic transitions, again the similarity is striking. At the aggregate level we find no sign of fertility decline in the periods chosen. Nijmegen and Lugang therefore reflect the situation in the last phase of the pre-industrial era. Mortality rates were coming under control and economic incentives for birth-control were becoming visible. Still, in both cities traditional attitudes towards procreation stood in the way of the acceptance of fertility decline. Looking beyond our period we can see that fertility decline in Lugang started exactly 60 years later than in Nijmegen, the same number of years that separates the two periods we compare.

Our next indicator is the age distribution in the cities. The age pyramid is an excellent graphical representation of the demography at a given moment in time which brings together the influences of fertility, mortality and migration. The data necessary for the construction of an age pyramid are only found in censuses, giving age and sex. We chose to use a census close to the start of our period of observation, 1849 for Nijmegen and 1815 for Lugang. In the Taiwan case the data unfortunately are grouped in four unequal clusters of ages. For that reason we calculated for Nijmegen the same age groups. The results are presented in Graph 1.3.

The general pattern of the age-composition in the two towns was very similar; an observation that once again confirms that the choice of periods to com-
pare is justified. Two differences appesar however. First, the younger age groups were relatively overrepresented in Lugang, whereas the two older age groups were proportionally large in Nijmegen. Life expectancy in the Netherlands was clearly higher than in Taiwan. The other difference has to do with the sex ratio. In Nijmegen, women were dominant in every age group. The difference in life-expectancy showed markedly for age 60 and higher when there were only 67 males on every 100 women. In Lugang too, women lived longer. The discrepancy with men was even bigger. Past age 60 there were only 43 men to match 100 women. For the youngest age groups, however, the Lugang census shows an excess of male children. Between 0 and 6 years we find 110 boys to 100 girls. In the age group 6-20 the balance was restored. After age 20 the situation was the same as in Nijmegen, with an overrepresentation of women.

Our last indicator is the economic structure of the two towns. From our earlier description it was already clear that both cities were captured in a pre-industrial situation, with no incentives for growth. As already mentioned, in Nijmegen, for centuries the quantitative division of the labor population remained the same: about 15 per cent in agriculture, 25 per cent in crafts and industry, and approximately 60 per cent in (traditional) services. This only changed in the late 1870’s. The 1915 census for Lugang informs us that we find in this city almost the same distribution of occupations: 20 per cent in agriculture, 29 per cent in industry and crafts, and 51 per cent in service like occupations.

Thus, our conclusion is that the comparison of Nijmegen between 1840 and 1890 with Lugang between 1895 and 1945 is justified. We have cities of approximately the same size and age composition that have not yet started the last phase of the demographic transition, and that suffer from an economic depression after a more glorious past. The only real difference is the sudden revival in Nijmegen after the demolition of the city walls. Although the Japanese period fostered a rise in standard of living in Lugang, this had not the same magnitude.

Sources
Two sources provide detailed information on the demographic events in individual Dutch lives: the civil registration and the household registers. The official registration of births, marriages and deaths in the Netherlands was officially effective as of 1811. It was the French government that imposed the registration as part of the so-called Code Napoléon on the Dutch citizens. After the French

12. Second Provisional Household Census of Taiwan, 1915
had gone in 1813, the new Dutch government announced that the registration had to be maintained as before. Even the new Dutch Civil Law of 1838 did not change the structure of this registration. For the whole 19th century therefore we find for every Dutch community the registers of births, marriages and deaths. Within three days after the birth of a child the father or, in his absence, the doctor or midwife who assisted at the delivery had to notify the authorities of the birth. Originally, the newborn child must be shown to the civil servant. After 1838, the civil servant could demand this when he thought it was necessary.

Marriages had for centuries been registered by priests or vicars. Since 1792, however, an identical registration by a civil servant for all Dutch citizens was required. This custom remained intact after the start of the Dutch Kingdom, including the obligation to announce each marriage in a public space in order to make objections possible. In the marriage certificate we find information on age, civil status and occupation of the couple, including reference to their respective parents. The burial of a deceased citizen was only allowed after the civil servant had registered the death, including the characteristics (name, age, sex, occupation, residence, spouse and parents) of the deceased.

Although prior to 1849 the use of a continuous population register was discussed on many occasions, it was introduced on January 1, 1850 following a Royal Decree of October 1849. The new population registers contained information on all inhabitants of a municipality, including affiliation to the head of the household, age, civil status, occupation and religious denomination. Migrants had to register their arrival or departure, and civil servants were obliged to add births and deaths too. Thus, essentially, the population registers were updated on a daily basis. The first registers were made during the preparation of the census of 1849. In the population register new inhabitants were added and deceased persons or emigrants were crossed out. Every ten years, when a new census was held, we also find a new population register. During the next ten years, then, again the process of adding and deleting continued.

The availability of two sources allows us to check the reliability of both. In essence, all authors agree on the reliability of the Dutch registration system. The only exception is the possibility that migratory movements were slightly under-registered. Although the civil registration is considered most trustworthy, the population registers contain important additional information. If we want to know what the household composition was, this can only be found in the population registers. The same goes for the religious affiliation of the inhabitants, which was not registered in the civil registration.

As in the Netherlands, the registration of the Taiwanese population was introduced by a foreign power.14 When the Japanese invaded Taiwan in 1895, they were ill-prepared for the new role and managed to establish a modern colonial
rule only by trial and error. While fighting armed resistance, endemic and epidemic diseases, and the exodus of the local gentry, successive Japanese Governors-General also issued regulations to improve sanitation and public health, education, and railways. After a first attempt to establish a household registration in 1896, the issuance of Directive 104 (Household Census Regulations) marked the starting date of a reliable registration of almost all inhabitants of Taiwan. Japanese patrolmen and their Taiwanese assistants were ordered to create this registration. Following the first registration the data had to be updated regularly. The most suspect individuals (vagrants and criminals) had to report every month. For higher social classes this obligation was limited to every three or even six months. After the census of 1905 a new Directive (no. 255) provided further detail for the registration. By January 15, 1906, the household register system was considered to be complete.

Essentially, the information gathered in the Japanese household registers very much resembles the Dutch registration. The birth and death dates of all household members are recorded, as is information about marriage, adoption, migration, and occupation. In the Taiwanese registers, on the other hand, we also find information on the ethnic affiliation of every household member, and on foot binding, opium addiction and vaccinations. The heads of the local hok networks were ordered to register events such as births, deaths, marriages, and especially migratory movements within ten days after they occurred. As in the Dutch population registers, a system of adding and crossing out was used to keep the information up to date. Although the Mountain Aborigines tribes escaped registration until well in the 1940’s, the household registers provide reliable information on the major part of the population. When compared to the registration in the Netherlands, there are two differences. When death or birth dates were considered inauspicious, this may have resulted in inaccurate registration. As for information on occupation, this is unfortunately restricted to heads of households only. After 1935, registration of occupations stopped altogether.

Although the questions guiding this study have been touched upon already in the previous pages, a more explicit formulation is necessary. The central issues dealt with here build on the knowledge laid down in existing historiography. We therefore decided to present a detailed overview of our research questions at the end of Chapter 2, which deals with this historiography.

East is east and west is west?
Population checks in Europe and China
Thomas Malthus starts his *Essay on the Principle of Population* with two indisputable facts. “First, That food is necessary to the existence of man. Secondly, That the passion between the sexes is necessary and will remain nearly in its present state.” The famous British vicar is realistic in assessing the consequences of these observations for the human species. Population will grow faster than the production of resources to feed it. More precisely, Malthus attributes to population the capacity to grow in a geometrical way, whereas food production only increases arithmetically. The combination of the two observations spells disaster. What mankind needs, therefore, is a constant check to balance these two unequal powers.

In the European demographic arena, Malthus informs his readers, the balance between population and resources is maintained in two ways. “An intimate view of the state of society in any one country in Europe, which may serve equally for all, will enable us to answer this question, and to say that a foresight of the difficulties attending the rearing of a family acts as a preventive check, and the actual distresses of some of the lower classes, by which they are disabled from giving the proper food and attention to their children, act as a positive check to the natural increase of population.” Many authors cite Malthus selectively, emphasizing only the preventive check or the restriction on marriage, which, according to the vicar “operates, though with varied force, through all the classes of the community”. He nevertheless also points at the effects of positive checks, “the check that represses an increase which is already begun”. This makes Malthus into a vehement opponent of the Poor Laws, because “Their first obvious tendency is to increase population without increasing the food for its support. A poor man may marry with little or no prospect of being able to support a family in independence. They may be said therefore in some measure to create the poor which they maintain”. As a result especially the lower classes suffer from the want of proper and sufficient food, from hard labor and from unwholesome housing. Next to the preventive check, this situation operates as a constant check to increasing population.

According to Malthus, other parts of the world are characterized by only one check. He introduces China as an example for this. “It is said that early marriages very generally prevail through all the ranks of the Chinese. Yet Dr Adam Smith supposes that population in China is stationary. These two circumstances appear to be irreconcilable. It certainly seems very little probable that the population of China is fast increasing. Every acre of land has been so long in cultivation that we can hardly conceive there is any great yearly addition to the average produce. The fact, perhaps, of the universality of early marriages may not be sufficiently ascertained. If it be supposed true, the only way of accounting for the difficulty, with our
present knowledge of the subject, appears to be that the redundant population, necessarily occasioned by the prevalence of early marriages, must be repressed by occasional famines, and by the custom of exposing children, which, in times of distress, is probably more frequent than is ever acknowledged to Europeans."

These citations provide us with the terminology that dominated historical demography since. To be sure, Malthus himself divided the world in two distinct parts, each characterized by one of the checks mentioned. In “the less civilized parts of the world and in the past” population just grew until it was stopped through positive checks by way of mortality. Contrary, in “the different states of modern Europe” severe population pressure was largely avoided by means of preventive checks, the most important of which was a “delay of the marriage union”, although Malthus explicitly mentioned positive checks in this part of the world too, especially for those who ignored the rules of judicious marriage.

We deliberately quoted Malthus extensively, because with his work he started two traditions that have heavily influenced historical demography ever since. First of all, Malthus’ distinction between mortality and nuptiality as the two equilibrating mechanisms has become an historical demographer’s classic. As we will see, the historiography since 1798 witnesses a changing relative importance attached to these factors. Secondly, China is introduced as the ideal part of the world with which to compare Europe. In this chapter we will trace the most important developments in the description of European and Chinese historical demography from Thomas Malthus on, highlighting both the divergent trajectories and the crossroads. The central question of our book originates from the latest development in this debate. Was population in China regulated through positive or preventive checks? Secondly, did the Europeans indeed restrict access to marriage to control demographic growth?

**Marriage and death in Europe. A debate settled**

First, we will concentrate on two concepts that have dominated the scholarly debate on the population developments in the past two centuries, the European marriage pattern and demographic transition theory. The two concepts neatly fit in the classical division between two equilibrating mechanisms. Translated into Malthusian terms, the European marriage pattern stands for preventive checks, whereas transition theory emphasizes mortality as the controlling mechanism in the pre-industrial world.

Until the 1980’s, mortality played a very important role in the demographic debate, particularly in demographic transition theory. Frank W. Notestein’s famous article ‘Population. The Long View’16 is often referred to as

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the official starting point of this theory that covers many centuries. The first phase of ‘primitive’ equilibrium of births and deaths at a high level is not dated exactly, but in the case of Europe logically refers to the period from the Middle Ages to about 1800. In the late 18th and early 19th century first mortality and later fertility declined. The new balance of births and deaths in Europe was reached again in the 1950’s or 1960’s. Notestein uses Europe only as the model. Although he starts his argument by pointing at the possible pitfalls of forecasting population trends, the rest of his paper essentially deals with the conviction that all modernizing populations pass through three stages, from ‘high growth potential’ via ‘transitional growth’ to ‘incipient decline’.17

The variables in this process are births and deaths. Remarkably, Frank Notestein did not once mention the role of marriage restriction in Europe. When discussing modern birth control practices in Europe, North America, Australia and New Zealand, he even explicitly stated: ‘They are the only populations that have thus far shown a way by which growth can be checked other than through death (...).’18 One can think of several explanations for the fact that the American father of the transition theory did not take marriage restriction into consideration, ignoring in this way the suggestion by Malthus, the European father of demography. To all contemporary witnesses marriage restriction was strikingly absent in the colonial and early national period of the history of the United States. During the 19th and 20th centuries this was less the case, but, despite cycles in nuptiality and differences between male and female marriage patterns, the need to wait for niches in order to establish a new household was clearly a European rather than an American obsession.19 Looked at in this way, one might argue that it is not remarkable that Frank Notestein did not discuss preventive checks in his publications.

Also, we have to acknowledge that Notestein’s 1945 paper focused on population growth rather than on population control. He starts his argument by stating that ‘the world’s population has been growing at a rapid and accelerating pace during the last three centuries’. The exceptional position of Europe is certainly mentioned, but Notestein does this in another way than one would have expected. He points to the fact that ‘all sections of the world have participated in this growth, but it has been particularly marked in Europe’. Further on, when the author discusses the pre-transitional situation, he refers to it as the demographic type of ‘high growth potential’, characterized by high and variable mortality and high and invariable fertility. ‘In these populations’, Notestein remarked, ‘rapid growth is to be expected just as soon as technical developments make pos-

possible a decline in mortality’.20 Again, marriage restriction is neither part of the pre-transitional equilibrium, nor of the set of possible reactions to growth.

The most convincing explanation for Notestein’s lack of interest in the European nuptiality valve, however, is this. Even when one takes ‘the long view’, attention will be directed at the truly revolutionary developments of the 19th and 20th centuries. After the relative stability of centuries, the sudden population growth that set in once mortality declined, and the following restriction of fertility within marriages were more interesting than pre-industrial homeostasis. Katherine Lynch refers to this when she writes: ‘Some confusion may have arisen over the years because the European Marriage Pattern, considered purely in its demographic effects, has been identified with the ‘natural fertility’ phase of the European demographic history.’21 This would imply that the founders of the transition theory considered the influence of nuptiality to have vanished by the time the transition became interesting.

We also have to take into account that Notestein was strongly policy oriented. As a matter of fact, the very reason why his 1945 publication is often regarded as the starting point of the transition theory rather than Warren S. Thompson’s 1929 ‘Population’, is the attention in the wake of the second world war for governmental and scientific planning at an international level to cope with the problems in developing and underdeveloped countries (Food for the World!).23 Serious demographers in the 1940’s and 1950’s obviously knew that marriage restriction was an unknown phenomenon in those parts of the world, and, therefore, concentrated on the direct fertility decisions. Even in his voluminous1992 overview of demographic transition theory, Jean-Claude Chesnais did not pay much attention to marriage restriction, because ‘this model of nuptiality appears to have constituted an important historical exception, temporally and spatially restricted to a fairly limited area.’24 In this view, marriage restriction is merely a sub variable within the first phase of the transition, and, on top of that, applicable in only a small part of the world.

Even in historical demographic studies on Europe itself, the role of mortality initially received more attention than nuptiality did. Jean Meuvret’s 1946 arti-

icle on the mortality crises induced many French demographers to consider positive checks as the instrument that regulated European populations before the onset of the modern fertility decline. 25 To be sure, the attention to mortality did not drive Malthus’ preventive check from the scholarly agenda. Take for instance the French demographer Adolphe Landry. In his *La Révolution Démographique* (1934) he explicitly dealt with marriage restriction: ‘(...) Le moyen que l’on employait à cet effet (i.e. to maintain the accustomed standard of living) était de pratiquer le célibat, ou de retarder le mariage. Une fois marié, on laisse agir la nature (...).’ 26 Had Malthus been able to read these lines, he would have nodded approvingly. The same goes for the Dutch demographer E.W. Hofstee. In 1954, he published an article that is well-known in the Netherlands, but, for obvious reasons, did not reach an international audience. 27 Still, it is worthwhile to give this paper a closer look, because, even nowadays, some of the ideas in it sound rather modern. Hofstee’s point of departure is the question of how to explain regional differences in birth rates in the Netherlands around 1850. After presenting a quantitative overview of demographic characteristics of the Dutch provinces, his conclusion is that it is variance in age at marriage and in marriage frequency that determine the variance in birth rates.

Hofstee explicitly referred to transition theory by stating that ‘one of the most viable hypotheses in demography’ asserts that there is ‘a certain relation’ between the development of birth rates and death rates. 28 In only a few sentences the author depicted the transition from a high level balance between births and deaths to a low level balance, including the intermediate phase of population increase. All this is geared at re-establishing the equilibrium between population and resources. Does this imply, Hofstee asked himself, that regional differences in Dutch birth rates in 1850 can be reduced to differences in death rates? The answer he gave is an unequivocal no.

26. Adolphe Landry, *La Révolution Démographique. Études et essais sur les problèmes de la population* (Paris 1934), 44. Translation: ‘(...) The way to reach this goal was to practice celibacy, or to postpone marriage. Once married, people let nature have its way (...)’.
His alternative explanation sounds familiar to those who have read Malthus. In the 18th century, Dutch fertility was determined by the so-called classical agrarian-crafts reproductive pattern. Basic to this pattern was that marriage was only possible if and when one had acquired a livelihood adequate to one’s occupation and social status. To illustrate this system, Hofstee gives the example of a farmer who has more than one son. Only one of the farmer’s sons would marry, often when the farmer himself retired. The other brothers and sisters would remain celibate and live their lives in the household of the married brother. In this way, the balance between population and resources was kept, without using contraception within marriage. One must assume, Hofstee added, that the same applies in the pre-industrial city. Artisans used the same instrument to regulate their number and even (a limited number of) laborers could depend on their contract of employment.29

The two examples show that marriage restriction has never been absent from the scholarly debate, even in the heyday of demographic transition theory. Still, it took until 1965 before it regained the central position that Malthus had accorded it. In that year John Hajnal published what may well be the most cited article in the historical demographic and family history literature. Its impact on our thinking about marriage, fertility and population control, therefore, can hardly be overestimated.30 Hajnal’s 1965 publication (and the 1983 sequel31) was the start of a process that canonized the decisive impact of nuptiality in the 1980’s. E. A. Wrigley, for instance, noted that “the most significant feature of Hajnal’s [1965] article...was simply that he placed marriage once again at the center of the stage.”32 Later publications confirmed this view.33

What exactly did Hajnal say in his 1965 article? First of all, he narrowed Malthus’ definition of Europe down to Western Europe. More precisely, he drew a line on the map of Europe from St. Petersburg (in western Russia) to Trieste (in northern Italy) and stated that to the west of that line a very specific marriage pattern existed. Age at marriage was high in comparison to all other populations.

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29. There probably are contemporary accounts of this marriage pattern in every country where it was practiced. For the Netherlands we have the paper of a village doctor in the province of North-Brabant, who, already in 1925, described the Hajnal marriage pattern in detail: P.A. Barentsen, ‘Het gezinsleven in het oosten van Noord-Brabant’, in, Werk, kerk en bed in Brabant. Demografische ontwikkelingen in oostelijk Noord-Brabant, 1700-1920, eds. G. van den Brink, A. van der Veen and A. van der Woude (’s-Hertogenbosch 1989) 17-32.


known, and more people remained celibate throughout life than elsewhere. In Eastern Europe, couples married at a younger age and the proportion never married was definitely smaller. The Western European marriage pattern dominated European demography for centuries, for it: “(...) can be traced back with fair confidence as far as the seventeenth century in the general population”. There is also a clear cut end to the pattern in Hajnal’s view. In the two decades before 1965 the ‘European pattern’ seems to be disappearing, he wrote.

Although Hajnal focused on Europe, he referred to other populations too. “Non-European civilizations” he wrote “are like Eastern Europe, or more so.” But why was it that the Europeans exhibited such a remarkable marriage pattern? In 1965 Hajnal suggested that “in Europe it has been necessary for a man to defer marriage until he could establish an independent livelihood adequate to support a family”, and he admitted he was tempted “to see in this the key to the uniqueness of the European marriage pattern”. Thus, the custom of neolocality is thought of as the primary reason for postponement of marriage. In the extended households of Eastern Europe and Asia the new couple could simply join the existing family. Still, Hajnal immediately went on to admit that this causal flow is not at all unambiguous. “Even if we understood how the age of marriage of men was determined at a given period it would still need to be explained how women’s age at marriage was effected. The uniqueness of the European marriage pattern lies primarily in the high age at marriage of women, rather than a high age at marriage for men.”

These observations lead to the question of what is exactly meant by the phrase ‘the Hajnal hypothesis’. Several interpretations are possible. Theo Engelen and Arthur P. Wolf distinguished between three alternatives. First of all, we can simply read Hajnal’s hypothesis as the ethnographic claim that as regards marriage, household structure, and life-cycle service, Europe is “unique or almost unique in the world”. To take one step further, it is Europe’s uniqueness that counts. We then refer to the requirement that a man must have an inde-
pendent livelihood before marrying, the ‘niche’ version of the hypothesis. Most often, however, authors using the European marriage pattern see it as a general population theory like the demographic transition theory. When Malthus, Landry, Hofstee, Wrigley and Dupaquier, to list only the authors cited here, refer to the European marriage pattern, they claim that in Europe nuptiality functioned as a kind of social thermostat that regulated the relationship between economic well being and population growth. In this study we adhere to the last interpretation of Hajnal’s papers. In our view, from at least the 17th century until the first half of the 20th century, in Europe nuptiality restriction was used to balance population and resources.

**Population checks in China. An ongoing debate**

When we turn to the population history of China, again the debate concentrates on whether the development of population was checked ‘positively’, by mortality, or ‘preventively’, by a combination of nuptiality and fertility. The citations from Malthus’ work showed that he was convinced that positive checks were the fate of China. How about contemporary Chinese observers, then? Ping-ti Ho informed us of the ideas of Chinese authors writing in the 18th and 19th century. As a consequence of rapid population growth, living conditions in China deteriorated in the fourth quarter of the eighteenth century. In 1793, this was the reason for Hung Liang-chi (1746-1809) to write two famous essays concerning this problem. Surprisingly, many of Hung’s ideas come very close to what Thomas Malthus wrote – five years later – in the first edition of his *Essay*. Hung’s theory of population describes the growing pressures while the means of subsistence and the increase of population are not in direct proportion. As for remedies, Hung expects 10 or 20 per cent of the population to die from flood, drought, sicknesses and epidemics. The government can do no more than stimulate the exploitation of new land and the introduction of intensive farming. A reduction of the fiscal burden is another possibility, and, if everything else fails, one can open public granaries for relief.

In 1820, another scholar, Kung Tzu-chen, reported on the developments since Hung: “In general the rich households have become poor and the poor hungry. (...) The provinces are at the threshold of a convulsion which is not a matter of years but a matter of days and months.” In 19th century local histories we find confirmation of Kung’s predictions. Customary living standards were replaced by bare subsistence, rural unemployment exploded, and even tradition-

al rice-exporting regions became dependent on other areas in years of bad harvests. It is therefore no surprise that 1851 witnessed the outbreak of the Taiping Rebellion.

The war did not relieve the pressure, according to the diaries of Wang Shih-to (1802-1889): “All the ancient forestry of Szechwan has been cut down and the virgin timberland of the aboriginal regions turned into farmland. Yet there is still not enough for everybody.” Wang’s solution for the problems of his country sounds extremely ruthless. His suggestions include the encouragement of large-scale female infanticide, the establishment of more nunneries and a law against remarriage of widows, postponement of marriage until higher ages (sic!), and discouragement of large families by taxation on children. The last suggestion is to drown all surplus infants of both sexes. Wang only wants to make an exception for the physically fittest.41

If anything, the Chinese observers seem to back Malthus’ view of China as an overpopulated country suffering from endemic poverty. No wonder, therefore, that a new generation of Western authors, publishing around 1930, saw no reason to change the traditional views. Both W.H. Mallory42 and H.D. Tawney43 confirmed that Chinese fertility was extremely high. They attributed this to the tradition of wanting as many sons as possible. Given the nature of the extended household, Tawney argued, the production of children was disassociated from the responsibility to feed them. For that reason “prudential restraints act with less force than elsewhere; and population, instead of being checked by the gradual tightening of economic pressure on individuals, plunges blindly forward, till whole communities go over the precipice.”44

To be sure, all the opinions presented until this point were based on very impressionistic data. Local observers and Western travellers were the sources from which far reaching conclusions were drawn. The first quantitative data were collected between 1929 and 1931 when John Lossing Buck conducted what has become known as the Chinese Farm Survey. In this survey the demographic characteristics and history of 40,000 families is recorded.45 The data were not taken at face value, but they were adjusted by Frank Notestein, who suggested that Buck’s data were far from perfect. When “an illiterate peasant population” is investigated “by enumerators with little experience in making field studies and only an hazy idea of the use to which their reports would be put”, one has to be

41. All citations from Ho, Studies on the Population of China, 271-275.
43. R.H. Tawney, Land and Labour in China (London 1932).
44. Tawney, Land and Labour in China, 104.
skeptical of the results, he wrote.\(^46\) Notestein dealt with this problem by rejecting 18 of the 199 areas studied, in which, in his view, either births or deaths or both were underestimated.

The group of Princeton demographers that presented the first scientific analysis of the Buck data in 1976 adjusted the fertility rates for a second time, again upwards. Despite this adjustment the conclusions of the analysis were contrary to received wisdom until that date. Instead of being extraordinary high, Chinese fertility appeared to be “very low”. Indeed, the fertility was such as expected “only in populations in which some combination of contraception and abortion in practiced.”\(^47\) Still, the authors did not claim that the Chinese deliberately controlled their fertility. Rather they pointed at the effects of prolonged breastfeeding by undernourished women and of reduced coital frequency in an impoverished population. The 1976 study in this way was a revolutionary break with the past. Not only was Chinese fertility now considered low, but also Barclay et al. added preventive checks to the positive check.

The Stanford anthropologist Arthur P. Wolf criticized these new findings.\(^48\) Although he acknowledged that Chinese fertility was not as extraordinarily high as earlier authors thought, he strongly believed that the Princeton group underestimated Chinese fertility. Also, he did not believe that preventive checks ruled. He claimed that because the authors underestimated both fertility and mortality, they thus did not find positive checks at work.\(^49\) Wolf’s opinion was based on three alternative sets of data. First, he used his findings from the household registers on Taiwan, accurately kept during the Japanese colonial period. His calculations for the Hai-shan region produced total (marital) fertility rates (TFR and TMFR) above those derived from the Farm Survey. His conclusion: “We must conclude that Chinese farmers on Taiwan enjoyed considerably higher fertility than mainlanders or accept the possibility that the Farm Survey data are inaccurate.”

Wolf acknowledged that Taiwan had special characteristics that may influence the comparison. Therefore, he also presented data collected on the China mainland for the explicit purpose of reevaluating the Farm Survey. In 1980-1981, he interviewed women aged 55 and over in Beijing, Fukien, Kiangsu, Szechwan, Chekiang, Shantung and Shensi. Unlike the interviews in the Farm Surveys, the interviews by Wolf followed the rules of scientific fieldwork. Although judged by


the sex ratio of the births collected his results were not completely satisfactory,
again the fertility rates of his population were clearly above the fertility calculat-
ed by the Princeton researchers. Wolf also introduced a third source of informa-
tion to compare the Farm Survey to. C.M. Chiao, Warren S. Thompson and D.T.
Chen conducted a four year study (1931-1935) of vital events in Chiang-yin coun-
ty in central Kiangsu.\textsuperscript{50} Careful interviewing and regular checks on the trained
reporters resulted in a highly reliable study. The results as far as fertility is con-
cerned exceeded the rates given by the Farm Survey, but also the rates found on
Taiwan: \textit{tfr} for the years 1931-1934 was 6.38, and \textit{tmfr} 7.41, against 4.99 and
5.65 in Buck's data as revised by Notestein.\textsuperscript{51}

Evidence from these three sources led Wolf to renounce the data from the
Farm Survey and the calculations later made by the Princeton group. He
nonetheless agreed with Barclay et al. on one point. Chinese fertility did not
reach the unparalleled level described by many authors. Wolf too accepted the
idea that Chinese marital fertility was only about 75 percent of that of pre-indus-
trial Europe. The logical next question was: what caused the relative low marital
fertility in China? Whatever the reason, it was certainly not deliberate fertility
control, Wolf argued. “Where Japanese peasants made the family fit the farm,
the Chinese assumed they could somehow make the farm fit the family.”\textsuperscript{52}
Again drawing on evidence from the Taiwan data, he found that women pursued
high fertility no matter how many sons they already had, up until age 40-45.
Also, although the level of fertility may differ from a natural fertility population,
the age pattern of all the populations mentioned here followed closely the curve
of natural fertility.

These findings confronted Wolf with a dilemma: “Why was marital fertili-
ty relatively low in a strongly pronatalist culture?”\textsuperscript{53} He solved this dilemma by
pointing to the following facts. First of all, the traditional emphasis on high fer-
tility was often countered by marriage customs that discouraged high fertility.
This refers to minor marriages, where a brother married his ‘sister’ (adopted at a
young age as his future bride) and to pre-adolescent marriages. Also, poverty,
possibly undernourishment, had a depressing effect on fertility. From his Taiwan
data Wolf showed that richer families (paying more land tax) had higher fertility
than poorer families (paying no or less land tax). Wolf concluded his argument
by once again refuting one of the points made by the Princeton group. This
group suggested that populations with universal and young marriage simply had

\textsuperscript{50} C.M. Chiao, Warren S. Thompson, D.T. Chen, \textit{An Experiment in the Registration of Vital Statistics in China}
(Oxford 1938).
\textsuperscript{52} Wolf, ‘Fertility in Prerevolutionary China’, 177-178.
\textsuperscript{53} Wolf, ‘Fertility in Prerevolutionary China’, 180.
to restrict the number of births. Contrary to that, Wolf claimed that young and universal marriage was essentially geared toward high fertility. The question, in his view, is rather how this intention was frustrated.

Ansley Coale, one of the authors of the Princeton paper, accepted the challenge. In his answer to Wolf’s critique he defended their conclusions.54 Wolf misunderstood two major points in the article of the Princeton group, Coale said. First, the authors did not claim that the Farm Survey data were correct. Instead, they used refined new demographic techniques to calculate vital rates from the incomplete and inaccurate data. Second, the authors did not suggest that low Chinese fertility was caused by deliberate restriction. To the contrary, “fertility was ‘natural’, meaning that Chinese couples did not take deliberate steps such as contraception and abortion to stop having children when the desired family size had been attained.55 Coale then described how the original data were corrected and showed that when comparing Wolf’s Hai-shan data and his 1980-1981 interviews on the mainland with the adjusted figures from the Farm Survey there is a remarkable resemblance rather than a difference.

Is fertility associated negatively with poverty and positively with the level of living? Yes, said Wolf. No, said Coale, because “As a general proposition, I think the assumption of a close association between the level of living and fertility is erroneous. (...) Clearly, if there is actual starvation, menstruation ceases and fertility is greatly reduced, but long-lasting malnutrition above the level of starvation seems to have very little effect.” And the relationship suggested by the Princeton group between early and universal marriage on the one hand, and moderate fertility on the other? Coale cited evolutionary theorists who claim that early and universal mating fosters mechanisms that inhibit fertility in order to avoid overpopulation. “Moderate reproduction is attained among larger mammals and birds by various genetically programmed restrictions on fertility, and in human populations by various social customs and practices.”56 We will return to these customs and practices later.

Evidently, Wolf and Coale did not reach an agreement on this issue. The debate disappeared from the journals for a while, but inevitably the issue to be solved re-emerged, activated again by a new generation of scholars in the China field.57 Their views were brought together in One Quarter of Humanity. Malthusian Mythol-

ogy and Chinese Realities by James Lee and Wang Feng. This book challenged the traditional assumptions of demographers with regard to Chinese fertility. Malthus was wrong, the authors argued, when he claimed that positive checks ruled Chinese population. In the Chinese case, actors were not just passive victims of circumstances. They had four ways of actively influencing growth rates: through (mostly female) infanticide, by a gender-unbalanced marriage market, by a low level of marital fertility and, lastly, through adoption. When translated in Malthusian terms, preventive rather than positive checks ruled Chinese demography, and they succeeded in keeping marital fertility low by a combination of late starting, long spacing and early stopping.

Wolf accepted the new challenge. Low marital fertility in China, he once again argued, is not the result of deliberate actions of Chinese couples. Rather, it is an involuntary consequence of chronic malnutrition, untreated diseases, hard manual labour, and economically enforced conjugal separation. Campbell et al. responded to the criticism, although they had hesitated to do so “since Wolf’s arguments are old”. This time, however, Wolf was not the only discussant on the ‘positive’ side. His position was shared by several China specialists. From their end, his opponents refuted Malthusian interpretations of Chinese history again at various occasions.

We will analyze this discussion in depth because the issue is central to the understanding of the Chinese part of our comparison. The findings, however, are also applicable to the European situation, for, as we already mentioned, the discussion on the relative importance of preventive and positive checks may have ended in favour of the preventive side, mortality also played an important role.

Food and fertility
There is an impressive number of publications on the relationship between nutritional status and fertility. The first conclusion from these empirical studies is that the link between food and fertility is contested. Only by way of selective citation can one arrive at a clear-cut conclusion, because some authors claim that malnourishment indeed influences fertility negatively, whereas other scholars doubt whether this relationship exists. Therefore, we will not even try to offer an exhaustive enumeration of monographs and articles on the subject. Instead, we demonstrate the polemic by using two manuals summarizing most of the recent literature. We refer to Peter T. Ellison, *On Fertile Ground* and James W. Wood, *Dynamics of Human reproduction*. Do these authors, both drawing on a large number of recent empirical studies, indeed support the claim that it is ‘archaic’ to believe in a relationship between nutrition and fertility?

James Wood’s survey provides us with a balanced view, offering both research in favour of the relationship between food and fertility, and authors denying the influence of nutritional status on fertility. The first issue Wood tackles is the age at which female fecundity starts and ends, menarche and menopause. He accepts that poorly nourished girls experience later menses than well-nourished ones. However, menarche does not simply function as an on/off switch through which childbearing becomes possible. It is a widely established fact that menar-
che is followed by a period of adolescent sub-fecundity. Even if the demographic effects of later menarche itself are not impressive, the prolonged sub-fecundity afterwards could strengthen its influence. Research into the relationship between age at menarche and the length of adolescent sub-fecundity, however, gives mixed results. Some studies show a positive correlation (late age at menarche implies a long period of sub-fecundity). Other studies show the opposite. Thus, the total time devoted to childbearing may be shortened by late menarche in two ways. As for differences in the age at menopause “it seems plausible that nutritional differences play some role”. Again, the implication for the period of the fecundity is clear: well-nourished women can reproduce for a longer period of time.

How about foetal loss, then? Does malnutrition result in an increased probability of foetal loss? Wood finds that we have to differentiate between spontaneous abortions in the early and later phase of pregnancy. Foetal loss in the first months of pregnancy is in most cases due to chromosomal aberrations in the eggs of older women, and thus independent of external circumstances. The decline in the incidence of late foetal loss (after 28 weeks of pregnancy) on the other hand is associated with improvements in nutrition, public hygiene and medical care. The effects on fertility are evident. Through late foetal loss the birth interval until next birth increases and total fertility decreases.

Wood deals extensively with the so-called maternal-depletion syndrome, the possible ongoing decline in maternal condition during the reproductive life of a woman. This syndrome is the consequence of the metabolic burden of successive gestations and periods of lactation. In situations where food is in short supply, the mother will not be able to recover before the next pregnancy starts, and ends up in a situation where foetal tissue will grow at the expense of maternal tissue. The automatic reaction that evolutionary biologists presume as an answer to maternal depletion, a decline of fecundity, is not, however, acknowledged by Wood.

When we turn to Ellison, we find an evolutionary physiologist who clearly believes in the existence of the relationship between food and fertility. He first differentiates, however, between the influences of nutritional status on conceiving and on successfully bringing to an end of a pregnancy. Surprisingly, he finds almost the same percentage of embryonic loss for present day American women and for their counterparts in Bangladesh, whereas the differences in living con-

67. Wood, Dynamics of Human reproduction, 404-408.
68. Ibidem, 422.
69. Ibidem, 266.
70. Ibidem, 16 and 204-205.
ditions clearly differ markedly. Women in Bangladesh marry as teenagers, work in labour intensive rice farming, and their nutritional status is low. Still, their incidence of embryonic loss is about the same as for American women: 34 per cent. This implies that environmental conditions do not matter. Not only the early embryonic losses seem to be independent of the circumstances women live in, also miscarriages occurring after implantation are almost equal in differential social and economic settings. Rates of spontaneous abortion, for instance, are not affected by malnutrition or famine. The conclusion seems to be that once implantation has occurred, the maternal body dedicates all its energy to the foetus, even if circumstances are adverse. As for the start of a new pregnancy, the evidence points in another direction. When looking at chances of conception, adverse energetic conditions do significantly reduce the probability. From an evolutionary point of view one could conclude that investment in a pregnancy is avoided when chances of giving birth successfully are low.  

Biologically the probability of conception is reduced by a suppression of the ovarian function. Several studies on non-Western populations (for instance the Lese of Congo’s Ituri Forest) show that this suppression starts when the energy balance is negative. This happens during the periods of the year when food supply is scarce. To be sure, suppression of the ovarian function also occurs among well-nourished women. A study of Polish women shows significant lower levels of progesterone for women with a high workload when compared to their less burdened colleagues. This does not come as a surprise. Even in modern Western populations one finds the same phenomenon among dieters and athletes. 

After giving birth, the mother’s investment in her baby continues through lactation. Although lactation uses between 15 and 50 percent of a woman’s energy budget, it is a very robust production, which will only stop under extreme circumstances of starvation. This continued investment in the wellbeing of her offspring occurs at the expense of the mother, and, if prolonged, can result in what Wood already called the “maternal depletion syndrome”, which is widely distributed in the developing world. Especially when female workloads are high, nutritional intake is low and births are closely spaced, female fat reserves fall progressively with an increasing number of births. Ellison then describes both the risk for women to end up in a downward spiral, and the natural response that is automatically generated in the ‘depleted’ female body: 

“It is easy to imagine how serious the negative consequences of maternal depletion can be, and therefore how important it is for a woman’s overall evolutionary fitness to maintain a sufficient separation of periods metabolizing for two. (...) The shorter the

71. Ellison, On Fertile Ground, 37-42.
interval separating births, the greater the risk of mortality of the offspring. Intervals of less than two years between births are particularly dangerous. (...) If metabolizing for two is a significant burden, metabolizing for three is nearly impossible, especially when the mother’s energy budget is constrained by external circumstances. It should come as no surprise, then, that natural selection has provided physiological mechanisms to reduce the likelihood of overlapping gestation and lactation.  

Louis Henry already pointed at this mechanism when he introduced the concept of ‘natural fertility’, that is parity independent fertility. Contrary to Malthus’ view, uncontrolled fertility was not uniformly high between and within populations, Henry concluded. Even without deliberate societal and individual control huge variation in fertility was found. He did not attribute this variation to the start and ending of the reproductive career, but rather to the pace of childbearing. From the three factors that constitute the birth interval (from birth to resuming fecundity, from there to actual conception, and from conception to birth), according to Henry, the first factor was most important, driven mainly by breastfeeding.

What we have, then, are two positions on what drives the length of birth intervals, nutritional status of the mother and breastfeeding. In the literature on this topic Rose Frisch emphasized the impact of nutrition. In her view it was nutritional status, and more specifically fat reserves of women, that regulated fertility. This, she added, is not only found in primitive societies, but in populations of historical Europe too. Further empirical research, however, raised doubt on this view and resulted in a strong polarization between the ‘nutritionists’ on the one hand, and those advocating the impact of breastfeeding on the other hand. Namely John Bongaarts argued that the effect of nutrition on birth intervals was trivial when compared to the influence of lactation. Ellison finds this polarization not productive, the more so because Henry had already resolved the debate. He simply observed that the two influences are related, in the sense that the duration of amenorrhea during lactation is not a constant, but dependent on the physiology of the woman, including her nutritional status. Ellison then concludes his plea for the ‘nutritionist’ view by stating:

“It can be presumed that natural selection has shaped female reproductive physiology in humans, as in other mammals, to make the most effective use of time and energy in

73. Ellison, On Fertile Ground, 95-97.
77. Ellison, On Fertile Ground, 126.
producing offspring. To a large extent these amount to the same thing, the optimal
spacing of births. (...) optimal birth spacing in turn involves physiological “decisions”
over the allocation of energy between competing categories: continued milk produc-
tion, maternal maintenance costs, a new pregnancy. (...) Especially under chronically
poor energetic conditions, a woman’s lifetime reproductive success may depend on
her ability to maintain long-term energy balance and avoid the downward spiral of
maternal depletion”.\footnote{Ellison, On Fertile Ground, 169 and 212-213}

Ellison’s survey uses an impressive number of studies on biological determinants
of fertility that for a large part are also found in Wood’s references. Surprisingly,
Wood’s conclusions are less unequivocal in favour of the ‘nutritional’ stand.
Ellison has a convincing explanation for the amazing contradictions in the stud-
ies referred to. He distinguishes between two opposing groups of scholars that,
in Wood’s qualification, disagree “vehemently”. Physiologists, on the one hand,
share the conviction that maternal malnutrition has a large impact on reproduc-
tion, while most demographers assume that this relationship, if at all, results in
only marginal effects.

When analyzing the differences, Wood concludes that some of the dis-
agreements are unnecessary. Physiologists may be right in stating that there is
a biological link between nutrition and ovarian function, but demographers
may be equally right in arguing that this link is not measurable at the popula-
tion level. In general, both studies from physiologists and demographers have
important limitations. Wood refers to problematic assessment of nutritional sta-
tus via anthropometric measurement and the use of small and selective sam-
ple. On top of that, demographers tend to divide undernourished and well-
nourished women by using a threshold value of the indicators applied, rather
than using a sliding scale. Physiologists, on their part, have stopped after estab-
lishing a biological link, and in doing so neglected measuring the actual conse-
quences for ensuing fertility. Most of all, however, both contestants have under-
estimated the complexity of the many relations involved here, and resorted too
easily to too simple models and measurements. The final conclusion, therefore,
can only be that “a strong linkage between maternal nutritional status and fer-
tility would be of enormous importance (...) if it could be established convinc-
ingly. The definitive refutation of such a linkage would be of equal significance.
The studies done to date are so deficient (...) that no firm conclusions are as yet
possible”.\footnote{Wood, Dynamics of Human reproduction, 522-529.}

It is time now to return to the discussion between Wolf and Lee et al.. The
question to answer was whether or not Wolf was right in claiming that low mar-
ital fertility in China can be explained by poverty and low food intake rather than by a set of conscious demographic actions. The human biology literature on the subject revealed that nutritional level could influence fertility in two ways. First, the age at menarche is proved to be related to nutrition. Well-nourished females experience menarche at an earlier age than undernourished women. Also, late age at menarche could, according to some, result in longer adolescent subfecundity. The second proposition argues that malnutrition prolongs lactational anovulation. All the participants in this discussion share the view that breastfeeding is a powerful way to increase birth intervals. This proposition argues that the increase would be even bigger among undernourished women. Thirdly, there is conclusive evidence that the ovarian function is impaired by low nutritional standard, resulting in a rise of anovulatory cycles, oligomenorrhea or luteal insufficiency. These opinions are based on recent and reliable research. If anything, they prove that Wolf had good reasons to point at nutrition as a possible determinant of fertility.

His position is backed also by the evolutionary biologists. They expect the female body to have an automatic adaptive response to adverse circumstances. When metabolizing for two is expected to endanger either the mother-to-be, in the first part of pregnancy, or the baby, in the last months of pregnancy, a lowered ovarian function will prevent conception. If a mother is already lactating for another child, the reaction is even stronger. All this is nature’s way of trying to avoid maternal depletion. Two more items can be added to the list reinforcing the negative influences on fertility of undernourishment. Women in this condition experience significantly more miscarriages in the second part of their pregnancy. This, too, results in an increase of birth intervals and, at one remove, in lower total fertility. Finally, in the same way undernourished women start their fecund life relatively late, they stop ovulating earlier.

These findings do not automatically declare Wolf to be right. Some of the relations mentioned are matched by research casting doubt on their strength. Other relations may be confounded by methodological faults. Most of all, even when the biological effect is established, one also has to measure the demographic implications. If we apply Wood’s division of the field, Arthur Wolf clearly is a physiologist, whereas Ansley Coale in the 1980’s, and more recently James Lee, Cameron Campbell and Weng Fang are demographers. Both parties display the vehement disagreement Wood described. Wolf unequivocally dismisses the claims of his opponents: “they are mistaken claims.”80 They, from their part, do not hesitate to qualify Wolf’s arguments as “old” or even “archaic”.81 Ellison and Wood have shown that empirical research as yet does not justify these outspoken opinions of the discussants.

The second question raised here deals with the nutritional standard of the Chinese population in successive historical periods. For even if Wolf is right in the discussion mentioned above, Chinese fertility could only be relatively low as a result of this reason when Chinese women were malnourished. Again, we enter a debate between two opposing groups of authors. The pessimist view follows Malthus and describes China as an overpopulated, impoverished part of the world. On the contrary, according to the optimists, China started an important period of economic growth at least from the closing decades of the 19th century on, followed by a standard of living that improved markedly. The disagreement between Wolf and Lee et al. is a reflection of this discussion. Wolf takes the pessimistic view, his opponents the optimistic view, and both discussants have their own supporters.

We have already quoted the observations of historical Chinese authors, who implicitly shared the pessimist view. These observations may well be biased, most of all by a limited regional scope. What we need, then, is an objective measure for livelihood. Authors like Komlos and Steckel claim to have found an index for such a measure by looking at the final height adults reach. This final height corresponds with the nutrition available for infants and children. The standard of living thus could explain historical, social and regional differences in heights better than genetics. Very recently, John Komlos and Jörg Baten looked back at the accomplishments of anthropometric history in the past decades and once again asserted: “A crisis caused by endemic malnutrition rather than by an acute subsistence crisis probably began with an initial response of the human organism to accommodate to changing nutritional circumstances by becoming smaller”. Again, this finding reminds us of Thomas Malthus who from own observation came to the same conclusion: “the sons of labourers are very apt to be stunted in their growth (...). Boys that you would guess to be fourteen or fifteen are, upon inquiry, frequently found to be eighteen or nineteen. (...) a circumstance which can only be attributed to a want either of proper or of sufficient nourishment.

Stephen Morgan has analyzed more than 10,000 records of height measurements for Chinese government or semi-government employees. The data were collected between 1933 and 1949, and cover people born between 1887 and

Clearly, late 20th century Chinese were better off than their ancestors measured in the 1940’s, Morgan stated. On average, they were 1.5 cm taller, and they reached this height about 5 years earlier. For the Chinese born between 1900 and 1930 Morgan also found regional differences in the development of height. The growth was most impressive in East (plus 1.3 cm) and South China (plus 1.2 cm). North Chinese men (plus 0.2 cm) and Central Chinese men (plus 0.4 cm) grew significantly less. Not only region, but also occupation mattered. As expected, the lower the socio-economic status of those measured, the shorter they were. When Morgan estimated the impact of region on height, controlling for period of birth and occupation, he reached the conclusion that the average national growth was fully driven by the developments in East China. The other regions witnessed either very slow growth (Central and South), or even negative growth (North).

Morgan’s conclusion is in favour of those who adhere to the pessimistic view on Chinese standard of living: “The stark regional variations point to the spatially differentiated and uneven pattern of economic growth and is a challenge to Rawski’s claim that there was a sustained rise in per capita consumption across China, not just in the developed regions.” As it is, only the most developed lower Yangzi area shows a sustained upward trend in final adult height that is in line with the optimist view on Chinese economic growth. Further, the differences between socio-economic groups support the claim that poverty was unevenly distributed within the regions covered. If Morgan’s conclusions are right, in many parts of China the food situation was such that it influenced human biology. By implication this might have had a negative effect on fecundity, if one accepts the possibility that nutrition influences fecundability.

The comparison of Chinese and European reproduction in the period between roughly 1850 and 1950 confronts us with amazing differences. Nearly all Chinese women married, and they did so at a relatively young age. Their European, especially Western European, counterparts lived up to the peculiar marriage pattern that makes this part of the world so exceptional. As a consequence, European brides were up to 10 years older, and 10 to 20 per cent of the European women remained celibate throughout life. All things being equal, this should have resulted in a higher (marital) fertility in China. Reality, however, differs from this prediction. Mainly as a result of shorter birth intervals TMFR in Europe was equal or even slightly higher than in China. This finding is shared by all scholars in the field.

The explanation, however, divides the same scholars in two diametrically opposing positions. Why is it that Chinese women bore relatively few children? For Arthur Wolf the answer is in line with the ‘positivist’ view put by Thomas 87.

Malthus. The younger generation of China specialists, headed by James Lee, disagrees fundamentally. They emphasize conscious preventive checks of the Chinese population which, in later publications, they label ‘proactive’ behavior.\(^88\)

The fundamental question to be answered in the ongoing debate is how to come to conclusions that are acknowledged by all participants. To be sure, we hope to have shown that at this moment there is evidence supporting both claims. We will now turn to the way the debate between Arthur Wolf and James Lee et al. has evolved recently. Can we find an explanation for the different conclusions by looking at the empirical foundations? We leave aside the discussion on the comparability of the datasets used (how representative for China as a whole are the people portrayed in the Qing imperial genealogies (1700-1830), the registers of the bannermen in Liaoning province (1774-1873), interviews with elderly mainland women in the 1980’s, or Taiwanese household registers covering the period 1905-1945?). Rather we concentrate on the methodological aspects of the debate. Surely, one first has to deal with biases in demographic measurement. When comparing European and Chinese fertility, the total marital fertility rate is influenced by the inclusion of the age group 15-19 and of pregnant brides. Even the age-specific measures, however, may be biased. The conventional method of detecting birth control is looking at the shape of the curve, concave indicating natural fertility, convex resulting from conscious limitation. When marriage duration is so different as is the case when comparing European and Chinese populations this may be misleading. Jan Van Bavel, for instance, suggested that the comparison should only include women married in the same age group.\(^89\) All this is straightforward demographic reasoning and can be solved easily. For experienced scholars it can not be a problem to reach agreement on problems concerning differential definitions and measurement.

The second major problem in the debate is the widely diverging way in which data are processed. Wolf relies on a combination of interviews, thorough knowledge of the local situation and descriptive statistics, whereas Lee et al. are convinced advocates of multivariate analysis methods. This in itself is reason for miscommunication. In our view, however, the differences in conclusions cannot be attributed to the methodological approach. Rather, the sophistication of statistical analysis or the years of experience hide more important issues that have to do with the interpretation of the results. For instance, how is one to deduce or refute rational, strategic action of historical actors from demographic measures?

First of all, when dealing with historical populations we are confronted with...
with a major conceptual problem. We have to infer strategic intentions from behavior. These data, however, may be very misleading. When we treat them *ex post facto* as an indication of strategic behavior, we might end up in circular argumentation. All analysis starts with collecting data on demographic behavior. The second step involves producing cross-tabulations, graphs and multivariate analyses in order to distinguish subgroups that deviate from the average, including the covariates of their behavior. Again, this is just straightforward research. The next step, linking the behavior patterns found to plausible strategies, is a methodological risky move in which we first deduce strategies from behavior and afterwards use them to explain this behavior.90

This is not all. How are we to know that the historical actors had all the information they needed to make strategic decisions? Did they have the same knowledge we have now with the benefit of hindsight? And since we deduce strategies from actual behavior, how are we to know that the result was the result actors were aiming at? Maybe their strategy simply failed or was confounded by the interference of strategies of other actors. We might be explaining the result of several conflicting individual strategies, a result that no one really intended. E.A. Wrigley even pointed to the existence of so-called *unconscious rationality*, behavior guided by societal norms and economic constraints, but known to actors only as the proper way to live.91 Is living up to unconscious rationality proactive too?

All this amounts to saying that determining conscious actions within historical populations is very difficult. Next we wonder, whether the new “Chinese demographic system” Lee et al. claim to have found is really new. They deduce conscious actions from the use of infanticide, from a gender-unbalanced marriage market, from a low level of marital fertility and, lastly, from adoption. This Chinese reality, they argue, replaces Malthusian mythology, and thus the distinction between European ‘preventive’ and Chinese ‘positive’ patterns. The new demographic system has at least two interesting characteristics. First, it implies that we are not discussing four independent phenomena. One might argue, for example, that infanticide is the core of the system. The other features are then simply consequences of infanticide. Given the excessive female infant mortality, the marriage market was obviously disturbed, resulting in almost universal marriage for women and restricted marriage opportunities for men. This in itself produced a highly rationalistic way of finding a marriage partner and hence may have produced the low fertility rates within marriage. Romance was not exactly

the main driving force behind Chinese marriages. This leaves us with adoption. Again, the need to adopt children is not an independent characteristic of the Chinese demographic system, but the result of infanticide and low marital fertility against the background of the Chinese preoccupation with lineage perpetuation. Many parents in this situation simply had to adopt either a son or a wife for their son. Looked at in this way, the system depicted here is one that is characterized first of all by infanticide. The conclusion that Chinese practised infanticide is hardly revolutionary.

This brings us to the second remark on the Chinese demographic system. James Lee and Wang Feng use the system to reject mortality by way of ‘positive checks’ as the main feature of Chinese population history. They may be absolutely right. Still, this clearly depends on the definition of ‘positive checks’. In contrast to their European and especially English contemporaries who prevented excessive population growth by limiting the number of marriages, Chinese women, in Thomas Malthus’ view, all married and did so at a young age. As a consequence, periods of high death rates are to be expected as a penalty of nature. To be sure, *One Quarter of Humanity* does not deny the existence of poverty driven mortality: “Peasants used female infanticide to respond to short-term changes in economic conditions. Increases in grain prices and declines in food availability clearly provoked increases in male mortality and in female infant mortality” (page 51).

The only reason why the authors deny the existence of positive checks is that this check was not left to nature. Instead, parents took fate in their own hands and killed a number of children, mostly females, of course, in order to avoid the penalty of nature: “Such an active use of mortality meant that survivorship was determined as much by endogenous decision making as by exogenous ‘misery’” (page 47). One could argue that this is at most a technical distinction. Maybe infanticide is just a variant of the phenomenon we call positive checks and not something completely different. The decision for parents to kill or abandon a number of their children may have been highly rational (page 58); it remained, basically, a poverty driven phenomenon after birth took place. In that sense it is close to the Malthusian definition of positive checks, even if one chooses to call this behavior proactive.

Wolf acknowledges the rational attitude Chinese had towards marriage and the family. As a matter of fact, many of the proactive actions taken by Chinese are described in his own work.92 Still, in his view, this does not explain all differences. Although low fertility was indeed caused by ‘late starting’, ‘early stopping’ and long birth intervals, one should also look for the causes behind

these mechanisms. Rather than ascribing them to conscious decisions, Wolf points at ‘biological’ influences. Women married before menarche or during pre-adolescent sub fecundity experience ‘late starting’ without proactive intentions. ‘Early stopping’ may be the result of the well established fact that coital frequency is negatively correlated with duration of marriage. On top of that, long intervals could be the consequence of malnourishment of the marital partners and the impact of a high risk of miscarriages.93

So far, we concluded that the fertility of human populations may have been influenced by endemic poverty. Also, the Chinese population may have been subject to endemic poverty until well into the 20th century. Moving on to the nature of Chinese demographic behavior, we can conclude that Wolf too agrees that Chinese families and couples actively influenced population development through infanticide, arranged marriages and adoption. Essentially, this narrows the discussion down to the central question whether or not fertility behavior was proactive.

Now let us assume that all discussants would use the same sources, construct the same measures and apply the same statistical techniques, would this automatically end the discrepancy when interpreting fertility? We are afraid not, and this constitutes the real impediment to agreement. It is not one analysis against another analysis. It is one conviction against another conviction that underlies the debate. As a result we find the same arguments over and over again. An example will help to prove our point. Son preference is an accepted characteristic of Chinese society. If we find evidence of longer birth-intervals for couples who already had a son (and we do find this both in Arthur Wolf’s and in James Lee’s tables), what does this mean? The conclusion Lee et al. draw from this finding is that parents consciously prolonged the following birth intervals and thus acted proactively. Wolf points at an alternative explanation: “[Girls] were often killed at birth; they were commonly neglected and died as a result; they were frequently sold as servant slaves; they were often given away as little daughters-in-law; and they were usually weaned two or three months earlier than their brothers”.94 As a result the mothers stopped breastfeeding earlier and their fecundity was restored sooner. Wolf then concludes that “(t)he couples with sons were not practising birth control. They had just relaxed a little.”95 But when, the objective reader might ask, does ‘relaxing’ stop and are we witnessing the start of ‘proactive’ behavior?

What we have here is the same statistical evidence with two different interpretations. No matter how long one discusses this issue, there is at this moment no

95. Ibidem, 147.
way to settle the debate. It seems that one either believes one or the other explanation. Although the debate on the surface uses scholarly argumentation, it is essentially a clash of beliefs.

Does this imply, then, that there is no possibility to choose sides? There is, but we cannot derive them from the study of the data at hand. Instead, one has to rely on argumentation on the macro-level. The ‘revisionists’ clearly modified Thomas Malthus’ over-simplistic view of Chinese demography. Obviously, the Chinese were ‘agents’ in the literary sense, using infanticide, nuptiality and adoption. Still, as far as fertility is concerned the presumed conscious activity of Chinese couples leaves us with a couple of highly interesting and, until now, unanswered questions. Why, for instance, was the number of Chinese births limited? Would it not be less troublesome for Chinese couples to simply increase or decrease the incidence of infanticide according to changing circumstances? This would have been in line with the homeostatic regulation of marriages in Europe. So, secondly, what did the Chinese know that the Europeans did not, until the end of the 19th century? In Europe marriage restriction was a rather effective mechanism to limit population growth, as was infanticide in China. If the Chinese were able to add another instrument to their possible reactions, why didn’t Europeans do the same? And, if indeed fertility regulation among Chinese populations was as widespread as Lee et al. claim, why is it that we do not find information on this in contemporary writings, proverbs or customs?

Positive, preventive or proactive? The questions guiding this study. The present study centres on the questions raised in the previous pages. We start with an analysis of nuptiality in Lugang and Nijmegen. Is marriage in our Taiwanese town indeed universal and young, and are young men and women in Nijmegen indeed restricted in their marriage opportunities? The analysis of age at marriage and proportion ever-marrying will take into account that population averages may conceal important differences between sub-populations. We will differentiate according to ethnicity and social status in order to see whether general differences in marriage behavior remain when we control for social characteristics. After having established the differences and commonalities in Nijmegen and Lugang in a descriptive way, we will concentrate on the explanation, both of age at marriage and hazard of marrying. To be sure, the comparison of Lugang with a European counterpart leads to a broad approach to marriage. Since marriage restriction is geared at keeping population within limits given the existing resources, one also has to look at illegitimacy and bridal pregnancy. Both phenomena are expected to be of minor importance under a regime of marriage restriction.

At first view infant mortality appears not to be part of reproduction. Still, the effects of the mortality of infants on the reproductive behavior of parents, be it
conscious or unconscious via biological mechanisms, is adequately demonstrated. When dealing with a Chinese population, the impact of infanticide must be considered too. Ever since Thomas Malthus, this topic has been a constant in the demographic studies of China. For these two reasons we dedicate a special chapter to the mortality of infants. We want to know what the characteristics were of those dying in their first year, and we want to know whether or not this affected the fertility of the couples involved.

Fertility is the subject of the second part of the book. Thomas Malthus mentioned only one check on fertility. In his view marriage restriction was the only way to control fertility, simply by limiting what one could call in demographic terms the number of fecund women years at risk. His argument misses one logical step, however. He takes it for granted that Chinese and European fertility are at the same level and thus that all marriages generate the same number of children, when one controls for age at marriage. Reality proves to be different. Louis Henry already showed that one finds differences in the fertility of so called natural fertility populations and he attributed these differences to customs of breast feeding. Although we still have to find out whether we agree with the explanation offered, we do agree with the general principle. Even parity independent fertility is influenced by factors that result in different numbers of births.

In the descriptive part of this section we will provide information on age specific measures of fertility, on the average number of children born per couple, on bridal pregnancy, on birth intervals, and on age at last birth. Like in the case of nuptiality, we will distinguish between the social groups within Lugang and Nijmegen, in order to compare only those groups that are really comparable. After having thus set the scene, multivariate analysis will enable us to explain differences in fertility within and between the populations studied.

The central question throughout this book will be to what extent reproductive behavior in Nijmegen and Lugang was preventive, positive or proactive. Did the inhabitants of the two cities, in other words, accept fate, did they act so as intentionally to neutralize fate, or did they behave in a way through which they, unconsciously, interfered with fate? Or, to paraphrase one of the contributions to the ongoing discussion: was Chinese reality indeed inadequately described by the Malthusian mythology that seems to suit Europe so well?

3

Nuptiality

One concept,

two realities
For a demographer the basic features of marriage are essentially the same in every non-polygamous society. A man and a woman form a new union in which the man has exclusive sexual rights to the woman, and, thus, are allowed to have offspring. Most authors focus on these characteristics. From this starting point they deal with variables like age at marriage, proportion married according to sex, and number of children born to the couple. This way of handling nuptiality offers the opportunity to compare marriage cross-culturally and over time. Nonetheless we have to be aware of the simplification of reality that is part of this approach. When a Nijmegen couple married at age 29 for the groom and 25 for the bride, and a couple in Lugang married respectively at ages 20 and 17, there is more to be said about the differences between the two marriages than the simple subtraction of the ages. At the demographical surface the marriages appear to be comparable events but they may well hide substantially different realities. Therefore, before applying the standard demographic measures to the populations of Lugang and Nijmegen, we will briefly look at the cultural, economic, social, and emotional meaning of marriage in both cities. This is not just an anthropological sidestep for the sake of adding folklorist color. Rather, it will prove to be essential to understand the findings in the demographic sections of this and the following chapters.

Let us consider first what marriage implied for Taiwanese couples and their families. Towards the end of the 19th century the Canadian missionary G.L. MacKay already noticed that “marriage is arranged by the parents of the contracting partners, without regard to the feelings and preferences of the parties themselves.” The rationale behind this was that marriage had nothing to do with affections but was directed only at obtaining “male posterity, who shall guard the graves of the dead and minister to the needs of the departed spirits of their ancestors.”97 We have reasons to doubt the objectivity of the observations by a Presbyterian missionary more than a century ago. His description, however, comes very close to what 20th century social scientists have found. Wolf and Huang neatly formulated the core of Chinese marriage by stating that “marriage and adoption are best viewed as the means by which families manipulated their composition to solve immediate problems and to achieve long-range goals”. Therefore “decisions about marriage and adoption were instruments of family policy, the outcome of deliberate assessments of family needs, means, and aspirations”.98 For the Western reader these observations contain an implicit warning not to look upon Chinese marriages as arrangements of a romantic nature. The very choice of spouses and the form of marriage were not in the hand of the

97. George Leslie Mackay, From Far Formosa. The Island, its People and Missions (originally 1896; Taipei: smc Publishing Inc. 2002) 120.
couple-to-be, but the exclusive right of the parents on both sides. Basically, marriages in China consisted of a transfer of rights over the woman who was to be the bride. And, as much recent scholarship has emphasized, these transfers took place within a functional legal system that backed informal parental authority with reliably applied state sanctions.99

Chinese society had very explicit ideas on the appropriate age of the woman that was transferred from one family to another. A well-known saying stated it like this:

Seventeen eighteen, just right  
Nineteen twenty, two years too old  
Twenty-one twenty-two, no one wants her  
Twenty-three twenty-four, you have to pay someone to take her.100

For the interpretation of this proverb one has to realize that the ages are mentioned according to the Chinese way of counting ages. Each lunar year in which a child has lived is counted: a newborn child starts at age 1 and becomes age 2 at the first Chinese New Year. In general one reaches the age comparable to the western system by subtracting one year. The most desirable age at marriage for a woman, therefore, was 16 or 17, that is, roughly at the age of menarche. By age 19 her chances on the marriage market had declined. By the time the first women in Europe married, Chinese women were already depicted as spinsters.

We can trace the businesslike background of marriages through the way they were contracted. First, the economic part of the arrangement was settled, before any official step was taken, the negotiations about bride price and dowry had to be completed. Next, the bride would receive the wedding rings from her future mother in law, while seated in front of her father’s ancestral altar, but facing the open doors. This was the first part of the transfer, indicating that the daughter would leave her parent’s house and descent line. On the day of the wedding, then, she would actually leave the house and her father’s authority. Behind her back the doors would be closed formally, showing that she had made a definitive step. Under no circumstances was she allowed to return to this house as a daughter. On the route that took her from her parent’s house to that of her future family the bride experienced the only period in her life that she was not officially subject to the authority of a male head of family. Upon entering her husband’s house this situation was immediately terminated. The bride had to pledge obe-

100. Arthur P. Wolf, personal communication.
dience to her parents-in-law, to the family’s ancestors, and to her husband. The last part of the transfer consisted of a visit, accompanied by her husband, to her natural parents, this time as a guest, not as a daughter. The responsibility for her support now lay with her husband’s family.

So far, this description suggests there is only one type of marriage in China, as there is only one type of marriage in Europe. This, however, is not the case. Three very different forms of marriage can be distinguished, and some women were transferred in a variety of non-marital or quasi-marital statuses (e.g. concubines). The union of two more or less grown up persons, the traditional form of marriage in Europe, is only one of them. To be sure, marriage between young adults was considered to be the best way to marry, and in some parts of China it was the only form. Especially in the northern part of Taiwan, however, many marriages were the result of calculations and actions by the groom’s parents long before the actual marriage occurred. We refer to the custom to adopt girl babies as future brides for the son of a family, the so-called *sim-puas* (little-daughters-in-law). As a result, ‘brides’ joined their family-in-law at a very young age, and were raised together with their future husband until the head of the household decided it was time they married.

The third form of marriage deviates from the other two with regard to the family the new couple belonged to after marriage. Given the importance attached to patriliny and ancestor worship in Chinese culture the preferred situation, as described, was for the bride to officially leave her birth family and join her husband’s family. When a husband joined his wife’s family this was therefore considered to be an embarrassing situation, both for the receiving family, who had not raised a son itself, and especially for the husband, who had not been able to bring a bride and thus possible offspring into his father’s line. Arthur Wolf has coined terms for these marriages: they are, respectively, major, minor and uxorilocal marriages.\(^{101}\) We will use these terms throughout this study.

As said, major marriages were considered to be the socially superior way of marrying in China. This is clear in the many marriage contracts that have been preserved, that served as evidence in courts of law should disputes arise. They almost all deal with minor and uxorilocal marriages. The rules for major marriages were clear-cut and did not need detailed clauses. Especially for uxorilocal marriages we find contracts stating the obligations of the husband in his wife’s family. This could range from explicit mention of the number of years he had to work in his wife’s family to the situation where the husband took his father-in-law’s surname and thus assigned all his children to his wife’s family’s lineage. All possible variations in between could also be contractualized.

What was the relative importance of these forms of marriage in Lugang? Table 3.1 informs us that major marriages were the clear dominant type. Also, during the colonial period this form of marriage gained importance. One out of five women from the first birth cohort still married in the minor fashion. From those born after 1915, only one out of ten had been adopted as little-daughters-in-law. Uxorilocal marriages started our period of observation as a smaller, but still significant part of all marriages at almost 10 per cent. Although the Japanese period witnessed the decline of the incidence of minor and uxorilocal marriages in Lugang, the two alternatives for a major marriage remained statistically significant.

From the description of marriage rituals we can already deduce an important characteristic of Chinese marriages. Although there is discussion on whether the fusion and fission of married couples in stem or complex households differed between wealthy and poor families, the general rule seems to be that the new couple after marriage lived in the household of the parents of the husband. Only with the death of the head of the household did the sons and their wives form separate households, in this way starting a new cycle.

In the Chinese world, the form of marriage was not just a neat categorization of anthropological manifestations of coupling. The three forms of marriage had very real implications both for the stability of the marriage and for its future fertility. Uxorilocal marriages suffered from the build-in tension caused by the subaltern position of the husband, who was often tied by contract to obli-

Table 3.1: Relative frequency of major, minor and uxorilocal marriages by sex and year of birth in Lugang

<table>
<thead>
<tr>
<th>Year of Birth</th>
<th>Number of Persons</th>
<th>Percent of Marriages</th>
<th>Major</th>
<th>Minor</th>
<th>Uxorilocal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1886-1900</td>
<td>312</td>
<td>73.4</td>
<td>17.6</td>
<td>9.0</td>
<td></td>
</tr>
<tr>
<td>1901-1915</td>
<td>464</td>
<td>78.4</td>
<td>16.4</td>
<td>5.2</td>
<td></td>
</tr>
<tr>
<td>After 1915</td>
<td>216</td>
<td>88.0</td>
<td>9.3</td>
<td>2.8</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>992</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Females       |                   |                      |       |       |           |
| 1886-1900     | 301               | 69.1                 | 21.6  | 9.3   |
| 1901-1915     | 458               | 78.6                 | 17.0  | 4.4   |
| After 1915    | 321               | 84.7                 | 10.0  | 5.3   |
| Total         | 1080              |                      |       |       |           |
gations towards his wife’s family. Minor marriages had to deal with the sexual aversion between the spouses that resulted from being brought up together, especially when they were brought together is a particular phase of their development. Minor marriages generated a significantly lower number of children, and their probability of adultery and divorce was higher than in major marriages. Accordingly, we will present separate analyses for major, minor and uxorilocal marriages whenever we believe it necessary for our understanding of family life.

We now turn to Dutch couples, especially those marrying in Nijmegen. Compared to the multifaceted reality in China, marriage in Nijmegen was simple: all marriages contracted there were of the ‘major’ form, although, in general, they were not arranged and contracted for by parents. Technically, however, we can distinguish between civil marriage and church marriage. In the Netherlands, only civil marriage was necessary to grant the new couple the official rights of the marital state. Since almost everybody in the 19th century adhered to a religious denomination, however, the ritual sanction for living together was given by a priest or a minister. Legally, the civil registration of a marriage always had to precede its clerical sanctioning. Often there was even a time lag between the two. The actual consummation of the marriage occurred only after the church wedding. We thus find a clear distinction from marriages in Lugang. In Nijmegen, authorities outside the family were necessary to start married life, whereas in Lugang the two families of bride and groom arranged this, using voluntary legal contracts only as insurance against failure to meet negotiated obligations.

Another difference concerns the age at which a couple started living together. We expect age at marriage in Nijmegen to be considerably higher than in Lugang. As far as the civil law was concerned, there were no real impediments to early marriage in the Netherlands. From 1838 on, the minimum age at marriage for men was 18 years and for women 16. If we look at the books written to give advice in matters of marriage, however, we find definite opinions on the proper age at marriage. These opinions all amount to this: marriages that were concluded at too young an age damaged the health of husband, wife and future children, whereas marrying too late was unnatural or indecent. Both partners had to be economically, socially and physically mature.

All authors also seem to agree that the age difference between bride and groom should be limited. The 19th century proverbs that support this opinion are not very subtle. A young man marrying an older woman is said to “spill his youth ploughing a field that will never bear fruit”, whereas a man who has reached a certain age and still wants to marry a younger wife is warned that “a young
woman is the horse on which older men ride to hell”. In general, the proper age at marriage was described as follows: “The first frivolity of youth must have vanished in order not to make a foolish step and to be able to fulfil the duties of the marital state. But it would also be wrong to wait until the freshness of youth is already gone and one is already settled too much in his or her own way of living, making it difficult to go and live together with someone else. Therefore, the age of approximately 25 years seems to be the proper age to marry.” This citation from an influential marriage guide published in 1866 is followed by a statement that in all simplicity summarizes the European marriage pattern: “unfortunately nowadays most men do not earn enough to take this step”.103

These remarks form a prelude to the next characteristic of Dutch marriages, the customs of neolocality and economic independence. On the day of the wedding, both husband and wife left their parental homes. How deeply rooted this custom was becomes evident when we see that it was even mentioned in the Bible: Therefore a man shall leave his father and mother and be joined to his wife, and they shall become one flesh (Genesis 2:24). Leaving his father and mother is refers not only to the place the new couple is going to live. It implies that all economic ties between the man and woman and their respective parents are cut. Until the moment of marriage, income generated by the unmarried children was expected to be handed to the parents, even if the children earned their money living as servants outside the parental household. An exception was only made for a small part of the income that was saved for marriage. This intergenerational transfer of money stopped at marriage.104

The last characteristic of nuptiality in the Netherlands deals with the preparation for marriage. When a man and a woman formed a new household they were no longer strangers. Due to the custom of engagement, they had known each other for several months or years before they appeared at city hall to have their marriage officially registered. In some cases this preparatory phase could result in the conclusion that the couple did not fit together, in which case the engagement could be broken with mutual consent and without consequences. This highlights the fact that Nijmegen men and women selected their partner themselves according to personal preferences, without interference from the older generation, and mainly for reasons of a romantic nature. Arranged marriages occurred in some higher social class Dutch families but they form the statistically insignificant exception to the general rule described here.

We will now return to the demographer’s way of dealing with marriage. When comparing a Western European and a Chinese town the obvious starting point is nuptiality. Ever since Malthus’ Essay we find the distinction between a restrictive marriage pattern in Europe and a Chinese pattern where young and almost universal marriage ruled. This guides our expectations for the situation in Lugang and Nijmegen. We presume the cities will reflect the differences in their respective microcosms. To be sure, John Hajnal already mentioned the existence of variations within areas characterized by a specific marriage pattern. After creating a boundary between a European pattern and a non-European pattern, he wrote that “significant departures from the European pattern may be found not only as one proceeds eastward but on the southern edge of Europe as well”. Since Hajnal wrote this, many of these departures have been fully documented. He also recognized that non-European societies may show “wide variation in the pattern of their marriage rates”. He nonetheless insisted that “all the varieties that exist are separated by a distinct gap from the European. (...) Europeans have married much later than others and more of them have remained unmarried throughout life.” We follow this line of reasoning and expect our two towns to be representative for the two demographic regimes.

Although Malthus and Hajnal mainly described marriage, one might argue for a bold interpretation of the European marriage pattern that the pattern is not at all concerned with marriage as such. Rather, the pattern is geared toward controlling the number of fecund women allowed into a situation where they are at risk of conceiving. This, then, provides us with the basic questions to answer in this chapter. Do we indeed find evidence for the existence of marriage restriction in Nijmegen and, at the other end of the Eurasian continent, of young and universal marriage in Lugang? Can we ascertain that marrying late or remaining unmarried throughout life was basically population policy at the level of the entire society? This clearly is the position taken by Thomas Malthus when he explicitly related marriage patterns to the regulation of population growth. The demographic effect of marriage restriction is demonstrated in many empirical

studies. A striking example is to be found in Sart, a village in the Belgian Arden-
nes during the 19th century. The total marital fertility rate (from age 20) was 9.2,
whereas the total fertility rate only reached 4.9.\textsuperscript{109} This shows that potential fer-
tility can be halved by way of reducing the proportion of fertile women married.

Obviously, inhabitants of 19th century Western Europe themselves were
not concerned with long term consequences of their actions and decisions. For
them, Malthusian logic was codified in traditions concerning marriage. Society
guarded laws, norms and values about who was allowed to marry and about what
the proper age at marriage was. With the benefit of hindsight we can see that the
cultural customs pre-industrial Europeans obeyed were based on a rigid eco-
nomic rationality. This explanation also fits the rapid transformation of customs
regarding marriage from the moment on when resources increased in a histori-
cally unparalleled way. By the end of the 19th century, soon after industrializa-
tion provided employment for those without a propertied niche, marriage
became almost universal and ages at marriage started a long period of decline.\textsuperscript{110}

The inhabitants of Europe, in this view, unconsciously performed an
amazing task. For centuries they kept population growth at a relatively low level.
Individual historical actors paid a high price for this result. Age at marriage for
men could be well over 30, for women three or four years less, whereas 10 to 20
per cent of the population never married at all. The consequence of this system
was ultimately to limit the number of births by keeping the number of sexually
active fecund women under strict control by reserving sexual relations for mar-
ried couples. The system only functioned as long as the participants lived up to
the regulations concerning marriage, sexuality and procreation. In all Western
European countries these regulations were uniform and simple: only within mar-
riage a sexual relationship was allowed and, therefore, only a married woman
could give birth to a child. By implication, every deviance from these rules endan-
gered the self-replicating marriage pattern. In an analysis of marriage restriction
in European countries or regions, therefore, we not only have to study age at
marriage and proportions ever married, but also the deviations from the control
of marriage. In other words, one has to deal too with the procreative use of
fecund women years outside marriage.

What options existed for individuals living under the conditions of a high-
ly restrictive marriage regime to escape these restrictions? First of all, the most

\textsuperscript{109} George Alter and Michel Oris, ‘Access to marriage in the East Ardennes during the 19th century’, in:
Isabelle Devos and Liam Kennedy (eds.), \textit{Marriage and rural economy. Western Europe since 1400} (Corn
Publication Series 3) (Turnhout 1999) 133-151, especially 140.

Kertzer and Marzio Barbagli (eds.), \textit{Family Life in the Twentieth Century (The History of the European Family:
blatant challenge to the system was to engage in sexual activities outside marriage. Not only did it undermine the explicit norm about sexuality, it also paved the way to a form of reproduction that could not be controlled through access to marriage. Measuring the importance of this deviation from the general rule is difficult. We have to rely on the only evidence of extramarital sexual activity registered in the archives, i.e. the number of illegitimate births. Especially in the younger age categories there is also a more subtle escape from the norm. Engaged couples could be forced to postpone the actual date of their marriage until all requirements were met, but it was much more difficult to prevent them from starting a sexual relationship. Again, we can know of this alternative only when it resulted in a pregnancy. In the European context a pregnancy forced a premature marriage and, thus, constituted a violation of the marriage restriction.

The implication of this line of reasoning is clear. One cannot stop after having measured the evidence for marriage restriction. It is of utmost importance to assess the effectiveness of the system also. We therefore use the four indicative variables in their mutual relationship: age at marriage and proportion ever married in this chapter, the number of extramarital births and the relative importance of bridal pregnancy in the next. Our Lugang data allow us to analyze the same variables in a society where marriage restriction is expected to be absent. What differences, then, does this comparison generate? Do the many celibates, either before marriage or throughout life, in western-European societies (in our case Nijmegen) exhibit a larger number of illegitimate births and bridal pregnancies when compared to China (in our case Lugang)? The demographic circumstances would make such a prediction likely.

The Proportion Ever Married
The first assessment of marriage patterns in our two cities uses information on proportion ever married. Since the Nijmegen data are not built around birth cohorts but around marriage cohorts, we can not calculate the probability of marriage by age at the individual level. Instead, we look at the proportion ever married at two moments in time, one at the beginning of the period studied here, the other toward the end of this period. For Nijmegen, we have censuses at a ten year interval from 1830 on, providing detailed information on both the civil status and the age of both sexes. In the following graphs the situation in the census years 1849 and 1879 is presented. Unfortunately, censuses in Taiwan are not as detailed at the local level. The age categories are summed for groups 0-5, 5-20, 21-59, 60 and higher. In order to construct measures comparable to Nijmegen we therefore calculated the proportion married from our household registers, again choosing a year at the beginning (1916) and one at the end (1936) of the colonial period. In both cities we used the total of the number married, widowed and divorced, in this way providing graphs with an approximation of the proportion
ever married. The graphs start with age 10. Even in Lugang marriages were never registered earlier than that. Since our main purpose is to reconstruct reproduction we stopped our observation at age 50, after which the possibility to bear children is expected to have ended.

This approach comes with possible biases. First, the Nijmegen graphs are based on a larger number of cases, 13,267 in 1849 and 14,747 in 1879. Our sample for Lugang only consists of 3,406 men and women in 1916, and 4,376 persons in 1936. Next, we present a picture rather than a movie. In the graphs we freeze a dynamic reality at one moment in time. We do not know, for instance, whether or not the older age categories married earlier or later than the younger inhabitants of the two towns. Also, the composition of the proportion ever married in both cities may vary. Unless we expect mortality and rates of divorce to be the same, the total number of ever married harbors different sub groups. Surprisingly, for example, we count only 12 divorced persons among the almost 15,000 inhabitants of Nijmegen in 1879.

Despite the shortcomings of the data, Graphs 3.1 and 3.2, in our view, present a reliable approximation of the marriage pattern. If anything, the graphs show that Thomas Malthus and John Hajnal were right when they stated that marriage patterns in Europe and China were structurally different. Marriages in Lugang were indeed registered at younger ages already, and more inhabitants married here than in Nijmegen. Still, this general observation does not take into account that these patterns were gender differentiated and that they witnessed
change in time. What the traditional descriptions did not inform us about, for instance, is the differences in nuptiality between men and women in China. Women married significantly younger than men in Lugang, although we also notice that this difference declined between 1916 and 1936. Even then, however, the differences remaining were relatively large when compared to the differences between the male and female part of the population in Nijmegen.

Let us now have a closer look at the information the graphs offer us. Women in Nijmegen started marrying in their late teens, but the real increase in the proportion ever-married occurred only after age 20. This increase was relatively slow, reaching a maximum proportion married of just below 90 per cent in 1849, and just over 80 per cent in 1879. Clearly, the number of inhabitants never marrying is the result of the restriction on marriage we anticipated. The historical change is remarkable. In 1879, more women married at an earlier age than 30 years before, but after age 40 we find fewer women ever married. This may point to a shift in the nature of restriction. A decline in the age at marriage seems to be corrected by a rising number of permanent celibates.

Marriage restriction is strikingly absent in Lugang, at least for women. They entered matrimony from age 12 on, and in 1916 by age 20, 85 per cent of them already were married. From age 35 on, approximately all women in Lugang were married, or had been. We find this to be the case both in 1916 and 1936. The extremely young marriages, however, seem to have lost importance by 1936. In this year, by age 20 only 68 per cent of the female population was married.
Although this was a significantly lower percentage than in 1916, it still is a world apart from Nijmegen, where in the second year of observation only 8.2 percent of all women were married at the same age.

The discrepancy between Nijmegen and Lugang males was less sharp. Men in Nijmegen definitely started marrying later than women, but in the higher age groups, where they were underrepresented (see Graph 1.3) a higher proportion of them ended up married. In 1849, this percentage was just above 90. Remarkably, the historical change for both sexes appears to be the same. By 1879, young marriage had gained weight, again controlled, however, by a concomitant rise in the proportion of permanent celibates. In Lugang, universal marriage was a prerogative for women only. More than 5 per cent of the male population in the Taiwanese city shared the fate of the Nijmegen never-marrying men, in 1936 even more than in 1916, namely over 10 per cent. As far as age at marriage was concerned, the difference with their European colleagues was impressive. Although they started marrying later when compared to women, in 1916, by age 30, 69 per cent of the Lugang males were already married, against 45 (1849) per cent in Nijmegen. This difference had almost disappeared in the later year of observation. Between age 40 and 50 we find on average 85.3 of the men in Nijmegen married (1879), against 87.6 in Lugang (1936). Not being married had important social consequences for Lugang men. George Barclay described the situation for Taiwan in the first half of the 20th century by stating that for a man to remain celibate was usually a mark of unexampled misfortune.¹¹¹ Lugang males who never married must be seen as the group that did not manage to marry even uxorilocally and, therefore, had to carry the burden of social inferiority.

When we bring the information from the graphs back to summary measures for four age categories, both the differences between the two cities, the differences between the sexes, and the historical changes clearly stand out. The choice for the age categories is inspired by our knowledge of age at marriage in pre-industrial European societies. The data for the age cohorts 20-24 and 25-29 are considered to give information on the age at marriage. In early European populations the majority married in the age category 25-29. One of the indicators for demographic modernization, then, is the gradual shift towards the age category 20-24. Given the custom of early marriage in Lugang we also added the age group 15-19. The probability of marrying after age 49 declines sharply in all human populations. Therefore, the proportion unmarried at age 45-49 is often treated as a measure for permanent celibacy.

Table 3.2 shows the striking difference between Nijmegen and Lugang even more clearly than did the graphs. For Nijmegen in 1849, we find that by the age of 24 only 7% of the population was married, for both men and women. This simi-

larity between the sexes disappears in the age group 25-29, when more men than women have ever been married. By the time the marriage market for first marriages is considered to be closed, at age 49, still more than 15 per cent of all women in this age group have never married, the corresponding percentage for men being 12. When we move to 1879, two conclusions immediately appear. The first is that marriage restriction remained active throughout the nineteenth century, but the second conclusion must be that its impact changed from the younger to the older inhabitants. In 1879, in the age groups between 20 and 29 and for both sexes, more people married. The proportion of never married inhabitants in the group 45-49, however, increased. For women this was even more so than for men, reaching almost a quarter of the total number of women in this group. These findings fall within the range set by Hajnal, who stated that in early nineteenth century Europe between 10 and 20 per cent of the women did not marry before the end of their fertile period. Anderson showed that empirical data prove Hajnal to be right.\textsuperscript{112}

Compared to the Dutch data, the differences between men and women are very apparent in our Taiwanese city. In 1916, it was as hard to find an unmarried woman between age 20 and 24 in Lugang as it was to find a married woman of the same age in Nijmegen. For Lugang males, on the other hand, marriage may have been more easily accessible than it was for their Nijmegen counterparts, Table 3.2 again shows that universal and young marriage were applicable to the female part of the population only. In Lugang too, the period studied here witnessed a change in time, albeit it that the change was not as uniform as it was in Nijmegen. The Lugang data for 1936 indicates that during the Japanese period very young marriages became less fashionable for women; especially in the youngest age group

more women were still single in this year. The general conclusion, however, must
be that in all age groups except the oldest, fewer Lugang women were married
compared to 1916. We can draw the same conclusion for men. Only men between
25 and 29 were married at higher ages in 1936 than in 1916.

The conclusions from the Dutch data correspond with our notions of nup-
tiality in Western European countries in this period. Still, when looking at the
exact numbers the rigidity of the system is striking. Supporters of the strong ver-
sion of the Hajnal hypothesis will point to the fact that this once again proves the
demographic effects of marriage restriction: the first ten years of the reproduc-
tive capacity of the female population is not used, and up to a quarter of this
capacity is not used at all. Women in Lugang seemed to have used their repro-
ductive period more efficiently, even in 1936.

### Age at Marriage

The proportion ever married by age has already provided us with an indication
of the ages at marriage in both cities. For a more detailed analysis of the central
tendency of the age at which first marriages occurred, we now turn to the indi-
vidual level data, which allow us better to assess the change in time. During the
19th century, men in Nijmegen married on average at 28.6 years, women at 27.4
years. The historical change of the mean ages at marriage is a logical result of the
situation within the city walls we described in Chapter 1. The growing overpop-
ulation of Nijmegen created problems that became more and more acute. Not
only did the housing situation deteriorate, the inhabitants of the city were
increasingly impoverished. Marriage restriction was the only answer available.
This explains the rise in average ages at marriage until 1890. The abolishment
of the city’s status of military stronghold and the following demolition of the city
walls opened up new possibilities for the inhabitants of Nijmegen. We can trace
this development in a small decline of ages at marriage for women in the last
period. We now clearly see that the decline of ages at marriage we found between

### Table 3.3: Average Age At First Marriage, Nijmegen 1830-1889

<table>
<thead>
<tr>
<th>Year of marriage</th>
<th>Men Avg</th>
<th>N</th>
<th>Women Avg</th>
<th>N</th>
<th>men-women</th>
</tr>
</thead>
<tbody>
<tr>
<td>1830-1849</td>
<td>28.3</td>
<td>230</td>
<td>26.9</td>
<td>244</td>
<td>1.4</td>
</tr>
<tr>
<td>1850-1869</td>
<td>28.8</td>
<td>436</td>
<td>27.6</td>
<td>456</td>
<td>1.2</td>
</tr>
<tr>
<td>1870-1889</td>
<td>28.9</td>
<td>94</td>
<td>27.4</td>
<td>102</td>
<td>1.5</td>
</tr>
<tr>
<td><strong>All</strong></td>
<td><strong>28.6</strong></td>
<td><strong>760</strong></td>
<td><strong>27.4</strong></td>
<td><strong>802</strong></td>
<td><strong>1.2</strong></td>
</tr>
</tbody>
</table>
the censuses of 1849 and 1879 was not a gradual one. Rather, the 1879 census showed the impact of very recent changes. In our Dutch data there is hardly any gender differentiation in the overall change of marriage ages. Although the level of the marital age differed, the change was by and large in the same direction, albeit that the amplitude of the changes varied, resulting in a changing difference between male and female age at marriage.

How representative are the Nijmegen couples for the Netherlands and for other Western European populations? Or, in other words, are the findings in this study also of importance beyond Nijmegen? First, we cite that the average age of Nijmegen brides is close to the age found in the province of Utrecht for 19th century women born before 1862. Van Poppel reconstructed ages at marriage for several regions in the Netherlands and our findings are completely in line with his. Even the increase in age at marriage until the 1860’s and the decline afterwards are shown in his results. Although relatively minor differences between several parts of the country existed, the Nijmegen couples we study here are a representative sample of the Netherlands as a whole.

The comparison to data from other European countries tells us that Nijmegen was also a representative town for this part of the world. Michael Flinn’s survey presents only information on women. Belgian brides who married between 1800 and 1849 did so at an average age of 27.9. There are more reconstructions dealing with the years 1780 to 1820. For that period, female age at marriage in France was 26.7, in Germany 27.5, and in Scandinavia 29.8. Wrigley and Schofield presented mean ages at first marriage for 12 reconstructions in England. Their calculations show mean age at marriage for men to be 25.3, and for women 23.4. In comparison to other northwest European countries these English ages at marriage are low. Other authors therefore criticized them, which led Schofield to recalculate female age at marriage for the 1816 birth cohort. His new estimate was 25.3, in this way bringing English women within the range of Western European populations.

For Germany, a more detailed comparison is possible. When we compare

114. Van Poppel, Trouwen in Nederland, 140-149.
the age at marriage for Nijmegen men (28.6) with John Knodel’s findings for his German villages (28.6), the resemblance is striking. Women in Nijmegen on the other hand married about one to two years later than their German colleagues.\textsuperscript{118} Again, this may be a logical result of the growing population pressure in the Dutch city. Even in ‘natural’ fertility populations it was known that the number of fecund women-years was especially essential for the final number of children. Surprisingly, however, the rise of age at marriage in the German villages resembled the Nijmegen situation, a slow increase at first and, towards the end of the century, a sharp decline. To be sure, a rising age at marriage in Nijmegen may still be the consequence of growing population pressure, but it may also be a reflection of a more general European development. On average, the age difference between Nijmegen brides and grooms (1.1) appears to be relatively small. The inhabitants of Knodel’s villages, for instance, exhibited a difference of 3.2 years.\textsuperscript{119} In sum, we may conclude that couples in Nijmegen married at approximately the same age as couples in the rest of the country and in Western Europe. What differences we find are, as Hajnal stated, differences within one system, which was clearly different from the Chinese system.

In Lugang, the average age at first marriage for men was 23 years, and for women 18.6 years. We already expected ages at marriage in Lugang to be considerably lower than in Nijmegen. Now that we can calculate the absolute difference for grooms this difference between ‘east’ and ‘west’ averaged more than 5 years, for women about 9. Also, Lugang offers a more complicated picture. Age at marriage for men witnessed a structural decline during the Japanese colonial period, while women born after 1901 married later than women born before that year. When we concentrate on the form of marriage most comparable to the Nijmegen marriages, major marriages, the age difference between Nijmegen and Lugang couples is slightly less than for all marriages. We also notice that the changes in age at marriage for minor marriages were less significant, especially for women. For couples marrying in the uxorilocal way, conclusions may be biased by the limited number of cases. Still, grooms in this form of marriage married later in every successive birth cohort, while for women we find a less unequivocal pattern with smaller amplitude.

As a general rule, in all populations, ages at marriage for men are higher than for women. Still, the age gap between grooms and brides in Lugang exceeded the values we know for Europe by far. In the first birth cohort we use, this difference was more than 6 years. In the following cohorts, however, we find a sharp decline to about 2.4 years in the last cohort. Again, this development is


\textsuperscript{119} Knodel, \textit{Demographic behavior}, 137.
dominated by major and uxorilocal marriages. The age difference between partners in minor marriages changed to a lesser degree and the direction of the changes varied.

The next question to be answered is whether or not the findings for Lugang are representative for Taiwan as a whole. At the Institute of Ethnology of the Academia Sinica in Taiwan, the household registers of 14 field sites are collected. When we compare the ages at first marriage for the birth cohort 1886-1901 in these populations, the position of Lugang is as follows. For men, the mean age at marriage was relatively high in all three forms of marriage. Men marrying in the major form, for instance, in Lugang married at age 24.4, while the range of the 14 field sites was between 20.7 and 24.6, averaging 23.2. Lugang brides, on the other hand, were younger than their colleagues in other communities. When we again take the major marriages as example, we find female average age at marriage for Lugang to be 19.0, whereas the general average was 19.7, the range being between 18.6 and 21.2.

Why is it that Lugang grooms were relatively old? Also, why is it that brides

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Table 3.4: Average Age at First Marriage, Lugang 1900-1945

### Men

<table>
<thead>
<tr>
<th>Year of Birth</th>
<th>Major Avg</th>
<th>Major N</th>
<th>Minor Avg</th>
<th>Minor N</th>
<th>Uxorilocal Avg</th>
<th>Uxorilocal N</th>
<th>All Avg</th>
<th>All N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1886-1900</td>
<td>24.7</td>
<td>229</td>
<td>21.6</td>
<td>55</td>
<td>27.0</td>
<td>28</td>
<td>24.4</td>
<td>312</td>
</tr>
<tr>
<td>1901-1915</td>
<td>23.2</td>
<td>364</td>
<td>21.9</td>
<td>76</td>
<td>24.4</td>
<td>24</td>
<td>23.0</td>
<td>464</td>
</tr>
<tr>
<td>After 1915</td>
<td>21.1</td>
<td>190</td>
<td>21.1</td>
<td>20</td>
<td>19.4</td>
<td>6</td>
<td>21.1</td>
<td>216</td>
</tr>
</tbody>
</table>

### Women

<table>
<thead>
<tr>
<th>Year of Birth</th>
<th>Major Avg</th>
<th>Major N</th>
<th>Minor Avg</th>
<th>Minor N</th>
<th>Uxorilocal Avg</th>
<th>Uxorilocal N</th>
<th>All Avg</th>
<th>All N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1886-1900</td>
<td>18.6</td>
<td>208</td>
<td>17.4</td>
<td>65</td>
<td>17.3</td>
<td>28</td>
<td>18.2</td>
<td>301</td>
</tr>
<tr>
<td>1901-1915</td>
<td>19.1</td>
<td>360</td>
<td>17.5</td>
<td>78</td>
<td>18.3</td>
<td>20</td>
<td>18.8</td>
<td>458</td>
</tr>
<tr>
<td>After 1915</td>
<td>18.9</td>
<td>272</td>
<td>17.4</td>
<td>32</td>
<td>18.1</td>
<td>17</td>
<td>18.7</td>
<td>321</td>
</tr>
</tbody>
</table>

120. These field sites are Ta-tao-cheng, Meng-chia, Chu-pei, Bei-pu and E-mei for the northern part of the island, Lugang, Ta-chia and Chu-shan for the central part, Ta-nei, Chi-pei, Chiu-ju and Tung-kang for the southern part, and finally Wu-chieh in the east and the Peng-hu islands.
follow the general trend more closely? Yu Guang-hong has dealt explicitly with the background of age differences at marriage in this city. He attributed early age at marriage for women to traditional Chinese social values. “A woman who got married late was usually suspected of immoral behavior that prevented her from finding a husband”, he argued. So, “a woman who remained single after marriageable age thus disgraced her family.” Or, as Hill Gates has put it more directly: “A girl was tucked into the marital bed as quickly as possible to preclude illegitimate pregnancy.” The reason behind relatively high male ages at marriage may in Yu’s view have had a very European reason: “Financial difficulty very likely postponed the age at marriage of Lugang men if they wanted to hold a formal wedding, namely a major marriage. Such a wedding usually cost a lot – a heavy financial load in Lugang’s staggering early twentieth century economy. On top of the normal expenses Lugang males had to pay for a specific Lugang ritual, called the Worship of Heaven. The expenses for this ceremony, on the eve of the wedding were as much as the salary of an ordinary worker for one or two months.”

Age at marriage by sub groups
All ages at marriage presented until this point are general averages of the total population. We do expect, however, that this average hides differences between sub groups of the two populations. The first cluster of variables possibly influencing marriage behavior contains information on the cultural identity of the actors. Our second cluster deals with the differential nuptiality of socio-occupational groups. Cultural influences are expected to shape the normative context within which marriages take place, whereas social position and occupation create the economic context. Or, in other words, we distinguish between economic motivation for marriage or marriage delay on the one hand, and cultural preferences on the other.

The best indicator for either cultural ties or cultural incompatibilities between subpopulations is the frequency of intermarriage. From what groups does one choose a marriage partner? And, more importantly, what groups are excluded from this possibility? Both in Taiwan and in the Netherlands we find

subpopulations that demarcate their position by marrying almost exclusively within the own group. The Taiwanese population can roughly be divided in three subpopulations. First, we can distinguish between the Han Chinese part of the population that has its origin in mainland China, and the plains Aborigines, descendants of Taiwan’s indigenous people. This distinction is of an ethnic nature. The Han Chinese also consist of two sub populations that obviously have no ethnical differences. The so called Hoklo are descendants from China’s southern Fujian province, whereas the forefathers of the Hakka came from Guangdong. Still, ethnic or not, at least until the 1930’s Hoklo and Hakka clearly constituted bounded social identities, which rarely intermarried. Every study dealing with Taiwanese demography has to take the possible influence of ethnic characteristics into account, although the discussion on its impact is undecided yet. In our Lugang population nor the distinction between ethnic groups nor the discussion on its possible influences matters. Lugang is almost completely Hoklo. In this comparison we cannot study the possible ethnic differences in nuptiality.

As one seldom finds a marriage across the ethnic or sub-ethnic boundaries in Taiwan, the 19th century Dutch civil registers rarely show the union of a Catholic and a Protestant person. The origin of the mutual demarcation is of a political and religious nature. Following the Dutch war of independence against Catholic Spain (1568-1648) Dutch society was dominated by the Protestants, leaving the Catholics in a secondary position. This domination was not only political, but soon also became economic. From the 17th until well in the 19th centuries we find among Protestants both the most influential and the richest part of the Dutch population. Even after the Catholics regained an equal legal position in the early 19th century, it took more than a century before their emancipation was completed. The effects of denomination on demographic behavior are studied mainly for the period after the fertility decline set in, starting in the 1890’s. The vehement opposition of the Catholic authorities against neo-Malthusianism resulted in a high and only slowly declining fertility of Catholic couples. Protestants, on the other hand, have to be subdivided into the liberal branch, the followers of which tended to accept new demographic behavior sooner than their orthodox Calvinist brothers. The latter resembled to a certain extent the Catholics.125

The question to be answered here is whether or not denomination influenced age at marriage in 19th century Nijmegen. Only the Catholic and liberal Protestant (Nederlands Hervormden) populations have enough marriages to take part in the comparison. Roman Catholic men married on average at age 28.7, while their brides were 28.1. For the Protestants the respective ages were 28.5 and 28.0. The conclusion must therefore be that in this period of the Nijmegen history religious denomination did not influence age at marriage.

Given the nature of marriage restriction we also expect the social and professional status of couples to influence their ages at marriage. Waiting for a niche is the core of this system. A marriage is only possible when the new couple has the means to form an independent household in which there are resources to maintain future children according to the standard of living deemed necessary for the social class involved. Clearly, then, one has to distinguish between those groups owning their own means of production, and those only selling their labor. For farmers, craftsmen and shop owners the age at which a new generation could take over was heavily influenced by the age at which the former generation retired or died. Our classification of the couples in the Nijmegen marriage records takes this into account. Unfortunately, it is a well established fact that the registration in these records of the occupation of women is deficient. We therefore used only the information on the groom’s occupation for the stratification of the couple.

Following a classical division of Dutch society\textsuperscript{126} around the middle of the 19th century we originally used Upper Middle Class, Lower Middle Class, Farmers, Laborers, and Proletarians. The distinction between the latter two is guided by the idea that the behavior of day laborers on the one hand, and of those with a regular employment, is different. Although finding a niche in the Nijmegen labor market is expected to be easier than finding an independent livelihood, it still requires restriction. The economic position of day laborers was by definition only guaranteed for the next day. Farmers are treated as a separate category since this group was known to be dependent on the transfer of land. Also, in order to avoid the division of land, farmers were motivated, consciously or unconsciously, to limit the number of offspring, and, thus, to delay marriage. In Lower Middle Class we bring together all those that owned either a business or shop, practiced a craft (master carpenter, inn keeper, etcetera), or held an occupation that presumed more education or training than laborers had (civil servants, military personnel in higher ranks). The grooms listed as Upper Middle Class were lawyers or medical doctors.

Our sample only contained six persons in this category, so we added them together with Lower Middle Class in Middle Class.

As far as the Nijmegen grooms are concerned, we find the differences in age at marriage we expected. Summarizing the data from Table 3.5 one could say that there is a division between proletarians and laborers on the one hand, and the remaining groups on the other. Those who just sell their labor on the market indeed married earliest. The distinction between laborers and proletarians on the one hand, and farmers and grooms belonging to the middle class on the other, is up to 2 years. This is in line with the observation that the lower social strata were less restricted by marriage regulations, and that they reached their maximum earning capacity at a younger age. Also, if we assume that the customary standard of living for lower class couples was well below the livelihood deemed adequate for farmers, middle and higher class couples, the results make sense.

The age difference between bride and groom again displays a division of the Nijmegen population in the same two categories, with proletarians and middle class couples having the larger differences. From his data on German villages Knodel drew the conclusion that the division was between higher class couples with large differences and lower class couples with smaller age differences. He also refers to other studies with the same results. The reason he sees behind the social variation in age differences applies to Nijmegen middle class couples too. Since going into service was not part of the normal life course of middle and higher class daughters, one can expect their parents to marry them out earlier, possibly in order not to have to support them for a longer period. When they did so, both the bride-to-be and the parents could choose a suitable husband, who had already proven to be successful in life, either by his financial position, or by his prolonged education. In both cases this almost automatically implied that this suitable husband was older than his bride. Knodel then shows that you can also turn the evidence around. Richer husbands could

<table>
<thead>
<tr>
<th>socio-occupational status</th>
<th>male</th>
<th>N</th>
<th>female</th>
<th>N</th>
<th>difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proletarians</td>
<td>28.3</td>
<td>79</td>
<td>26.0</td>
<td>84</td>
<td>2.3</td>
</tr>
<tr>
<td>Laborers</td>
<td>28.3</td>
<td>486</td>
<td>27.4</td>
<td>513</td>
<td>0.9</td>
</tr>
<tr>
<td>Farmers</td>
<td>30.4</td>
<td>68</td>
<td>29.3</td>
<td>72</td>
<td>1.1</td>
</tr>
<tr>
<td>Middle class</td>
<td>29.4</td>
<td>126</td>
<td>27.1</td>
<td>133</td>
<td>2.3</td>
</tr>
</tbody>
</table>

Table 3.5: Average Age at First Marriage by Socio-Occupational Status of the Husband, Nijmegen 1810-1890
afford to marry a younger wife, whereas less fortunate men only met the necessary financial conditions for marriage by choosing a bride that had saved already for many years as a servant or otherwise. This bride would by definition be older.  

This explanation may be valid for the German case, but it leaves us with the question why proletarian wives married so young in Nijmegen, especially when compared to women marrying laborers. We probably have to do with an urban phenomenon that Knodel did not encounter in his villages. For rural women the variation in occupations is less than in cities. It is here that we find the difference between proletarians and laborers. When we select only couples in which both man and wife married for the first time, brides of laborers have different occupations than proletarian brides. About 28 per cent of women marrying laborers were domestic servants and 27 per cent had no occupation. When we calculate the same percentages for women marrying proletarians we find respectively 18 and 57 per cent. Add to this that domestic servants married at an average of 28.5 years and women without occupation at age 26.7, and the low age of proletarian brides is explained.

In Lugang, the social position of the couple is approximated by the occupation of the head of the household in which they were incorporated. Since the categories ‘upper middle’, ‘agrarians’ and ‘proletarians’ contained very few cases we combined ‘lower middle’ and ‘upper middle’ in one group ‘High’, and the other occupations in ‘Low’. The differences in age at marriage between the two groups were less than we found in Nijmegen. Also, there is no clear direction to the relationship. Lower class men marry at a higher age than more well-to-do grooms, whereas brides showed the opposite. On the basis of Table 3.5 and 3.6 we can not but conclude that socio-occupational position in Lugang probably does not influence the age at which couples marry.

When compared to Nijmegen, Lugang marriages had one special charac-

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127. Knodel, *Demographic behavior in the past*, 141.
teristic that deserves our attention, the division in three distinct forms of marriage. Given the background of minor, major and uxorilocal marriages we expect that the ages at marriages should differ. Table 3.7 confirms this expectation. Minor marriages were registered earliest, both for men and women. The difference with major marriages averaged 1.7 or 1.8 year, with a difference between groom and bride of about 4.6 years. The largest age gap between men and women is to be found among uxorilocal marriages. Again this confirms our earlier description of these marriages. Since marrying uxorilocal is considered to be a socially less desired step for men, only those who already reached, by Chinese standards, an advanced age resorted to this opportunity to get married.

**Seasonal variation**

In historical societies many parts of life were directed by fate rather than by choice. This certainly applies to demographic characteristics. Before modern birth control was introduced, the occurrence of births was dependent on circumstances nine months before the date of birth. Fecundity of a couple could be adversely influenced by weather conditions or food supply. Intercourse depended on these two factors too, but also experienced the consequences of the rhythm of agricultural labor or seasonal labor migration. Death rates fluctuated also, but again the variation was dictated by external circumstances enhancing or mitigating the hazard of dying. Marriages were the exception to this rule. In almost all societies date of marriage was more or less optional.

This aspect of marriage provides us with an opportunity to study the preferences prevailing in our two towns. The freedom of choice was certainly not absolute, and it was not a privilege open for all couples. Take for instance the Dutch pregnant brides. Especially those pregnant for more than one month already were urged to marry as soon as possible to avoid public knowledge of their situation. These couples often could not wait until their favorite month. All the other couples, however, could only choose within a range set by customs and economic opportunities. Within historical European populations we find time and again a standard distribution of the marriages over the year, dictated as they were by the clerical and the agricultural calendar. In March, and to a lesser degree in
December, few marriages were contracted. Church regulations strongly disapproved of marriage in Lent (the period of preparation for Easter) and Advent (the period of preparation for Christmas). On top of that, the high workload in the harvest months August and September saw to it that these months too knew only a few marriages, especially in rural areas.\textsuperscript{128}

In Graph 3.3 we present the proportional distribution of marriages over the year in Lugang and Nijmegen during the period studied here. The Nijmegen graph is based on more than 15,000 marriages. For Lugang the percentages are calculated from a total of almost 5,000 marriages. May was clearly the favorite month to marry in Nijmegen. The fluctuations among the other months show that we are dealing with an urban rather than a rural society. Given the average number of marriages in August and September, the harvest season was no impediment to marriage in Nijmegen. The religious periods of abstinence, on the other hand, stand out. Although Lent falls at a different date each year and comprises six weeks, March is always included for most of its duration. December logically hosts the four weeks of Advent. The city of Nijmegen, in other words, was throughout the 19th century a society where religion ruled nuptiality.

Our Taiwanese town was obviously not influenced by the Christian calendar. Graph 3.3 shows, however, that marriages were not evenly distributed in Lugang either. Here, December, January and February were the favorite months to start a new marriage. These are the months preceding the Lunar New Year and therefore considered best suited for a change in the family situation. This preference was very strong, since in these three months almost half of all marriages were contracted. At the other end of the continuum, July and August witnessed few nuptials. Again the reason is to be found in the Chinese calendar. The seventh month after Lunar New Year is called the Ghost Month, and this was not an auspicious month for marriages. Since the Lunar New Year occurs in February, but has no fixed date, the Ghost Month is situated partly in July and partly in August.

In sum, these findings show that the populations we study both in Lugang and in Nijmegen were still in a pre-modern phase of development. Traditional conventions dictated the seasonality of marriages. Paradoxically, the obedience to these regulations once more stresses the fact that of the three major demographic processes only marriage was within control of the historical actors. The fact that this control was used to live up to demands from other institutions does not change this conclusion. Thus, we are dealing in this study with two societies firmly rooted in their own cultural traditions.

\textsuperscript{128} Knodel, \textit{Demographic behavior in the past}, 144-146.
Conclusions

This chapter started with the expectation of finding two very different marriage patterns in Nijmegen and Lugang. According to the relevant literature the European marriage pattern must rule in our Dutch city. The pattern is considered to be the instrument that succeeded for centuries to keep the European population at the relatively low level adequate for the pre-industrial societies it harbored. At the surface one can trace the working of the pattern in marriage restriction. The advanced ages at marriage and the high proportions never-married, however, hide the basic aim of the pattern, namely to keep the number of fecund women years in the marital state as low as necessary to limit population growth. The guiding question in this chapter was to know whether we can indeed find evidence for marriage restriction. The city of Nijmegen in the 19th century is an excellent test case for these questions. Within its fortified walls the population had only very limited possibilities for growth. So, by 1850, a situation arose where
population control was called for, the more so because the economic structure of Nijmegen was such that misery was an endemic characteristic. In Lugang, on the other hand, marriage was not used to restrict the number of births. Contrarily, the only rationale behind marriage was the wish to have as many sons as possible. As a result we expected marriage in Lugang to be young and universal.

After an empirical check our general conclusion must be that Nijmegen and Lugang were indeed characterized by two very divergent marriage patterns. The familiar distinction between a pattern where marriage restriction ruled in Europe on the one hand and a pattern with young and universal marriage in China on the other hand applied in our towns. We find this both in the age at marriage and in the proportion of the population that never married. Couples marrying for the first time did so in Nijmegen at age 28.5 for men and 27.3 for women. During the first half of the century these ages increased. After 1850, and especially after 1860, a marked decline set in. These ages prove that Nijmegen is a representative case study, for the Netherlands as well as for other western European countries. The variation found is minimal when compared to Lugang, where men in the colonial period married 5.5 years younger, and women even 9 years younger than their Nijmegen counterparts. The proportion of permanent celibates strengthens the picture of a restrictive versus a non-restrictive marriage pattern. In Lugang all women simply married, most of them even before age 25. Contrary, in Nijmegen up to 20 per cent of the women never married.

Thus far, the description by Malthus and Hajnal of the two marriage patterns fits the reality of Nijmegen and Lugang. Our findings do come with qualifications, though. Universal marriage does not apply to Lugang men. In the beginning of the colonial period about 5 per cent of them never married, and by its end, more than 10 percent remained celibate throughout life. When we compare the 1936 values with the 1879 values in Nijmegen we scarcely find any difference. We also noticed a change in time. The traditional very young age at marriage for women in Lugang gradually disappeared during the Japanese period, whereas the grooms of successive birth cohorts started marrying earlier.

Lugang was not as representative for Taiwan as Nijmegen was for the Netherlands. Lugang grooms were relatively old, whereas the brides were younger than their colleagues in other Taiwanese field sites. These differences, however, are variations within one pattern that is clearly another pattern than that adhered to in Europe. Within the Nijmegen population, the general pattern of restriction worked out differently for the sexes and the occupational groups. Men had to wait longer to marry when their social and economic position was higher. We did not find a comparable difference for the brides. Rather, women marrying men from the higher social ranks were relatively young. Occupational class was not a predictor for age at marriage in Lugang. Given the prevalence of very young ages at marriage for women, this is what we expected. It appears, however, that
in Lugang even for men social class was not relevant for age at marriage. For what it is worth we noticed only that Lugang men with a higher occupational status – contrary to Nijmegen – married slightly earlier than lower class men.

Did the young inhabitants of our two cities conform to the rules laid down by society? We want to know, in other words, about possible rebellion against this control. Did historical actors protest whenever their prospects for marriage were curtailed by engaging in extramarital sexual activities? Furthermore, if this is the case, do we find evidence for this protest in illegitimacy and bridal pregnancy? This aspect of nuptiality will be dealt with in the following chapter.
4
Illegitimate births and bridal pregnancy
Deviations from societal rules
Our findings in the previous chapter are in line with the predictions made earlier. Marriage restriction was still very active in 19th century Nijmegen, while the opposite was true in colonial Lugang. As a consequence, Nijmegen was populated by a large number of men and women who were not or not yet married. They thus constituted a potential source for illegitimacy and bridal pregnancy. Given the early age at marriage in Lugang, especially for women, the probability of being pregnant at marriage here seems relatively small. We will analyze the extramarital sexual activity in both cities by looking at bridal pregnancy and illegitimate births. As mentioned before, this not only informs us of patterns of sexual behavior and cultural norms about this topic, in the European case it is a necessary complement to our knowledge of marriage restriction. Every activity possibly resulting in extramarital births constituted a breach with the ultimate goal of this restriction.

What do we expect to find? In a straightforward argument for pre-concepting societies, extramarital sexuality is expected to increase in periods when restrictive measures prohibit more marriages, and vice versa. On the aggregative level of the city, the result would logically be that the curve of the marriage rate and the curve of extramarital sexual activity would be in the opposite direction. Reality proves to be more complicated. In England, for instance, Wrigley found that changes in marital, extramarital and pre-bridal fertility moved parallel to each other.129 Obviously, the forces regulating access to marriage also controlled the access to extramarital sexuality. This is not a general European feature, however. In other countries the expected reverse development was found, indicating that whenever more young people were longer barred from licit sexual activities, they protested by a deviating from the general rules. As for Lugang, the major marriage pattern as such does not generate expectations of bridal pregnancy and illegitimacy. We do expect differences, however, between the forms of marriage. Especially in the case of minor marriages there is a higher probability of prenuptial conception since the future bride and groom lived under the same roof, whereas partners in a major marriage only met shortly before or at the wedding.

Before presenting data on illegitimacy in Nijmegen, let us examine what is to be expected given the situation on the European continent. In almost every European nation, a surge in illegitimate conceptions occurred from approximately 1750 on, reaching its climax around 1850. In some cases, almost half of all births were illegitimate. Edward Shorter explained this by pointing at the social disruption caused by agrarian reforms, urbanization and industrialization. The traditional normative networks of villages used to enforce marriage promises when a woman was pregnant and the father of the child refused to take his responsibi-

This was less possible in an urban environment and even in the countryside the moving labor force escaped societal control. In this way migration and poverty caused the ‘immorality’ of early 19th century Europe. From 1850 on, however, illegitimacy ratios declined again.\(^{130}\)

In the Netherlands, Kok found the same development. The 19th century started with a marked rise of illegitimacy in the first decades. In the 1820s, the illegitimacy ratios declined again as a consequence of improving economic conditions and, thus, improved marriage opportunities. This process gained strength from the middle of the century on when clerical as well as secular authorities devoted much attention to disciplining the inhabitants of the country. This action was highly successful. Around 1900, the Netherlands came to be known as ‘the moral nation’ of Europe because of its low levels of illegitimacy.\(^{131}\)

As mentioned before, the possibility to reconstruct the extent of extramarital sexual behavior of historical populations is limited. It is only possible to find a minimum measure by looking at illegitimate births and at pre-bridal pregnancies. Table 4.1 presents the percentage of illegitimate births in Nijmegen as calculated from the Nijmegen birth registers. We recognize the development as described by Kok for the country as a whole. The first decades of the century witnessed a high number of illegitimate births followed by a marked decline in the 1820’s. In the 1830s, however, a new rise started, culminating in the early 1840’s when almost one out of ten births was illegitimate. The nationwide decline after 1850 is visible in Nijmegen too. A remarkable change occurs by the end of the


<table>
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<th>Nijmegen</th>
<th>Lugang</th>
</tr>
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<tbody>
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<td>period</td>
<td>%</td>
</tr>
<tr>
<td>1811-1820</td>
<td>8.6</td>
</tr>
<tr>
<td>1821-1830</td>
<td>6.0</td>
</tr>
<tr>
<td>1831-1840</td>
<td>7.2</td>
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</tbody>
</table>
1870s. Suddenly, within a few years, the illegitimacy ratio dropped from 7 to 3 percent of all births. For the moment, we can only guess why this remarkable decline in illegitimacy occurred. First of all, it is part of a nationwide decline, and the reasons therefore are not restricted to Nijmegen only. The civilizing offensive of clerical and civil authorities appear to have been successful in Nijmegen too. Also, because it came very shortly prior to the secular decline in marital fertility, one can not rule out the possibility that contraceptive methods and appliances were accepted outside marriage before married couples accepted them. The decline was so steep, however, that we also suspect an influence of the economic resurrection of the city from the late 1870’s on.

The next question to be answered is whether the growth of illegitimacy in nineteenth century Nijmegen was a reaction either to a more severe restriction of marriage possibilities, or to a release of the restriction. Graph 4.1, therefore, also contains the crude marriage rate to offer a first indication of the change in both measures. The year 1850 appears to be a turning point. During the first half of the 19th century the inhabitants of Nijmegen seem to have reacted to a decrease in marriage possibilities by engaging more in illegitimate sexual activities. Illegitimacy more or less mirrored the changes in nuptiality rates, showing more illegitimate births in years when the number of marriages was low and vice versa. The correlation between the two series is negative, -0.418. In the second half of the century, Wrigley’s description for the opposite pattern in England appears to be appropriate here too, with more illegitimate births when the marriage rate increased and vice versa. This also shows in a reversal of the direction
of the correlation. After 1850, this is positive, namely 0.605. This correlation would have been even higher if not for the sudden steep decline of illegitimacy between 1870 and 1880.

For the whole of the 19th century, 6.7 per cent of all births in Nijmegen were illegitimate. In Lugang we expected this proportion to be lower. Table 4.1 shows that this was indeed the case, although only marginally for the period as a whole. On average 6.5 percent of the Lugang births were illegitimate. The colonial period, however, witnessed a sharp decline in illegitimacy, from 10 percent in the first decades of the 20th century to less than 4 percent in the period 1936-1945. The onset of this decline is found elsewhere in Taiwan also. For this reason we think it was a general development for the island as a whole. For Lugang, however, the surprising conclusion is that in a period when ages at marriage for women were rising, and consequently there were more women at risk of conceiving outside marriage, the opposite happened.

Our second measure for extramarital sexuality is the number of pregnant brides. In Nijmegen we want to know to what extent couples started sexual relations before marriage. In a general sense this constitutes a violation of the pattern of marriage restriction, one of the rules of which was that sexual relations outside marriage were not allowed. More specifically, we want to know what the reaction of engaged couples was when marriage restriction became more severe. Did more of them revolt when their marriage was postponed by starting premarital sexual relations? Again, we expect bridal pregnancy to be of less importance in Lugang. We remember Gates’ remark that girls were tucked in the marital bed as soon as possible, exactly to avoid premarital pregnancies. Therefore, the number of fecund, unmarried girls in Lugang was small compared to Nijmegen. Also, most of the couples marrying did not even know each other until very shortly before marriage, let alone have the privacy necessary for intercourse. Only minor marriages formed a distinct exception to this rule. For that reason, in Lugang we are interested in the differences in bridal pregnancy between the three forms of marriage.

Calculating the number of pregnant brides is not as straightforward as it may seem at first view. We can define bridal pregnancy in several different ways: by taking the proportion of pregnant brides from all brides, from brides of first marriages only, from brides that afterwards had at least one child, or from brides marrying before the end of their fecund years. The following analysis will calculate bridal pregnancy as the percentage of those marriages for which we find at least one birth in the registers. In this way we exclude the sterile marriages that would only diffuse our findings. We thus also exclude the couples that immediately after marriage left our populations, because we can not find a first birth to

match to their date of marriage. In Nijmegen the impact of social position is taken into account, in Lugang both social position and form of marriage.

The second major decision deals with another aspect of bridal pregnancy. Within how many months after marriage has a child to be born to be considered the result of a bridal pregnancy? The biological variation in the time of gestation is relatively small, both within and between populations. Live births almost all follow a pregnancy of between 35 and 40 weeks. Following this biometric approach to pregnancy one expects a birth to occur between 8.1 and 9.3 months after conception. Socioeconomic status, however, does make a difference. As we will see, bridal pregnancy is more characteristic for lower class couples than for middle class couples. It is also known that preterm births occur relatively frequently among women of lower socioeconomic status.133

For authors like Knodel the foregoing information leads to the conclusion to consider brides pregnant when a child is born within the first eight months of the marriage.134 We decided to limit bridal pregnancy to those marriages that resulted in a birth within the first seven months after the date of marriage only. The reason for this definition is simple. We want to count only those marriages in which the couple was aware of the pregnancy before marriage, and consequently were prompted to marry earlier than they otherwise might have done.

Let us consider the possibilities when a woman gave birth to a child in the eighth month after marriage. This most certainly may have been the result of a premarital conception. Given the short duration of pregnancy before marriage, however, the bride may not have been aware of her situation when the decision to marry was taken. Also, many couples started having intercourse after the moment the wedding was officially planned by betrothal, reading of the banns, or another forms of public announcement. In both cases the characteristics of the marriage are not significantly different from marriages without a pregnant bride. We want to count it only as a bridal pregnancy when a couple married earlier than usual because of the pregnancy. Obviously, in a purely technical sense the number of pregnant brides was bigger than our estimate. Still, it is the forced character of the marriage that interests us, since this is a direct violation of marriage restriction, adding extra fecund women years to the period of risk.135 In sum, it is forced marriages we are looking for rather than pregnant brides.

134. Knodel, Demographic behavior in the past, 209.
Since we have all entries for births, marriages and deaths of 19th century Nijmegen at our disposal, we could easily link marriages and births. The name of the bride and the groom had to match the ‘mother’ and ‘father’ field in the birth certificate. Whenever a child was born within seven months after its parents’ marriage, we considered it to be a bridal pregnancy; this procedure yields a conservative estimate of bridal pregnancy since we only find the really ‘forced’ marriages. In order to facilitate a comparison with authors using the eight month definition we include these numbers too.

On average and following our definition, more than one fifth of the 19th century Nijmegen brides, more precisely 21.9 per cent, were pregnant at the date of marriage. (See Table 4.2). In a society where extramarital sexuality is explicitly forbidden, and where the success of marriage restriction depends on following that rule, this finding is remarkable. Also, the variation in the proportion of bridal pregnancies is small. From the 1820’s to the 1850’s we find a marked decline in the relative number of pregnant brides. In the 1860’s, the proportion of forced marriages increased again reaching the century’s maximum of one quarter of all marriages in the economically booming period of the 1880’s.

Was Nijmegen exceptional in this regard? The answer is negative. The proportion of forced marriages in Nijmegen was only slightly higher when compared to the results of studies in other Dutch municipalities. For the first half of the nineteenth century, 18.5% of 7505 marriages in five regions of the Dutch countryside were ‘forced’. Given the stricter social control in rural areas, one can safely assume that couples in Nijmegen’s urban context engaged more

Table 4.2: Proportion of bridal pregnancies, Nijmegen 19th century

<table>
<thead>
<tr>
<th>Year of marriage</th>
<th>Total number of marriages</th>
<th>Birth within 7 months</th>
<th>Birth within 8 months</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>1821-1830</td>
<td>637</td>
<td>152</td>
<td>23.9</td>
</tr>
<tr>
<td>1831-1840</td>
<td>744</td>
<td>176</td>
<td>23.7</td>
</tr>
<tr>
<td>1841-1850</td>
<td>836</td>
<td>189</td>
<td>22.6</td>
</tr>
<tr>
<td>1851-1860</td>
<td>862</td>
<td>154</td>
<td>17.9</td>
</tr>
<tr>
<td>1861-1870</td>
<td>1064</td>
<td>229</td>
<td>21.5</td>
</tr>
<tr>
<td>1871-1880</td>
<td>1098</td>
<td>215</td>
<td>19.6</td>
</tr>
<tr>
<td>1881-1890</td>
<td>1178</td>
<td>290</td>
<td>24.6</td>
</tr>
<tr>
<td>1821-1890</td>
<td>6419</td>
<td>1405</td>
<td>21.9</td>
</tr>
</tbody>
</table>
in premarital sexual relations.\textsuperscript{136} Still, the Nijmegen proportion of bridal pregnancies is well within the variation found in the countryside, as the values ranged from 2.5 to 28.3 percent. The relative number of forced marriages in Nijmegen was about the same when compared to studies in other western European countries. Knodel found that 25 percent of the 19th century marriages in his German villages began with a pregnant bride.\textsuperscript{137} This finding has to be matched with the last column of Table 3.9, since Knodel used the proportion of marriages given birth to a child within eight months. In their definition for bridal pregnancy in England, Wrigley and Schofield calculated all births within the first seven and a half months after marriage. Again the percentage of English pregnant brides was close to the percentage found in Nijmegen.\textsuperscript{138}

We find, thus, a marked difference between illegitimacy and bridal pregnancy. It seems clear that many Nijmegen couples considered betrothal as tantamount to marriage, making their premarital sexual relations only a minor breach of what local culture expected of them. During the period of engagement the taboo on intimacy for the not-married appears to be less severe.

The most important secondary finding in the study on the 19th century Dutch countryside was that in every region, the Protestant population had a much higher proportion of bridal pregnancies than the Roman Catholic population, averaging respectively 24.4 against 11.6 percent.\textsuperscript{139} This difference between the denominations appears to be a constant in Dutch society. When studying the city of Breda in the second half of the 19th and the first decade of the 20th century, Engelen and Hillebrand found 31 percent of all Protestant marriages started with a pregnancy, whereas only 19.2 percent of the Catholic brides were pregnant. Hendrickx reached the same conclusion for the villages of Borne and Wierden. He found the percentage of bridal pregnancy for the Roman Catholic village to be approximately 15, whereas the Protestants totaled 35 percent.\textsuperscript{140} For Nijmegen we have information on the religion of only a limited number of couples. Here too, we find the Protestant denominations to have a proportion of bridal pregnancies (24 percent) above that of Roman Catholics (19 percent), albeit that the difference is relatively small.

While the differences between the denominations may be straightforward and easy to determine, the explanation for this phenomenon is not easy

\textsuperscript{136} Engelen and Meyer, ‘Gedwongen huwelijken,’ 197.

\textsuperscript{137} Knodel, \textit{Demographic behavior in the past}, 212.

\textsuperscript{138} Wrigley and Schofield, \textit{The population History of England}, 367.

\textsuperscript{139} Engelen and Meyer, ‘Gedwongen huwelijken.’

at all. Both the Protestant and the Roman Catholic clergy strongly opposed sexual activities outside of marriage. It has been suggested that the preference for celibacy among Catholics might be the reason behind lower bridal pregnancy rates.\textsuperscript{141} In our view this explanation does not hold. Even among Catholics only a marginal proportion of the population would become priests or enter a monastery or convent. All others were expected to raise as many children as possible. Relatively high ages at marriage were caused, as was the case for Protestant couples, by the social and economic circumstances of the time. Therefore, when bridal pregnancy among Protestant couples was twice as high as among Catholics, this points either towards a stricter control by the Catholic clergy, towards at more deviance among Protestant youngsters. This automatically leads us to the control mechanism that is only practiced by Catholics. They had to go to confession regularly, and acknowledge what rules they had violated. Is it too bold to assume that these private conversations between priests and youngsters had a mitigating effect on the sexual behavior of the latter?

Deviation from rules set by society is not a phenomenon independent from social position. In order to determine the strength of this influence the Nijmegen marriages were arranged by occupational group of the groom. Again, the population is divided into five major classes: upper middle, lower middle, farmers, laborers and proletarians. In Table 4.3 we present the relative distribution of forced and regular marriages. According to this classification bridal pregnancy was clearly a lower class phenomenon. Among laborers and -to a lesser degree- proletarians a disproportionate number of marriages started with a pregnancy. Contrarily, farmers and members of the lower and upper middle class were underrepresented in the category forced marriages.

\textsuperscript{141} P. Meurkens, \textit{Bevolking, economie en cultuur van het Oude Kempenland} (s.l. 1985) 150-158.

<table>
<thead>
<tr>
<th>occupational category</th>
<th>% forced marriages</th>
<th>% regular marriages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper middle</td>
<td>0.3</td>
<td>3.6</td>
</tr>
<tr>
<td>Lower middle</td>
<td>15.3</td>
<td>24.9</td>
</tr>
<tr>
<td>Farmers</td>
<td>4.3</td>
<td>8.2</td>
</tr>
<tr>
<td>Laborers</td>
<td>79.1</td>
<td>62.6</td>
</tr>
<tr>
<td>Proletarians</td>
<td>1.0</td>
<td>0.7</td>
</tr>
</tbody>
</table>
The line of argument until now has been that ‘unnaturally’ high ages at marriage foster premarital sexual activities. As such, prebridal pregnancy would be a typical characteristic of populations living in the Western-European part of the world. If Hajnal is right, Eastern-European and Asian couples-to-be were tempted for a shorter period, or not at all, to consummate their marriage before the actual wedding. In many of these, including China, an absolute seclusion of pubescent girls was enforced whenever possible. Hence, we expect the number of bridal pregnancies in Lugang to be considerably lower than it was in Nijmegen. When we consider the data in Table 4.4 and look at the proportion of pregnant brides for all marriages, we find that indeed premarital pregnancy in Lugang is significantly lower than the average of almost 22 per cent in Nijmegen. On average, not even one out of ten Lugang brides was pregnant at marriage. When we limit the comparison to major marriages, the form of marriage that is closest to the Nijmegen way of marrying, the discrepancy is even bigger, 5 per cent in Lugang and 22 per cent in Nijmegen.

The low number of bridal pregnancies in Lugang is exactly what we expected for the two reasons already mentioned. First, couples did not live through a period of engagement during which a sexual relationship could evolve, and, secondly, most of the women married so young that they hardly had time to become pregnant before marriage. Even after marriage many of the younger brides would experience adolescent sub-fecundity. Given all that, the proportion of pregnant brides in minor marriages is, at first glance, puzzling. In this form of marriage the proportion of bridal pregnancies even exceeds the Nijmegen proportion. How is it possible that these marriages exhibited bridal pregnancy rates many times higher than major marriages did? Were not these marriages exactly those characterized by a sexual aversion between bride and groom who were raised as brother and sister? To be sure, this issue is dealt with by Wolf in great detail, because initially it seemed to contradict his sexual aversion-hypothesis.

<table>
<thead>
<tr>
<th>Year of Marriage</th>
<th>Number of Women</th>
<th>Proportion Pregnant at Marriage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Major</td>
<td>Minor</td>
</tr>
<tr>
<td>1906-1915</td>
<td>87</td>
<td>33</td>
</tr>
<tr>
<td>1916-1925</td>
<td>187</td>
<td>41</td>
</tr>
<tr>
<td>1926-1935</td>
<td>279</td>
<td>49</td>
</tr>
<tr>
<td>1936-1945</td>
<td>295</td>
<td>29</td>
</tr>
<tr>
<td>1906-1945</td>
<td>848</td>
<td>152</td>
</tr>
</tbody>
</table>
management of marriage by parents accounts for the apparent contradiction. We must assume that his findings for the Hai-shan data apply for Lugang too.

What happened is this. By general agreement the appropriate time to consummate a minor marriage was the eve of the lunar New Year. On this evening, after dinner, the head of the household would announce that his son and the sim-pua designated to be his wife should start sleeping together as husband and wife. Since only the closest family members witnessed this ceremony, the actual registration of the marriage could be postponed until the bride was pregnant. If the ‘marriage’ did not result in a pregnancy, a divorce was not even necessary. In consequence, their actual sexual cohabitation started long before the official registration, often many months after lunar New Year. By definition, therefore, we will find a large proportion of the brides in minor marriages to be pregnant. But why, one might ask, do we not find the same procedure among major and uxorilocal marriages? There too it was of utmost importance to only match couples that would add sons to the lineage. The explanation is straightforward. Whereas in minor marriages nothing changed at the surface (the new couple had lived already in the same household for many years), in major and uxorilocal marriages the evidence of a person moving officially from household to another made a delay of the registration of the marriage impossible.142

The next step will be to look into the characteristics of the couples entering a forced marriage. Especially in the Nijmegen case we want to know whether premarital sexuality was a conscious or unconscious protest against impediments to a marriage. And, is the expression ‘forced marriage’ adequate? The hypothesis about marriages starting with a pregnant bride is that this pregnancy forced the couple to a marriage that was premature. If this is indeed the case, a pregnant bride and possibly also her husband will be younger than the other couples. There is empirical evidence for this opinion too. In the first half of the nineteenth century pregnant brides in the Dutch countryside were 4.9 years younger than their non-pregnant counterparts. For their spouses the difference was 5.3 year.143 The logical conclusion is that bridal pregnancy was not an accepted phenomenon and must be treated as a clear deviation from the rule. Also, the effect on potential fertility is significant. Almost five years is added to the most fecund period in a woman’s life.

For the Nijmegen marriages the ages at marriage were calculated for forced as well as for normal marriages. In order to avoid fluctuations due to

142. Wolf, Sexual attraction, 135-145. Famous for the flexibility with which they manipulated the sequence of events leading to marriage, some Chinese even delayed a bride’s transfer after the marriage ceremony by as much as six years. The ‘bride’ moved to her husband’s home only after she became pregnant.

small numbers we chose to present the ages in averages per decade. From Graphs 4.2 and 4.3 we can learn first of all that in Nijmegen the expected differences between the ages at marriage for forced and normal marriages indeed existed. Both men and women lived up to this expectation. Men married normally at an average age of 29.6 years, whereas the age for spouses of pregnant brides was 27.2. Although the 19th century witnesses fluctuations between one and four years, regular marriages are always concluded at a higher age. For the female population we find a less marked difference. ‘Regular’ brides married at 27.5, whereas pregnant brides married at 25.7. This century average hides information, as Graph 4.3 shows. Until 1850, women in what we call forced marriages were younger, but only marginally. The real difference becomes manifest after 1850, when between one and a half and four years is added to married life.

The developments depicted in Graph 4.2 and 4.3 provide another piece of important information on marriage restriction and the deviance it may evoke. If there existed a direct causal relationship between restriction and deviance, we would expect the ages of forced marriages to decline, or at least stay the same, when restriction caused age at regular marriage to increase. This is clearly not the case. If anything, the change in ages of forced and regular marriages moved in the same direction. Still, the pervasive influence of the marriage pattern is visible. In the 1840’s, 1850’s and 1860’s, Nijmegen’s economy was in crisis and over-population was at its peak. In the same period we see age at regular marriage for men rise from 28.2 to 30.7, and for women from 26.8 to 29.1. This is an indica-
tion of the vitality of the restriction mechanism. Almost a quarter of all marriages may be ‘forced’, but the reaction to economic circumstances for ‘regular’ marriages was very traditional.

It is time to return to our Taiwanese town. Do we find the marked differences in age at marriage for pregnant and non-pregnant brides here too? And is there a social differentiation similar to the one in Nijmegen? Table 4.5 provides the data on age at marriage for regular and forced marriages. Given the special position of minor marriages we excluded them in order to make comparison with Nijmegen feasible. If anything, the data show that the expression ‘forced marriage’ is not applicable to Lugang marriages. Except for men in the first cohort, marriages in which the bride was pregnant were conducted at a higher age rather than at a younger age when compared to regular marriages. The pregnancy of an unmarried woman was not a sign of an impatient engaged couple who had not waited to consummate their marriage until the day of the wedding. Rather, it seems that women and men whose marriage was being considered at a relatively advanced age would not have their union formalized before the fecundity of the couple was established.

In Lugang, we do not find the clear social division of bridal pregnancy we established in Nijmegen. Since the number of cases is small we only compared the ‘higher’ (lower middle and upper middle) and ‘lower’ (agrarians, laborers and proletarians) occupational classes. Couples belonging to the ‘lower’ class formed 48
for Nijmegen, a pregnant bride was a lower class phenomenon. By contrast, in Lugang we have found that bridal pregnancy in minor marriage was a deliberate test of fecundity. It now appears that in major and uxorilocal marriages the same rationale is found, especially among those couples that entered the marriage market at a relatively high age. This reason seems to be most influential in the middle class. The proverb cited at the beginning of this chapter comes to mind again. Maybe in the Lugang case fathers did not have to pay someone to take their ‘old’ daughter, but the daughter at least had to prove that she was able give her husband the sons he hoped for.

### Conclusion

We hypothesized that the large group of unmarried young people in Nijmegen would give rise to a high number of illegitimate births and of bridal pregnancies. The Lugang women married so soon after menarche that they hardly could become the mother of an illegitimate child. Bridal pregnancies are expected to be of less importance also, since the Taiwanese situation did not allow a long engagement period. The predictions are verified by our data. Of all births in Nijmegen about 7 per cent were illegitimate, versus 4 per cent in Lugang. The discrepancy in bridal pregnancy rates is even more amazing. About 22 per cent of the Nijmegen brides knew they were pregnant on their wedding day. When we compare this to the equivalent form of marriage in Lugang, major marriages, we find only 5 per cent pregnant brides. Cultural differences surface once more. The Western-European pattern was founded on internalizing values and this clearly failed when couples were engaged to be married. The Taiwanese control was much more effective. Prevention of unwanted sexual relations here consisted of avoiding proximity. The high proportion of bridal pregnancy among minor mar-
riages seems to contradict this observation, but can be explained by reasons that have nothing to do with extramarital sexuality. Also, the characteristics of couples starting marriage with a bridal pregnancy were clearly different from the Nijmegen ‘forced’ marriages. They may, indeed, be the consequence of ‘forced’ pre-marital sex testing the bride’s fecundability.

These data prove that in Nijmegen the marriage pattern was very effective in limiting the number of years that fecund women were at risk of conceiving. Even without additional information, we may draw two major conclusions. The first is that marriage restriction in 19th century Nijmegen was very effective indeed in limiting the number of births, given the number of fecund years not used. After analyzing the data on the fertility of the couples studied here in Chapter 6, we will be able to be more specific on this topic. Secondly, the sociological adage that there is no control without deviance proves to be true here too. Many Nijmegen couples refused to ignore their natural inclinations while waiting for the suitable age or circumstances to marry.

Looking at the implications of these findings we first find interesting information on authority and control. Who was in control? What was the part of life one wanted to control? In Lugang, young and universal marriage of women shows that this society was clearly trying to maximize the number of children in order to fill the ranks of a family other than the bride’s natal home. Parents were in control of partner selection and of the timing of marriage. Lugang young people were forced to marry with a stranger or with their ‘brother’ or ‘sister’ at the earliest possible time. Parents in Nijmegen, on the other hand, hardly influenced the marriage of their children. Partner selection was the prerogative of the people involved and the timing of marriage was laid down in norms and values about when this was appropriate. Control in Nijmegen was geared toward keeping the many not yet married inhabitants from engaging in sexual activities outside marriage.

Both in Lugang and in Nijmegen these control mechanisms were effective. This determines the general outline of the two demographic regimes. The control was not absolute, however. In Nijmegen we find clear evidence of illegitimacy and bridal pregnancy to a larger extent than in Lugang. And in Lugang not all sons managed to reach the Confucian ideal of major marriage. Most of all, however, in this chapter we found evidence that behind the demographic façade of the two patterns an even more important difference was hidden. We could summarize this difference by stating that in Europe marriage at least started as a loving companionship, while in China, at best, a marriage might evolve in that direction. This may have had even larger consequences for fertility than the difference in the net number of fecund women years in marriage. Chapter 6 will deal with this.
5

Infant mortality

‘The Massacre of the Innocents’
In the previous chapter we established that women in Lugang married more than ten years earlier than Nijmegen women. In theory – and following Malthus’ implicit prediction that fertility is only regulated through marriage - this should result in a higher final parity. Before assessing whether or not this is manifested in the actual fertility, we first focus on another striking characteristic of pre-industrial demography, namely infant mortality. By modern standards the chances of survival for newly born children in pre-modern societies were astonishingly low. Almost one quarter of infants did not reach their first birthday, and mortality remained high in childhood. From an economic point of view one might conclude that pre-industrial fertility was very inefficient. In order to reach a certain number of surviving children, many more births were necessary. From an emotional point of view some authors referred to this phenomenon as “the massacre of the innocents”.

The high death rates of the very young deserve attention in themselves because they highlight the economic conditions of life in the societies involved, the social differentiation within these societies, and the ‘deliberate’ choices made by the historical actors. Since infant mortality is a reflection of general mortality, more precisely the mortality of the most vulnerable members of society, its level also permits us to assess whether Malthus’ prediction on the prevalence of positive checks in Chinese society is valid. The existence of preventive checks in Nijmegen is already confirmed by our data on nuptiality. Do we also find evidence of positive checks in Lugang? According to the classic division of the world in two parts, mortality should be significantly higher in our Taiwanese city than in Nijmegen.

Positive checks thus may show in a high level of mortality, but can also have a very deliberate form. Remember that Malthus mentioned the “custom of exposing children”. James Lee and his collaborators also emphasized infanticide as one of the ways in which Chinese couples consciously regulated the number of their offspring. In their view, the gender-differentiated character of infant mortality provides us with a strong indication of ‘proactive’ behavior. For that reason the comparison between Nijmegen and Lugang will deal explicitly with possible differences in infant mortality between girls and boys. Is there indeed a higher mortality among Lugang female babies than among male babies? And – since this custom does not have to be restricted to Chinese parents only – do we find evidence of gender differences in infant mortality in Nijmegen as well?

To be sure, the attention paid in our study to infant mortality goes beyond this point and also focuses on its demographic consequences. We want to know what influences we can expect from infant mortality on fertility. First of all, there is an indirect biological relationship between infant mortality and fertility. In order to fully understand this relationship, let us consider the components of an average birth interval. A birth is followed by a postpartum infecundable period of
approximately 1.5 months before the female ovulation cycle starts again. From that point on the next conception is possible. When no contraceptive measures are used it takes on average 9.5 months from the last birth before the next conception takes place (7.5 months normal waiting time, plus 2 months for intermediate pregnancy loss). If one adds to this the gestation period, a birth interval of 20 months is the result. Twenty months, then, is the minimum average birth interval. Many factors may prolong the interval, such as a higher than average incidence of fetal loss, relatively low coital frequency, or reduced fecundity of one of the partners.

Here we are especially interested in the factor that without any doubt most influences the first part of the interval, the postpartum infecundable period, namely breastfeeding. Lactation can delay the resumption of normal ovarian activity from several months to two years beyond the regular period of 1.5 months. Even when the nursed child is completely weaned it takes two months before menses return. This, then, is the first influence infant mortality may have on fertility. The death of a suckling infant causes a quicker return to normal fecundability. A tabulation of birth intervals following an infant death and following infant survival shows that the birth interval can be reduced by 35 percent when the previous infant dies. Although this impact is witnessed everywhere, its strength varies between natural fertility populations. When we find specific social groups, periods or months with relatively high infant mortality, we have to take this into account when analyzing differential fertility in the next chapter.

Next, the death of an infant or a child can have non-biological consequences in the same direction, namely an increase in fertility. This reasoning starts with an observation in the Nijmegen civil registers. Very often we find parents gave the following child the same name as the previous, deceased child. There may be many reasons for this custom. One can think of it as an emotional reaction that was part of the mourning process. In this case we can see the next child as a replacement for the deceased child. The parents make this very clear by giving the substitute child the same name. A replacement birth can also be taken very literally. When a couple had a target number of children the death of a child had to be annulled by the birth of another. This may even happen when parents did not have a well defined number of expected children, but simply aimed at a large offspring. When this was the implicit or explicit goal, replacement births are to be expected. Again, high infant mortality then results in higher fertility, and possible fertility differences may – mirabile dictu - be the result of mortality differences.

The level and development of infant mortality in the Nijmegen and Lugang

The European decline in mortality started during the 18th century when crisis mortality was mitigated through successful preventive measures against epidemic infectious diseases. After that, for most of the 19th century, mortality stabilized, until around 1900 a new period of decline set in. This phase is characterized mainly by lower infant and childhood mortality as a result of the prevention and better treatment of diarrhea and tuberculosis.\textsuperscript{145} The general mortality level of the 19th century hides interesting changes in infant mortality. Whereas adult mortality stabilized or even slightly declined, the chances of survival for the very young declined in the third quarter of the century. In Germany\textsuperscript{146}, France\textsuperscript{147} and Spain\textsuperscript{148} we find evidence of rising infant mortality between roughly 1840 and 1870. This development and the reason behind it was recognized very early. L. Emmett Holt mentioned it in his 1913 presidential address for the American Association for the Study and Prevention of Infant Mortality. He attributed the mid-19th century increase of infant mortality to the process of urbanization and industrialization. Densely populated cities and, especially, mothers working in factories proved fatal for many babies.\textsuperscript{149} The link between women’s work and infant mortality is breastfeeding, because all authors agree on the fact that the extent and duration of breastfeeding is the best predictor of infant mortality.\textsuperscript{150} The Netherlands were no exception. Van Poppel and Mandemakers observed that for the country as a whole infant mortality increased markedly between 1840 and 1875.\textsuperscript{151}

We probably know more of the demography of early 20th century Taiwan than of any other Asian country. The reason for this exceptional position is the

\textsuperscript{146} K. Knodel, \textit{Demographic behavior in the past}, 40.
\textsuperscript{147} J. Vallin, ‘ Mortality in Europe from 1720 to 1914. Long-Term Trends and Changes in Patterns by Age and Sex,’ in: Schofield et al., \textit{The Decline of Mortality in Europe}, 38-67, especially 51.
\textsuperscript{150} The most striking example of this relationship is provided by Knodel, \textit{Demographic Behavior in the Past}, 45; he finds a marked difference in the high infant mortality of his Bavarian villages, where breastfeeding was rare, and in East Frisia, where breastfeeding was common.
amount and quality of data available. The censuses conducted by the Japanese colonial government (1895-1945) provide information on the aggregate level. On top of that, the accurately kept household registers contain detailed information on individuals and their households. Taiwan, however, was not representative of other countries in the region, exactly because of the influence on the demography of the same colonial ruler. The Japanese Governor-General soon found that more Japanese soldiers died in Taiwan of diseases than as a result of hostilities. In order to eliminate major epidemics and indigenous diseases on the island he launched large-scale programs to control major epidemics, to improve public health conditions, and to increase medical resources. The effects of this efforts show in a declining crude mortality rate of Taiwan from 30 per 1000 inhabitants in 1906 to 16 per thousand in 1942.\textsuperscript{152}

Whether or not this general decline affected infant mortality has been recently assessed by Yang Wen Shan and Hsieh Ying-Hui on the basis of data for 14 field sites across the island. They confirm Barclay’s impression\textsuperscript{153} that the long-term trend for infant mortality was declining between 1905 and 1945. They also point to temporal fluctuations in the development, and their graphs show that the secular decline only started after 1920. As far as the magnitude of the decline is concerned we disagree with these authors when they state that it was characterized by a relatively slow pace.\textsuperscript{154} Since male infant mortality went from 223 in 1908 via 195 in 1925 to 130 in 1945, and the respective rates for women were 207, 136 and 130, this is an impressive decline. On the whole, the colonial period thus witnessed a general decline in infant mortality and a closing of the distance between male and female infant mortality.

The findings mentioned above guide our expectations for infant mortality in Lugang and Nijmegen. If the Dutch town lives up to the national average, the mortality among the very young will probably show a rise, whereas the probability of survival for babies in the Taiwanese town is expected to increase. In


\textsuperscript{152} Liu Shi-Yung, ‘Differential Mortality in Colonial Taiwan,’ Annales de Démographie Historique (2004) 229-247. See also Barclay, Colonial Development and population in Taiwan, 145, who reports the same finding.

\textsuperscript{153} Barclay, Colonial Development and population in Taiwan, 161.

Nijmegen, we calculated infant mortality by using the information on births and infant deaths of 1201 non-sterile marriages. The Lugang infant mortality rates were derived from the household registers in the same way, although the starting point is 1920. We have reason to believe that, especially in the first years after the introduction of these registers, there was a slight underregistration with regard to births as well as infant deaths. This has been established by Barclay who expected underregistration only for the period before 1915. The same author also refers to three exceptional years of epidemic diseases. In 1915 the country suffered from an unusual high number of malaria deaths. The worldwide influenza outbreaks following World War I hit Taiwan in 1918 and 1920. Since we are interested in the long term development, we used information only from 1920 on, and divided the rest of the colonial period into 1922-1933 and 1934-1945.

Our first observation is that the average level of the infant mortality rate (IMR) we find for Nijmegen is 145. The national average of IMR is markedly higher since the provinces in the western part of the country witnessed the death of more than a quarter of all infants. The level for sedentary Nijmegen residents, however, fits the description for the province of Gelderland as given by Hofstee. Infant mortality in Gelderland ranged from 126 in the 1840’s via 151 in 1875-1879 to 145 in 1890-1894. The 19th century average is of only statistical value since infant mortality in Nijmegen exhibits a marked change, that by and large follows the general direction we expected from other research. In other words, the general rise of European IMR in the second half of the century is visible for Nijmegen residents too, especially after 1870. By contrast, Lugang IMR declines dramatically from well above the Nijmegen level (206 versus 129) at the beginning of the periods compared here to a level below the Nijmegen value (144 versus 167).

<table>
<thead>
<tr>
<th>Period</th>
<th>Nijmegen</th>
<th>Lugang</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>live births</td>
<td>infant deaths</td>
</tr>
<tr>
<td>1830-1849</td>
<td>1019</td>
<td>132</td>
</tr>
<tr>
<td>1850-1869</td>
<td>2770</td>
<td>385</td>
</tr>
<tr>
<td>Total</td>
<td>5210</td>
<td>754</td>
</tr>
</tbody>
</table>

Table 5.1: Infant Mortality in Nijmegen and Lugang

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155. Barclay, *Colonial Development and population in Taiwan*, 160 (on underregistration) and 146 (on epidemics).
allows us to deal with the prediction made by Thomas Malthus. He expected positive checks to be more active in China than in Europe. Since we have only two observations for Lugang (206 in 1922-1933 and 144 in 1934-1945), we have to be careful with our conclusions. Still, Malthusian penalties for unlimited female nuptiality seem indeed to have been the fate of Lugang in pre-Japanese times. The Japanese health measures started before 1920, so the IMR must have been higher at the start of the century, leaving us with a marked difference when compared to Nijmegen. We have to put this observation in proportion, however. First, the sharp decline between the two periods shows that a Chinese population could very quickly move to an IMR markedly below the average European level. On the other hand, a European population could reach a ‘Chinese’ level of IMR at the same pace. The difference in other words, was not as structural and as marked as we expected.

The components of infant mortality: neonatal and post-neonatal mortality

We now move to the two components of infant mortality. Deaths in the first month of life are commonly referred to as neonatal mortality. Causes for neonatal mortality are mostly endogenous following obstetrical trauma, congenital defects, or functional inadequacy, but could also include some exogenous factors like malnutrition, infections, and unhygienic circumstances. Mortality from the first month to age 1 (post-neonatal mortality) is mostly attributed to exogenous causes only. At this age, infants die mostly of diseases of the digestive system, especially those weaned early, of respiratory diseases, and of epidemic diseases as smallpox, measles and dysentery. Clearly, differences in the socio-economic situation of a population and changes in this situation over time will have a

156. To be sure, more infants died in Nijmegen than 145 per 1000. Since we reconstituted a sample of marriages from the Nijmegen registers we retrieved by definition only information on the sedentary population. When a city has a more or less closed population, this does not pose a problem. In Nijmegen, however, this is not the case. For the second half of the 19th century we have information on the migratory movements in the city. Between 1851 and 1900 every year on average 1859 persons left the city and 2090 people migrated to Nijmegen. This implies there was a change of about 15 per cent of the population each year. Obviously, the moving part of the population was not a representative sample of the total. It consisted for the major part of members of the garrison, people working in shipping, and casual laborers, many of them moving in and out of the city with their families. Given the nature of the occupations and the social strata involved we expect the IMR of these groups to be higher than for the sedentary population. This is indeed the case. The average infant mortality according to the civil registration is 175. When we only take our sample of Nijmegen residents, infant mortality declines to 145. In the comparison with the sedentary Lugang population we will therefore use the infant mortality of the resident inhabitants of Nijmegen only.

stronger effect on post-neonatal than on neonatal mortality. Table 5.2 contains information on the relative distribution of neonatal and post-neonatal mortality. Note that neonatal mortality is defined as the number of deaths in the first month of life divided by the number of live births, whereas the deaths between month 1 and month 12 (post-neonatal) are divided only by the number of children surviving the first month. As a result the sum of neonatal and post-neonatal mortality is not equal to the IMR.

As said, given the different causes for neonatal and post-neonatal mortality it is generally accepted that neonatal mortality is less dependent on changes in the socio-economic circumstances, and, thus, more stable. This is what we find in Nijmegen. The change in neonatal mortality is relatively modest and the general direction is downward. This is the same conclusion reached for Belgium and France. In those countries the decline in neonatal mortality is attributed to two causes. More and better trained midwives are said to reduce the mortality of newborns. Also, since mothers were better nourished, they had fewer premature births and they gave birth to children with a better natural resistance.\textsuperscript{159} This may have also been the case in Nijmegen, but the latter explanation especially becomes doubtful when we look at the change in post-neonatal mortality. The rise of general IMR is completely driven by increasing post-neonatal mortality. Since this part of infant mortality is caused by exogenous factors only, this indicates impoverishment rather than a rising standard of living. Therefore, only the influence of bet-

ter medical knowledge concerning childbirth, and the presence of trained midwives seems responsible for the decline of neonatal mortality in Nijmegen.

The relative significance of the components of infant mortality in Lugang was manifestly different from that in Nijmegen. First of all, as we already saw, the general direction of the $IMR$ was downward in stead of upward. This resulted in the surprising finding that chances of survival for infants were higher in Lugang than in Nijmegen by the end of the two periods compared here. When we look at the two parts constituting infant mortality, Lugang again deviates sharply from Nijmegen. The relative importance of neonatal mortality was much higher, in the first period even higher than post-neonatal mortality. So, although the general decline of the Lugang $IMR$ was also caused by a decline in post-neonatal mortality, the greatest contribution was made by the decreasing neonatal mortality.

Barclay had noticed the high level of neonatal mortality in Taiwan and its sharp decline during the colonial period. He was surprised to find this, since “neonatal mortality is thought to be resistant to measures that bring infant mortality under control and thus to most general health measures”. His explanation, however, amounts to saying that neonatal mortality was influenced by almost every characteristic of society. The extent of the decline in neonatal deaths was revolutionary. Even at the low level of 1933-1945, however, neonatal mortality in Lugang was double the level in Nijmegen in the comparable period. This is the more surprising since post-neonatal mortality at the same time was much lower in Lugang than in Nijmegen.

A conclusion like this immediately raises doubt about the quality of the data used. Since the level and change of both neonatal and post-neonatal mortality in Nijmegen follow closely what we find elsewhere in Europe, this doubt is directed at the Lugang data especially. To check for irregularities in the household registers of Lugang we calculated infant, neonatal, and post-neonatal mortality for three other field sites too. Chu-shan, Tanei, and Ta-Tao-Cheng served as our control populations. The results only confirm the situation in Lugang. In all three populations we find a sharp decline in neonatal mortality between 1922-1933 and 1934-1945, whereas post-neonatal mortality was less important for the general decline of infant mortality. This finding is also corroborated by the multivariate analysis of infant mortality in Taiwan between 1905 and 1945 by Yang and Hsieh. When compared to the $IMR$ in the second half of the first year, the chance of dying in the first week is four times as high, and in the next three weeks twice as high.

An aspect of Chinese reproductive culture that has received much attention as an indigenous health measure is ‘doing the month’. When a family can

afford to do so, mother and newborn are secluded in a bedroom closed to all outside visitors. It has often been assumed that this seclusion will have saved many infants from neonatal exposure to pathogens, and hence lowered possible early infant mortality. The figures given here do not disprove such a contention, but they raise skepticism toward it. Whatever effect ‘doing the month’ may have had in lowering neonatal mortality, Japanese public health measures showed how much more effectively they could be lowered by non-traditional means.

Only one conclusion is possible. The impact of medical innovations and health measures both in the Netherlands and Taiwan primarily affected chances of survival for babies immediately after birth. We must also conclude that the effect in the Netherlands was more impressive. Whether this is the result of better measures as such, or of a lower starting point of the development, we do not know. The very low post-neonatal mortality in Lugang (and in the three control populations) can be explained by the custom of Chinese mothers of breastfeeding their infants for a long period of time. This is absolutely contrary to the declining number of European mothers who did so. The result is shown clearly in rising post-neonatal mortality on the European continent after approximately 1850.162

Sex differences in infant mortality

We already concluded from Table 5.1 that positive checks in Lugang were more active than in Nijmegen, although the differences were less sharp than expected. In order to trace the existence of positive checks we also have to look for sex differences in infant mortality in our two towns, because both Malthus, in 1798, and Lee and Wang, in 1999, referred to infanticide as one of the options for Chinese parents for controlling the number of their offspring. Given the importance of sons under patriline this method would be applied more often to girls than to boys. The topic is very complicated however. First of all, biology favors survival chances for girls. When mortality rates for boy and girl infants are the same, this implies that sons get preferential treatment. Only a higher female infant mortality rate points almost certainly at gender specific treatment of infants. Also, from the demographic measures one cannot learn what exactly happened. A society could use direct infanticide, preferential neglect, differences in age of weaning, or a combination of all these measures.

The literature on this subject is biased in suggesting that direct or indirect infanticide is a Chinese or Asian predilection. When comparing a European and a Chinese population, one has to be aware of son preference in European societies too. A study in Italy showed that during the last two decades of the 19th cen-

tury only infant mortality exhibited the expected gender difference. Male infant mortality had an excess of about 10 per cent. At older ages, the probability of death for girls was higher, 3 per cent between age 1 and 4, 6 per cent between age 5 and 9, and even 17 per cent between age 10 and 14. Clearly, the infant mortality differences were driven by biological factors, whereas social factors dominated mortality for those from 1 to 15 years. We find evidence for this conclusion in the disappearance of excess female child mortality after 1900 when the status of girls gradually improved.\textsuperscript{163}

Isabelle Devos found that mortality of girls in 19th century Belgium was 15 to 20 percent higher than mortality of boys, especially for childhood and adolescent mortality. Devos claimed that her findings were representative of most Western European countries.\textsuperscript{164} There is evidence, however, that a higher probability of dying for girls is not a universal European phenomenon. Knodel, for instance, did not find evidence for preferential treatment of sons in his fourteen German villages.\textsuperscript{165}

Since we only look at mortality as a determinant of fertility, we limit our presentation of mortality in Lugang and Nijmegen to infants, and divide the IMR into its neonatal and post-neonatal component. In both cities average infant mortality among boys is higher than among girls. More precisely, male infant mortality exceeds female infant mortality in Nijmegen by 13 per cent and in Lugang by 18 per cent. When we divide infant mortality into neonatal and post-neonatal mortality the conclusion remains the same. For the whole period studied here, both neonatal and post-neonatal mortality were higher for boys than for girls, in Lugang as well as in Nijmegen. However, gender differentiation was highest in the first month of life. Lugang excess male mortality was 39 per cent, whereas the same measure for Nijmegen was 29 per cent.

Change over our period points in the same direction, although less unequivocally. In Nijmegen, male IMR rose markedly during the 19th century, whereas female IMR declined first, and then increased only slightly above its original level. Neonatal male mortality rose in the last period of observation, while female neonatal mortality declined structurally, especially between the first two periods. The largest contribution to the general rise of male IMR came from the post-neonatal mortality. Again, the rise in probability of death for women in this age group was less marked. Contrary to our expectations, the sex differenti-


\textsuperscript{165} Knodel, Demographic Behavior in the Past, 79.
ated probability of dying favored male infants in the first period (1830-1849) at both neonatal and post-neonatal ages. Only after 1850 did the biological advantage of females reveal itself.

The Lugang data tell a different story. Assuming that neonatal mortality is caused mainly by endogenous factors, we find the expected result. Male neonatal mortality is higher and even rises between the two periods. In post-neonatal mortality, on the other hand, we find evidence for preferential treatment of sons. Even in the first period the differences between male and female mortality are only marginal. More significant is the finding that between 1933 and 1945 female post-neonatal mortality was 5 per cent higher, which runs contrary to the biological advantage girls had over boys. The interpretation could be that here son preference shows itself. Interestingly, though, this is not the case for neonatal mortality in the two periods, and it also does not appear for post-neonatal mortality in the first period. These calculations provide no evidence for a specific Chinese form of ‘proactive’ behavior, namely infanticide, the less so since we also find relatively high female infant mortality in Nijmegen before 1850.

Table 5.3: Sex Differences in Infant, Neonatal Mortality, and Post-Neonatal Mortality in Lugang and Nijmegen

<table>
<thead>
<tr>
<th>Period</th>
<th>IMR</th>
<th>Neonatal</th>
<th>Postneonatal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>F</td>
<td>M</td>
</tr>
<tr>
<td>Nijmegen</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1830-1849</td>
<td>125</td>
<td>135</td>
<td>39</td>
</tr>
<tr>
<td>1850-1869</td>
<td>145</td>
<td>133</td>
<td>38</td>
</tr>
<tr>
<td>1870-1889</td>
<td>190</td>
<td>142</td>
<td>44</td>
</tr>
<tr>
<td>Total</td>
<td>153</td>
<td>136</td>
<td>40</td>
</tr>
<tr>
<td>Lugang</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1922-1933</td>
<td>222</td>
<td>188</td>
<td>137</td>
</tr>
<tr>
<td>1934-1945</td>
<td>155</td>
<td>133</td>
<td>83</td>
</tr>
<tr>
<td>Total</td>
<td>184</td>
<td>156</td>
<td>107</td>
</tr>
</tbody>
</table>
Causes of infant deaths and the seasonal distribution

There is no doubt as to what caused the general decline of mortality in Lugang. The beneficial effects of the Japanese health measures showed here as elsewhere in Taiwan, and brought down neonatal mortality especially. In Nijmegen, neonatal mortality was already relatively low, but the general infant mortality was high and rising. Information on the causes of death could help us to understand better what was happening. Was there, for instance, a difference between the two towns in the causes of infant deaths? Unfortunately, there are no direct data available on the causes of death in Nijmegen and Lugang. We do have information, however, on the national level. The Japanese colonial government did publish causes of death by age for 1938 and 1942.\textsuperscript{166} This allows us to assess the contribution of the two main causes of infant deaths, intestinal and respiratory diseases. The first category comprises what the report calls \textit{Intestinal Infection} and \textit{Diarrhea}, the second category brings together \textit{Bronchitis} and \textit{Pneumonia}. The two categories together explain the major part of infant deaths. More importantly, however, they show that respiratory diseases, which are not directly related to breastfeeding, made an important contribution to the overall infant mortality.

There is general agreement on the main cause of death for Dutch infants. In 1809, during the French occupation, King Louis Napoleon already decreed that more mothers should breastfeed their children, or do so for a longer period. Several 19th and early 20th century medical observers also pointed to high infant mortality as a result of intestinal diseases, especially in the summer months.\textsuperscript{167} A more recent study of infant mortality in the city of Tilburg showed that intestinal diseases were the major cause of death in the 19th and early 20th century, especially in the warm summer months.\textsuperscript{168} A quantitative analysis of causes of death revealed that for the period 1903-1907 almost 33 per cent of all Dutch

\textsuperscript{166} Taiwansheng wushinianlai tongjitiyao (1946), 286-290 (1938) and 310-314 (1942).
\textsuperscript{167} Otto W. Hoogerhuis, \textit{Baren op Beveland. Vruchtbaarheid en zuigelingensterfte in Goes en omliggende dorpen gedurende de 19de eeuw} (Wageningen 2003) 4-12.
infant deaths were the result of intestinal diseases, against 14.9 per cent for diseases of the respiratory system. Please note that the percentage for intestinal diseases closely matches the Taiwan data mentioned before, whereas respiratory diseases had fewer infant victims in the Netherlands.

This situation was not specifically Dutch. In the late 19th century, crowded urban centers in England and Wales the existence of the so-called urban sanitary-diarrheal-effect is clearly visible, again especially in summer. A convincing proof of the relationship between excess mortality of infants in summer and breastfeeding is reported by Pollet. She presented a graph of weekly deaths from diarrhea in Paris 1898. When comparing children that were breastfed and those that were bottle-fed she finds, throughout the year, a higher number of infant deaths among the bottle-fed. In weeks 31 till 41 (mainly July and August) this difference reached a tremendous magnitude. The chance of dying for weaned children was up to 8 times higher than for breastfed children. At any rate, the limited data we have points at different factors behind infant mortality in Lugang and Nijmegen. The seasonal distribution of infant deaths can shed more light on this issue.

The probability of dying is not evenly spread over the year. Even contemporary populations know seasonal fluctuations in mortality, and this is yet more the case for historical populations. Most often the seasonality of deaths is best visible among the most vulnerable groups in society, the very young and the very old. We therefore calculated for our two cities the number of infant deaths per month. The main reason for this calculation is that it provides us with information on the vulnerability of the infant populations, on the type of dangers, and possibly even on the causes of death. Breschi and Liv Bacci concluded that children born in the winter period were especially at risk of respiratory infections. They also found that these risks became small when adequate measures for pro-

172. In order to avoid influences of the seasonality of births, the calculation takes the number of deaths below age 1 per month divided by the number of live births in the same month. This obviously creates a slight bias since not all children are born on the first day of the month and, thus, we find their deaths over a two month span. We consider this bias negligible.
tection were taken. When children were born in summer the risks of infections of the digestive tract prevailed. This, according to the authors, was related to breastfeeding. Since mother milk provided the child with immunity, the danger was highest for infants that were not breastfed.\textsuperscript{173}

If our hypothesis is right and Nijmegen mothers indeed breastfed their infants less than Lugang mothers, especially in the second half of the 19th century, we expect a higher incidence of infant mortality in summer. In 1903, Jonkers established that Dutch infant mortality was especially high in summer. The cause, in his view, was clear. High temperatures contaminated the food infants were given. As a result, the high infant mortality in summer was found mainly in the infants that were not breastfed.\textsuperscript{174} More than 90 years later, Hoogerhuis came


\textsuperscript{174} E.J. Jonkers, Beschouwingen over de oorzaken der groote kindersterfte en de middelen, die tot verbetering daarvan kunnen leiden (meer speciaal in het eerste levensjaar) (Groningen 1903) 38.

\textsuperscript{175} Hoogerhuis, Baren op Beveland, 121-126.
to the same conclusion for the province of Zeeland. Knodel found higher levels of infant mortality in late-summer for his German villages too. In his case, however, there was also a winter peak, since cold weather was dangerous for infants too.

Graph 5.1 suggests that our hypothesis for Nijmegen is correct. July and August are especially dangerous for infants. These are the only two months with an average maximum temperature of over 21 degrees Celsius. In this period the danger of contamination of supplementary food obviously was highest. Surprisingly, the seasonal fluctuation of infant mortality was about the same in Lugang. Since breastfeeding was nearly universal in Taiwan, the causes for the summer infant mortality peak cannot be the same as in Nijmegen, where breastfeeding was less universal and probably even declining in our period. When we look at the critical threshold above which IMR rises over the average level, we find in the Lugang case an average maximum temperature of 29 degrees Celsius in the months from May until October. Especially the temperatures of 30 degrees and over in June, July and August prove to be fatal for many infants. The different threshold levels already indicate that in Taiwan possibly other variables may cause the summer mortality. As for winter, mortality among infants is higher in Nijmegen than in Lugang. Again, the climate explains this. On average, the maximum temperature in the months November till February in Nijmegen was 6.1 degrees. The same months averaged in Taiwan 21.9 degrees. Thus, the mild winters in Taiwan appear to have been less dangerous than the relatively cold winters in Nijmegen.

For the time being there is another indication in favor of the breastfeeding hypothesis in Nijmegen. When we divide infant mortality in this city during the 19th century into two parts the impact of summer becomes more pronounced in the second period. Before 1850, 31.2 per cent of all infant deaths occurred during the months of July, August and September. After that year, the percentage was 36.0. This is in line with the predicted effect of more women working in occupations outside their own homes during the second half of the 19th century. Atkins reported on the effect of women working on breastfeeding for Blackburn in 1915. His findings show that whereas about 75 per cent of all women breastfed their infants in the first month, this percentage declined already sharply in the second month. In the fifth month half of the women not working still breastfed their child. The percentage of women working outside their home was less than 25. The impact of this difference on infant mortality was enormous. Artificially fed children had higher chances of dying for every cause of death. As far as diar-

177. Historical data of the Koninklijk Nederlands Meteorologisch Instituut in the Netherlands at www.knmi.nl.
rhea and enteritis were concerned the death rate of children receiving breast-feeding was 3.7, against 34.8 for children who were bottle-fed. Although we take into account that Atkin’s study covers the first decades of the 20th century and the English experience, we expect the Nijmegen situation to be comparable.

There is still another way to gain more insight in the reasons behind the Nijmegen and Lugang infant mortality. According to the literature on the subject infants in the first month are protected by the immunity they received from their

179. P.J. Atkins, ‘Mother’s Milk and Infant Death in Britain, circa 1900-1940,’ *Anthropology of Food* 2 (September 2003), Table 1 and 3.
mother. Also, if breast feeding was given only for a short period of time, as was the case in Nijmegen, this would imply that the number of breastfed babies would decline rapidly during and especially after the first month of life. The expected effect from possibly contaminated supplementary food would therefore appear only gradually. In order to check this possibility we divided infant mortality in the weeks immediately after birth and the rest of the first year. Since Lugang mothers breastfed their children for a long period of time, up to 30 months, the pattern should be different.

Graph 5.2 indeed qualifies the findings from Graph 5.1. In Nijmegen, cold weather in winter and part of spring has a declining impact on infants. The vulnerability of the newly born showed most clearly in the first week, but was less already in the second week, and declined further in the third week and the rest of the first year. The variations in autumn infant mortality were spurious. The effects of summer, however, again favor the breastfeeding hypothesis. The older the infant was, the more it suffered from high temperatures. If we assume that babies were only breastfed for a very short period immediately after birth, this is the effect one may expect. As long as the baby was living on mother’s milk the risk of infections from contaminated food was small. The situation in Lugang was clearly different. Summer was a dangerous period of the year for infants of all ages, starting in the first week of life. For this reason we may conclude that breastfeeding habits were not or to a much lesser degree of influence here. Again, this is in line with our knowledge of universal and prolonged breastfeeding by Chinese mothers. From Table 5.4 we have learned that there was a striking resemblance between the causes of death for male and female infants in Taiwan, highlighting once more that preferential treatment of sons probably did not influence infant mortality. We, therefore, must look for reasons of high infant mortality that were active mainly in summer (37 per cent of all infant deaths) and that were not differentiated according to sex. Paul Katz described the danger of the hot and humid summer months for the inhabitants of Chekiang. In his view the high temperatures allowed insects and microparasites to grow in food and water, and, thus, to infect human beings with contagious diseases like cholera, dysentery, smallpox and malaria. In their endemic forms these diseases frequently took the lives of the old, the young, and the infirm. If anything, the summers in Lugang were hotter and more humid than in Chekiang. We take it, then, that a large part of Nijmegen infant mortality was the result of a relatively low incidence of breastfeeding and the dangers concomitant on supplementary food. As for Lugang, we conclude that infants there instead fell victim to general infectious diseases.

Socio-economic differences in infant mortality

The level of infant mortality in historical western societies is often attributed to the socio-economic status of the parents, and, thus, to standard of living. Thomas McKeown is the best known advocate of this position. The debate on this topic is not settled, however. Samuel Preston, for instance, argued that indicators of standard of living were responsible for 25 per cent at most of the rise in life expectancy. In his view the effects of public-health technology had a greater impact. This discussion is seriously confounded by the use of different populations in different periods of development. Still, if we look only at comparable pre-industrial populations, the findings vary. Knodel found remarkably little difference in infant mortality between social classes and attributes this to general influences prevailing in the countryside that affect infants irrespective of social class. Two studies in the Dutch province of Noord-Brabant reached the same conclusion.

If we only look at studies for historical Dutch society, however, the evidence also points at social class as an important covariate of infant mortality. Van Poppel and Mandemakers conclude their study of 19th century Dutch infant and child mortality by stating that although the risk of dying was relatively high for infants and children in all social groups, there still was a considerable difference between these groups. Middle and upper class families used their resources to improve the chances of survival of their children. This was mediated by the acceptance of hygienic practices, by using pure water, and by a better disposal of waste and sewage. Hoogerhuis too found clear social differences in infant mortality in Goes. Especially infants born in the group of laborers had a relatively low chance of survival. This author, however, also points to high infant mortality among children of the lower middle class.

The discussion of the reasons behind the decline of infant mortality in Taiwan is heavily dominated by the question of whether or not the measures

183. Knodel, Demographic Behavior in the Past, 74.
186. Hoogerhuis, Baren op Beveland, 143-146.
taken by the Japanese colonial government worked. In 1954, Barclay acknowledged that the Japanese “aside from probably raising levels of living (...) developed a concerted program against an important group of dangers to health. (...) In fifty years of administration the Japanese quickly eliminated epidemics.”

His analysis did not include differences in social position of the parents. This is also the case with later studies on differential infant mortality in Taiwan. They deal extensively with sex and ethnic differences, causes of death, demographic characteristics of the births and the families involved, but leave occupation out of the analysis.

According to Table 5.5 the social and economic position of the parents did indeed influence infant mortality, especially in Nijmegen. In the Dutch city our findings show that the lower the standard of living was, the higher the chance that an infant died before reaching its first birthday. Given the small number of cases in the group “upper middle class” we decided to create one group joining upper middle and lower middle. Of all 1000 live births in this group 124 died before age 1. At the other extreme we find children of proletarians. Their chance of dying as an infant was about 175 per 1000. The infant mortality of laborers with a fixed position and farmers hardly differed, and took the intermediate position between the other two groups.

Our Lugang sample was even smaller. Therefore, we had to create two groups, one consisting of proletarians, laborers and farmers, the other formed, as in Nijmegen, by the two representatives of the middle class. Although here too we find higher infant mortality in the lower class, the differences are less dra-

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Table 5.5: Infant mortality according to occupational class

<table>
<thead>
<tr>
<th></th>
<th>Nijmegen</th>
<th></th>
<th>Lugang</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Live births</td>
<td>Deaths &lt;1</td>
<td>IMR</td>
<td>Live births</td>
</tr>
<tr>
<td>proletarians</td>
<td>558</td>
<td>97</td>
<td>173,8</td>
<td>2465</td>
</tr>
<tr>
<td>laborers</td>
<td>3265</td>
<td>464</td>
<td>142,1</td>
<td>“lower”</td>
</tr>
<tr>
<td>farmers</td>
<td>445</td>
<td>65</td>
<td>146,1</td>
<td>“higher”</td>
</tr>
<tr>
<td>Higher</td>
<td>728</td>
<td>90</td>
<td>123,6</td>
<td>unknown</td>
</tr>
<tr>
<td>unknown</td>
<td>214</td>
<td>38</td>
<td>177,6</td>
<td>unknown</td>
</tr>
<tr>
<td>All</td>
<td>5210</td>
<td>754</td>
<td>144,7</td>
<td></td>
</tr>
</tbody>
</table>


matic. As already mentioned the information on occupation comes mainly from the first two decades of the household registers. Since there is a marked decline of infant mortality during the period of observation, it is no surprise to find the category “unknown” to have the lowest infant mortality. On the basis of the descriptive statistics we are inclined to conclude that infants in Lugang were subject to general environmental influences that were less dependent on social class. We must wait for the multivariate analysis at the end of this chapter to assess whether the differences found are statistically significant.

Dutch demographic history is heavily influenced by religious forces. Especially in the period when the modern fertility decline started, Roman Catholics and to a lesser degree Orthodox Protestants started this process later and the decline was relatively slow. There is evidence of religious differentiation in infant mortality too. The latest contribution on the subject is by Van Poppel, Schellekens and Liefbroer who analyzed differentials in infant and child mortality in Holland between 1855 and 1912. They start with an overview of a well known discussion. Are religious differences in mortality caused by socio-economic characteristics or by lifestyle? The authors cite several studies in which the relative contribution of the two major causes are assessed. The conclusion is unambiguous. Even when the socio-economic differences are controlled for, direct causal links between religion and (infant) mortality remain.\(^\text{189}\)

In the Nijmegen case, we are able to test the influence of religion on infant mortality; religion is of no demographic importance in Lugang. The closest one can get in Taiwan to a cultural type of variable comparable to religion in the Netherlands is ethnicity. Ordinarily, one divides the population into two Han groups (Hokkien and Hakka) and a non-Han group consisting of Aborigines. The Lugang population, however, is totally Hokkien. For that reason, our ‘cul-


tural’ explanation of infant mortality has relevance only for Nijmegen. The group with unknown religion makes it difficult to draw firm conclusions from Table 5.6. Since they have the highest infant mortality, they are not a ‘rest’ category divided representatively over the religions. As it is, the most obvious conclusion is surprising. If anything, the literature on the subject expects Roman Catholics to have a relatively high infant mortality.\(^190\) This is not the case in Nijmegen. Catholics, closely followed by Orthodox Protestants, have the lowest level of \(\text{IMR}\), whereas the chance of dying for infants of Liberal Protestants is 30 per cent higher. This may be the result of adhering to different socio-economic groups. The numbers are too low to subdivide the table further, so we will establish whether or not religion has an independent influence in the following multivariate analysis.

**Multivariate analysis of Infant Mortality**

In the previous paragraphs we found several factors to be linked to the level of infant mortality and its two components. The problem with these relationships, however, is that they hide the interrelationships of the independent variables. When, in the Nijmegen case, both higher occupational position and Catholicism go together with relatively low infant mortality, this may be due to one of the two only, the second just being a covariate of the other. Statistically we can use a logistic regression to assess the independent influence of every variable while simultaneously controlling for the other influences. In order to do so infant mortality for every case is dichotomized, having the value 0 when the child survived at least until its first birthday, and the value 1 when the infant died. The procedure provides us with the possibility to establish the strength of the association of every variable with infant mortality via the so-called odds ratio, the \(\chi^2\) and the level of significance. For every variable one value is treated as the standard providing us with the 1.00 level against which the influence of the other possible values is assessed.

The model to explain infant mortality consists of variables measuring social and cultural differences between the couples, but the model also includes demographic and biological characteristics. First of all, we divided the period in two sub periods. In Lugang the effect of the Japanese health measures was noticeable from approximately 1925 on. We therefore used this year as the dividing point. The rise of infant mortality in Nijmegen started about 1860. For that reason we expect infant mortality to be higher in the period 1860-1890 than in the years between 1830 and 1860. The sex of each child born is included in the model to find possible differential mortality as the result of gender preferences. Whenever female infant mortality does not show the expected biological advan-

tage over male infant mortality, this points at preferential treatment. We also expect age of mother to have an influence on an infant’s chances of dying for an infant. Relatively young and relatively old mothers may, for biological reasons, give birth to more vulnerable children. Given the concept of maternal depletion, as formulated in Chapter 2, we also predict the infant to be especially vulnerable when the birth interval was small (thus not leaving the mother time to recover from the previous pregnancy and delivery), or when the parity of the child is high (indicating that the mother may be weakened by a rapid succession of births). The introduction of the variable “twins” is guided by the idea that in pre-industrial societies the survival chances of twins were especially small. In order to control for this influence we included a dummy variable. The variables mentioned until this point have a biological background. The socio-cultural influences are measured by looking at occupational class and, in the Dutch case, at religious denomination. The definition of these variables is the same as in the previous paragraphs. Since the model also tries to assess the influence of birth intervals the regression is limited to second births and higher only.

Our first regression deals with infant mortality in general. Table 4.7 clearly rules in favor of biological determinants of infant mortality. Both in Lugang and Nijmegen the birth of a twin was a situation society could not handle. The chance of dying for twins in Lugang was more than twice as high as for single births. In Nijmegen, the chance was four times as high. Premodern cities did not have the facilities to take care of premature and underweight babies. Maternal depletion appears to be more than a theoretical construct. When the interval from the previous birth was less than 16 months a mother was faced with a triple burden. Her body was still recovering from the previous pregnancy and delivery, was probably still nursing the previous child, and, on top of that, experienced the effects of the new pregnancy. As a result the child born after this second pregnancy had a 40 per cent (in Nijmegen) or 54 per cent (in Lugang) higher chance of dying within one year. Independent of the birth interval children born as parity seven or higher had significantly lower chances of survival than lower parity children.

The period variable has the expected effect. Since Nijmegen witnessed a rise in infant mortality, we find the odds ratio to be relatively high. By contrast, declining infant mortality rates in Lugang resulted in a 30 per cent lower chance of dying after 1925. Please note that the Nijmegen odds ration is not significant at the 5 per cent level. The most surprising finding, however, comes from the gender differences. If anything, we would expect female children to be worse off in Lugang. The actual situation reveals better survival chances for females, in line with the biological advantage female babies have. In Nijmegen too, male infants have a higher risk of dying, but again this finding is not statistically significant.

The death of infants in the first month of life is generally expected to be determined by factors other than those causing death in the rest of the first year.
### Table 5.7: Logistic regression on infant mortality

<table>
<thead>
<tr>
<th></th>
<th>Odds ratio Nijmegen</th>
<th>Chi²</th>
<th>P-value</th>
<th>Odds ratio Lugang</th>
<th>Chi²</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Period</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;1860 (1925 in Lugang)</td>
<td>1.000</td>
<td></td>
<td></td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;=1860 (1925 in Lugang)</td>
<td>1.122</td>
<td>1.507</td>
<td>0.220</td>
<td>0.700 **</td>
<td>8.232</td>
<td>0.004</td>
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<td></td>
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<td></td>
<td></td>
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<td>Male</td>
<td>1.172</td>
<td>3.294</td>
<td>0.070</td>
<td>1.230 *</td>
<td>4.560</td>
<td>0.033</td>
</tr>
<tr>
<td>Female</td>
<td>1.000</td>
<td></td>
<td></td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mother’s age at birth</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15-24</td>
<td>0.841</td>
<td>0.662</td>
<td>0.416</td>
<td>0.888</td>
<td>0.758</td>
<td>0.384</td>
</tr>
<tr>
<td>25-34</td>
<td>1.000</td>
<td></td>
<td></td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35-44</td>
<td>1.118</td>
<td>1.129</td>
<td>0.288</td>
<td>1.350</td>
<td>3.601</td>
<td>0.058</td>
</tr>
<tr>
<td>&gt;=45</td>
<td>0.943</td>
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<td>0.849</td>
<td>0.001</td>
<td>0.001</td>
<td>0.971</td>
</tr>
<tr>
<td><strong>Birth interval (in month)</strong></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>&lt;16</td>
<td>1.401 *</td>
<td>6.416</td>
<td>0.011</td>
<td>1.338 *</td>
<td>6.065</td>
<td>0.014</td>
</tr>
<tr>
<td>16-23</td>
<td>1.000</td>
<td></td>
<td></td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;=24</td>
<td>0.913</td>
<td>0.762</td>
<td>0.383</td>
<td>0.989</td>
<td>0.008</td>
<td>0.928</td>
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<td><strong>Parity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-3</td>
<td>0.914</td>
<td>0.718</td>
<td>0.397</td>
<td>1.168</td>
<td>1.347</td>
<td>0.246</td>
</tr>
<tr>
<td>4-6</td>
<td>1.000</td>
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<td>1.000</td>
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</tr>
<tr>
<td>&gt;=7</td>
<td>1.421 **</td>
<td>8.482</td>
<td>0.004</td>
<td>1.377 *</td>
<td>4.509</td>
<td>0.034</td>
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<td><strong>Twin</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>3.906 ***</td>
<td>33.240</td>
<td>0.000</td>
<td>2.190 **</td>
<td>6.241</td>
<td>0.013</td>
</tr>
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<td></td>
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<td><strong>Occupation</strong></td>
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<td></td>
<td></td>
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<td></td>
</tr>
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<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>proletarian</td>
<td>1.174</td>
<td>1.291</td>
<td>0.256</td>
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<td>-</td>
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<td>agricultural</td>
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<td>0.057</td>
<td>0.812</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>higher occupation</td>
<td>0.932</td>
<td>0.274</td>
<td>0.601</td>
<td></td>
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<td><strong>Occupation (social class)</strong></td>
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<tr>
<td>Low</td>
<td>-</td>
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<td>-</td>
<td>1.000</td>
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<td></td>
</tr>
<tr>
<td>High</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.832</td>
<td>3.417</td>
<td>0.065</td>
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<td>Unknown</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.962</td>
<td>0.036</td>
<td>0.850</td>
</tr>
<tr>
<td><strong>Religion</strong></td>
<td></td>
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<td></td>
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<tr>
<td>Liberal Protestants</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Roman Catholics</td>
<td>0.747</td>
<td>2.128</td>
<td>0.145</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Religion unknown</td>
<td>1.111</td>
<td>0.338</td>
<td>0.561</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*p < .05; **p < .01; ***p < .001*
We therefore present a separate logistic regression for neonatal mortality in Table 5.8. As predicted, the demographic variables have an important influence. Small birth intervals and being a twin implied a dangerous situation for both Lugang and Nijmegen infants, and this effect was even more visible than for infant mortality in general. The differences with Table 5.7 are marked as well. The first three children a woman bore in Lugang, for instance, had a significant higher chance of dying. Although this was also the case in Nijmegen, the result was not significant here. We intend to attribute this to the role of young, inexperienced mothers. This was clearly more the case in Lugang where many women married just after or even before menarche. Children of adolescent mothers faced even more risks than other children in our two cities.

At first sight, the influence of socio-occupational position on neonatal mortality in Nijmegen is amazing. The literature on the subject agrees on the conclusion that neonatal mortality is less influenced by environmental variables. In Nijmegen, however, when compared to the standard value for laborers, neonatal mortality was almost double the level for proletarians, and half the level for middle class families. Since there is no reason to expect genetic deficiencies to be differentiated by social class, general poverty is the best explanation for this finding. This conclusion can also be drawn from the Lugang data, although the finding here is not as sharp and not significant. Poverty in Nijmegen probably influenced the risk of dying through the care given during and immediately after delivery. Traditionally, a woman giving birth was assisted by a midwife, and only when problems arose was a medical doctor called. Although since 1818 midwives were officially trained, one finds regular complaints about unofficial midwives. They could keep their niche for the simple reason that their services were less expensive. This, then, goes to the heart of the matter. The difference in neonatal mortality between the very poor and the well-to-do was the result of the possibility to hire adequate help (a trained midwife or a doctor) during and after the delivery.191

When we turn to the mortality of infants between one month and one year our model contains only a few variables with significant influence. See Table 5.9. The improvement of life chances for infants in Taiwan in the second half of the Japanese colonial period is clear. The other variable still significant is the age of the mother. When children survived their first month, their chance of dying was highest when the mother was over 35. We must presume that older mothers were less capable of breastfeeding their children. Small birth intervals, both in Lugang and Nijmegen, did not predict post-neonatal mortality. Many babies born within 16 months after the previous birth died within four weeks. If they survived until one month their chances of dying were no longer influenced by the interval. High parity remained a risk factor in Nijmegen, also for infants over one month.

Table 5.8: Logistic regression on neonatal mortality

<table>
<thead>
<tr>
<th></th>
<th>Odds ratio</th>
<th>Chi²</th>
<th>P-value</th>
<th>Odds ratio</th>
<th>Chi²</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nijmegen</td>
<td></td>
<td></td>
<td>Lugang</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Period</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;1860 (1925 in Lugang)</td>
<td>1.000</td>
<td>1.000</td>
<td></td>
<td>1.000</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>&gt;=1860 (1925 in Lugang)</td>
<td>0.998</td>
<td>0.000</td>
<td>0.989</td>
<td>0.729</td>
<td>3.824</td>
<td>0.051</td>
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<td><strong>Sex</strong></td>
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<tr>
<td>Male</td>
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<td>1.325</td>
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<td>1.000</td>
<td></td>
<td>1.000</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td><strong>Mother's age at birth</strong></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>15-24</td>
<td>0.519</td>
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<td>1.000</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>35-44</td>
<td>0.927</td>
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<td>0.477</td>
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<td>&gt;=45</td>
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<td>1.781</td>
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<td>0.001</td>
<td>0.979</td>
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<tr>
<td><strong>Birth interval (in month)</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>&lt;16</td>
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<td>0.013</td>
<td>2.082</td>
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*p<.05; **p<.01; ***p<.001
Table 5.9: Logistic regression on post-neonatal mortality

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<th>Chi²</th>
<th>P-value</th>
<th>Odds ratio Lugang</th>
<th>Chi²</th>
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<td>&gt;=1860 (1925 in Lugang)</td>
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<td>1.964</td>
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<tr>
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*p<.05; **p<.01; ***p<.001
Maternal depletion is a possible explanation, as is the standard of living that must have declined parallel with the proliferation of offspring.

**Conclusion**

Children born in 19th century Nijmegen had a 15 per cent chance of dying before their first birthday. This risk for their Lugang counterparts in the first decades of the 20th century was 17 per cent. Although at first view this confirms Thomas Malthus’ prediction on the prevalence of positive checks in Chinese society, it also shows that the difference between the two cities was not as marked as expected. This conclusion is the more valid since Nijmegen witnessed an increase in infant mortality of 12 per cent, while IMR declined in Lugang with 30 per cent. As a result, by the end of the periods we compare here, infants in Lugang were better off than infants in Nijmegen. The hypothesis of proactive behavior regarding mortality is also falsified, at least for infants. We find no clear distinction between female and male infant mortality, and the differences we did find were present in Nijmegen as well as in Lugang. Infanticide was rare in both cities.

Although social class and religion seem to influence infant mortality when using simple descriptive statistics, this influence disappears when controlling for other variables. The only direct relation between social class and infant mortality that remains is found in Nijmegen neonatal mortality. We attribute this to the possibility of the mother to hire adequate assistance for the delivery. In Lugang, the level of neonatal mortality was remarkably high, especially in the period until 1920 despite elaborate cultural protection of neonates. This provides us with an indication that giving birth in Lugang was an even more precarious action than in Nijmegen. In the Taiwanese city, on the other hand, there was no link with the socio-occupational situation. The most surprising finding about the background of infant mortality in our two cities, then, is the absolute dominance of biological factors over socio-cultural factors. The chances of survival were dictated by birth-interval, parity and being a twin rather than by occupation or, in Nijmegen, religion.

When we turn to fertility in the next chapter, we take with us the conclusion that social difference in fertility, if it existed, cannot be explained by differential infant mortality. This takes us to the closing remark. We found one clear common characteristic of infant mortality in Nijmegen and Lugang, the summer peak. Although we presume different causes behind this seasonal high mortality (contaminated additional food in Nijmegen and temperature induced endemic diseases in Lugang), the effects for fertility may be very important. If fertility is completely up to nature, the high level of infant mortality in the summer months must logically result in a high level of conceptions a few months afterwards. When this proves not to be the case, we may have an indication for proactive behavior.
6

Fertility

Malthusian reality or proactive behavior?
In the Malthusian perception of reproduction the only restriction on the number of births was the number of women that entered matrimony and the age at which they took this step. For the world Malthus lived in this was an adequate description. Given the near absence of methods and appliances for birth control, fertility in the late 18th and early 19th centuries was indeed determined primarily by the length of time fecund women were at risk of conceiving: that is, the years between approximately 15 and 50 lived as a married woman. The result was, in Louis Henry’s terminology, ‘natural’ fertility, fertility uninfluenced by parity, the number of children already born to a couple, or by a target family size. Still, the evidence from empirical studies informs us that natural fertility was not the same in every society. Even in populations not deliberately controlling fertility, the range of number of births was large. Henry himself pointed to the fact that the differences were caused by behavioral as well as biological variables.192

This chapter first presents the demographic characteristics of marital fertility. We will compare the age specific marital fertility of Nijmegen and Lugang. Next, we try to understand the differences found by presenting the determinants of fertility. An assessment of differential fecundability proves to be very informative. Post-partum non-susceptibility is the next determinant identified in many studies. Final parity, then, is also dependent on the average birth intervals and on the age at which women stopped having children. The variables gathered upto this point allow us to calculate the expected number of children ever born to a woman. In this way, the theoretical fertility of the age specific marital fertility is replaced by a measure more appropriate to the reality described. All this amounts to deconstructing general marital fertility in its composing parts. The causes behind the differential fertility of Lugang and Nijmegen, and the possible change in these differences are dealt with in a multivariate analysis. At this point the socio-economic and socio-cultural variables are also introduced.

Age Specific Marital Fertility and Total Marital Fertility Rate
Before dealing with the factors responsible for the variation in ‘natural’ fertility we will first turn to an often used general measure of fertility in our two towns, the age specific marital fertility (asmf). This measure provides information on the number of children married women bore in the five year age categories from 15-19 to 45-49, and is expressed as the number of births per 1000 women years. The interpretation of asmf is guided by two ideas. First, that without interference in fertility the number of births a married couple experiences declines with age. Also, in societies where family limitation is accepted,

192. Louis Henry, ‘Some Data on Natural Fertility’, Eugenics Quarterly 8 (1961) 81-91; see also the discussion on this topic in Knodel, Demographic behavior in the past, 251-254.
fertility is especially lower in the higher age groups, when many couples have reached the target number of births, and, thus, are motivated to prevent further conceptions.

The asmf of Lugang and Nijmegen is represented in Graph 6.1. Since marriage rarely occurred for Nijmegen women before age 20, the graph only shows fertility from that age on. Also, since we are interested in the possibility of voluntary fertility control we only used data on the couples that had at least one child, excluding sterile marriages. For the sake of comparison we included data on the fertility of the Hutterites, an Anabaptist North-American population that aimed at maximum fertility. As such this population represents a clear case of high and ‘natural’ fertility. When we look at the development of fertility by age group, all three populations exhibit the convex shape of asmf that is said to indicate natural fertility. The differences are nonetheless informative. In the youngest age group (20-24) the Dutch fertility is approximately the same as the Hutterite fertility. In Lugang, the same age group reached only 68 per cent of this level. We have to control, however, for the fact that the majority of Taiwanese women had already married before age 20. Between 15 and 19 their fertility was 0.359, which was even higher than that of Hutterite women of the same age (0.300). The decline of fertility from age 25-29 on reflects the change in biological fecundity by age. In all age groups the order from high to low fertility remains the same, with the Hutterites as the most fertile population, Lugang wives being least fertile, and Nijmegen in an intermediate position.

Although the difference in level of fertility in the left panel of Graph 6.1 is clear, the three populations all seem to experience a natural decline of fecundity by age. This is even more evident when we standardize the fertility by calculating indices using the value of the age group 20-24 as our base. The right panel of Graph 6.1 exhibits the clear convex shape that goes with populations that do not intentionally stop having children after a target number of births. Knodel used another measure to check for stopping behavior using the asmf. Since the relationship of marital fertility with age is more or less constant for natural fertility populations, the ratio of total marital fertility over age 30 to total marital fertility over age 20 is relatively fixed. For natural fertility populations, the ratio is approximately 50 per cent, whereas modern populations using family limitation have a ratio of 25 per cent or lower.193 The Hutterite population indeed had a ratio of 52 per cent. Fertility over age 30 in Lugang was only slightly less (50 percent), but even the Nijmegen ratio was well within the range of natural fertility (47 per cent), which leads us to conclude that in our two towns marital fertility was not restricted by stopping during the period observed.

Until this point we looked at the two datasets from the implicit assump-

tion that they represent the demography of pre-industrial societies. This does not imply, however, that changes in time were not possible. For that reason we also present the ASM for three sub periods (before 1850, 1850-1869, 1870-1882) in Nijmegen and for two sub periods in Lugang (1906-1925 and 1926-1945). See Graph 6.2. The shape of marital fertility in the Dutch town was convex throughout the 19th century and therefore fosters the idea that birth control was not yet introduced. We find only one piece of evidence in favor of birth control, more specifically of early stopping. The ratio of fertility above age 30 to the total fertility above age 20 declines from 0.48 to 0.43. This might be an indication of the first steps towards family limitation later in the century. During the colonial period we find no major changes in fertility in Lugang. From age 30 on, there is an almost perfect similarity.

The only surprising finding has to do with Lugang women in their twenties. Their fertility in the second quarter of the 20th century was significantly higher than in the first quarter. Unlike in Nijmegen, there is no evidence of stopping behavior in the last period. Although the ratio of births over 30 to all births declines from 52 to 48 per cent, this is explained solely by the higher values of the age groups 20-24 and 25-29. These higher values in themselves are interesting, although no definitive explanation is possible at this point. We know for sure that the Japanese colonial government managed to increase the Taiwanese standard of living and to improve medical conditions. We do not know whether this
development encouraged couples to have more children or whether they simply became more fecund as a result of improved living conditions.

As previously indicated, the Lugang demography is heavily influenced by the three forms of marriage. Arthur Wolf convincingly showed that marital fertility of minor marriages was significantly below average as a result of sexual aversion of couples who had been raised together as children in one family.194 Uxorilocal marriages were socially stigmatized and, thus, also started with built-in tensions. Again, one might expect consequences for marital fertility. From Graph 6.3 we may conclude that low fertility in minor marriages was indeed a reality in Lugang too, although the difference from the other forms of marriage was especially marked in the age groups under 35. Major marriages had a fertility that followed the ‘normal’ curve of declining fecundity by age. For uxorilocal marriages we find a relatively low value of fertility in the age group 25-29. Our explanation for this has to do with the nature of uxorilocal marriages. We probably witness two peaks in this form of marriage. The first includes marriages of women whose parents from the start aimed at attracting a husband from another household. When they had only daughters, this was the simplest way to perpetuate the family. Another group of parents were those who had given up hope of a major marriage for their daughters. By the time still single daughters reached the age when European women married such parents used the uxorilocal mode as their secondary strategy. “Twenty-three twenty-four, you have to pay

194. Wolf and Huang, Marriage and adoption; Wolf, Sexual attraction.
someone to take her." These new, late marriages, then, boosted the fertility of the 30-34 age group.

From the data on the age specific marital fertility we can also calculate the total number of children born to married women (tmfr) in the population at hand by summing the five year values, and multiply the sum by 5. One has to be aware of the characteristics of this measure however. tmfr is a theoretical construct providing the number of births a woman would have had if she married at her 15th (or 20th) birthday and remained married until age 50, and if she experienced the average fertility of all women in the respective age groups. The potential biases of this fertility measure become evident when one realizes its calculation assumes that all women between, for instance, 35 and 39 had the same number of births, irrespective of whether they married at age 20, 25 or 30, and thus irrespective of the number of children they already had before entering this age group.

Since we are comparing two populations with a very different marriage behavior, especially as far as the age at marriage is concerned, the calculation in Table 5.1 presents tmfr15-49, which is more appropriate for the Lugang situation, and tmfr20-49 which represents the Nijmegen case better. Again we included the Hutterite values for reference.

If anything, this calculation shows that Lugang women did not use the additional decade of married life to maximize their number of children. Even if we
compare the total number of births in Lugang from age 15 on with the number of births Nijmegen women had from age 20 on, fertility in our Dutch town was higher. Comparing \( \text{tmfr} \) for the total fecund life span 15 to 49 is biased by the small number of Nijmegen women married before age 20. Still, the total fertility in the city is even a fraction higher than the control population of Hutterite women, whereas Lugang fertility is 28 per cent lower. Both in Lugang and Nijmegen the last period of observation had a higher total marital fertility than earlier periods. From this evidence, then, we can conclude that the two populations had not yet begun the process of fertility control. Form of marriage in Lugang had the expected influence on final fertility. Minor marriages had fewer children than the other forms, irrespective of whether we measure from age 15 or age 20.

These results most certainly need clarification. Why is it that our Taiwanese population only had a comparatively low level of fertility? And why did ASM in the Netherlands decline much faster than Hutterite fertility? The questions are the more pressing since several indicators seem to rule out the possibility of voluntary birth control. We can only find the answers by first studying the possible determinants of fertility.

**Determinants of fertility**

When Louis Henry introduced the concept of natural fertility, he acknowledged the possible differences in levels of this parity-independent fertility.\(^{195}\) A very

---

**Table 6.1: Total Marital Fertility Rate (\( \text{tmfr} \)), Nijmegen and Lugang**

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<th>( \text{tmfr 15-49} )</th>
<th>( \text{tmfr 20-49} )</th>
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<td>9.2</td>
<td>7.4</td>
</tr>
<tr>
<td>Minor marriages</td>
<td>8.1</td>
<td>6.2</td>
</tr>
<tr>
<td>Uxorilocal marriages</td>
<td>9.3</td>
<td>7.3</td>
</tr>
<tr>
<td>All</td>
<td>9.0</td>
<td>7.2</td>
</tr>
<tr>
<td><strong>Hutterites</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>12.4</td>
<td>10.9</td>
</tr>
</tbody>
</table>
informative attempt to describe the background of these differences was published in 1988 by Campbell and Wood. Although their analysis studies total fertility rather than marital fertility, the results are applicable to the fertility of married couples too. The comparison between 70 natural fertility populations and 70 controlled fertility populations reveals that the mean total fertility rate (tfr) was respectively 6.1 and 2.6. Although the difference is clear, they also found that, given the maximum biological capacity for reproduction, no traditional population reproduced at this maximum level. What is more, the variance between natural fertility populations is very high (three times as high as among controlling populations). The typical variation in natural fertility results in tfr’s between four and eight. Higher fertility is only found in colonizing populations, and lower fertility is characteristic of populations with a high prevalence of pathological sterility. In sum, we may conclude that natural fertility is neither fixed nor typical.

We can distinguish many factors responsible for the differences in natural fertility found. Roughly, one uses the impact of socioeconomic, of behavioral, and of physiological variables. These factors, however, can only affect fertility when they operate via one or more of the so-called proximate determinants. Campbell and Wood use the example of religious denomination. This variable does not affect fertility itself, but can be mediated by a proximate factor such as coital frequency or the duration of lactation. A sensitivity analysis allowed the authors to attribute a relative importance to the proximate determinants listed. Differences in natural fertility are mainly caused by the duration of lactational infecundability and the age at marriage. The fecund waiting time to conception may be an important cause of variation too, as is age at menarche. Age at menopause, however, has hardly any influence. This is even more the case with the level of intrauterine mortality and the length of gestation. Finally, Campbell and Wood looked behind the aggregate measure of fecundability, assessing the relative importance of the proportion of ovulatory cycles, the duration of the fertile period, the probability of conception per insemination in the fertile period, the ovarian cycle length, and the frequency of intercourse. Their analysis shows that the variation in TFR is almost completely explained by the length of birth intervals, which themselves are fully explained by differences in lactational infecundability.

195. Henry, 'Some Data on Natural Fertility'.
In his empirical analysis of fourteen German villages in the 18th and 19th centuries, John Knodel also summarized the factors influencing, in his view, the level of natural fertility. Not surprisingly, these factors overlap with the ones described by Campbell and Wood: the onset of permanent sterility, fecundability, the duration of postpartum non-susceptibility, and the risk of spontaneous intrauterine mortality. Since our analysis of Nijmegen and Lugang only uses information on non-sterile marriages, data on the first variable is abundant. The information on intrauterine mortality in Lugang is not recorded in the household registers. In Nijmegen, we cannot be sure that all stillbirths were registered, and even if they were, the criteria are not known and possibly were changing over time. For that reason intrauterine mortality is not analyzed in the following paragraphs. Both fecundability and postpartum amenorrhea, however, will be included.

The implication of these two publications for our comparison of Lugang and Nijmegen is clear. First of all, the absolute level of fertility as such does not inform us about the absence or presence of deliberate birth control. The alternative explanations for the differences are lactation and nuptiality. The fecund waiting time to conception may be another important third cause of variation too. Interestingly, the variation in TFR’s is almost completely explained by the length of birth intervals, which in turn are fully explained by differences in lactational infertility. Thus, our own analysis will deal with differences in fecundability, birth intervals, and age of the mother at last birth. The development in time and the social differentiation of these phenomena will also be taken into account.

**Fecundability**

Fecundability can be defined in its most simple form as the probability of conception during a menstrual cycle in the absence of contraception. Since we cannot use exact biological measurements for fecundity, we have to turn to approximations that allow us to compare the two populations at hand, and the changes over time. The measure presented in Table 5.2 is the proportion of marriages that experienced a first birth in the 9th, 10th or 11th month after the marriage date. For this calculation we excluded marriages starting with a bridal pregnancy or with the legitimization of a child born before marriage. Therefore, the confounding influence of breastfeeding is absent. The result is an index of the chance that marital intercourse resulted in a pregnancy within three months. Comparing the proportions through time and between populations enables us to approximate the relative fecundability. The reasons behind these differences are not immediately clear. Low fecundity may be the result of biological factors, like the number of anovulatory cycles or the length of the cycle, but social factors, like the frequency of intercourse, may be a cause too.
The most general and obvious conclusion from Table 5.2 is that fecundability in Nijmegen was much higher than in Lugang. The proportion of quick pregnancies was higher in every subgroup. Consequently, the average birth interval between wedding and first birth was about 6.5 months lower in Nijmegen. We will return to the reasons for this remarkable difference. Here, we will only analyze the differences within the populations. First of all, both in Lugang and Nijmegen, the probability of early pregnancies rose in the periods we study. Rising fecundability is also visible in the declining birth intervals, although in Nijmegen the intermediate period has the smallest interval.

The reliability of our approximation for fecundability can also be assessed by looking at the differences between the age groups at marriage. As expected, we find only very few women in Lugang marrying after age 30. In Nijmegen, the age group 40 and higher is very small. Still, the overall direction of the change in fecundability is in line with the physiological expectations. Very young brides suffer from adolescent subfecundity, which reduces their chances of a pregnancy in the first three months of marriage. In both towns fecundability reached its maximum level for the ages 20 to 29. Nijmegen women only experienced a decline in fecundability after age 30, which is consistent with the rise of anovular cycles at this age, and possibly with the decline of the frequency of intercourse. It is important to notice that our conclusions for Nijmegen are very much like the conclusions Knodel reached for the 19th century German villages.199

Again, the data in Table 6.2 only inform us of a higher fecundability among the European women when compared to their Taiwanese counterparts. The reasons behind this difference are not clear yet. From the description of marriage customs in both societies, however, we remember how marriages started. Lugang couples were very young and often strangers or a ‘brother’ or ‘sister’. Understandably, a first birth for marriages like this came later than for Nijmegen marriages which brought together mature and self-chosen partners.

**Post-partum subfecundity**

The data presented in the previous section gave us an idea of the basic fecundability of our two populations. Studies of the causes of differential fertility emphasized that the second most important variable is the length of the period of postpartum non-susceptibility. Again, this period varies widely, even between natural fertility populations. The evidence available suggests that breastfeeding can delay the return of normal ovarian activity by at least a few months and at most by more than two years. This depended on the frequency and the intensity of suckling.200 In the chapter on infant mortality we already mentioned the dif-

199. Knodel, *Demographic behavior in the past*, 272-275. The proportion of first births within 9-11 months after marriage for his 19th century cohorts averaged 0.47 and the mean interval was 16.6.
ferences in breastfeeding behavior between the Lugang and Nijmegen women. Breastfeeding was nearly universal in China and was carried on for a prolonged period of time. Contemporary European sources on the other hand attributed high infant mortality rates to the custom of relatively brief breastfeeding. This situation worsened during the 19th century when more women engaged in industrial labor. This general description of the situation leads us to presume that Chinese fecundability, relatively low as it was already, was influenced downwards more downwards as a result of longer breastfeeding.

Unfortunately, we do not have direct information on the proportion of women feeding infants themselves in Lugang and Nijmegen, let alone information on the duration and intensity of suckling. Following the suggestions by Knodel, we therefore calculated two estimates of the effects of breastfeeding on fertility. First of all, we use the information we gathered on the interval between marriage and first birth. Since we excluded women who already gave birth, this measure captures birth intervals not influenced by postpartum infe-

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Table 6.2: Proportion of first births within 9-11 months, by marriage cohort and age at marriage

<table>
<thead>
<tr>
<th>Marriage cohort</th>
<th>Lugang N first births</th>
<th>proportion 9-11 months</th>
<th>Average interval</th>
<th>Nijmegen N first births</th>
<th>proportion 9-11 months</th>
<th>Average Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>1906-1925</td>
<td>310</td>
<td>0.12</td>
<td>26.8</td>
<td>&lt;1850</td>
<td>220</td>
<td>0.49</td>
</tr>
<tr>
<td>1926-1945</td>
<td>452</td>
<td>0.27</td>
<td>20.3</td>
<td>1850-1869</td>
<td>359</td>
<td>0.47</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1870-1882</td>
<td>75</td>
<td>0.52</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age at marriage</th>
<th>Lugang</th>
<th>Nijmegen</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-19</td>
<td>533</td>
<td>28</td>
</tr>
<tr>
<td>20-24</td>
<td>182</td>
<td>199</td>
</tr>
<tr>
<td>25-29</td>
<td>12</td>
<td>227</td>
</tr>
<tr>
<td>30-34</td>
<td>4</td>
<td>133</td>
</tr>
<tr>
<td>35-39</td>
<td>-</td>
<td>59</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age at marriage</th>
<th>Lugang</th>
<th>Nijmegen</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-19</td>
<td>533</td>
<td>28</td>
</tr>
<tr>
<td>20-29</td>
<td>194</td>
<td>426</td>
</tr>
<tr>
<td>30-39</td>
<td>4</td>
<td>192</td>
</tr>
</tbody>
</table>

---

cundity. Logically, the main difference between first and second births is the fact that some of the mothers were breastfeeding the first child before conceiving the second. Comparing the first and second interval, therefore, provides us with an indication of the impact of breastfeeding.

There may be biases in this measure. Only if couples did not try to influence the interval and if we assume that behavioral characteristics, like frequency of intercourse, did not interfere, the differences we find reflect the direct variation caused by breastfeeding. Age specific marital fertility does not suggest voluntary control. Also, most populations starting birth control did so after reaching a given parity. We expect the influence of the other intervening variables to be negligible too. Although several studies showed that frequency of intercourse indeed changes during marriage, our calculations refer to behavioral differences in a relatively short period after marriage, which gives us reason to rule out this interference.

The estimate of postpartum non-susceptibility in Table 6.3 shows that breastfeeding in Nijmegen prolonged the average interval by 7.5 months. Since the return of regular menses after stopping breastfeeding occurs in approximately 2 months, this implies that Nijmegen women on average only breastfed for 5.5 months. We also find another confirmation of the increasing fecundability of Nijmegen couples, because both the length of the first and of the second interval declined during the 19th century. Remarkably, the decline is most visible in the second intervals, 3.5 months versus 0.2 months. This finding is in line with the observation that breastfeeding was a custom in decline in 19th century Europe. What is the consequence of this observation? When fewer women in Nijmegen breastfed their infants or the same number of women did so for a shorter period of time, the return of normal ovarian function came earlier and thus fecundity rose. Smaller birth intervals are the logical result.

The increasing fecundability of Lugang couples in the Japanese colonial period was visible already in the rising \( \text{tmfr} \) and in the decline of average birth intervals. We can draw the same conclusion from Table 6.3. The average birth interval in the second quarter of the 20th century was smaller than in the first quarter of that century, irrespective of whether we look at first or second births. What is new is the presumed effect of breastfeeding on the length of the intervals. When during the second interval breastfeeding became influential, on average 8.2 months were added to the first interval. Given the two months necessary for the return of menses, this finding would indicate that Lugang mothers on average breastfed only a half month longer than Nijmegen mothers, namely a little over 6 months.

Interestingly, the difference was more pronounced in the second period. When looking at the elements of the subtraction, the larger difference was mainly caused by a lower first interval, and, thus, a marked rise in fecundity. At first sight, there is no reason to expect an increasing target family size for Lugang cou-
The most acceptable explanation for the differences found seems to be that the improvement of the standard of living and the effects of better medical care also showed in a rising fecundity.

The second way of assessing the lengthening influence of breastfeeding on birth intervals is more commonly known. In this calculation one uses the observation that the death of an infant logically ends breastfeeding. This, then, makes it possible to compare birth intervals when the previous child died within the first year with birth intervals when the previous child survived at least until age 1. Theoretically, in the latter case we witness the full effect of breastfeeding. When, however, the child opening the interval died, this had a diminishing effect on the length of the interval.

The strength of this effect can be measured by comparing the probability of conception after the death of an infant with the probability when the infant lived at least until age 1. We calculated the probability for the first 36 months after the previous confinement. Since we want to distinguish the pure effect of breastfeeding the calculation only uses the intervals for parity 2 and higher. Also, in order to eliminate erratic fluctuations the probabilities are presented as three year moving averages. Graphs 6.4 and 6.5 show the results for the two towns.

For both Lugang and Nijmegen the pervasive influence of the survival sta-

<table>
<thead>
<tr>
<th>Period</th>
<th>1*</th>
<th>N</th>
<th>2**</th>
<th>N</th>
<th>Diff.</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1850</td>
<td>16.8</td>
<td>220</td>
<td>25.1</td>
<td>318</td>
<td>8.3</td>
</tr>
<tr>
<td>1850-1869</td>
<td>16.1</td>
<td>359</td>
<td>23.7</td>
<td>432</td>
<td>7.6</td>
</tr>
<tr>
<td>1870-1882</td>
<td>16.6</td>
<td>75</td>
<td>21.6</td>
<td>127</td>
<td>5.0</td>
</tr>
<tr>
<td>All</td>
<td>16.4</td>
<td>654</td>
<td>23.9</td>
<td>877</td>
<td>7.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Period</th>
<th>1*</th>
<th>N</th>
<th>2**</th>
<th>N</th>
<th>Diff.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1906-1925</td>
<td>24.1</td>
<td>366</td>
<td>30.7</td>
<td>304</td>
<td>6.6</td>
</tr>
<tr>
<td>1926-1945</td>
<td>17.6</td>
<td>565</td>
<td>26.8</td>
<td>423</td>
<td>9.2</td>
</tr>
<tr>
<td>All</td>
<td>20.2</td>
<td>931</td>
<td>28.4</td>
<td>727</td>
<td>8.2</td>
</tr>
</tbody>
</table>

* Interval between marriage and first birth (bridal pregnancies excluded);

** Interval between first and second birth.

Table 6.3: Estimation of postpartum non-susceptible period by marriage cohort

| Period | Nijmegen | | Lugang |
|--------|----------| |--------|
|<1850|16.8|220|25.1|318|8.3|
|1850-1869|16.1|359|23.7|432|7.6|
|1870-1882|16.6|75|21.6|127|5.0|
|All|16.4|654|23.9|877|7.5|
|1906-1925|24.1|366|30.7|304|6.6|
|1926-1945|17.6|565|26.8|423|9.2|
|All|20.2|931|28.4|727|8.2|
tus of the previous infant on the probability of the next conception is convincingly demonstrated in the two graphs. Intervals starting with the birth of an infant that died within the first year had the highest probability of conception again 4 months after the previous delivery, for the Dutch as well as for the Taiwanese couples. The difference in the graph containing conception probabilities after the birth of a surviving infant is crystal clear. This probability peaked much later, for Lugang after 21 months, for Nijmegen after 15 months. Breastfeeding in Lugang prolonged the post-partum subfecundity by 6 months. For the likelihood that relatively more Lugang women breastfed longer than their Nijmegen counterparts, we find another confirmation in the changing probabilities of conception following the survival of an infant. In Taiwan, probability of conception remained below 0.01 until the eighth or ninth month after the previous delivery. Nijmegen women passed this line in the third month and reached the 0.03 point after 6 months, whereas in Lugang this happened in the thirteenth month.

The evidence presented in the two graphs uses the effect of the death of an infant within the first year. The strength of this influence depends on the moment the infant died within the first year. One expects the difference with the intervals in which the previous child survived to be highest when an infant died in the first month. Therefore, we limited the observations in Table 5.4 to the cases where an infant died in the first month of life. The Nijmegen data show the expected results. The comparison of the interval following an infant death before 1 month, and the interval starting with a child surviving past 1 year, results in a difference of 6.6 months. This average hides significant temporal developments.

Graph 6.4: Probability of conception after death or survival of previous infant, Nijmegen
The impact of breastfeeding declined from 9.1 in the period before 1850 to 3.9 in the last period. This, of course, reminds us of the complaint by contemporaries that the custom of breastfeeding declined during the 19th century. Given the industrial labor opportunities in an urban environment, this phenomenon was most visible in cities. Knodel found for the comparable period 1825-1899 in his German villages an average difference of 8.4 months. The urban-rural difference is indeed apparent.

In sum, we conclude from Graphs 6.4 and 6.5, and Table 6.4 that breastfeeding in Nijmegen prolonged the birth interval by somewhere between 6 and 7 months. This finding can lead to two conclusions. First of all, one could argue that the differences found are not to be explained by breastfeeding at all. The death of an infant in this view simply encouraged parents to have a replacement birth as soon as possible. Or, parents with a surviving child would take their time before planning a next child. This assumption, however, is contrary to the combined results of Tables 5.3 and 5.4. The maximum difference between a surviving and a dying infant is remarkably close to the extra 7.5 months second births took when compared to first births. For the time being, our conclusion is that breastfeeding in 19th century Nijmegen prolonged birth intervals for a period of 6 to 7 months.

The impact of breastfeeding on birth intervals shows in Lugang too. When an infant died in the first month, this shortened the following interval by 8

months, which was longer than in Nijmegen (6.6). The effect of infant deaths shows in every cell of the table. Whenever an infant died in the first month this resulted in an interval to the following birth that was short compared to intervals following a child surviving to age 1. The lengthening effect was even bigger in the second cohort. It would be difficult to explain the difference between the first and second cohort from demographic or socio-economic causes. Rather, we presume that the results for the second cohort reflects reality, whereas under registration of infant deaths biases our data for the first cohort.

**Average birth interval**

We have already used the interval between marriage and first birth as an indicator for fecundability of the two populations we study here. It is also necessary to look at the intervals in general. In the case of Lugang, for instance, we hinted at the possible influence of the special way in which marriage partners were chosen and the marriages were contracted. We assumed that the ‘strangers’ marrying each other in Lugang would need more time for the first birth than a husband and his wife in Nijmegen who only married after an engagement. This difference between Nijmegen and Lugang marriages would become smaller with the duration of marriage after in Lugang too husband and wife became accustomed to each other. If indeed the first birth interval was influenced by the mechanism described here, the difference between the following intervals would logically be smaller. If, on the other hand, the differences between the two cities remain, this would indicate that we have to look for a more structural cause. Before tracing the differences, we will first analyze the results in each town separately.

For Nijmegen, the data from Table 6.5 confirm our earlier observation.

**Table 6.4: Birth interval after death or survival of previous infant**

<table>
<thead>
<tr>
<th></th>
<th>Infant dies in first month</th>
<th>Infant survives</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average next interval N</td>
<td>Average next interval N</td>
<td></td>
</tr>
<tr>
<td>Nijmegen &lt;1850</td>
<td>19.3 47</td>
<td>28.4 1276</td>
<td>9.1</td>
</tr>
<tr>
<td>1850-1869</td>
<td>20.0 66</td>
<td>26.7 1755</td>
<td>6.7</td>
</tr>
<tr>
<td>1870-1882</td>
<td>20.1 13</td>
<td>24.0 504</td>
<td>3.9</td>
</tr>
<tr>
<td>All</td>
<td>19.8 126</td>
<td>26.4 3535</td>
<td>6.6</td>
</tr>
<tr>
<td>Lugang 1906-1925</td>
<td>24.7 186</td>
<td>32.2 1374</td>
<td>7.5</td>
</tr>
<tr>
<td>1926-1945</td>
<td>20.5 120</td>
<td>29.7 1088</td>
<td>9.2</td>
</tr>
<tr>
<td>All</td>
<td>23.1 306</td>
<td>31.1 2462</td>
<td>8.0</td>
</tr>
</tbody>
</table>
Throughout the 19th century average birth intervals declined, which leads us to conclude that fecundability was rising. For couples married after 1870 the average birth interval was 3.7 months (= 14 per cent) lower than for those married before 1850. This decline is visible in all categories presented here and, thus, constitutes a structural development. Interestingly, the speed of the decline gains weight as parity grows. The interval up to parity 3 decreases by 9 per cent during the 19th century, intervals for parity 4 to 6 by 17 per cent, and the intervals of 7 and higher by 21 per cent.

When we read the table by rows rather than by columns, we can assess the change in the intervals by parity instead of by period. After parity 3 the length of the interval increased first. An interval for parities 4 to 6 took on average 4.6 month longer than the first three births. The finding is not surprising. We expect fecundability to decline with the duration of marriage, both through diminishing biological fecundity of the wife and a decline of coital frequency. It is paradoxical, then, that from parity 7 on, the interval declines again, although only marginally. The explanation for this phenomenon, however, is not difficult to find. The couples who managed to get of 7 or more offspring were not representative of the population in general. We assume that only the most fecund couples belonged to this group and in this way influenced the average interval of later parities downwards.

Before analyzing birth intervals in Lugang, we must point to the possible bias in our data. Since registration in the household registers stopped in 1945, we find an overrepresentation of lower parity births. Many higher parity births logically escape our observation. On top of that, the higher order births included in our sample reflect the situation of the most fecund couples, those who managed to get
aged to have 7 or more births in a smaller period of time. Clearly, the conse-
quency is that birth intervals in Lugang as presented in Table 5.5 are slightly
biased downwards. The general direction of the Lugang intervals was similar to
the Nijmegen findings though. During the Japanese colonial period the mean
birth interval declined for every parity group. Again, we must assume that the
health measures taken and the rising standard of living fostered fecundity.

Contrary to Nijmegen, however, the decline did not quicken as parity rose.
Rather, the opposite is true. The intervals for the first three births were 13 per cent
smaller in the second period, in the intervals 4 to 6 only 7 per cent and those
from parity 7 on 6 per cent. Since the proportion of minor marriages declined in
the colonial period and the female age at marriage increased, the decline in the
first intervals was to be expected. Both adolescent sub-fecundity and the number
of couples suffering from a lack of sexual attraction became less important.
Reading Table 6.5 by rows again yields the same results as in Nijmegen. Intervals
by parity first increased, and then declined again for parity 7 and higher. The
explanation for this change is probably the same as the one given for Nijmegen.

A comparison of the birth intervals in the two towns starts with the obser-
vation that the average interval between two births in Lugang was about 5 months
longer than in Nijmegen. This average, however, is not evenly distributed along
birth order. The difference for the first three births is especially impressive.
Nijmegen couples took 6.9 months less for every birth in this category. From
there on, the difference between the two cities declined. For parity 4 to 6 Lugang
couples took 3.1 month longer per birth and from parity 7 on the difference was
only 2.3. From whatever angle we look at Table 5.5, time and again the birth inter-
vals in Nijmegen suggest a higher fecundability. The causes for this difference
may be manifold. Purely biological factors, like longer or more anovular cycles,
or a higher incidence of intrauterine mortality, are a possible determinant. Still,
behavioral factors can not be ignored. Differences in the length or intensity of
breastfeeding, or in coital frequency could explain the variety in intervals just as
well. We will return to this topic.

Age at last birth
The previous sections explored the beginning and spacing of marital fertility in
Nijmegen and Lugang. Historical demographers tend to pay special attention to
the third characteristic of fertility, stopping. In almost every population starting
birth control we find that a decline of the age of women at last birth is the first
indicator of the introduction of birth control. Once, to use Ansley Coale’s termi-
nology \( ^{203} \), the number of children was within the calculus of rational choice and

\[ ^{203}\text{Ansley J. Coale, ‘The decline of fertility in Europe from the French Revolution to World War II’, in: S.J.}
\[ \text{Behrman et al. (eds.), Fertility and family planning (Ann Arbor 1969).} \]
the means or methods to limit births were available, these populations stopped having children after the desired number of offspring was reached. As a result, the age at which women bore their last child started declining. Therefore, age at last birth is an often-used measure to detect birth control. Knodel, for instance, found that this age for the women in his German villages declined from just above 40 in the 18th century to below 38 by the end of the 19th century. His conclusion was that this “was the result of a fundamental transformation of reproductive behavior from a pattern characteristic of natural fertility to one indicative of deliberate attempts to stop childbearing before the end of the wife’s reproductive years”.

This brings us to the logical next question: what exactly was the ‘natural’ age at last birth? A convincing survey of available data by Wood shows that the mean age at menopause was 49.5 years with a variance of 9.1. Although this marked the definitive end of a female’s reproductive career, actual childbearing ended several years before, even when the population did not use contraception. Wood brings together evidence from natural fertility populations in Germany, North-America, France, England, Sweden, and several non-European communities. The range within which women bore their last child appears to be very limited, between 38 to 41 years. These findings prove Knodel’s conclusion right and at the same time hand us a measure to detect active interference with the age at last birth.

When using a reconstitution of families as we did here, a simple calculation of the age at last birth may cause problems. Women may leave our observation because they died at an early age, or because they left the community and thus the registers. This objection can be neutralized by looking at only women who could be followed until age 45. They obviously did not die or leave. Table 5.6 presents the age at last birth for women selected thus in the column All. Again, we only included first marriages. According to this calculation Lugang women stopped having children two years before their counterparts in Nijmegen did so. Findings like this, early stopping in Chinese societies, are often presented as evidence of deliberate birth control. This may have been the case, but we favor an alternative explanation. In historical populations it is difficult to think of women or couples between 20 and 30 that deliberately controlled the number of births by stopping. Even if they intended to do so, the means and methods available simply lacked the efficiency to reach that goal. We therefore assume that women who stopped having children before their 30th birthday simply were not able to continue reproduction for reasons beyond their control. Many of them may have had a difficult delivery at a young age and as a result were not able to conceive

204. Knodel, *Demographic behavior in the past*, 291-293.

anymore. We assume this is what happened in Lugang marriages where the women had no or only one child early in marriage, and the family adopted a son four or five years after the date of marriage or last birth. By that time the family presumably accepted the sterility of the couple and envisioned an alternative strategy. Therefore, a more realistic assessment of the average age at last birth can be calculated by only including those women who stopped after age 30. This information is presented in the right part of Table 6.6.

The Nijmegen values for age at last birth were similar to those found in surrounding countries. We have already cited the German ages. In Belgium too women stopped having children at age 40 or slightly older. Published data also show the change in ages at last birth in a population that actively controlled fertility. France is the well-known leader in the European fertility decline. Before 1750, mean age at last birth was still 40.4. The decline was already visible in the period 1740-1790, but became evident between 1780 and 1820 when women bore their last child at age 36.7.206 We find a slight decline in the age at last birth for Nijmegen women too. Still, given the example of France, this decline is so marginal that we cannot draw the conclusion that the women stopped childbearing earlier than nature compelled them to. Rather, the average ages presented point at ‘natural’ stopping well within the limits described by Wood. Thus, Nijmegen women started childbearing many years after biology allowed them to, but biology did dictate when they stopped having children.

The measurement of age at last birth in Lugang is complicated by the truncation of the data in 1945. For only 116 of the couples in the sample were we able to follow fertility until the end of the woman’s reproductive career, 91 of whom stopped childbearing after age 30. By implication these women were mostly part of the first marriage cohort and, therefore, we can not trace a development in

<table>
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<tr>
<th></th>
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</table>

time. The most surprising finding from Table 5.6 is that women in Lugang who had at least one child at age 30 or later stopped having children at exactly the same age their Nijmegen counterparts did.

What we find then is that when we look at the age at last birth of all women the possibility of birth control exists, but when we select only women who did not stop at a very young age, the difference between Nijmegen and Lugang evaporates. We must allow for both possibilities. A more definite answer to this question is only possible after we analyze the covariates of age at last birth in a multivariate regression. With this we can assess the possible logic of stopping.

**MacDonald’s Index**

This chapter started with the presentation of age specific marital fertility (\(asmf\)) in the two towns we study. This measure has many advantages for comparative research. The calculation of fertility in every five year age period (15-19, 20-24, ..., 45-49), for instance, takes into account the number of years lived in this period and the number of births occurring. As an estimate of the number of births in a completed family, however, the measure is defective. We already mentioned that the result is a theoretical estimate of fertility per couple. In reality not all women started bearing children at age 15, neither did they all stop at age 50 or did they experience in every age group the average fertility of the total population. Not even Lugang women all married at age 15, and the differences in age at marriage between Nijmegen and Lugang couples have been well demonstrated. \(asmf\), therefore, can not provide us with the average final parity of a completed family.

For this purpose, P. McDonald developed a better instrument. His equation takes into account at what age reproduction started, what average of the birth intervals were, and at what age women stopped bearing children.\(^{207}\) He thus includes the three classical determinants of fertility: starting, spacing and stopping. Starting is a straightforward variable that does not create discussion. When we deal with marital fertility, the period at risk of conceiving simply begins with the wedding ceremony. The only possibly confounding factor is the relative number of bridal pregnancies. Spacing and stopping on the other hand has been the subject of serious discussion in the literature on fertility decline. First of all, authors tend to emphasize either stopping or spacing as the major determinant of the decline.\(^{208}\) Stopping behavior implies the negation of natural fertility since stopping logically is the result of the existence of a desired family size and is acti-


vated after reaching a given parity. There are good reasons to think that this behavior is not to be expected in traditional societies. For the detection of the start of the fertility decline it is, however, a frequently used measure. Spacing, on the other hand, is parity independent, but presupposes historical actors continuously able to make decisions about a next birth given the contemporary circumstances.\(^{209}\) We agree with authors claiming that stopping behavior only tells half the story, for it does not capture the possibility that couples also could limit their offspring by non-parity related behavior. Even if they did not aim at a specific number of children, there may have been reasons why they wanted to space births in such a way that the biological wellbeing of mother and child, or the economic position of the household was best served.\(^{210}\) Intentional spacing behavior, therefore, is just as important for fertility and fertility differences as intentional stopping behavior.

The second problem with spacing and stopping is the possible interrelationship. Since spacing aims at increasing the length of birth-intervals, it will also prolong the interval between the last birth and permanent sterility. In this way spacing behavior brings the age at last birth down to a lower age. Consequently, when we find a lower age at last birth we cannot simply attribute this to stopping. Barbara Okun used simulation methods to assess the relative sensitivity of mean age at last birth to stopping and spacing. Her conclusion was that McDonald’s index provides an excellent method to distinguish between the effects of spacing and stopping.\(^{211}\) As a result we use this index for our Lugang and Nijmegen populations too.

The original McDonald’s equation controls for the proportion of non-sterile women in the population. Here, we use a slightly simplified version of this measure since we only include marriages that witnessed at least one birth. The number of children ever born \((\text{ceb})\) is calculated in that case by the equation \(\text{ceb} = 1 + \left(\frac{l-m-f}{i}\right)\), where \(l\) is the mean age at last birth of the wife, \(m\) is the mean age at marriage of woman who at least had one birth, \(f\) is the average length of the interval between marriage and first birth, and \(i\) is the mean length of inter birth intervals. Please note that we have two values for the variable age at last birth: one for all marriages, the other only for those who stopped childbearing after age 30.

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211. Okun, ‘Distinguishing stopping behavior’.
Let us first present the CEB of our two populations. We immediately see the difference with the ‘theoretical’ values for TMFR as presented in Table 6.1. Married women in Nijmegen would have had 12.5 births if they married at 15 and remained married until 50, and meanwhile had the average fertility. The same result for Lugang women would have been 9.0. When we control for differential starting, spacing and stopping, the number of births decreases to much lower levels. The higher number of births in Lugang was expected given the Malthusian assumption that age at marriage was a major determinant of final fertility. Still, the actual differences between CEB in Nijmegen and Lugang (6.8 and 5.9, respectively) are relatively small. In the case of all women, a married life that lasted for 7 more years only yielded 0.9 more births. When we select only women who stopped after age 30, the difference was more pronounced, 1.8 more births in 8.6 more years.

McDonald’s calculation also allows us to assess the relative importance of starting (m and f), spacing (i) and stopping (l). We use the data for women who stopped having children after their 30th birthday, since, in our view, they represent the situation best. We start by taking the Nijmegen fertility as the baseline. This implies that all Lugang parameters are equal to the Nijmegen parameters, and, thus, that CEB is 6.5. We then introduce Lugang women and step by step replace the Nijmegen parameter by the Lugang parameter, starting with the indicators for starting, followed by spacing and stopping. Graph 5.6 is the result. In order to control for the possible differences in form of marriage the graph originally contained information on all marriages in Lugang and on major marriages only. Although some minor differences between forms of marriage was visible,

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Note that the interval between marriage and first birth now is smaller than presented earlier, since in this calculation the marriages with a pregnant bride are included.
this appeared to be of no importance for the comparison with Nijmegen. Therefore, we can restrict our description of the differences to all marriages, both in Nijmegen and Lugang.

How to read Graph 6.6? First of all, we replaced the Nijmegen parameter for age at marriage with the Lugang value, while keeping the other parameters at the Nijmegen value. As a result we are able to calculate what Lugang fertility would have been when the difference with Nijmegen women would have consisted only of differences in age at marriage. From Graph 6.6 we learn that final parity of Lugang marriages in this case would have been 10.4. Next, we also introduce the Lugang interval between marriage and first birth. Since this interval in Lugang was bigger than in Nijmegen, the $c_{eb}$ declines to exactly 10. Average intervals were also larger in Lugang, so when we replace the Nijmegen mean interval by the Lugang mean interval, final parity declines to 8.3. Since Lugang women stopped having children at exactly the same age as Dutch women, this final parameter does not change the Lugang $c_{eb}$, which then is 1.8 births more than in Nijmegen.

This McDonald’s stepwise de-standardization of marital fertility provides us with important insights. We already expected final parity in Lugang to be much lower than theoretically possible. The actual values are nonetheless surprising, bringing theoretical fertility down by 2.1 births. Clearly, the average birth interval is the most important contributor to this decline, whereas the interval between marriage and first birth is of minor importance, as is the case with age at last birth. All these calculations show what mechanisms determined that fertility in Lugang was higher than in Nijmegen. They do not, however, explain what caused, for example, average birth intervals to be that much higher in Lugang. Looking for these causes will be the purpose of the next section.
**Multivariate Analysis**

The start of the fertility career of Nijmegen and Lugang couples was first of all determined by age at marriage. This is dealt with in the chapter on nuptiality. Our multivariate analysis of differences and similarities in Lugang and Nijmegen fertility therefore focuses on spacing and stopping. Can we explain why the average birth interval in Lugang was more than four months longer? And is it possible to understand stopping behavior when we use the appropriate covariates? The answer to these questions is essential for our understanding of the nature of reproductive behavior in the two towns, and thus at the two extremes of the Eurasian continent. As already mentioned, the debate on this topic has two opposite sides. In the neo-Malthusian view low fertility in China was caused mainly by physiological factors. Nutritional status of women and health conditions are considered to be decisive influences. Prevailing differential customs with regard to breastfeeding may have influenced the length of intervals also. Breastfeeding, of course, is an intermediate factor between physiological and behavioral causes. If indeed Chinese women’s nutritional status was below that customary in 19th century Europe, this in itself would lengthen the post partum infecundability. It simply took depleted women longer to recover from the physiological consequences of lactating. The revisionists, who refute the neo-Malthusian explanation, rather focus on behavioral determinants of relatively low fertility in China. They argue that a combination of conscious and unconscious behavior patterns guided fertility to levels definitely lower than biologically possible, and labeled this ‘proactive’ behavior.\(^{213}\) In our models we tried to include variables identifying the impact of both behavioral and physiological variables on fertility.

Spacing is analyzed with a multivariate Cox regression. The first variable in the model we designed is **period**. We want to assess whether the populations we study witnessed a historical change simply by dividing the marriages into two periods. For Nijmegen the dividing point is marriages before and after 1850, in Lugang this was 1925. The model contains two variables that are of a purely physiological nature. First, we introduced a measure for fecundability by looking at the marriages that produced a child within 11 months after the date of marriage. Obviously, high fecundability should show throughout the marriage. The variable **fecundity** has a value 1 when the couple indeed had a birth very shortly after marriage and a value 0 if this was not the case. Without any doubt the biological fecundity of women diminishes with age. The convex shape of the asmf graph of natural fertility populations shows the pace of this decline. To take this into account we use **agemotheratbirth**. This variable measures the age of a mother at the date when the interval is closed. Biology situates highest fecun-

\(^{213}\) We refer to the discussion between Arthur Wolf and Ansley Coale in the 1980’s, and between Arthur Wolf and James Lee et al. more recently. See Chapter 1, footnotes 34-46.
dity in the ages between 20 and 29. For that reason, this is our reference group. Before age 20, adolescent subfecundity may interfere, after age 30 the first signs of decreasing fecundity appear. Since this process gains weight after age 40, we used age groups 30-39 and 40-49.

Distinguishing between physiological and behavioral variables is not always easy. Age of the father, for instance, may interfere with the length of the birth interval. In most cases, however, the age of the father is highly correlated with the age of the mother. Also, for men fecundability as such does not necessarily decline before a very advanced age. We do expect, on the other hand, that frequency of intercourse is influenced by the age of the husband. The variable oldfather attributes value 1 to all intervals at the closing of which the father was over 50. Age at marriage clearly may influence behavior also. The younger a couple starts having children, the sooner will they feel the need to space births, if a custom of spacing exists. The variable ageatmarriage (of the wife) measures the possible influence by comparing very young marriages (< 20), and relatively old marriages (between 30 and 40, and over 40) to the reference group of marriages contracted between age 20 and 30. lastinterval informs us of the influence of this variable. Every study on the topic found that last intervals tend to be longer than average intervals, mainly as a consequence of diminishing fecundity of the couple.

The last set of variables assesses the impact of behavioral influences. First, we want to know whether son preference is visible in our data. As mentioned before, Chinese couples are expected to aim for as many sons as possible in order to perpetuate the patriline. Two variables measure the possible influence of this preference by the length of birth intervals. sexpreviouschild simply distinguishes between intervals where the previous child was a boy or a girl. If spacing was indeed one of the options of couples, then son preference would result in shorter intervals after the birth of a girl. Obviously, parents may have taken into account the total number of sons rather than the sex of the lastborn. Therefore we introduced sonsalready by dividing the intervals in a group where the ratio of boys to girls was in favor of male offspring, and a group where this was not the case.

The effects of infant mortality have been dealt with extensively earlier in this chapter. We remember that the death of an infant could have a direct biological influence on the length of the next birth interval by diminishing the period of postpartum subfecundity as a result of shorter lactation. Also, the death of an infant could induce a quick replacement birth, simply because the parents aimed at a fixed or maximum number of children. previousinfantdied measures this influence. Unfortunately, the data at hand, especially in Lugang, do not allow us to study the impact of social position on birth intervals in detail. Therefore, occupation uses a crude division of the couples in higher and lower social class. Proletarians, laborers and those employed in agriculture form our ‘lower’ class. All occupations above this level are considered ‘higher’ class.
The most conspicuous characteristic of Taiwanese marriages was the existence of three forms as marriage, as described in the nuptiality chapter. Since this distinction is not present in Nijmegen marriages, the effect of this variable is only calculated for Lugang. The reference category of the variable formofmarriage is major marriages. The other possibilities are ‘minor’ and ‘uxorilocal’.

When birth-control is accepted in a society, we expect parents to feel the necessity of spacing more when the number of children they already have increased. To test the viability of this assumption we used paritygroup. This variable comes with a problem though, since high parity logically was most common among older women with declining fecundability. Also, we want to be able to observe a change in behavioral patterns during the reproductive career. There is no reason to expect parents to have the same attitude towards a new birth irrespective of whether they already had 0, 3 or 6 children. In order to trace both constants and variables in the determinants of Nijmegen and Lugang fertility we did our regressions by parity. Obviously, the total number of observations becomes small by parity 8. Therefore, we limited the calculations to parity 2 to 7 only. Table 6.8 contains the outcome for the significant effects.

The results first of all emphasize the dominant influence of physiological factors. Both in Nijmegen and Lugang the length of intervals between births increased with the age of the woman. The only reason why this influence was not significant for Lugang women over age 40 is the fact that so few of them gave birth at that age. So, the natural decline of fecundity is visible in our results. Towards the end of the reproductive time span, declining fecundity became dominant. Therefore, the last interval was significantly lower, a finding that is in line with all studies on the topic. It comes as no surprise that the death of the infant opening the interval significantly shortened this interval. The descriptive evidence presented already pointed in the same direction. Age at marriage clearly influenced fertility. When women married at a relatively young age the length of birth-intervals was longer when compared to the reference group marrying between 20 and 29. Marrying between 30 and 39 resulted in shorter intervals. In the exceptional cases that women married after age 40 this was the case for the first births too. So, in both societies late marriage encouraged the speeding up of reproduction. It is impossible to decide whether this is the result of deliberate behavior or the effect of declining frequency of intercourse with the duration of marriage. We think it is important to also point at the variables that prove to be not significant. Neither in Nijmegen nor in Lugang did our measure of fecundity influence birth-intervals. Women who bore a child within 11 months after marriage were not more fecund throughout their reproductive career.

We now turn to the results that distinguish the reproductive pattern of the two towns. If son preference was living reality in Nijmegen this does not show
Table 6.8: Cox regression on the covariates of birth intervals in Lugang and Nijmegen. Variables with a significant effect only

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+ means higher hazard to have next birth
B: Nijmegen

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+ means higher hazard to have next birth
in our regression analysis. This variable is expected to be of more importance in a Chinese population. Lugang couples indeed showed signs of son preference, albeit that the effects are not as pervasive as predicted. By all accounts we know that when the firstborn was a son, this was of great importance in Chinese society. The treatment of this child was taken very seriously, more so than when the firstborn was a daughter. Especially the weaning for girls was earlier. For that reason we find that the interval between the first and second birth was significantly longer when the first birth was male. There is no sign of preferential treatment for sons born later in marriage. When we take the influence of the variable boysalready into account the only significant influence shows for the third birth. So, when parents had two sons already, the interval for the next child was longer. It seems, then, that Chinese parents wanted at least two sons. After reaching that number we find no evidence that parents actively pursued more sons. Intervals by form of marriage in Lugang emphasize the impact of lack of sexual attraction of the partners in minor marriages. Especially the first three children were born after longer intervals when compared to major marriages. After the third child this influence had no statistically significant effect anymore.

Some variables appear to be only of significant influence in Nijmegen. The difference in birth-intervals we already found between the first and the second half of the 19th century is of statistical significance. After 1850, births in Nijmegen were closer together than before 1850. Since the European fertility decline started by the end of the century, this finding informs us that the couples we study here had not reached that stage yet. Another piece of evidence supports this conclusion. The introduction of birth-control was always found first among the higher social classes. In Nijmegen, however, the lower social classes, laborers and proletarians, had longer birth-intervals. If anything, this would favor the idea that fecundity was higher among the wealthy inhabitants of the city. Finally, then, contrary to Lugang we also find an influence of the age of the father in Nijmegen. Even when we control for the age of the mother, fathers over age 50 significantly delayed the next conception.

When women cease bearing children many years before the onset of physiological infecundity, this implies that they deliberately limited their offspring. The measure most often used as evidence of birth control, therefore, is stopping behavior. Our information on Lugang and Nijmegen until this point revealed only that Nijmegen women on average had their last birth at 41.1 years, whereas Lugang women stopped more than 4 years earlier, at 36.8. According to the findings on fertility in natural fertility populations, stopping in the Dutch city must at first sight be attributed to biological decline of fecundability of the couple. This conclusion has to be modified only when the average age of stopping hides differences within the population that will only show in a multivariate analysis.
using the relevant covariates. In Lugang, on the other hand, the age at last birth was clearly below the level of ‘natural’ stopping, unless we only look at women stopping after age 30. Does this result tell us that Lugang women deliberately stopped having children before biology compelled them to do so? This may be the case. An alternative explanation is that menopause came earlier in Taiwan than in the Netherlands, and thus, at one remove, the last birth too. Again, before we can give a final answer we have studied whether differences in age at last birth existed within Lugang. Are the averages representatives for the total population or do we find subgroups with deviating behavior?

A logistic regression on the age at last birth will help us to find the answers. The model used is very similar to the one explaining differential length of interval, with the exclusion only of last birth interval. Period will again show whether stopping behavior changed over time and fecundity informs us of the possible influence of the relative biological level of fecundity of the couple. Rising agemotheratbirth logically will give a higher chance of stopping. The age of the father at last birth could effect stopping too, for maybe it is not the age of the mother that caused stopping, but the age of her spouse. Is stopping a result of the number of children already present in the household? If so, paritygroup would have a significant effect. ageatmarriage is a possible cause for stopping also. Women marrying at an older age would, in theory, feel the need to stop bearing children later than younger brides. If stopping was deliberate and we take son preference into account, sexoflastchild\textsuperscript{214} and sonsalready should have significant explanatory power. Again, if stopping is deliberate and linked to a target number of children, then previousinfantdied is relevant, for it would postpone stopping. We also include occupation to detect class differences, and formofmarriage to measure the impact of differences in the nature of the marriages studied here.

A first look at the result of the logistic regression shows that stopping behavior was less influenced by our independent variables than spacing was. The only variables with a significant influence have to do with the age of the couple. In Lugang, the chance of stopping increased exponentially for women between 30 and 39 (13 times as high as the previous age group) and do even more so after women passed their 40th birthday (58 times as high as the reference group). Stopping in Nijmegen was mediated through parity rather than through age, although the impact was less impressive. We cannot argue that higher parity logically came with higher age, since the variable measuring the age of the mother fails to show a significant correlation. The logistic regression on the Nijmegen data also offers two surprising findings. Women married

\textsuperscript{214} Note that the definition changed when compared to the spacing model. Now we use sex of the last born, whereas in the spacing model it is sex of the previous child.
### Table 6.9: Logistic regression on stopping in Lugang and Nijmegen

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*p<.05 ; **p<.01; ***p<.001

Lugang: N=733; model Chi-square=87.846; df=17.
Nijmegen: N=3520; model Chi-square=674.752; df=16.
between age 30 and 39 stopped significantly earlier than younger and older brides. We find it difficult to offer a logical explanation for this outcome. The second surprise is the effect of the ratio of boys to girls. Women stopped bearing children earlier if they had more sons, a finding that would have made more sense in Lugang. We do have to consider, however, that the relative prevalence of male births over female births appears statistically with the rise of parity. This relationship might have biased our results.

On average then, stopping appears to have been a function of age rather than of circumstances. We find no significant change in time. Fecundity of the couple was not visible in spacing behavior, and does not affect stopping either. When the last child was a boy, chances of stopping were not greater than when it was a girl. Neither did the death of the last infant induce parents to have yet another child. Furthermore, women stopped childbearing irrespective of the occupation of the head of the household and of the form of marriage. Still, the impact of parity on stopping in Nijmegen might be a first sign of birth control in this city. Whereas the fertility of Lugang women after age 30 was more and more dictated by age, according to the regression age did not interfere with stopping in Nijmegen. Rather, Nijmegen women stopped after reaching parity over 3, even more so after parity 6.

It is time now to combine the results for spacing and stopping behavior in order to assess whether or not fertility in our two towns was deliberately controlled. The evidence against birth control, in Nijmegen as well as in Lugang, is overwhelming. First of all, the ratio of fertility over age 30 against fertility over 20 was fixed at approximately 50 per cent, exactly the proportion expected in ‘natural fertility’ populations. In both cities we find a rise instead of a decline both of the TMFR and of the number of births per married couple. We attribute this to a rising fecundability since we also find a rising number of early pregnancies and a decline in the birth intervals. Also, the multivariate analysis of birth intervals and of stopping shows biological factors are the only significant explanatory variables. When women in Nijmegen and Lugang grew older, the length of the intervals also increased, and stopping too is a function of age rather than of circumstances.

To be sure, two pieces of information about Lugang at first sight favor the birth control thesis as postulated by James Lee et al. Late marriage resulted in a shortening of the birth intervals. Further, the average age at which women stopped childbearing in Lugang is well below the Nijmegen age. Both findings, however, also come with alternative explanations. Couples marrying relatively late had by definition a young marriage at higher ages. Since research on the topic showed that it is the age of a marriage rather than the biological age of the partners that determines frequency of intercourse, we have a plausible explanation for higher fertility among couples marrying late. Average age at stopping,
then, appears to have been different only when we include women stopping at a
very young age. If we limit this to women who had at least one child at age 30 or
higher, Nijmegen and Lugang women stopped at exactly the same age. So, unless
one wants to argue that part of the population of Lugang in the colonial period
already deliberately decided to stop childbearing before age 30, there is no evi-
dence for birth control in this variable either.
7

Conclusion and discussion
Even today we expect few inhabitants of the Dutch city of Nijmegen to be familiar with the existence of a town in Taiwan. The same observation, but the other way around, goes for the people living in contemporary Lugang. In the period we study here, the scope of our actors was even more limited. Why then is it that this book brings together the two populations? What can we gain by comparing the demography of Lugang and Nijmegen? The title of this book already suggests that our main focus was the simple fact that whatever the social, economic, and cultural differences between the two opposite ends of the Eurasian continent, the people living there only had one life at their disposal. In this life the demographic parameters were the gridlines within which the other components of the human existence had to find a place. Birth and death formed the logical markers of start and end, but marriage, reproduction and migration were so invasive that they too had a major impact on the life course. Oblivious of each other as they may have been, this is what inhabitants of Nijmegen and Lugang shared, the one march from birth to death.

Another shared experience was the constant threat of poverty or even starvation. The unequal power of the growth of population and resources was a phenomenon people had to take seriously long before Thomas Malthus described it in his famous *Essay*. According to some it is in the reaction to population pressure that we can distinguish the demographic regimes of the world. In Europe, Malthus wrote, more specifically in Western Europe, John Hajnal added, marriage restriction was used for centuries to regulate population within relatively safe limits. Late marriage for most, or even permanent celibacy for some, resulted in a fertility level that kept the population of Europe practically stable between the Middle Ages and the nineteenth century. This ‘preventive’ check on population was not used in China, the Malthusians say, and the result was a high pressure and extremely vulnerable demographic regime. Famine, epidemics and social unrest were the major characteristics of this ‘positive’ check on population. For the inhabitants of Lugang and Nijmegen this would imply that the shared experience (threat of overpopulation) evoked different reactions.

When analyzing the demographic behavior of the two towns we were looking for the way their inhabitants reacted to population pressure. Basically, we want to know whether fate, circumstances or choices dictated their lives. Did households in Lugang indeed force their young members to marry as soon as possible in order to foster fertility, and thus labor capacity? Was marriage restriction active in Nijmegen? The next step, of course, is to check whether or not the differences in nuptiality resulted in differential fertility. In both cases we also want to know what relationship nuptiality and fertility had with social, economic and cultural covariates. Do these possible relationships point at active, conscious and strategic interference with reproduction? Questions like this can only be answered by using detailed information on the level of individual actors. Both in
Taiwan and in the Netherlands sources are available that provide the information necessary. The Dutch population registers are very similar to the Taiwanese household registers as kept by the Japanese colonial government, and, thus, make possible a comparison of life courses in the two cities.

The theatre within which the lives were lived had to be as uniform as possible in order to fully understand the possible differences in behavioral alternatives. We selected Lugang (between 1895 and 1945) and Nijmegen (between 1840 and 1890), two provincial towns in a period of economic misfortune. Their size is about the same (approximately 30,000 inhabitants), as is age distribution of the population and the economic structure. Nijmegen and Lugang, then, are highly comparable cities. We assume that the results from the comparison are also representative of the two demographic systems the cities belong to. This is not to say that Nijmegen as such was representative for Western Europe, nor was Lugang for China. Still, the differences between the two systems were enormous when compared to the differences within the systems. In this way, we will treat the demographic behavior in Nijmegen as representative of the demography of the western part of Europe, and the demography of Lugang as characteristic of Chinese society.

Our understanding of European historical demography underwent a major change in the second half of the twentieth century. For decades scholars were convinced that the driving factor behind demographic change in pre-industrial Europe was mortality. This position was strange in light of the Malthusian axioms, because it stressed the existence of positive checks. From the 1950’s on, alternative views gradually became stronger. As a result, in 1981, E. A. Wrigley could write that John Hajnal’s 1965 article on the western European marriage pattern was “the single most important publication tending to create a new logical status for population history. (…) placing marriage once again in the center of the stage.” Since then, scholarly attention has been directed at deepening the understanding of the impact of nuptiality rather than at finding alternative determinants of demographic history.

In China, on the other hand, our comparison of a Dutch and a Chinese town automatically becomes part of an ongoing discussion on the essence of Chinese demography. What happened is this. The division by Thomas Malthus of the world in a ‘preventive’ and a ‘positive’ part was not challenged for more than a century. The same goes for his concomitant ideas on China as a “reckless” nation with young and universal marriage, and therefore high fertility, overpopulation, and high mortality. The first empirical data became available only via the Chinese Farm Survey in the 1930’s, and a thorough scholarly analysis of these
results had to wait another thirty years. The data resulted in a revolutionary new view of Chinese fertility. Ever since Malthus, extremely high fertility was considered received wisdom. Discussion on the exact values continues, but all authors agree on the fact that, in reality, fertility in China instead of being far above European level, was only about 75 per cent of this level.

The agreement on the relatively low level of Chinese fertility immediately raised another question. Given the young ages at marriage and universal marriage in China one would have expected a number of births above the European number. Therefore, the new question was: What caused this low level of fertility? The most important contributors to the debate were Arthur Wolf and Ansley Coale in the 1980's, and Arthur Wolf and James Lee more recently. Crucial in this new debate was the possible link between fertility and food. Wolf time and again claimed that poor health and undernourishment had a direct negative effect on fertility, whereas Coale attributed low fertility to 'customs and traditions' often encountered among populations practicing young and universal marriage. For James Lee and his collaborators nutrition was negligible as explanation for low Chinese fertility. Even if the biological association existed, they claimed, one would have to prove that poverty in China was such that this would have this consequence. This, in their view, was not the case. Lee et al. presented a revolutionary new theory of Chinese demography in which they highlighted the conscious and active (later on they called this 'proactive') behavior of Chinese with regard to reproduction.

The new theory renounced the Malthusian view completely. Instead of being passive victims of unrestricted nuptiality and thus unrestricted fertility, Chinese couples were in control of their demographic behavior. Through infanticide, an unbalanced marriage market, low marital fertility, and adoption they regulated population growth. A closer look at this provocative new theory on Chinese reproduction showed both interesting contributions to our knowledge, and theoretical weak spots. On top of that we found that the literature on food and fertility did not renounce a link between nutrition and fertility as categorically as did Lee. And more recent studies on the standard of living in China in the first half of the 20th century have not come up with a straightforward proof of nation-wide economic growth.

Thus, the comparison of Nijmegen and Lugang also has to deal with this debate. Was fertility in Lugang the result of 'proactive' behavior, was it caused by customs and traditions, or was it simply the consequence of malnutrition? By presenting the situation in both a European and in a Chinese city we can see what differences, if any, existed between a population living up to marriage restriction and a population with young and universal marriage.

Our analysis of nuptiality in Nijmegen and Lugang shows that the traditional Malthusian characteristics indeed apply. Marriage in the Netherlands was clearly
restricted when compared to our Chinese population. This is made clear both in the age at marriage and the proportion ever-married. Still, young and universal marriage in Lugang appears to be the privilege of women only. Whereas in Nijmegen between 10 and 20 per cent of the women never married, in Lugang invariably all women were married in their thirties. Chinese men, on the other hand, encountered more problems in entering marriage. By the end of the periods compared, almost as many Lugang men were never married as in Nijmegen. Interestingly, the sex differences in Lugang were more distinct than in Nijmegen. This also shows in the ages at marriage. The gap between Nijmegen men (28.6) and women (27.4) was small when compared to Lugang where men on average married at 23 and women at 18.6.

A comparison of the findings in our two towns with other cities, regions, or countries in their respective parts of the world showed that both Nijmegen and Lugang can be treated as representative. If we look at the differential nuptiality of subpopulations within the two towns, variation emerges. The socio-economic position of the Nijmegen men was a powerful predictor of age at marriage. Lower class men married definitely younger than their more prosperous fellow citizens. In Lugang, this difference is hardly noticeable. Here, it is form of marriage that influenced age at marriage most, with groom and bride of minor marriages as the youngest, and couples contracting an uxorilocal marriage as the oldest. Although we expected to find an influence of religion in Nijmegen, our data did not corroborate that. The seasonal distribution of marriages demonstrated that both societies lived up to the traditions of their ancestors. In Lent and Advent hardly any marriages were registered in Nijmegen, and in Lugang no parents wanted a child's marriage to begin in the Ghost Month.

Since we see marriage restriction as a mechanism basically designed to control population growth, we included information on illegitimacy and bridal pregnancy in our nuptiality analysis. All things being equal, the assumption must be that both phenomena should be of greater importance in Nijmegen, simply because there were more unmarried women at risk of becoming pregnant. Still, the level of illegitimacy was approximately the same, with the Nijmegen average only slightly higher. Also, the change in both cities was definitely downwards. The expected difference does show in bridal pregnancy though. In Nijmegen more than one fifth of all brides were pregnant, in Lugang only just over 8 per cent. The only exception we find is among minor marriages. Heads of household were very keen in establishing whether or not a marriage would produce offspring. Since minor marriages could start without interference or knowledge of others, the official announcement of a marriage was often postponed until the bride was pregnant. More than a quarter of the minor marriages therefore started with a pregnancy. The different function of bridal pregnancy also appears in the ages. In Nijmegen pregnant brides and their grooms
were clearly younger than couples marrying in the regular fashion. In Lugang, except in minor marriages, rather the opposite was true, as if older brides were tested first before being accepted by their family-in-law.

There are at least two reasons to study infant mortality in the context of a study geared at understanding reproductive processes. Probability of death for the most vulnerable inhabitants of Nijmegen and Lugang will show the strength of positive checks. According to the Malthusian view one would expect mortality to be higher in Lugang than in Nijmegen. Since one of the two cities is of Chinese origin we also want to know whether infanticide was part of the demographic apparatus. James Lee and his collaborators argued that this was one of the ‘proactive’ possibilities of parents. Perhaps even more important is the possible effect of infant mortality on fertility. The death of an infant terminates lactation and thus female post-partum subfecundity. We know that this factor may have a big impact on fertility because it can reduce birth intervals up to one-third.

Our first finding was that when we measure positive checks through infant mortality, the difference between Nijmegen and Lugang was not that great with an 85 per cent survival chance for Nijmegen babies against 83 per cent in Lugang. During the period covered here infant mortality in Nijmegen increased from 129 to 167 – an increase found in many European countries – whereas the medical policy of the Japanese colonial government in Taiwan resulted in a declining infant mortality, from 206 to 144. This shows that the difference between our Chinese and European populations was neither as structural nor as marked as one would expect from the Malthusian model.

We do find a marked difference between Nijmegen and Lugang when we compare the levels of neonatal and post-neonatal mortality. Neonatal mortality in the Dutch town was stable or slightly declining – again, as was the case in most European countries – while neonatal mortality in Lugang was double the Nijmegen level. The sharp increase in Nijmegen infant mortality was therefore completely driven by post-neonatal mortality. We deduce from these findings that delivery and taking care of newly born babies in the Netherlands was arranged better than in Taiwan. The increase in post-neonatal mortality on the other hand proves that the economic conditions in Nijmegen deteriorated in the 19th century. In the Taiwanese colonial period, the opposite was true.

With regard to the seasonality of infant mortality the pattern in Taiwan and the Netherlands looks very much alike although the reasons behind the similarity vary. Summer is a dangerous part of the year for infants, both in Nijmegen and Lugang. In the Netherlands, as in all other European countries, this is caused by the contamination of artificial baby food in the hot summer months. Since Taiwanese women breastfed their children much longer, at least as long as we measure infant mortality i.e. until the first birthday, the summer peak in infant
mortality in Lugang must have another reason. The best explanation is that the hot and humid Taiwanese summers favored contagious diseases.

The most surprising result from our multivariate analysis is the predominance of biological factors when explaining infant mortality. Although social class in a descriptive presentation seems to influence the level of infant mortality, this association disappears when we control for other variables. The only class effect that remains is found among neonatal mortality in Nijmegen. Obviously, the richer the parents, the better medical care they could hire for the delivery and the immediate aftermath. For the remainder we only find that in both cities chances of dying for infants are influenced by being a twin and by small birth intervals. Interestingly, the sex differences in infant mortality do not follow the path shown by Malthus or Lee. Male babies died more often than female babies, and we therefore have no evidence of female infanticide.

We first calculated the fertility of married couples in Lugang and Nijmegen via the theoretical measure of the total marital fertility rate and found Nijmegen women to have 12.5 hypothetical children between 15 and 49 years, and women in Lugang 9.0. TMFR does not take into account that age at marriage varied in the two populations. Closer to reality, therefore, is the index developed by McDonald. This index results for women who reproduced at least until age 30, in 6.5 births in Nijmegen, and 8.3 births in Lugang. Although now the expected higher fertility in China emerges, the Taiwanese couples clearly did not fully utilize the 8.6 years extra married life they had. This implies that contrary to Malthus’ view fertility was not only determined by the number of fecund years in marriage.

The data also provided strong evidence for an increase of actual fertility and of fecundity during the period studied here. Again, this is not the expected outcome for populations using birth control. With regard to fecundity, we concluded that fecundity in Nijmegen was higher than in Lugang, even up to double the level. This is the most powerful explanation for the relatively high marital fertility in Nijmegen. Although women in the Netherlands started reproducing later, they used their time more efficiently with birth intervals that were 5 months smaller than in Lugang. Age at last birth is a measure often used to prove the existence of deliberate birth control. Our analysis showed that the lower average age at last birth in Lugang is confounded by the large number of women who had already stopped child bearing before reaching the age of 30. Given the nature of Chinese family life and the importance of offspring it is hard to believe that such a ‘modern’ behavior existed in colonial Lugang. When we include only women who stopped having children after age 30, both in the Netherlands and Taiwan, the result is that in both populations women stopped reproducing at exactly the same age, namely 40.4 years. The last argument against wide-spread birth control in Lugang and Nijmegen is that a multivariate analysis clearly showed that
both spacing and stopping were associated with age rather than with social and cultural characteristics of the couples.

It is generally accepted that Chinese marital fertility was only about 75% of the level in Western Europe. If it is not birth control that determined relatively low marital fertility in China, what factor did? As already mentioned, Arthur Wolf invoked impoverishment and malnutrition as possible causes. The link between malnutrition and fecundity is established in many sources, and low fertility on the Chinese continent presumably is occasioned by severe poverty. For colonial Taiwan in general and Lugang in particular we mentioned another plausible explanation. In our view, Chinese parents were not aware of the fact that the way they arranged marriages created a result opposite to what they envisioned. The newly wed couples must have felt awkward finding a stranger in their bed, or maybe even worse, someone with whom they grew up. In many cases the selection of a partner by the parents must have resulted in lifelong misery. Whatever the other consequences, our Lugang couples, at least initially, were expected to begin reproductive intercourse without a period of cultural foreplay. They thus could not live up to the fertility level of the couples in Nijmegen that at least started marriage as loving partners.

Let us return to Thomas Malthus once more. Yes, Nijmegen belonged to the “states of modern Europe” in which restricted access to marriage was a living reality and genuinely regulated fertility. Although we can only confirm that women in Lugang all married at a young age, this did not automatically result in higher fertility. Malthus simply did not see the complexity of the mechanism. In Lugang, the nature of matchmaking and marriage resulted in the same restriction of fertility. Emmanuel Le Roy Ladurie ended his famous study on the peasants of the Languedoc with the remark that in 1798 already Malthus “was a prophet of the past; he was born too late in a world too new”. His theory does not do justice to the Nijmegen situation where rising infant mortality is evidence of positive checks next to the preventive checks, nor is the Taiwanese colonial period adequately described by simply assuming that positive checks were in total control. Certain customs and conditions, as Ansley Coale called them, saw to it that fertility did not reach the level Malthus expected it to do. Lugang too was beyond the simple dichotomization between positive and preventive checks. Some authors concluded from observations like this that we should qualify the models of the British vicar as “Malthusian mythology”. As a replacement they suggested a system just as rigid, and again juxtaposing China and Europe as different worlds. That historical reality is much more complicated than this is one of the lessons we can learn from the way the inhabitants of our two towns lived their one life.

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