EFFECTS OF GENDER RATIO ON SAVING RATE, HOUSE PRICE AND CRIME RATE IN CHINA

By

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November 2021

Chairman : Associate Professor Wan Azman Saini Wan Ngah, PhD
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The gender ratio is defined as the relative number of males to 100 females. Usually, the gender ratio will be balanced in a region or country. However, the gender ratio is exceptionally imbalanced in China. The National Health and Family Planning Commission of China claims that in 2030, 30 million males will not get married in China, which is a prominent issue affecting many economic and social aspects of society.

Moreover, geographically closer regions tend to have similar economic behaviour. This study challenges traditional econometrics by analysing economic behaviour related to gender imbalance. This thesis has examined whether; the saving rate, housing prices and the crime rate in China had a spatial effect and tested the effects of the gender ratio on; the saving rate, housing prices and the crime rate.

The first objective was to test the impact of gender imbalance on the saving rate. This study found that China's household saving rate had a positive spatial autocorrelation. Using data from 30 provinces over the period 2000-2017 and accounting for the spatial effect, this study did not find any significant relationship between the gender ratio and saving rate. This result was because male children have higher income potential, allowing their parents to save less, offsetting the competitive saving hypothesis that males need to save more to increase their relative standing in the highly competitive marriage market with a skewed gender ratio. Moreover, the saving rate may not be a good proxy for men's relative standing in the marriage market. Females might focus more on items that convey higher socioeconomic status, such as; expensive houses and luxury cars.

For the second objective, this study extended the existing research on the link between housing prices and the gender ratio. The result demonstrated that a positive spatial autocorrelation characterised housing prices in China. The result revealed a direct positive relationship between housing prices and the gender ratio using data from 30 provinces over the 2000-2017 period. This finding supported the competitive housing hypothesis, which predicts that a higher gender ratio will cause higher house prices if housing is viewed as a tool for improving one's status. Furthermore, the result showed that the adjacent province's gender ratios positively affected housing prices in the local province. This outcome may have been because some males migrate from adjacent provinces to the local province for marriage if they have a high gender ratio. However, they also need to buy a house to improve their status, as it is an essential pre-condition for marriage. This situation is likely to increase the demand for houses and lead to higher prices in the local province.

The third objective has extended the literature on the link between the gender ratio and the crime rate. Similarly to the saving rate and house prices, the crime rate in China displayed a positive spatial autocorrelation. This study found a positive relationship between the crime rate and gender ratio using data from 30 provinces between 2000-2017 and controlling for spatial effects,. The results supported that the high gender ratio caused; maleness effect, incentive effect, and the civilizing effect resulting in more crimes. Furthermore, the result also revealed that the gender ratio in adjacent provinces positively affected the crime rate in the local province as the distance was negatively related to the migrant transfer intention. People in an adjacent province with a higher gender ratio were more likely to migrate to the local province. The crime rate would increase with more men based on the maleness effect. The men from a province with a higher gender ratio were more likely to have the civilising effect. This outcome may have explained the high crime rate in the local province.

This study's findings have shed new light for policymakers to devise specific policies related to gender imbalances that will improve the quality of life for citizens.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

KESAN NISBAH JANTINA TERHADAP KADAR SIMPANAN, HARGA RUMAH DAN KADAR JENAYAH DI CHINA

Oleh

HAN XIN PING

November 2021

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Nisbah jantina ialah bilangan relatif lelaki berbanding 100 wanita. Kebiasaannya, nisbah jantina harus seimbang di sesebuah wilayah atau negara. Walau bagaimanapun, nisbah jantina sangat tidak seimbang di China. Suruhanjaya Perancangan Kesihatan dan Keluarga Nasional China mendakwa 30 juta lelaki tidak akan berkahwin pada tahun 2030 di China. Ianya menjadi isu penting dan mempengaruhi banyak aspek ekonomi dan sosial. Lebih-lebih lagi, kawasan yang berdekatan cenderung mempunyai tingkah laku ekonomi yang serupa. Pemerhatian ini membangkitkan cabaran kepada kaedah ekonometrik tradisional dalam menganalisis tingkah laku ekonomi yang berkaitan dengan ketidakseimbangan jantina. Tesis ini bertujuan untuk mengkaji sama ada kadar simpanan, harga perumahan dan kadar jenayah di China mempunyai kesan spasial atau tidak dan menguji kesan nisbah jantina terhadap kadar simpanan, harga perumahan dan kadar jenayah.

Objektif pertama adalah untuk menguji kesan ketidakseimbangan jantina terhadap kadar simpanan. Kajian ini mendapati bahawa kadar simpanan rumah tangga mempunyai autokorelasi spasial positif di China. Dengan menggunakan data wilayah dari 30 wilayah selama tempoh 2000-2017 dan mengambilkira kesan spatial, kajian ini tidak menemui hubungan yang signifikan antara nisbah jantina dan kadar simpanan. Ini kerana anak lelaki mempunyai potensi pendapatan yang lebih tinggi dan dengan itu membolehkan ibu bapa menabung sedikit. Ianya berlawanan hipotesis penjimatan kompetitif yang menyatakan bahawa lelaki perlu menyimpan lebih banyak untuk meningkatkan kedudukan relatif mereka di pasaran perkahwinan yang sangat kompetitif dengan nisbah jantina yang tidak seimbang. Tambahan pula, kadar simpanan mungkin bukan proksi yang baik untuk kedudukan relatif dalam pasaran perkahwinan. Wanita mungkin juga lebih fokus kepada sesuatu

yang memberikan status sosioekonomi yang lebih tinggi seperti rumah besar dan kereta mewah.

Untuk objektif kedua, kajian ini memperluas penyelidikan mengenai hubungan antara nisbah jantina dan harga perumahan. Hasilnya menunjukkan bahawa harga rumah di China mempunyai ciri autokorelasi spasial positif. Dengan menggunakan data dari 30 wilayah selama tempoh 2000-2017, hasilnya menunjukkan hubungan positif langsung antara harga rumah dan nisbah jantina. Penemuan ini menyokong hipotesis perumahan yang kompetitif yang meramalkan bahawa nisbah jantina yang lebih tinggi akan menyebabkan harga rumah yang lebih tinggi jika rumah itu dilihat sebagai alat untuk meningkatkan status seseorang. Selanjutnya, hasil menunjukkan bahawa nisbah jantina di wilayah yang berdekatan akan mempengaruhi harga rumah di wilayah tersebut secara positif. Ini mungkin disebabkan sebilangan lelaki berpindah dari wilayah yang berdekatan ke wilayah tempatan untuk tujuan perkahwinan jika mereka mempunyai nisbah jantina yang tinggi. Namun, mereka juga perlu membeli rumah untuk meningkatkan status mereka, kerana rumah itu merupakan syarat penting untuk berkahwin. Keadaan ini cenderung meningkatkan permintaan rumah dan menyebabkan harga lebih tinggi di wilayah tempatan.

Objektif ketiga memperluas literatur mengenai hubungan antara nisbah jantina dan kadar jenayah. Sama seperti kadar tabungan dan harga rumah, kadar jenayah di China juga menunjukkan adanya hubungan korelasi spasial yang positif. Setelah mengambilkira kesan spatial, kajian ini mendapati hubungan positif antara kadar jenayah dan nisbah jantina. Ia menyokong bahawa nisbah jantina yang tinggi akan mempunyai kesan kejantanan, kesan insentif, dan kesan perabadan yang mengakibatkan peningkatan jenayah. Selanjutnya, hasil juga menunjukkan bahawa nisbah jantina di wilayah yang berdekatan akan mempengaruhi kadar jenayah di wilayah setempat secara positif kerana jaraknya berkait negatif dengan niat pemindahan pendatang. Penduduk di wilayah bersebelahan dengan nisbah jantina lebih tinggi cenderung berpindah ke wilayah tempatan. Berdasarkan kesan kejantanan, dengan kadar lelaki lebih banyak jenayah akan meningkat. Lelaki dari wilayah dengan nisbah jantina yang lebih tinggi juga cenderung mempunyai kesan peradaban. Ini dapat menjelaskan kadar jenayah yang tinggi di wilayah tempatan.

Diharapkan penemuan ini akan memberi sinar baru bagi para pembuat dasar dalam merangka polisi khusus yang berkaitan dengan ketidakseimbangan jantina yang akan meningkatkan kualiti hidup warga negara.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:

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FDI	Foreign direct investment
GDP	Gross domestic product
LM	Lagrange Multiplier
LR	Likelihood ratio
ML	Maximum likelihood
OLS	Ordinary least squares
OECD	Organization for Economic Co-operation and Development
OLG	Overlapping generations
SRB	Sex ratio at birth
SDM	Spatial Durbin model
SEM	Spatial error model
SLM	Spatial lag model
SOE	State-owned enterprise
USSR	Union of Soviet Socialist Republics
US	United States
VIF	Variance inflating factor
WTO	World Trade Organization

CHAPTER 1

INTRODUCTION

1.1 Background

1.1.1 Gender ratio in China

The gender ratio (i.e. relative numbers of males to 100 females) fluctuates in different countries and regions. According to Fisher's principle, most animal species produce approximately equal males and females. Similarly, the gender ratio of humans is also approximately 100:100 (Fisher, 1958). If there were more males, they would obtain less than one partner on average. Therefore, the the fitness of females will be better, favouring couples that have produced more female offspring.

On the other hand, if there were more females, males might obtain more than one mate on average. In this situation, the fitness of males would be better, favouring couples that have produced more male offspring. Therefore, the fitness of males and females is only equal when equal numbers of the genders are produced (West, 2013).

Even though the gender ratio in humans is approximately equal, the sex ratio at birth (SRB) in humans is not precisely 100:100. The normal worldwide human biological interval is between 102 to 107 males for every 100 females (UN, 1955). Pongou (2013) explained that this situation was driven by the higher infant mortality for males than females. Nature provides more newborn males than females due to human's genetic and biological makeup; Figure 1.1 presents the SRB for a selected group of countries. It indicates two countries where the SRB has been relatively high: China and India.

Meanwhile, Figure 1.2 shows the evolution of the SRB in China from 1980 to 2017., China's SRB was 111, 117 and 118 in 1990, 2000 and 2010, respectively. These ratios were substantially higher than the normal biological norm. Figure 1.3 reveals the SRB distribution map, which shows the imbalances within China's regions. The map shows that the SRB was higher in the southeast provinces but lower in the central and northeast provinces. However, the SRB was in the normal interval in western provinces.

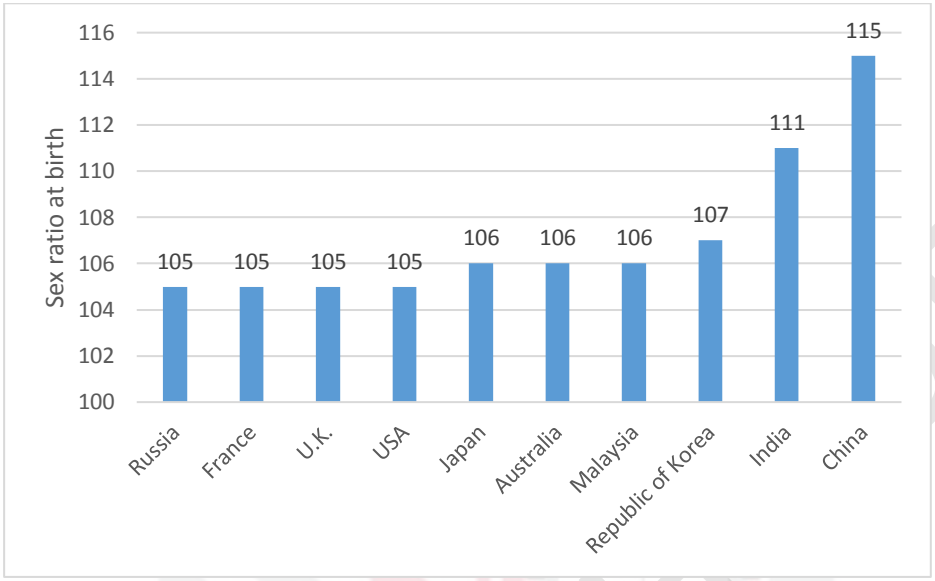

Figure 1.1 : Sex Ratio at Birth (SRB) for Selected Countries in 2017
[Source : Hannah (2019)[1]]

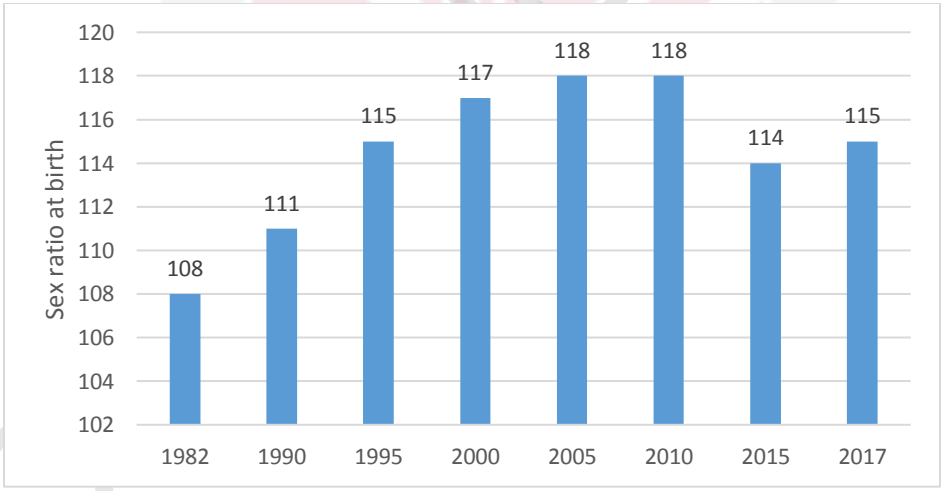

Figure 1.2 : SRB in China from 1982 to 2017
[Source : Data for 1982-2015 was from National Population Survey. The data for 2017 was from Hannah (2019)]

[1] https://ourworldindata.org/sex-ratio-at-birth

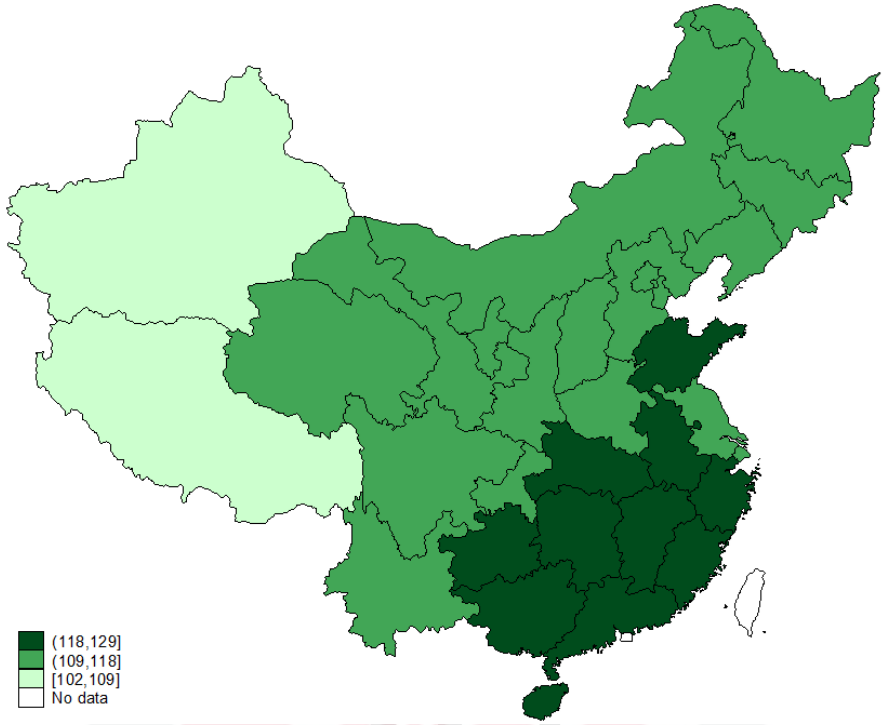

Figure 1.3 : The SRB distribution for China (mainland)
[Source : Sixth National Population Census of the People's Republic of China]

As a result, many researchers have explored the causes of the growing SRB imbalance in China. Some have believed that China's one-child policy has been the most prominent reason for the imbalance in the SRB in China (Das Gupta, 2005; Ebenstein, 2010). Dreyer (2012) mentioned that the skewed gender ratio was a specific product of China's family planning policy. Saich (2011) stated that China's imbalanced SRB was an adverse consequence of the country's family-planning policy. Guilmoto (2009) argued that the problem was triggered by the availability of gender selection technology in Asia. The increased availability of B-scan ultrasonography machines can quickly test the gender of a foetus, allowing prospective parents to quickly check their child's sex and abort the pregnancy if the foetus's sex was not of their choice. This argument was further supported by Chen et al. (2013), who found that the imbalanced SRB in China was significantly influenced by gender selection technology. Zhang (2017) argued that the imbalance in the SRB occurred because of traditional Chinese culture, which prefers sons rather than daughters. Li et al. (2011) concluded that higher SRB in China resulted from a combination of the preference for sons, the one-child policy and the availability of gender selection technology. The traditional preference for sons in China has been a fundamental issue. If there weren't a culture emphasising the preference for sons, people would not care about choosing their child's sex. The one-child policy in China compounded this problem because each family

only had one opportunity for one child. As a result, gender selection technology became an essential tool for them in identifying the sexual status of their unborn child. They would abort a pregnancy if the sexual status of the unborn child was not consistent with their preference and wait for another opportunity. Therefore, a detailed evolution of China's one-child policy, the preference for sons and gender-selective technology are discussed below.

1.1.1.1 One-child policy in China

The first Chinese leader, who led the country from 1949 to 1976, Mao Zedong, trusted a theory that emphasised that "more population means more power". However, overpopulation was a national problem in China during the 1950s and 1960s. For example, based on the first census data conducted in 1953, the total population of China was more than 600 million people. Even at that time, some policymakers and academics advocated that the Chinese government should have a national family planning policy. Deng Xiaoping, the second Chinese leader and vice premier in the 1950s, appealed to citizens to use contraceptives. Ma Yinchu, the Chancellor of Peking University, made a public speech on "Control population and scientific research" in 1955 proposing family planning in China. The leadership in China discussed this plan, but Mao insisted on his belief that a higher population meant more power. Then, during the Great Leap Forward movement in 1958, family planning was seriously blamed, and Ma Yinchu was categorised as a "rightist" (Tian, 2009).

After the Great Leap Forward Movement (from 1958 to 1959), China suffered three years of famine starting in 1960. However, the Chinese fertility rate was very high at that time, as the records show that the total fertility rate was around six births for each family in the early 1960s (Banister, 1991). As a result, in 1962, the central government established the family planning commission to determine population policy and control the size of families (Tian, 2009; Ebenstein, 2010).

However, the family planning commission was not functional for a long time as China's Cultural Revolution, which started in 1966, stopped all the policies and operations made by the family planning commission. In 1970, China's total population was more than 800 million, and the country was suffering from slow economic growth and declining living standards. People believed that overpopulation was the leading cause of this problem. Eventually, the government concurred that overpopulation had caused many problems, and in the early 1970s, Mao claimed that China's population must be controlled (Peng, 1996).

In 1971, China's national family planning operations came into effect again. A slogan was introduced as "One child is good, two are just fine, and three are too many". In 1973, the central government held a birth planning conference

during which they recognised the importance of population control. They created a new slogan, "Later, Longer, and Fewer". 'Later' referred to the government encouraging people to get married later. It was suggested that people married after reaching 25 years old for males and 23 years old for females. 'Longer' referred to the government encouraging people to have three years gap between planning for another baby. 'Fewer' referred to the government encouraging people to have two babies at most. Participation was voluntary, and the outcome was good. As a result, the birth rate in China decreased by half between 1971 to 1978 (Zhang, 2017).

In 1978, Deng Xiaoping became the second Chinese leader. After discussions with demographers, he was convinced that overpopulation remained a severe problem in China (Peng, 1996). In 1978, China comprised one-fourth of the world's population but only had 7 per cent of the world's arable land. More than 60% of China's population were under 30 years old. Many children born in the 1950s and 1960s had become adults and reached marriage age. Deng believed a strict population policy would help economic reform and increase living standards. He thought controlling the population was a viable way to increase China's gross domestic product (GDP) per capita. Therefore, in 1979, Deng Xiaoping proposed quadrupling China's GDP per capita by 2000. He sought to carry out economic reform, implemented the "Open Door Policy", and changed the direction of foreign trade from the Union of Soviet Socialist Republics (USSR) to Western countries. Based on this background, China's central government started to conceive its one-child policy in 1979 (Peng, 1991).

Scharping (2013) recorded the implementation of the one-child policy in China from 1979 to 1983. The Communist Party Central Committee called for legal, economic, and administrative ways to support the one-child policy in 1980. And the central government made the judgment to the officials from economic growth, the implementation of the one-child policy and social stability. So, it prompted officials to implement the one-child policy in their governed areas (Hardee-Cleaveland & Banister, 1988).

However, the one-child policy was not stable in the mid-1980s. The reason was that many rural families were firmly against this policy, especially families with one female child. Based on this phenomenon, the central government created a new policy in 1984 to make the one-child policy more feasible in rural areas. Under the new policy, fourteen exceptions permitting a second child were introduced. The most notable exception was that if parents in rural areas had a daughter as their first child, the government allowed them to have a second child. Thus, local governments implemented the relaxed one-child policy believing it as a signal that the policy was less critical. As a result, China's birth rate increased between 1984 and 1986. In 1986, the central government reiterated the importance of the one-child policy and tightened the policy in China between 1986 and 1990. Since 1990, the one-child policy

remained relatively stable, and this policy lasted for the next 20 years (Zhang, 2017).

In early 2013, a National Health and Family Planning Commission survey found that only around half of eligible couples wanted to have two children. The main reason that the other half of eligible couples did not want to have a second baby was the pressure of the cost of living for the second baby. Wang Peian, the Deputy Director of the Commission, claimed that China's population would not increase sharply in the short term if the government relaxed its one-child policy. That was the first sign that the government might relax the one-child policy after its implementation around 30 years previously.

In November 2013, China announced a new rule concerning the one-child policy. In the new rule, families could have two children if either parent was an only child in their family. Under this new rule, more than 11 million families were permitted to have a second child. Nevertheless, from the National Health and Family Planning Commission data, only 1 million families applied to have a second child in 2014, even though the demographers predicted around 2 million families would apply. The central government claimed that the result was expected, indicating the relaxed one-child policy would continue progressing with a good start. In October 2015, the government announced abolishing the one-child policy, allowing all families to have two children. Thus, the one-child policy stopped operating officially.

1.1.1.2 Son preference in China

The preference for sons was another reason to cause an imbalance of the SRB. It represents people's attitude in China that sons have more value than daughters. In China, the preference for sons has been quite common and can be linked to various reasons. This section explains the preference for sons, including cultural and economic factors.

Role of sons in religion

In the belief system of Confucianism in China, sons play a unique role. Confucianism encourages a patrilineal system in China. Dong Zhongshu (179BC–104 BC) proposed that fathers guide sons and husbands guide wives. Dong believed that it was essential to follow these orders to achieve social stability. Dong's theories significantly affected Chinese culture. Emperor Wu (157BC-87BC) accepted Confucianism as the official religion to achieve societal stability based on this theory. Henceforth, females were viewed as inferior in China (Tang, 1995).

Patrilineality

Because of the role of sons in Confucianism, patrilineality has been very important in the Chinese kinship system. There are many aspects of patrilineality. For example, there is a social fact that sons could inherit their family assets or from their kinship system. But daughters rarely inherit family assets. They are only given a dowry. Another case has been that married couples will live in the husband's home, especially for peasant families where land has been the critical, valuable good inherited. Due to this, a unique phenomenon has occurred. If a family did not have a son, the family might adopt a son from the man's relations. This situation was important for some families because they wanted to continue the family line by whatever means (Ebenstein, 2014).

The role of ancestor worship

In China's ancestor worship, it is important to have male offspring. People have explicit beliefs concerning the afterlife and perform ancestor worship to ensure that departed souls enjoy welfare after they die. Chinese culture believes that if people do not have sons, grandsons and great-grandsons, their afterlife will be troubled. It is regarded as bad for people's souls and the souls of people's predecessors to not fulfil filial duties. It is an essential filial duty to care for one's parents, and taking care of ancestors is an extension of taking care of parents. Chinese culture believes that angering ancestors will bring bad luck through unfilial acts, which helps to ensure compliance (Smith, 1974). There has been another unique case for sons concerning their role in the family name. Only sons can deliver the family name to their offspring, which is essential in Chinese culture to extend the family line, reflecting the preference for sons in Chinese culture (Zhang & Ma, 2017).

Kinship systems and the construction of gender

Chinese clans had their territories in ancient times, which was China's primary traditional social organisation. If a man in a clan wished to marry, it was the culture to implement strict exogamy in the village. Thus, the wife would be an outsider. Clanship was popular in villages, so men from other places appeared as intruders. Therefore, if a man married and lived with his wife's family, he would face humiliation from other villagers. Hence, men held a significant social role to construct social order, and women were only natural producers. Father's ordained children's identities and integration into the social order. Only boys could remain in the family lineage and put their names on the genealogical record. Girls could not put their names on the record, representing identification in society. This situation was another reason for discrimination against daughters (Ebenstein & Leung, 2010).

Payan & Ohayon (2017) showed that a woman would be considered excluded from her original family when she married. Her position in the family would cease to exist, and a new position would be produced in the husbands family for the incoming bride. If the woman had to return to her original family for some reason, she and her family would need to work harder, as other villagers might think that she was an incursion on their property rights. This situation made it difficult for women to return and live with their parents after marriage.

Old age support

Support during old age has been the fundamental economic reason that kinship systems generate economic motivations for a preference for sons. It is a simple fact that sons are the people who offer support to their elders in China. Most older people will live with their married children, overwhelmingly their sons. This situation provides a vital economic explanation for parents choice of sons. Moreover, it is a culture that parents live with single kids of both genders. However, if parents live with their married children, living with a married daughter in Chinese culture is uncommon. Ebenstein & Leung (2010) mentioned this phenomenon and stated that when the Chinese government established the Old-Age Pension Plan, parents had a replacement for support during old age from their sons. Thus, parents perceived preference for sons would subside.

Poverty

Poverty might raise the propensity to spend more on sons than on daughters. Even though the net value of resources was positive for boys and girls, the boys would be higher because of physical advantages. So, if a family were wealthy, they would take care of both their sons and daughters. If they were poor, they might give their resources to their boys because they have more value. Das Gupta & Shuzhuo (1999) proved it and indicated starvation increased the degree of discrimination in China in the 1960s.

1.1.1.3 Gender selective abortion in China

Many researchers believe that the phenomenon of imbalanced SRB has generally been caused by gender-selective abortion (Ebenstein, 2011; Zhou et al., 2012; Chen et al., 2013). This phenomenon started from the wide availability of B-scan ultrasound machines to conduct illegal prenatal gender diagnoses since the late 1970s.

Figure 1.4 shows the geographic distribution of counties in China using ultrasound technology from 1980 to 1995. In 1980, most counties had no ultrasound technology, with only a few counties showing that they had ultrasound technology. By 1985, ultrasound technology had become popular in

many counties. In 1990, most counties had ultrasound technology, except some counties in Neimenggu and Xinjiang provinces. By 1995, almost all counties had ultrasound technology. Figure 1.5 shows the percentage of counties with ultrasound machines from 1975 to 1995. Before 1980, ultrasound machines were scarce in China. Only around 10 per cent of counties had ultrasound machines. However, by the 1980s, the spread of ultrasound machines was wide. The percentage of ultrasound machines in counties increased from 10 per cent to above 95 per cent. By 1995, the data shows that ultrasound machines were used in each county.

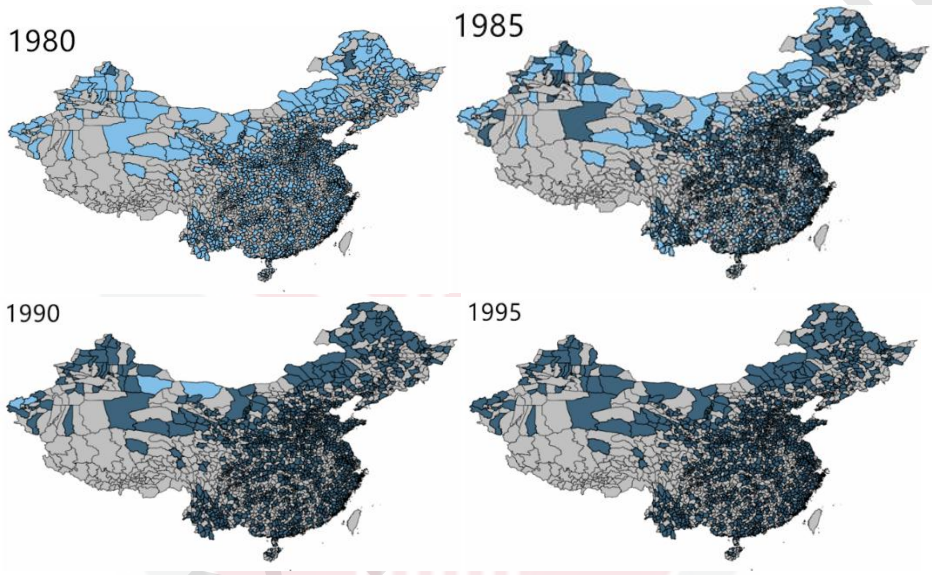

Figure 1.4 : The Spread of Ultrasound Technology across Chinese Counties
(Adopted from Chen et al., 2013)
Note : dark blue = ultrasound; light blue = no ultrasound; grey = no data

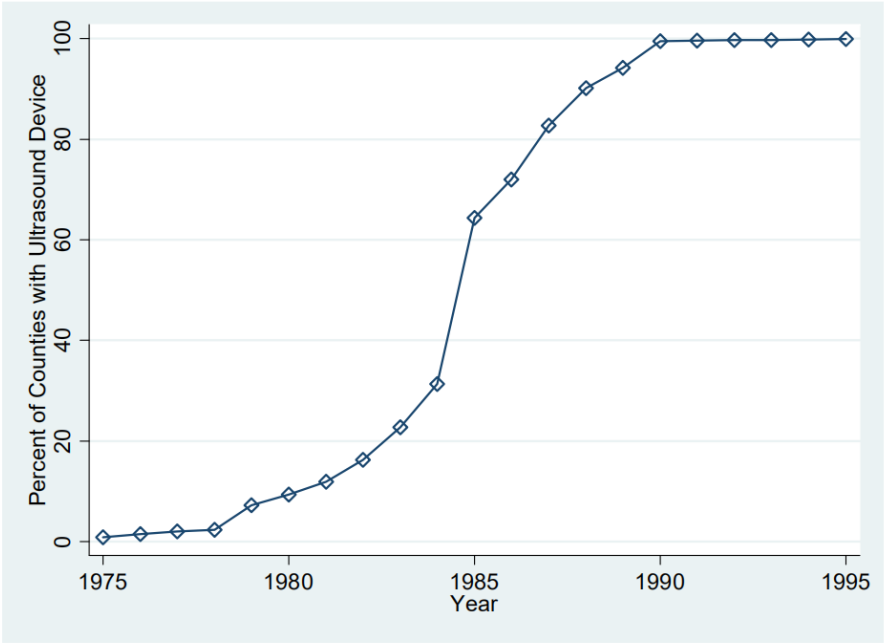

Figure 1.5 : Percentage of Counties with Ultrasound Machines from 1975 to 1995
(Source : Chen et al. 2013)

Official responses and popular attitudes

As ultrasound machines only became easily accessible in China in the 1990s, using the technology in gender-selective abortions was not a significant problem. Official and popular attitudes were more critical. To prevent ultrasound machines from being used for prenatal gender determination and potentially abortions, the central government issued laws to regulate this situation in the 1980s. In 1986, the Chinese government issued a regulation that only authorised hospitals could use ultrasound machines to carry out prenatal diagnoses and diagnose certain hereditary diseases. Other hospitals and clinics were not allowed to carry out this diagnosis. The Law on Maternal and Infant Health Care (1994) confirmed that the prenatal diagnosis of gender for non-medical reasons was forbidden. The State Council on Extending the Population and Family Planning Program in 2006 reaffirmed that gender selection was outlawed.

Some surveys have shown that most Chinese people believe that gender selection abortion should not be accepted. Junhong (2001) conducted a survey to test the attitude toward gender selection in a central rural area in 2000. 92% of the interviewees did not support gender selection abortions and believed it would cause a gender imbalance and social problems. Only 3% of the

interviewees supported gender selection abortion. A survey by Nie (2005) showed that 14% of the respondents consented to an abortion if they wanted a girl, but the foetus was a boy. At the same time, 12% of the respondents consented to an abortion if they wanted a boy when the foetus was a girl. The results indicated that most of the population did not support gender selection abortions in China and that there was no apparent son preference in abortions. However, the situation was quite different in real life. Junhong (2001) examined 753 pregnancies in his survey, including 427 male and 279 female foetuses. One-fourth of the female fetuses were aborted, while only 2% of the male fetuses were aborted. So, even though most people did not support gender selection abortion in principle, many of them still did it when faced with a foetus with an unfavoured gender.

1.1.2 Saving rate in China

With the development of the gender imbalance, the saving rate in China has also increased fast in recent years. The official Chinese newspaper: The People's Daily, in 2015 reported that the Chinese household saving rate was already the highest in the world. Figure 1.6 presents the household saving rates of a few selected countries. For all countries, except China, it shows that the household saving rates were below 10%, while China's rate was considerably higher at 36.22% in 2017.

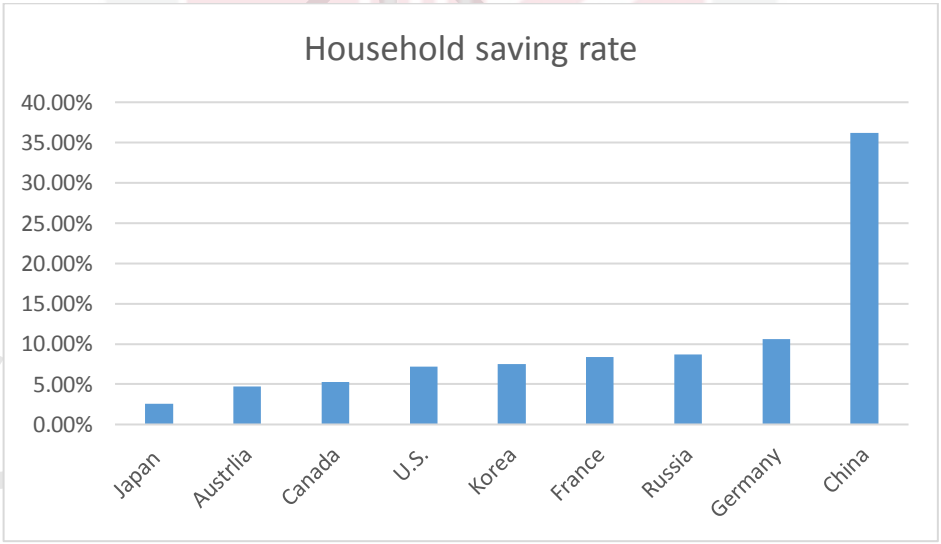

Figure 1.6 : Household saving rate for Selected Countries in 2017
(Source : OECD[2])

[2] https://data.oecd.org/hha/household-savings.htm

Focusing on the evolution of the household saving rate in China, Figure 1.7 shows that the household saving rate has fluctuated with an increasing trend from 7.26% in 1953 to 36.22% in 2017. However, the increase was not stable during these years. Figure 1.8 shows the household saving rate distribution in China. In the eastern provinces, the household saving rate was relatively high, while the household saving rate was relatively low in the western provinces. According to a report issued by Fidelity International in 2021, Chinese women's savings were around 563 thousand Yuan, which was about 7% higher than Chinese men's savings.[3] The household saving rate has shown fluctuating increases amid massive structural transformations in China. The surge in household savings can be categorised into four phases:

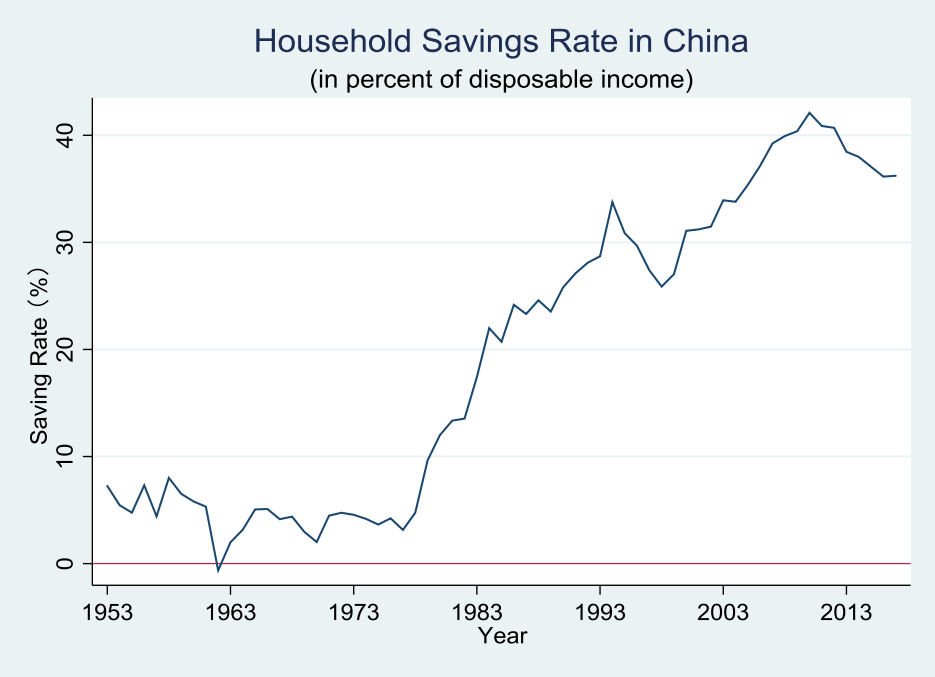

Figure 1.7 : Saving rate in China from 1953 to 2017
[Source : Author's calculation based on the China statistical yearbook and Modigliani and Cao (2004)]

[3] https://baijiahao.baidu.com/s?id=1693583273698363994&wfr=spider&for=pc

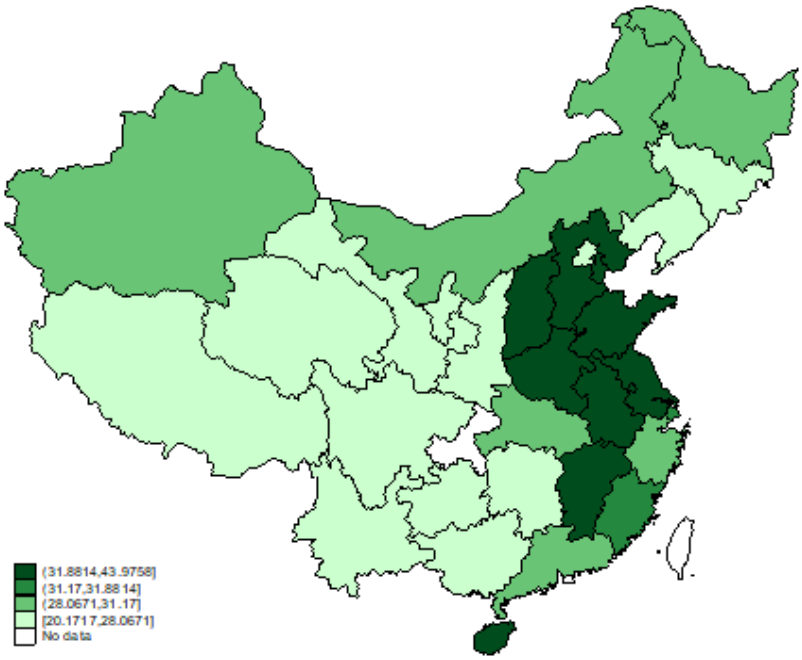

Figure 1.8 : The Saving Rate Distribution in China
(Source : China Statistics Yearbook)

The first stage was from 1953 to 1978, when China was a planned economy. This situation meant that the country's entire economy was planned. People were employed according to the plan; goods were distributed following the plan; housing, retirement pensions and medical resources were all arranged. At that time, household savings were basically due to unsatisfied consumption rather than through wealth growth (Cristadoro & Marconi, 2012). So, the household saving ratio was relatively low during that period. A period of negative saving occurred in 1962 when the country faced a severe natural disaster between 1960 and 1962. Without considering these three years, the average saving rate was still below 5 per cent during that period. On the whole, there was not much household accumulation at that time. Modigliani & Cao (2004) concluded that in this pre-reform period, the real income per capita rose by around 60 per cent, but it wasn't reflected in the household saving rate.

The second stage started in 1979 after China implemented the one-child policy and the de-collectivisation of farming in country areas. Even though in the late 1980s there was a short-term dip in the saving rate, which may have been due to economic growth slowing down, the overall household saving rate increased from 5 per cent to 25 per cent of disposable income at that time.

The third phase commenced in the 1990s, following Deng Xiaoping's south tour, implementing the policy of state-owned enterprise (SOE) reform and transforming the social safety net. The household saving rate rose to an extraordinary level of 34 per cent in 1994. After that, the household saving rate declined until 2000. Modigliani & Cao (2004) explained that the decline was because of the rapid growth in pension distribution in the 1990s, which negatively affected saving for old age.

The fourth phase started in 2001 when China became a World Trade Organization (WTO) member. The household saving rate returned to 30 per cent of disposable income because of the export-driven boom. In 2012, the household saving rate reached above 40 per cent at its peak. After that, the household saving rate declined slowly. By 2017, the household saving rate was 36.22 per cent which was still high compared to other countries.

1.1.3 Housing prices in China

Similarly to the evolution of the saving rate in China, the housing market's growth has experienced several different periods since 1949. Essentially, there have been three distinct periods: the welfare house phase (1949 to 1978), the dual-track reforming phase (1979 to 1997), and the market governed phase (1998 until now).

1.1.3.1 The Welfare House phase (1949–1978)

When the People's Republic of China was established in 1949, the government nationalised private land and houses in urban areas. The government then implemented the welfare house policy, which rented houses to people in urban areas. Lim & Lee (1990) showed that the government providing welfare houses was a tool to indicate that socialism was better than capitalism. Chen & Gao (1993) stated that socialist housing provision reflected the equality of the political and economic system. Zhang (1997) believed that Maoists mainly influenced China's housing policy from 1949 to 1978.

Some literature has explained why the government implemented public rental houses. Zhang (1997) stated that the public rental house policy was part of a national policy to assist the Chinese development plan. Wu (1996) mentioned that employment unit public housing provision was an essential part of the Chinese planned economy. Zhang (2000) believed that it was easy to generate allegiance and social stability by the employment unit system.

1.1.3.2 Dual Track Reforming Phase (1979–1998)

Along with economic reform in China, housing reform was also implemented simultaneously. The housing reform consisted of three main elements: renting reform, denationalising public houses, and opening the housing market. Ping Wang & Murie (1996) demonstrated that some experimental reform of government institutions in China stimulated the housing market's evolution. Shaw (1997) divided the whole housing reform process into four stages: the funded house selling stage (1979-1985), the rental rises with funding stage (1986-1988), the favoured house selling stage (1989-1990), the complete reform stage (1990-1997).

Lim & Lee (1990) indicated that the adjustments to China's housing rules were driven by the different political philosophies of privatising possession and pricing systems. They claimed that the evolution from welfare houses to market housing represented a crucial political policy of housing reform. Nevertheless, some literature has stated that housing reforms started primarily for financial motivations. The World Bank (1992) claimed that China's housing reforms were initially intended to ease severe housing scarcity by reorganising housing investing decisions; the fundamental purpose was to ease the rising financial problem of urban house aids. However, the privatisation of the ownership of houses was an essential indicator of the changing economic policy in China. Ping Wang & Murie (1996) indicated the unsuitability of the welfare house structure with China's overall economic change, which turned out to be the primary influence to reform the housing industry. Chen & Gao (1993) described why the welfare house structure became a problem for economic liberalisation by misrepresenting actual house prices. Workers needed to return the house to the employer organisation when they departed, which led to the rigidity of workers through combining workers with employers and hindered the competitiveness of state-owned enterprises by exerting heavy public pressure. Lai (1998) stated that with the growth of economies, economics became the main reason to push housing reform. The appearance of a liberalised housing market profited the market economy. Ping Wang & Murie (1996) discussed how the central government used the housing market's growth as a valuable tool to incentive economic reform.

In 1998, the central government suddenly announced the welfare houses had stopped operating. Some researchers believe that the unexpected policy change offset the deficit from the 1997 Asian financial crisis (Man, 2011; Wang et al., 2012). A lot of the social housing supply was quickly commercialised. Adams (2009) predicted that the commercialised social house supply area in 1999 comprised around 2.5 million square meters. The value was about 2.5 trillion Yuan which was one-third of China's GDP in 1998.

1.1.3.3 Post-reform Housing Development (1998-now)

The Chinese government has formulated macroeconomic policies since 1998 to monitor the housing market. Figure 1.9 shows the house price trend in China from 2000 to 2017. The average house price in China has increased from ¥1948 per square meter in 2000 to ¥7614 per square meter in 2017. Figure 1.10 shows the house price distribution in China. The highest house prices were in Beijing and Shanghai, the most important cities in China. The eastern maritime provinces had higher house prices than the western inland provinces.

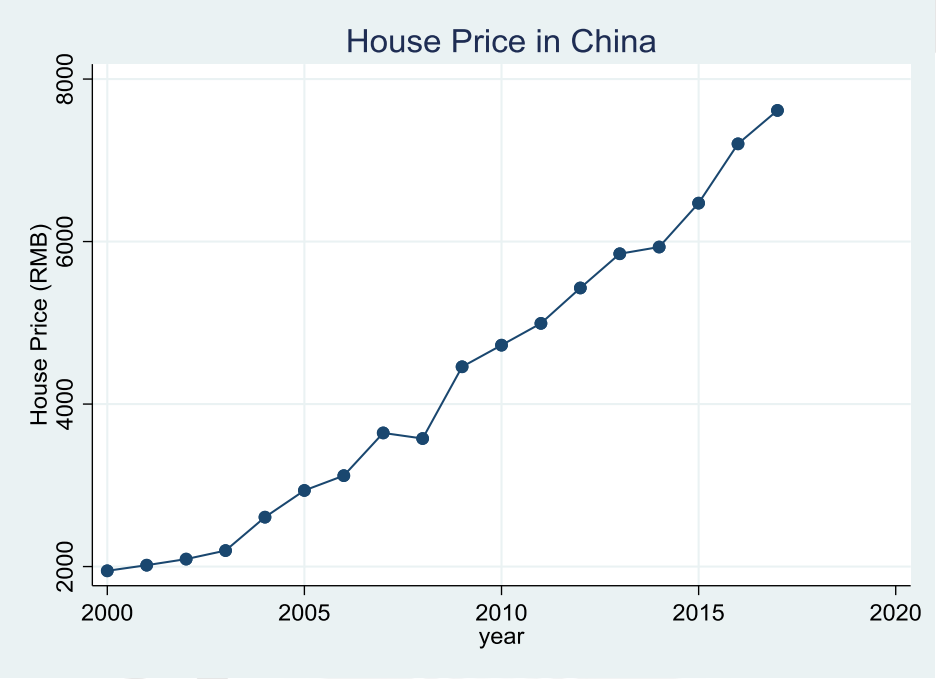

Figure 1.9 : House prices in China from 2000 to 2017
(Source : China statistic yearbook)

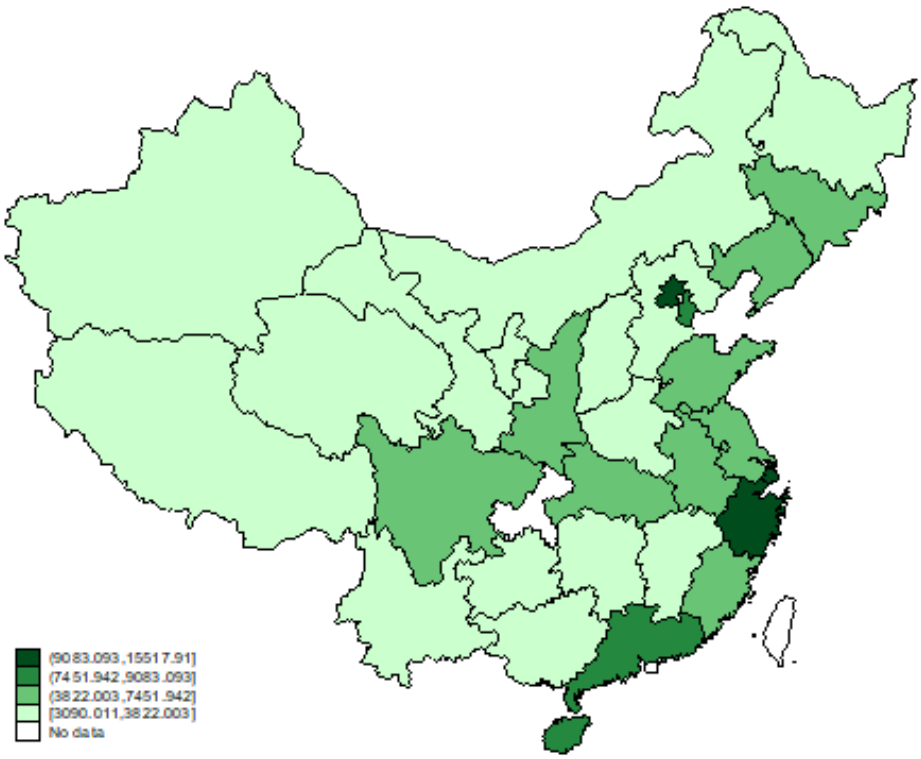

Figure 1.10 : The House Price Distribution in China
(Source : China statistic yearbook)

Stephens (2010) analysed the effect of the urban Chinese housing policy by comparing it with European transition countries. The findings revealed that the Chinese post-reform housing regime had adopted some ideas from market-housing models, such as; privatisation, property rights, and the mortgage market. However, Wang et al. (2012) showed that the market forces were limited as the state had remained a major housebuilder since 1999. In China, public housing development was perceived as related to expansionary policy to counter the global recession while dampening the overheating housing market. It was also essential to promote social stability by providing sufficient housing and maintaining political unification. However, the supply of houses was determined by the government's plan because the government owns the land in China. The supply of housing will consider many factors, such as; the financial condition, city planning, population etc. Once confirmed, the supply of houses is relatively rigid, unlike normal goods. Figure 1.11 shows the different demand and supply curves for normal goods and houses. The supply curve for houses was steeper than for normal goods. Once the demand curve shifts to a higher level (such as an income increase), the number of houses will not quickly increase, even with a price hike.

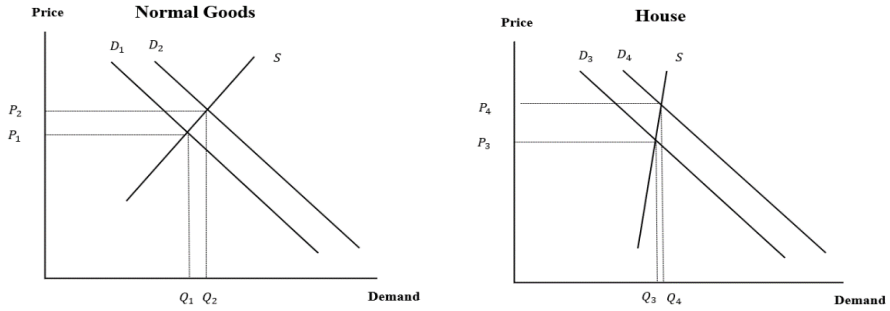

Figure 1.11 : Demand and Supply Curves for Normal Goods and Houses

1.1.4 Crime rate in China

Similarly to the evolution of housing prices in China, the crime rate has also experienced different periods since 1949. From 1949 to 1956, China has undergone the development of transferring production to common ownership. During that time, the central government tried to reduce criminal gangs and the prevalence of narcotics and gambling, to decrease crime. The main nonpolitical crimes were; theft, arson, rape, murder, and robbery. The majority of economic crimes were committed by business people engaging in; tax evasion, theft of public property, and bribery. (Heiland et al., 1992)

Between 1957 and 1965, rural areas experienced little reported crime. Crime rates increased later, with 1981 representing a peak in reported crime. This outcome may have been correlated to the economic reform in the late 1970s. These reforms allowed some elements of a market economy and gave rise to an increase in economic activity. (Bakken, 2005) In 1986, China first shared the crime rate with Interpol. Since 1987, China has issued the China Law Yearbook to report crime statistics annually. The criminal law system in China only has national criminal law. Local governments should follow a standardised procedure to record crimes, and the crime rate is collected at the provincial and national levels.

The number of arrests per 10,000 population has increased over the last 30 years. Figure 1.12 shows that the number of arrests per 10,000 population was 3.8 in 1987. By 1997, the number of arrests increased to 4.1. In 2007, the number of arrests dramatically increased to 8.5. And in 2017, the number of arrests was 9.5 per 10,000 population. Liu (2005) believed that growing economic motivation had been a driving force for financially motivated crimes from the transition to a market economy in China. This result is because the transition collapsed the long-established social organisation of the central planning system. Thus, the crime rate rose with the lack of social integration (Cheong & Wu, 2015).

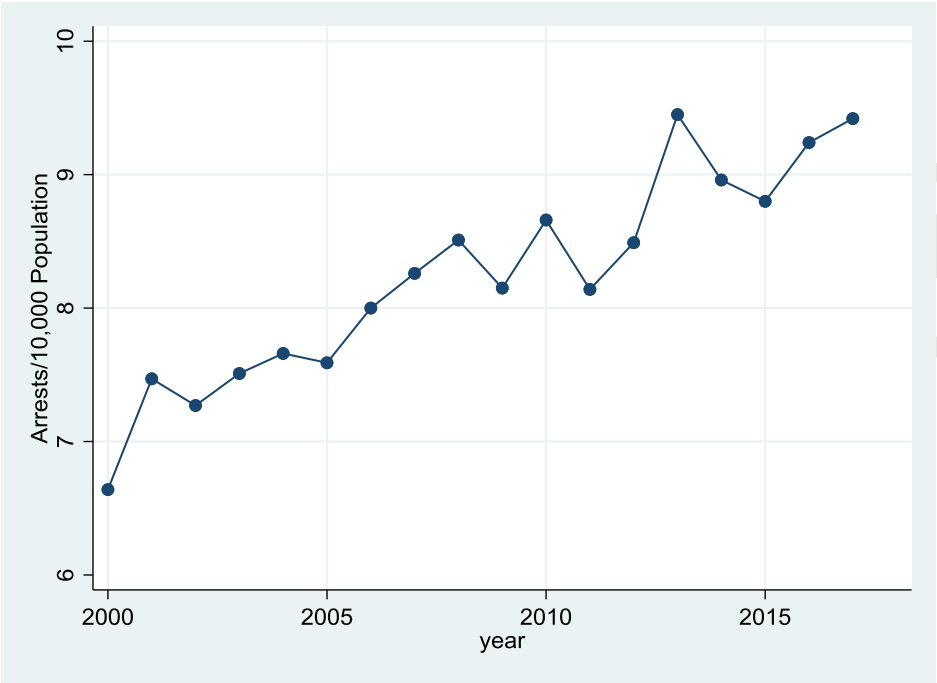

Figure 1.12 : The number of arrests per 10,000 people in China from 2000 to 2017
(Source : China law yearbook from 2001 to 2009 and the Author's calculation based on the Procuratorial Yearbooks of China from 2010 to 2018)

Even though the crime rate has increased over recent years, it is still safe in China. Based on the data of Numbeo, the rank of the Chinese crime index was 92 out of the 125 countries in 2017. Figure 1.13 lists some crime indexes for selected countries in 2017. The crime index for China was 33.9, higher than Japan, Korea, and Germany but lower than Canada, Australia, France, Russia, and the U.S. Figure 1.14 shows the crime rate distribution in China. The high crime rate provinces are mainly the southern and western provinces. The central, northern and eastern provinces have relatively low crime rates. However, the increasing crime rate has become a severe socioeconomic problem in China.

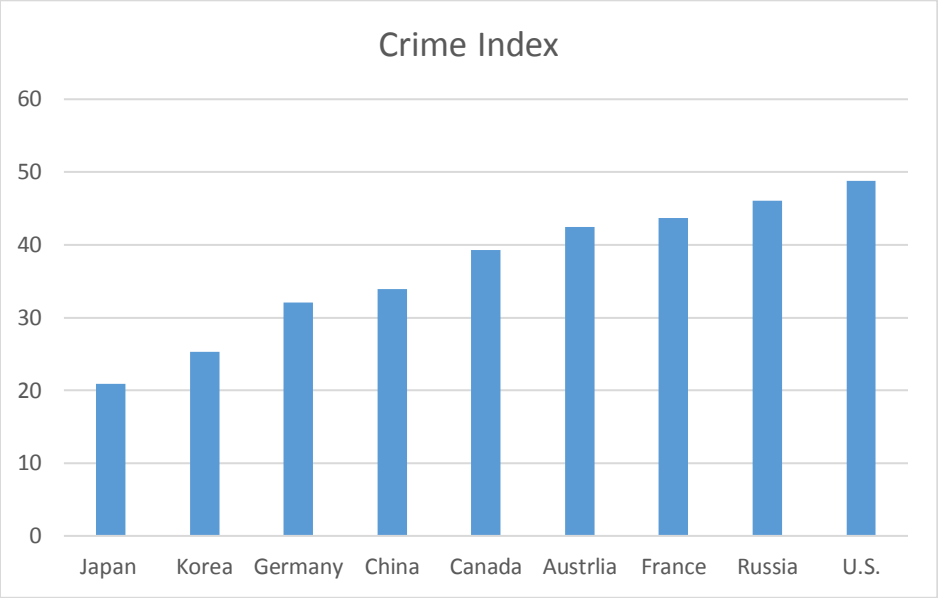

Figure 1.13 : Crime Index for Selected Countries in 2017
(Source : Numbeo[4])

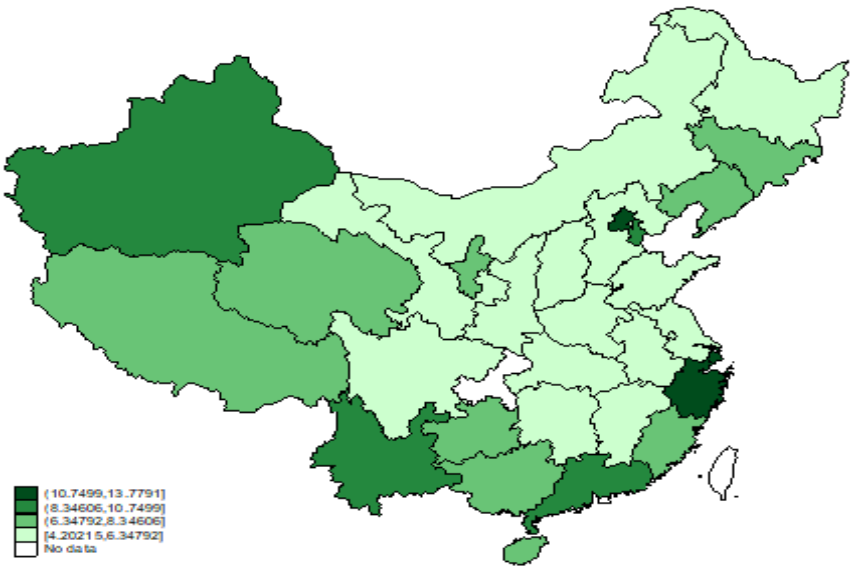

Figure 1.14 : The Crime Rate (per 10,000 people) Distribution in China
(Source : China law yearbook and Author's calculation)

[4] https://www.numbeo.com/crime/rankings_by_country.jsp?title=2017

With the increasing crime rate in China, some scholars have analysed this phenomenon from population aspects. With a shortage of brides, more well-off men will be more likely to marry, leaving many lower socioeconomic classes without marriage partners. Thus, these single men may be marginalised in society, resulting in antisocial behaviour (Hudson & Boer, 2002). Wright (1994) believed that young and single men were the foremost perpetrators of crime worldwide and were more willing to take risks to get rich and attract females. Hu (2006) also showed that men aged 16 to 25 conducted more than two-thirds of China's violent and property crimes. Sampson et al. (2006) indicated that getting married decreased, by around 35 per cent, the odds of crime compared to similar single men. Skardhamar et al. (2014) found that the desistance process tended to start up to several years before marriage, and it was quite low after marriage. Figure 1.15 shows the proportion of men who committed crimes over the 11-year observation period. Before five years of marriage, the proportion of males committing crimes was relatively high. The proportion tended to decrease with marriage coming up. After marriage, the proportion of men committing crimes was relatively stable and low. Therefore, married men had a lower crime level than unmarried men.

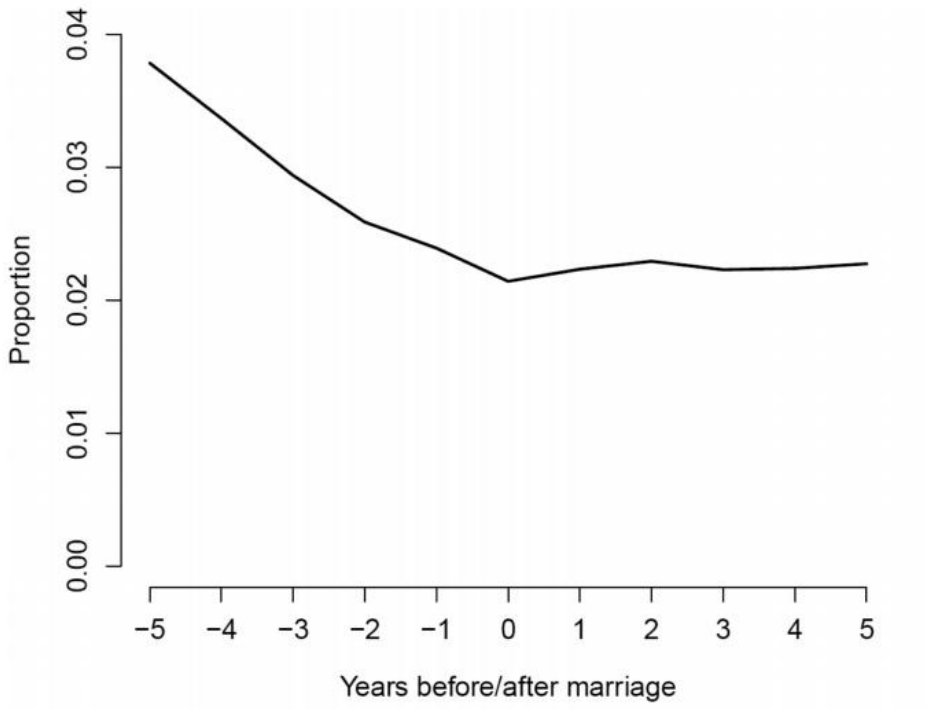

Figure 1.15 : Observed crime rates each year before and after the year of marriage
(Source : Skardhamar et al. 2014's calculation)

1.2 Problem statement

With the development of the skewed SRB, the gender imbalance and its implications have become a prominent issue in China (Golley & Tyers, 2012). Zhu et al. (2009) indicated that the gender ratio in China was very imbalanced, especially for the under 20 years old category. The National Health and Family Planning Commission of China (2014) predicted that 30 million men would not marry in 2030. The Chinese National Census reported 723 million males and 688 million females in China at the end of 2020. Huang (2014) predicted that surplus Chinese men would peak at 41.41 million in 2043. Therefore, the marriage market will become even more competitive (Li et al., 2014). This situation will lead to women's hypergamy, which means that women could find a partner who is better than themselves, and the “left” males will be single (Du et al., 2015). This phenomenon has the potential for many socioeconomic consequences. Du et al. (2015) stated that gender imbalance enhanced the postnuptial bargaining power of wives in intra-household resource allocation. Chang & Zhang (2015) indicated that the increasing ratio of males to females stimulated men’s animal spirits and induced them to initiate entrepreneurial activities. Bhaskar & Hopkins (2016) demonstrated that the imbalance between males and females caused the more abundant sex to invest more, while the scarcer one invested less. Nowadays, the gender imbalance in China is more pronounced than before, bringing unexpected consequences. This study discusses some of the potential consequences of the imbalanced gender ratio.

1.2.1 Saving Rate and the Gender Ratio

The first significant development in China is that household saving rates have increased over the past years. Some existing literature has tried to explain this phenomenon. Modigliani & Brumberg (1954) proposed the classical life cycle hypothesis and predicted that the savings rate would increase with the share of the working-age population in the total population with no or negative savings for retirement or young kids. Modigliani & Cao (2004) applied the life cycle hypothesis to the Chinese household saving rate and found the growth rate and the inverse of the young dependency ratio were the two most important explanatory variables for China’s high household saving rate. However, Cristadoro & Marconi (2012) used provincial-level data to conduct an empirical analysis and found that neither demographic factors nor rapid growth could explain China's high household saving rate. They believed that the precautionary saving hypothesis appeared to be the likely cause of the rise in China's saving rate. This argument was also supported by Chamon & Prasad (2010). The precautionary saving hypothesis postulates that the saving rate increases to mitigate income uncertainty (Blanchard & Giavazzi, 2006). However, Wei & Zhang (2011) stated that public pensions and healthcare provisions have improved in China over the last decades. However, the saving rate has continued to increase over the years. This situation contradicts the precautionary saving hypothesis. Another reason has been cultural norms. Costa-Font et al. (2018) indicated that traditional economic interpretations have

not successfully explained the differences in saving rates in different countries. One hypothesis is that savings respond to culturally specific social norms. They believed cultural preferences were an important reason for the differences in saving behaviour in different countries, and this relevance remains for up to three generations. However, Wei & Zhang (2011) pointed out that cultural norms were usually persistent. So, it has been hard to explain the visible increase in China's savings rate in the last decades.

Considering these issues, Wei & Zhang (2011) proposed the competitive saving hypothesis to explain China's high household saving rate. Their main idea is that the increased pressure in the marriage market comes from the more severe gender imbalance, which has made it increasingly difficult for men to marry. Therefore, people save more to improve their relative position in the competition for marriage. When the gender ratio in the pre-marital cohort rises, families with boys increase their savings in response to the increasing pressure from the highly competitive marriage market. In contrast, families with girls might not decline their savings for two offsetting reasons. Firstly, they are enticed to decrease their savings to benefit from their future sons-in-law with high savings. Secondly, they want to avoid their daughters losing bargaining power if the relative wealth level of the husband and wife affects their relative bargaining power within a family. These two different reasons are opposite. Du & Wei (2013) developed a model to formalise the concept of the competitive saving hypothesis. They estimated that the competitive saving hypothesis accounted for 60 per cent of the household savings rate rise. However, Banerjee et al. (2010) obtained a contradictory conclusion, where a male child had higher income potential, thereby allowing parents to save less. Daughters, by contrast, have a lower income potential in China, and, thus, parents must save more to smooth their consumption in the future. Griskevicius et al. (2012) used US data and showed that a high gender ratio led males to ignore the future and seek instant rewards. A high gender ratio reduced males' desire to save for the future and enhanced their willingness to incur debt for instant needs. Based on the latest report issued by Fidelity International in 2021, Chinese womens' saving was higher by 7% than Chinese men's saving, which also contradicted Wei & Zhang (2011)'s theory.

The inconclusive findings on the relationship between the gender ratio and the saving rate had motivated researchers to investigate further on this crucial issue. Several researchers have pointed out that the saving rate had a spatial effect in China. The main idea of spatial effect is that what happens in one place will influence another nearby place. Tobler (1979) described this situation and named it the First Law of Geography: "Everything is related to everything else, but closer things more so". Culture is a significant driver of household saving behaviour (Fuchs-Schündeln et al., 2020), so closer regions tend to have a similar culture, and the saving rate might have a spatial effect. Wang et al. (2016) tested the spatial effect of the household saving rate in China based on culture. The result shows the household saving rate in China had a spatial effect. It was also supported by Xu & Gong (2019), who proved that the

household saving rate had a positive spatial autocorrelation in China. Therefore, the saving rate should be modelled by the spatial model, which includes spatial effect in the equation to measure the determinants of the saving rate. However, this has been largely ignored in the previous literature. Therefore, their results may have been biased (Banerjee et al., 2010; Wei & Zhang, 2011; Griskevicius et al., 2012; Du & Wei, 2013). The first objective revisited this critical issue concerning the impact of gender imbalance on the saving rate in China using an econometric methodology accounting for the spatial effect.

1.2.2 House Prices and the Gender Ratio

Another significant development in China has been that house prices have soared following the housing market's liberalisation in the late 1990s. Several studies have examined the factors which may have explained this phenomenon. They have focused mainly on economic factors, such as; population density, household income, foreign direct investment (FDI), and the urbanisation rate (see, for instance, Feng et al., 2017; Wang et al., 2017; Ding, 2019; Mao & Shen, 2019). However, some social media have conducted engaging surveys relating to the housing market. A report in the China Economic Daily (March 8, 2010) showed that around 80 per cent of mothers' claimed that they would be against their daughters marrying a man who did not have a house. China's largest dating website, "Zhen Ai," issued a Chinese singles report in 2018 and claimed that almost 80 per cent of single girls required men to buy a house before they got married. These reports have drawn the interest of a few academics' to explore the impact of gender imbalance on socioeconomic conditions, such as housing problems, which is a huge concern for the public nowadays.

For instance, Brown et al. (2011) indicated that the groom's family typically provides a new house for a married couple. However, there is no requirement for the bride's family to provide a house in China. Moreover, Li & Chand (2013) demonstrated that demand from females significantly impacted housing prices in China. Wei et al. (2012) showed that imbalances in the gender ratio had driven China's house prices owing to the status associated with owning a house. This argument was also supported by Ng (2015) and Yang et al. (2020). Based on the phenomenon, house ownership was considered a pre-condition for marriage in China (Wrenn et al., 2019). Wei et al. (2012) explored homeownership's implications as a status good on house prices. They discovered that if a family's housing value was an essential pre-condition variable in the marriage market, the competition for marriage partners might encourage people to buy a better house. Therefore, they proposed a new competitive housing hypothesis that a house was a "status good" in China's marriage market. When the gender ratio between males and females increases, there will be a more significant challenge for males to get married. Thus, competition for marriage partners creates a scenario where people chase house purchases to secure marriage. Yang et al. (2020) extended the

competitive housing hypothesis and indicated that families with a son aged above 25 years old were prone to buy extra houses in China. Li & Wu (2017) used household survey data to analyse and indicate that urban families with a son in China were more likely to own a larger house. Nevertheless, this argument was denied by Zhang et al. (2012), who posited that an increase in the gender ratio only accounted for minimal variations in house prices in China.

The inconclusive findings concerning the relationship between the gender ratio and housing prices had motivated researchers to explore further on this crucial issue. Several researchers have pointed out that house prices have a spatial effect in China. They indicated that house prices in closer provinces had a bandwagon effect where people's preference for houses increases as the number of people buying them increases. Meanwhile, the price of raw materials to construct houses in closer provinces will be linked. Therefore, house prices in China have a spatial effect and should be modelled by a spatial model including spatial effects in the equation to measure the determinants of housing price in China (Zhaohui, 2012; Dejin & Zhiliang, 2014; Xie & Ni, 2014; Wang et al., 2017). However, this situation has been largely ignored in the previous literature, and their results might have been biased (such as Wei & Zhang, 2012; Ng, 2015; Yang et al., 2020). The second objective revisited this critical issue on the impact of gender imbalance on house prices in China by considering a spatial model that considers this essential econometric modelling issue.

1.2.3 Crime Rate and the Gender Ratio

Thirdly, the cost of crime includes; property loss, medical costs, pain, the opportunity cost in working hours, reducing the value of life, and some social costs, such as; police, court, equipment recovery, etc. (Sullivan, 2012). Therefore, decreasing crime is suitable for social development. Criminal issues are related to public safety and social stability. The containment of crime is a foundation for building an effective state (Cheng et al., 2017), thus, attracting many researchers' interest. Becker (1968) proposed that people choose to commit criminal acts if the expected utility earned from unlawful acts exceeded the expected utility earned from lawful acts. Sharp et al. (2013) showed many motives for committing a crime, but the economic motive was the main one. Thus, several studies have examined the factors which may explain this phenomenon, and they have focused mainly on the economic factors, such as; income, the urbanisation rate, income inequality, unemployment rate, and deterrence (Liu, 2005; White & Habibis, 2005; Chong & Wu, 2015).

Edlund et al. (2013) established a relationship between crime and the gender ratio in the crime-prone age between 16-25 years. They concluded that the skewed gender ratio could account for one-seventh of the rise in crime in China. This argument was also supported by Jiang & Li (2011). They used provincial data in China and found that the crime rate rose with the increasing

gender ratio in the age band of 15-29, which indicated that gender imbalance in China increased the crime rate and caused social insecurity. Cameron et al. (2019), using survey and experimental data from prisons in China, also supported the argument that high gender ratios caused direct pressure on men to appear economically attractive to get a marriage partner in China. Marriage market pressures result in a higher propensity to commit economically rewarding crimes. South et al. (2014) used individual data in India and indicated that a high gender ratio in the local community was positively correlated with harassment. However, Kaur et al. (2016) used Indian state-level data. They found that men invested more in marriage and family when women were in short supply, ensuring stability in society lowering violent crimes. Schacht et al. (2016) used US county-level data and found that criminal and violent behaviour related to the male mating effort was least common in male-biased gender ratios. The findings challenged the conclusion of Jiang & Li (2011), Edlund et al. (2013), and Cameron et al. (2019), who believed that the gender imbalance would lead to elevated levels of violence.

The inconclusive findings on the relationship between the gender ratio and the crime rate have motivated researchers to explore this crucial issue further. Several researchers have pointed out that the crime rate has a spatial effect. The Chinese society of criminology issued a blue book concerning China's crime governance in 2018 and proposed that the spatial effect was a crucial factor influencing the crime rate. This outcome was because if one province had a higher crime rate, people in that province and adjacent provinces would have more chances to imitate and study this behaviour; thus, the crime rate would be higher in the local province (Xiao-bing, 2013; Liu & Cao, 2016). Trisnawati & Ismail (2019) also showed that the geographical circumstances of other regions might influence the crime rate in one particular region because the relationship between the crime rate and crime location is considered a spatial data phenomenon. Therefore, the crime rate should be modelled by spatial modelling, including spatial variables in the equation to measure the determinants of the crime rate in China (Anselin et al., 2000; Cracolici & Uberti, 2009; Buonanno et al., 2012; McIntyre & Lacombe, 2012; Xiao-bing, 2013; Liu & Cao, 2016). However, this has been largely ignored in previous literature, and, therefore, their results may be biased (such as Jiang & Li, 2011; Edlund et al., 2013). Therefore, the third objective in this research revisited this critical issue concerning the impact of gender imbalance on the crime rate in China using an econometric methodology that accounted for spatial effects.

1.3 Research Questions

Based on the gaps identified in the literature, this study attempted to answer the following research questions:

i. Does the gender ratio affect the saving rate in China?

ii. Does gender imbalance have any influence on house prices in China?

iii. What is the nature of the relationship between the imbalanced gender ratio and the crime rate in China?

1.4 Research Objectives

The general objective of this study was to evaluate the implications of an imbalanced gender ratio on economic and socioeconomic conditions in China. Specifically, the aims of this study were:

i. To investigate the spatial effect of the saving rate and the relationship between the saving rate and the gender ratio after considering the spatial effects in China.

ii. To examine the spatial effect of house prices and the relationship between house prices and the gender ratio after considering the spatial effects in China.

iii. To explore the spatial effects of the crime rate and the relationship between the crime rate and the gender ratio after considering the spatial effects in China.

1.5 Significance and Contribution of the study

This study has made some critical empirical contributions to the body of literature. The main contribution of this study has been its consideration of spatial effects. The spatial effects consider what happens in one place will influence another nearby place. However, many economists do not recognise this effect and test the variables directly. If spatial effects have occurred in the economic phenomenon, their test's conclusion will be biased. Therefore, it is essential to consider spatial effects in economic models. This study considered that and gave a further explanation for the economic phenomenon.

This study's first objective investigated the relationship between the household saving rate and gender ratio in China. This examination was because the traditional saving rate theory, including; the life cycle hypothesis, precautionary savings hypothesis and culture, could not fully explain the increasing saving

rate in China. Therefore, some studies have proposed the competitive saving hypothesis and considered the household saving rate as a competitive advantage in China's marriage market and analysed the increasing saving rate from the point of the highly competitive marriage market based on a high gender ratio (Wei & Zhang, 2011; Du & Wei, 2013). The competitive saving hypothesis was the first hypothesis that connected the gender ratio and Chinese economics. Since then, scholars have paid more attention to the effect of the gender ratio on economics. Wei & Zhang (2011) considered the effect of local variables on the local saving rate, which provided another point of view to explain the economic phenomenon. However, recent studies have indicated that the household saving rate has spatial effects (Wang et al., 2016; Xu & Gong, 2019). The previous studies concerning the competitive saving hypothesis have ignored that and might have obtained biased results. This study fills the theoretical gap by using spatial econometrics, which addresses the critical limitations of the traditional estimation techniques employed in previous studies to test the competitive saving hypothesis. Therefore, compared with Wei & Zhang (2011), this study did not consider the effect of local variables on the local saving rate but also considered the effect of adjacent regions' variables on the local saving rate. This outcome is important for economic policymakers when considering the role of the gender ratio in the saving rate and its spatial effect.

The second objective extends the research between house prices and the gender ratio. This objective is quite similar to the first objective. Wei et al. (2012) considered houses a status good for marriage in China when analysing increasing house prices from the perspective of the highly competitive marriage market based on a high gender ratio. However, they ignored the spatial effects mentioned in recent studies (Xie & Ni, 2014; Wang et al., 2017). This objective fills the gap and uses spatial econometrics to revisit the competitive housing hypothesis. Policymakers need to understand the role of the gender ratio on house prices and its spatial effects because high house prices have become an important economic issue in China.

The third objective extends the research between the crime rate and the gender ratio. From Becker's (1968) research, traditional economic variables affecting the crime rate have focused on; income per capita, the urbanisation rate, income inequality, unemployment rate, police expenditure etc. However, some scholars have indicated that a high gender ratio might affect the crime rate (Jiang & Li, 2011; Edlund et al., 2013; Cameron et al., 2019). Therefore, this study has considered the gender ratio a key variable influencing the crime rate in China's highly competitive marriage market. Furthermore, this study has considered the spatial effects on the crime rate (Anselin et al., 2000; Xiao-bing, 2013; Liu & Cao, 2016). They only considered the spatial effects of the crime rate but did not consider the effect of the gender ratio on the crime rate. Thus, the contribution of the spatial effects of crime and the role of the gender ratio on crime will enable policymakers to understand crime incidents from a better perspective. Meanwhile, modern theories have also proved that males are

more likely to commit crimes than females. So, policymakers should pay more attention to crime in the cities or regions with more males.

This study was conducted mainly from the point of view of the gender ratio to analyse economic behaviours. Based on the conclusion, the relationship between the saving rate and the gender ratio was insignificant, and the relationship between house prices, crime rates, and gender ratios was significant. Thus, when policymakers formulate policies, they should consider the effect of the gender ratio on house prices and the crime rate to improve citizens lives. The saving rate should consider the young dependency ratio, income growth rate, and precautionary motive. Because of its spatial effect, local governments should formulate policies with the central government to give a better result.

1.6 Organisation of the study

This study is organised into five chapters. Following is a brief explanation of each chapter: Chapter one gives a general overview of the study and includes the background, problem statement, research questions, research objectives and the significance and contribution of the study. Chapter two reviews existing and relevant literature on the gender ratio and marriage market, the saving rate, house prices and the crime rate. The review also provides the variables influencing the saving rate, house prices and the crime rate. Chapter three presents the research methodology for this study. The key variables and their measurements are outlined, and the regression models and the estimation techniques employed in the data analysis are specified. This chapter also provides the sources of the data used in this study. Chapter four discusses the key findings from the study based on the objectives. Chapter five summarises the thesis, highlights the study's significant contribution, and discusses the study's key limitations.

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