Chapter 3
Population Size Challenge: Low Total Fertility Rate

Abstract The total fertility rate measures the average number of children who will be borne by a woman over her lifetime, and its accurate measurement can help better predict future population development. Despite the efforts of many parties to provide a measure, we still cannot systematically realize the determinants affecting the total fertility rate or accurately estimate it. This chapter conducts a meta-analysis to examine the determinants affecting the fertility intentions of China’s fertile women and the estimations of the total fertility rate in China. Thirty-one determinants affecting China’s total fertility rate are identified considering three aspects: demographic, social, and economic. The methods and data for estimating China’s total fertility rate are analysed, and the estimation results are compared. Notably, research on the total fertility rate is often limited by a lack of authoritative datasets. To alleviate this problem, this chapter compiles and summarizes the existing datasets used to report the total fertility rate.

Keywords Total fertility rate · Population development · Meta-analysis · Fertility intention · Fertile women · China

3.1 Introduction

The total fertility rate, sometimes also called the fertility rate, absolute/potential natality, period total fertility rate, or total period fertility rate, measures the average number of children that will be borne by a woman over her lifetime. Due to some limitations to the indicator definition, scholars have continuously attempted to refine the total fertility rate and accurately measure fertility levels (Bongaarts and Feeney 1998; Gao and Chen 2013).

The accurate estimation of the total fertility rate is very important for predicting population development and designing a suitable population policy. Due to various obstacles, however, it is very difficult to accurately estimate the total fertility rate. Based on the 2010 population census data (Population Census Office under the State Council and Department of Republation and Employment Statistics National Bureau of Statistics 2012), China’s estimated total fertility rate in 2010 was only 1.18, while the actual total fertility rate in cities, towns, and villages was only 0.89, 1.16, and
1.44, respectively. However, most scholars query the population census and think the total fertility rate has been significantly underestimated (Wang and Ge 2013). The famous demographer and president of the China Population Society, Prof. Zhai Zhenwu, argues that the total fertility rate has been significantly underestimated and that China’s total fertility rate should be approximately 1.6 (Guo 2015; Zhai et al. 2015). Based on data for the number of newborn infants from the China Statistics Bureau, the total fertility rate from 2000 to 2010 should fall into the range of 1.50 to 1.64 (Cui et al. 2013; Peng 2011). The significant differences between the above total fertility rates estimated for 2010 in China by different authoritative experts and institutions reflect the large difficulties in accurately estimating the total fertility rate.

China has entered a period with a low total fertility rate since the 1990s (Guo 2008; Zhao and Guo 2010). From 1950 to 2015, the decrease in the total fertility rate in America, Japan, and India were 42.42% \( \left( \frac{3.3 - 1.9}{3.3} \right) \), 53.33% \( \left( \frac{3 - 1.4}{3} \right) \), and 59.32% \( \left( \frac{5.9 - 2.4}{5.9} \right) \), respectively, while that of China was 73.33% \( \left( \frac{6 - 1.6}{6} \right) \). China’s current total fertility rate is far smaller than the worldwide average (2.45) and even than the average for developed countries (1.67) (Ren et al. 2019). A rate of 2.1 is regarded as the standard level for promoting sustainable population development (Goldstein et al. 2009; Guo 2008, 2010; Huang 2020; Zhang and Chen 2020). Although under the new two-child policy, the fertility rates became slightly higher for the second and third babies and further, the fertility rate for the first birth saw a large reduction, which led to a decline in the overall fertility rate (Guo 2017).

Data from the 66 countries and regions that entered the post-transitional stage before 1997 reveal that the risk of a low-fertility trap has spread from 22 countries and regions to other parts of the world (Wu 2019). China is facing a very high risk of falling into the low-fertility trap (Chen and Zhai 2016; Liu and Chen 2019); thus, China has prioritized improving the total fertility rate by designing policies to increase the fertility intentions of fertile women.

Compared with controlling the total population number and encouraging fertility intentions, increasing the total fertility rate creates a greater challenge for governments. The low total fertility rate would have many negative consequences, such as the shrinking workforce, the increasing ageing population, a limited population size, the vanishing demographic dividend, and a serious leftover men phenomenon (Ren et al. 2019).

However, policymakers still cannot clearly understand the determinants of the low total fertility rate (Wang 2010). Before encouraging fertility intentions, policymakers should first realize the determinants affecting the fertility intentions of fertile women and the total fertility rate. Existing studies reveal that the determinants include social determinants, economic determinants, and demographic determinants (Cai 2010; Chen et al. 2010; Guo 2000; Morgan et al. 2009; Zhenzhen et al. 2009). Although these existing studies indicate the determinants affecting the total fertility rate, they do not allow them to be integrated, understood, and compared. Therefore, this study conducts a meta-analysis to summarize and analyse the determinants affecting the total fertility rate and the estimations of the total fertility rates.

The remainder of the chapter is structured as follows. Section 3.2 presents the research design and some general quantitative findings from the reviewed literature.
Then, Sect. 3.3 conducts the meta-analysis to analyse the determinants affecting the fertility intentions of fertile women and the total fertility rate in China. Subsequently, Sect. 3.4 summarizes the existing authoritative estimations of the total fertility rate, and Sect. 3.5 provides the important datasets. Section 3.6 proposes effective suggestions to improve fertility intentions and the total fertility rate. Finally, conclusions and discussions are presented in Sect. 3.7.

3.2 Research Designs and General Findings

3.2.1 Research Designs

To understand the fertility intentions of the fertility rate and the total fertility rate in China, this chapter conducts the meta-analysis to analyse the existing related literature from Web of Science Core Collection database and CNKI database. The Web of Science Core Collection database is one of the world’s largest abstract and citation database of peer-reviewed research literature. The CNKI database is one of China’s largest abstract and citation databases.

To obtain full-scale results, this chapter conducts an extensive and systemic search using the combination of these two keywords (“total fertility rate” and “China”) from the Web of Science Core Collection database. All articles reviewed herein are obtained as of May 31, 2020. I also analyse the related references of the journal articles.

In the CNKI database, this chapter conducts an extensive and systemic search using the keyword “总和生育率”, which is the Chinese keyword representing the “total fertility rate”. As all searched articles are written in Chinese for studying the Chinese population, it is not necessary to add the keyword “China”.

The search for relevant papers in this process is by no means exhaustive, but the main influence factors affecting the total fertility rate can be found. Only full-length articles are used for the meta-analysis. I thus exclude conference papers, conference reviews, book chapters, editorials, short surveys, and letters from the analysis. Finally, 71 articles are analysed for understanding China’s total fertility rate. Among the 71 articles, 55 articles are published in Chinese, and the rest 16 articles are published in English.

3.2.2 Descriptive Quantitative Analysis

3.2.2.1 Overall Growth

Figure 3.1 illustrates the annual number of the identified journal articles on China’s total fertility rate.
In our identified journal articles, the easiest article was published in 2004, and I can identify significant increasing trends in the number of identified journal articles. Although China’s total fertility rate has been studied for more than 16 years, I can still find ever-increasing interesting articles published in high-quality journals. In 2019, the number of English journal articles was as high as six.

### 3.2.2.2 Publication Sources

The 71 journal articles are distributed across 38 different journals, including 14 English journals and 24 Chinese journals. The specific publication information are presented in Table 3.1. Top-tier journals have also published research on total fertility rate; these journals include *Nature, PLOS One, Population and Development Review, World Development, Chinese Journal of Population Science (in Chinese), Economic Research Journal (in Chinese), Insurance Studies (in Chinese), Journal of Financial Research (in Chinese), Population Research (in Chinese),* and *Social Sciences in China (in Chinese).* The journals that published three or more than three articles include *Population Research (in Chinese)* (18 articles), *Chinese Journal of Population Science (in Chinese)* (6), *Population Journal (in Chinese)* (3), and *Population and Development (in Chinese)* (3). Two English journals published two articles that include *Demographic Research* (2) and *Population Research and Policy Review* (2).

The top two leading Chinese journals in the demographic field, i.e., *Population Research (in Chinese)* and *Chinese Journal of Population Science (in Chinese)*, are very interested in the topic about the total fertility rate due to the below two reasons. First, the low total fertility rate is very important for the population development in
### Table 3.1 The journal information

| Journal                        | Article number | Journal                                      | Article number |
|--------------------------------|----------------|----------------------------------------------|----------------|
| **English Journal**            |                |                                              |                |
| Asian Population Studies       | 1              | Demographic Research                        | 2              |
| Heliyon                        | 1              | International Journal of Environmental Research and Public Health | 1              |
| Journal of Biosocial Science   | 1              | Journal of Population Research               | 1              |
| Marriage & Family Review       | 1              | Nature                                       | 1              |
| PLOS One                       | 1              | Population and Development Review            | 1              |
| Population Research and Policy Review | 2          | Reproductive Health                         | 1              |
| The Journal of Human Resources | 1              | World Development                           | 1              |
| **Chinese Journal**            |                |                                              |                |
| Academic Bimestrie (in Chinese)| 2              | Chinese Journal of Population Science (in Chinese) | 6              |
| Economic Perspectives (in Chinese) | 1            | Economic Research Journal (in Chinese)       | 1              |
| Insurance Studies (in Chinese) | 1              | International Economic Review (in Chinese)   | 1              |
| Journal of Catastrophology (in Chinese) | 1           | Journal of Dongbei University of Finance and Economics (in Chinese) | 2              |
| Journal of Financial Research (in Chinese) | 2           | Journal of Peking University (Philosophy and Social Sciences) (in Chinese) | 1              |
| Journal of Shanxi University of Finance and Economics (in Chinese) | 1         | Modern Finance and Economics-Journal of Tianjin University of Finance and Economics (in Chinese) | 1              |
| North-west Population Journal (in Chinese) | 3         | Population and Development (in Chinese)     | 3              |
| Population and Health (in Chinese) | 1           | Population Journal (in Chinese)             | 3              |
| Population Research (in Chinese) | 18           | Social Sciences in China (in Chinese)        | 1              |
| Sociological Studies (in Chinese) | 1            | South China Population (in Chinese)          | 1              |
| Statistical Research (in Chinese) | 1            | Statistics & Decisions (in Chinese)          | 1              |
| Theory Monthly (in Chinese)    | 1              | Youth Studies (in Chinese)                   | 1              |
China. Second, the public still have little understanding about the total fertility rate, and need to know more about the determinants causing the low total fertility rate and the accurate estimation of the total fertility rate. Therefore, Sects. 3.3 and 3.4 would summarize the determinants causing the low total fertility rate and the existing methods and datasets for estimating the total fertility rate.

### 3.3 Determinants of the Fertility Intention and Total Fertility Rate in China

The determinants affecting the fertility behaviours are complex (Chen 2019; Xu 2010). The explanations for the low total fertility rate can be summarized considering three aspects: demographic determinants, social determinants, and economic determinants.

#### 3.3.1 Demographic Determinants

The demographic determinants include marriage age, length of the interval between marriage and childbearing, marriage delay, divorce rate, educational background, labour participation, participation in pension insurance, retirement age, infertility rate, and rural residence. The existing studies for analysing demographic determinants are summarized in Table 3.2.

China's marriage age is continuously increasing and causes a low total fertility rate (Guo and Tian 2017; Shi et al. 2019; Wang et al. 2019a; Wei et al. 2018), as delaying marriage and fertility negatively affect the fertility intentions (Guo and Tian 2017; Shi et al. 2019; Wang et al. 2019a). The length of the interval between the first marriage and the first childbearing directly affects the fertility level of the fertile women (Fu et al. 2013). In China, nearly 70% of women give birth to a child within one and a half years of marriage, and 90% of women of childbearing age give birth to a child within two and a half years of marriage (Li and Jiang 2009). A decrease in nuptiality or in the marital fertility rate would also reduce the total fertility rate (Yip et al. 2015). One study reveals that marriage deferral can explain approximately two-fifths of the Chinese fertility decline in the 1990s (Retherford et al. 2005, 2004). In China, the current divorce rate is relatively high and thus restrains fertility levels (Yang 2015).

These marriage-related determinants are highly affected by the educational background of fertile women (Li et al. 2016). The total fertility rate is negatively affected by education level (Wang and Zhang 2020; Yang et al. 2007), as education level increases the interval between the first marriage and the first childbearing and thus reduces the total fertility rate (Liang 2013). Since education is assumed to present a cost at a young age and result in higher productivity during adulthood, the fertility
### 3.3 Determinants of the Fertility Intention and Total Fertility Rate in China

#### Table 3.2

| Variables                          | Influence mechanism                                                                 | Studies                                                                                                                          |
|------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| **Marriage age**                   | The late marriage age decreases the total fertility rate                              | Shi et al. (2019), Wang et al. (2019a, b), Wei et al. (2018), Guo and Tian (2017), Jiang et al. (2019)                           |
| **Age interval between marriage and childbearing** | Age interval between first marriage and first childbearing is increasing and causes the low total fertility rate | Fu et al. (2013), Liang (2013), Retherford et al. (2004, 2006)                                                                     |
| **Marriage delay**                 | Marriage postponement caused a decline in the fertility level between 1989 and 2000 as well as between 2000 and 2010 | Guo and Tian (2017), Jiang et al. (2019)                                                                                         |
| **Divorce rate**                   | The divorce rate restrains the fertility levels                                       | Yang (2015)                                                                                                                      |

Data:
- 2017 fertility survey data investigated by the National Health Commission of China
- A multistage stratified cluster sampling survey with 2,516 women respondents in rural Shaanxi
- The 1990, 2000, and 2010 population census data, the 1995, 2005, and 2015 small population census data with 1% sample, and the 1‰ population sample data
- The 1990, 2000, and 2010 population census data
- The 2000 and 2010 population census data
- The 1990 and 2000 population census data
- The 1992, 2000, and 2010 population census data and the 1991, 2001, and 2011 Hong Kong population statistics

(continued)
Table 3.2 (continued)

| Variables                  | Studies                     | Influence mechanism                                                                 | Data                                      |
|----------------------------|-----------------------------|--------------------------------------------------------------------------------------|-------------------------------------------|
| Education background       | Yang et al. (2007)          | Woman literate rate negatively affects the total fertility rate                       | The statistical data from 109 countries   |
|                            | Liang (2013)                | The education level increases the interval between first marriage and first childbearing, and thus reduces the total fertility rate | The 2000 and 2010 population census data  |
|                            | Striessnig and Lutz (2014)  | When education is assumed to present a cost at a young age and results in higher productivity during adult age, the fertility rate that in the long run keeps dependency at a minimum turns out to lie well below replacement fertility both in Europe and in China | Thousands of alternative simulations for different fertility levels |
| Labour participation      | Sasser (2005)               | The labour participation rate of the fertile women reduces the total fertility rate   | The data with labour participation rate and income |
| Participating in pension insurance | Chen and Zhang (2019) | Participating in pension insurance reduces people’s total fertility desire by 14.1%, the desire to give birth to sons is reduced by 7.2%, and the desire to give birth to daughters is reduced by 5.4% | Chinese General Social Survey (CGSS) 2010, 2012, 2013, and 2015 data |
| Retirement time           | Dong and Kang (2020)        | Extending the retirement time would reduce the time of the elderly people for caring for the children, and thus reduce the total fertility rate | The 2010 population census data and the 2005 people sample data |
| Infertility rates         | Guo (2008)                  | The current high infertility rates reduce the total fertility rate                    | N/A                                       |

(continued)
| Variables          | Studies             | Influence mechanism                                                                 | Data                                           |
|--------------------|---------------------|-------------------------------------------------------------------------------------|------------------------------------------------|
| Rural residency    | Wang and Chi (2017) | The significant positive effect of rural Hukou is found only in places close to Beijing, suggesting that there is some unique rural residency characteristic in this place that operates independently from economic and fertility policy factors | Geocoded 2010 county-level census data         |
rate, which in the long run keeps dependency at a minimum, lies well below replacement fertility both in Europe and China (Striessnig and Lutz 2014). There is no doubt that a high education level increases the labour participation rate of fertile women. As working women must invest more to have children and address the trade-off between career and family, the labour participation rate of fertile women reduces the total fertility rate (Sasser 2005). Participating in pension insurance also reduces people’s total fertility desire by 14.1%, with the desire to give birth to sons being reduced by 7.2%, and the desire to give birth to daughters by 5.4% (Chen and Zhang 2019). Extending the retirement age would reduce the time that elderly people can spend caring for children and reduce the total fertility rate (Dong and Kang 2020).

One serious physical condition is the current high infertility rate, which is estimated to be approximately 15% (Guo 2008). The high infertility rate directly reduces the total fertility rate. In some specific regions, rural Hukou residency also has a significant positive effect on the total fertility rate (Wang and Chi 2017).

### 3.3.2 Social Determinants

Social determinants include social stability, political freedom, retirement security system, urbanization rate, floating population, regional education quality, environmental pollution, gender ratio, women’s social status, social fertility culture, and the family planning policy. The existing studies analysing social determinants are summarized in Table 3.3.

The fertility intentions of fertile women are affected by whether society is stable. During the period of war, women usually have very slow fertility intentions (Wang and Zhang 2020). Earthquake disasters have a significant impact on the fertility pattern of the population in the disaster areas and have played an inhibiting role in the fertility level in the short term (Jiao et al. 2019). Deteriorating political freedom in upper- to middle-income countries exerts downward pressure on fertility rates, while it contributes a positive effect to fertility rates in lower middle- and low-income countries (Wang and Sun 2016). Changes in retirement security rate have a negative incentive for the marriage structure and the total fertility rate (Wang and Liu 2015; Wei et al. 2018). Due to various demographic factors and the current sound social security system, many fertile women marry late (Wang and Liu 2015) and have low fertility intentions.

Fertility intentions differ between cities, towns, and villages. With the accelerated growth in the urbanization rate, the total fertility rate is decreasing (Guo and Yu 2016). Urbanization was responsible for approximately 22% of the decrease in the total fertility rate from 1982 to 2008, and its effect was especially important from 2001 to 2008. In most provinces, urbanization is associated with a decline in provincial-level fertility (Guo et al. 2012). The floating population reduces the total fertility rate, as the fertility rate of the floating population is significantly smaller than that of the urban population and even smaller than that of the rural population (Guo 2008). The
### Table 3.3 The social determinants affecting fertility intentions and total fertility rate

| Variables                     | Studies                        | Influence mechanism                                                                 | Data                                      |
|-------------------------------|-------------------------------|--------------------------------------------------------------------------------------|-------------------------------------------|
| Social stability              | Wang and Zhang (2020)         | The total fertility rate is increased by social stability                              | N/A                                       |
|                               | Jiao et al. (2019)            | Earthquake disasters have a significant impact on the population fertility pattern in the disaster areas, and have played an inhibiting role in the fertility level in the short term | Population data from Sichuan Statistics Yearbook 2009 |
| Political Freedom             | Wang and Sun (2016)           | Worsening political freedom in upper-income countries exerts downward pressure on fertility rates, while it contributes a positive effect to fertility rates in lower-income countries | Samples covering 70 countries in four income categories from 1973 to 2011 |
| Retirement security system   | Wang and Liu (2015)           | Retirement security system negatively affects the marriage structure and total fertility rate | Related data of China and countries of ASEAN from 1989 to 2013 |
|                               | Wei et al. (2018)             | Social security benefits are significantly and negatively related to desired fertility | A stratified cluster sampling survey with 2,516 women respondents in rural Shaanxi |
| Urbanization rate             | Guo and Yu (2016)             | Urbanization rate would reduce the total fertility rate                                | The two-period OLG model and numerical experiment |

(continued)
| Variables                     | Studies         | Influence mechanism                                                                                                                                                                                                 | Data                                                                                     |
|-------------------------------|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| Population floating          | Guo et al. (2012) | Urbanization was responsible for about 22% of the decrease in the total fertility rate from 1982 to 2008, and its effect was especially important from 2001 to 2008. In most provinces, urbanization is associated with a decline in provincial fertility | The 1982 and 1990 population census, and the 2001 and 2008 population survey with 1‰ sample |
| Population floating          | Guo (2008)      | Population floating reduces the total fertility rate                                                                                                                                                                    | N/A                                                                                       |
| Population floating          | Liang (2006)    | A large number of the migrant population causes the low total fertility rate                                                                                                                                          | The 1990 and 2000 population census data                                                                                                        |
| Population floating          | Li and Guo (2014)| The fertility level of the floating population is relatively small                                                                                                                                                  | 2012 floating population monitoring data                                                                                                         |
| Regional education quality    | Wang et al. (2019a, b) | Regional education quality has a direct negative impact on the childbearing willingness for a second baby                                                                                                           | Chinese General Social Survey (CGSS) 2015 data                                                                                                    |
| Environmental pollution      | Guo et al. (2019)| PM2.5 concentration has a negative impact on the second baby intentions of the floating population. It exhibits marked regional heterogeneity: the desire for a second baby across migrant groups living in South China decreases if PM2.5 concentration goes up, while migrants coming from, and living in, North China show strong intentions to have a second baby despite an increase in PM2.5 concentration in northern cities | Chinese Floating Population Dynamic Survey in 2014 administered by the National Health Commission, the National Prefecture-level City Matching Data administered by the National Bureau of Statistics of China, and the air pollution index PM2.5 collected by the Green Peace Organization |
| Variables | Studies | Influence mechanism | Data |
|-----------|---------|---------------------|------|
| Gender ratio | Striessnig and Lutz (2014) | The optimal fertility level falls even lower when climate change is factored in as well as gender ratio. | N/A |
| | Guo (2008) | Traditional “son preference” opinion causes the unbalanced gender ratio and thus reduces the total fertility rate. | N/A |
| Women's social status | Striessnig and Lutz (2014) | The optimal fertility level falls even lower when climate change is factored in as well as gender ratio. | N/A |
| | Wang and Zhang (2020) | Young people abandon the traditional family status and have lower fertility intentions. | Interview data |
| Social fertility culture | Wu et al. (2016) | Traditional rural women’s cultural views towards fertility are significantly but positively related to their desired fertility. | N/A |
| Family planning policy | Wei et al. (2018) | The family planning policy is effective in controlling China’s total fertility rate. | N/A |
| | Ding et al. (2019), Shi et al. (2019), Wang et al. (2019a, b), Li et al. (2019a, b), Chen (2019) | The family planning policy is very effective in controlling the total fertility rate in China. | Chinese General Social Survey (CGSS) |
| | Zhu (2020) | The family planning policy is effectively increasing the total fertility rate in China. | 2012 data |
| | Li et al. (2019a, b), Zhang et al. (2019) | The new one-child policy has a limited effect in increasing the total fertility rate in the long term. | The Population census data and the yearly population data with a 1% sample from 1973 to 2011 |
| | Wang and Sun (2016) | Population policies, measured by the contraception prevalence rate, are effective in reducing the total fertility rate. | Samples covering 70 countries in four income categories from 1973 to 2011 |
fertility level of the floating population is relatively small (Li and Guo 2014), and a large number of migrants cause a low total fertility rate (Liang 2006).

The total fertility rates show significant differences between the 31 provinces. Regional education quality has a direct negative impact on the willingness to bear a second baby (Wang et al. 2019b). Environmental pollution also significantly reduces the total fertility rate. The PM2.5 concentration has a negative impact on the second baby intentions of the floating population, although this impact exhibits marked regional heterogeneity: the desire for a second baby across migrant groups living in South China decreases if the PM2.5 concentration increases, while migrants coming from and living in North China show strong intentions to have a second baby despite an increase in the PM2.5 concentration in northern cities (Guo et al. 2019). The optimal fertility level falls even lower when climate change is factored in as well (Striessnig and Lutz 2014).

Family planning policy and social fertility culture are two important social constraints affecting Chinese families. The family planning policy is an external system that restricts people’s fertility behaviours, and the social fertility culture is the societal opinions that affect people’s fertility behaviours. Decades ago, the Chinese people strongly considered childbearing to represent continuing the family bloodline, and traditional fertility culture is significantly and positively related to the total fertility rate (Wei et al. 2018). However, the traditional “son preference” causes an unbalanced gender ratio, which reduced the total fertility rate (Guo 2008). Currently, women’s social status has significantly increased, and the former “men outside the home, women inside” lifestyle has shifted to become the “equality of men and women”. The improvement of women’s social status has led young people to abandon traditional opinions about family and children and to develop relatively low fertility intentions (Wu et al. 2016).

Measured by the prevalence rate for contraception (Wang and Sun 2016), the family planning policy has been very effective in controlling the total fertility rate in China (Ding et al. 2019; Zhu 2020). The two-child policy increased China’s total fertility rate in 2016, particularly the willingness to bear a second baby (Li et al. 2019b; Shi et al. 2019; Wang et al. 2019a; Zhang et al. 2019). However, some scholars propose that not all women will have increased fertility intentions under the two-child policy because two children increase their opportunity costs by reducing the labour supply, wage income, and healthy human capital (Li et al. 2018; Zhu 2020). Implementation of the two-child policy will have short-term effects on China’s future birth rates (Zhang et al. 2019) but a limited ability to increase fertility levels and limited effects on the national population size and structure (Li et al. 2019a).

### 3.3.3 Economic Determinants

Economic determinants can be divided into social-economic background, family economic structure, and fertility economics for childbearing. The specific economic determinants include globalization, regional human development index, house price,
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partible inheritance mechanism, income level, household consumption, fertility benefits, childbearing cost, opportunity cost of childbearing, and time pressure. The existing studies analysing economic determinants are summarized in Table 3.4.

The socio-economic background includes globalization, regional human development index, house prices, and partible inheritance mechanism. The total fertility rate is negatively affected by globalization, as one of the characteristics of globalization is rising economic inequality and increasing pressure from the intermediate social class. As globalization increases, fertility intentions show a significant U curve correlating with economic resources (Wang 2010). Globalization increases the proportion of families at the middle-income level and thus reduces the total fertility rate. Some studies have found that the total fertility rate is negatively related to the regional human development index (Tao et al. 2017; Zhou 2015), while others find that the total fertility rate shows a U-shaped relationship with the regional human development index (Chen and Zhai 2016; Myrskylä et al. 2009). High house prices restrain the development of the total fertility rate (Guo and Jiang 2018). Under the traditional partible inheritance mechanism, fertility intentions were significantly negatively associated with birth order (Li and Zhen 2015).

The family economic structure includes family income and household consumption. The fertility intentions of families with high or low incomes are significantly higher than those with middle incomes. The high fertility rates of people with low incomes create the low-quality labour population (Guo and Yu 2017). A rural family may reduce the number of births according to the trade-off between quality and quantity, which may be the main cause of the fertility decline in China (Song et al. 2012). Families with high incomes can provide superior conditions for their children and have a relatively high willingness to give birth (Zhu and Chen 2012), while families with middle incomes have high life requirements and are under strong social pressure. Therefore, fertility level and household consumption are shown as inverted U-shaped curves (Xue 2016).

From the perspective of fertility economics, fertility decision-making is mainly determined by fertility benefits and costs. The families in the low or medium classes in terms of fertility benefits have a low desire for a second baby, while those in the higher class for fertility benefits have a high desire. Fertility benefits can be grouped into reasons related to one’s path in life, anticipated positive experiences, and feelings drawn towards children. To have a child makes one’s family complete; is the next stage of life; provides happiness, fun, and enjoyment; brings care and company in old age; and children are “lovely” and “cute” (Adams 2016). The significant benefit factors of having a second baby include parenting joy, health risks, mutual care among siblings, and the flourishing of the family (Chen et al. 2019). Fertility costs include the childbearing cost, the opportunity costs for childbearing, and time pressure. The fertility intentions of fertile women are reduced by high childbearing costs, which include family childbearing costs and the social childbearing costs (Wang and Liu 2017; Wang and Long 2018; Xia and Yang 2019). However, the unbalanced childbearing cost allocation mechanism causes China’s families to bear most of the childbearing costs (Xia and Yang 2019). The fertility intentions of some fertile women will not be increased by the two-child policy (Zhou and Chen 2013), since
| Variables                        | Influence mechanism                                                                 | Studies                                      | Data                                                                 | Notes                                                                 |
|---------------------------------|--------------------------------------------------------------------------------------|----------------------------------------------|----------------------------------------------------------------------|----------------------------------------------------------------------|
| Globalization                   | Globalization causes the low total fertility rate                                   | Wang (2010)                                 | N/A                                                                 | The 1982, 1990, 2000, and 2010 population census data               |
| Regional human development index | The total fertility rate is negatively related to the provincial human development index | Tao et al. (2017)                           | The 1990 and 2000 data about the total fertility rate and human development index | Data from 109 countries with over 5 million people in 2010          |
|                                 | There is a strong reverse relationship between the regional human development index and the total fertility rate among the 109 studied countries | Zhou (2015)                                 | N/A                                                                 | Data from 109 countries with over 5 million people in 2010          |
|                                 | The fertility intention shows a significant U-shaped curve correlation with the regional human development index | Chen and Zhai (2016)                        | Data from 109 countries with over 5 million people in 2010          | Data from 109 countries with over 5 million people in 2010          |
|                                 | The fertility intention shows a significant U-shaped curve correlation with the regional human development index | Myrskyla et al. (2009)                      | N/A                                                                 | Data from 109 countries with over 5 million people in 2010          |
|                                 | High house prices restrain the development of the total fertility rate               | Guo and Jiang (2018)                        | China Statistics Yearbook 2006–2017                                | Historical birth data of the Que family from 1670 to 1996           |
| Partible inheritance mechanism  | Under the traditional partible inheritance mechanism, fertility intention was significantly negatively associated with birth order | Li and Zhen (2015)                          |                                                                     |                                                                     |
### Table 3.4 (continued)

| Variables          | Studies                | Influence mechanism                                                                 | Data                                           |
|--------------------|------------------------|-------------------------------------------------------------------------------------|------------------------------------------------|
| Income level       | Li (2016)              | The fertility intention shows a significant U-shaped curve correlation with the family income | The income data of the 31 provinces from 1978 to 2013 |
|                    | Song et al. (2012)     | The fertility decision-making of rural families is determined mainly by the incomes and the childbearing costs with fixed land. Rural families reduce the number of births according to the trade-off between quality and quantity, which is maybe the main cause of the level of fertility decline in China | China Statistics Yearbook 2005–2010             |
|                    | Guo and Yu (2017)      | Fertility rate of people with low incomes is high, causing the low quality of the labour population | 2010 Chinese family monitoring survey          |
| Household consumption | Xue (2016)            | The fertility level and household consumption are shown as an inverted U-shaped curve | China Statistics Yearbook 1978–2014             |
| Fertility benefit  | Chen et al. (2019)     | Participants in the lowest- and medium-benefit classes have low fertility desire for a second baby, while those in the high-benefit classes have a high desire. Fertility benefit factors include parenting joy, health risks, mutual care among siblings, and flourishing of family | A total of 396 participants                     |
| Variables                  | Influence mechanism                                                                 | Studies                                                                 | Data                                                                 |
|----------------------------|---------------------------------------------------------------------------------------|------------------------------------------------------------------------|----------------------------------------------------------------------|
| Fertility benefit          | To have a child makes one’s family complete; is the next stage of life; provides happiness, fun, and enjoyment; brings care and company in old age; and children are “lovely” and “cute”. These reasons can be grouped into life course reasons, anticipated positive experiences, and feelings that draw towards children. | Adams (2016)                                                          | Twenty-five semi-structured, in-depth interviews                      | *(continued)* |
| Childbearing cost          | The current high childbearing costs reduce the fertility intention of the fertile women | Wang and Liu (2017), Wang and Long (2018)                               | N/A                                                                  | *(continued)* |
| Opportunity costs for childbearing | The fertility decision-making of rural families is mainly determined by the incomes and the costs of raising children with fixed land. Therefore, rural families may reduce the number of births according to the trade-off between quality and quantity, which is maybe the main cause of the level of fertility decline in China. | Song et al. (2012)                                                     | China Statistics Yearbook 2005–2010                                   | *(continued)* |
| Pecuniary costs of having children are significantly and negatively related to their desired fertility       | Wei et al. (2018)                                                                        |                                                                       | Chinese General Social Survey (CGSS) 2012 data                        | *(continued)* |
| *(continued)*               | The family planning policy is very effective in controlling the total fertility rate in China | Zhu (2020)                                                             |                                                                      | *(continued)* |
### Table 3.4 (continued)

| Variables      | Studies                  | Influence mechanism                                           | Data                                                  |
|----------------|--------------------------|----------------------------------------------------------------|-------------------------------------------------------|
|                | Ji and Zheng (2018)      | Qualitative analysis                                          | N/A                                                   |
|                | Wei et al. (2018)        | The opportunity cost for childbearing is significantly and negatively related to their desired fertility | A multistage stratified cluster sampling survey with 2,516 women respondents in rural Shaanxi |
|                | Time pressure            | Chen et al. (2019)                                            | Time pressure significantly affects the fertility desire for a second baby | A total of 396 participants |
the two-child policy increases their opportunity costs by reducing the labour supply, wage income, and healthy human capital (Zhu 2020). The potential opportunity costs significantly reduce the total fertility rate (Ji and Zheng 2018; Wei et al. 2018). Time pressure is also a large barrier to fertility desire (Chen et al. 2019), and extending the retirement age would significantly increase time pressure (Dong and Kang 2020).

Based on the above meta-analysis, this chapter draws Fig. 3.2 to analyse the factors influencing the total fertility rate.

### 3.4 Estimation of the Total Fertility Rate

To date, China’s total fertility rate has not been well measured due to the lack of authoritative datasets. China has more than 1.4 billion people and 9.6 million square kilometres, so it is very difficult to accurately survey all fertile women. Many scholars are continuously searching for ways to survey fertile women and calculate the total fertility rate.

To help realize the estimation of the total fertility rate, this section summarizes and compares the estimation results for China’s total fertility rate. The existing estimations of China’s total fertility rate since 2000 are summarized in Table 3.5.

#### 3.4.1 Estimated Methods and Data Sources

Various methods have been adopted to calculate China’s total fertility rate based on different data, and these studies reach different conclusions. The total fertility rate can be the summation of the fertility rate based on birth order (Lu 1989; Zhang 2006), calculated based on the fertility rate at different ages multiplied by the proportion of fertile women at those ages (Wang 2003, 2019; Xu 2010; Zhang 2006; Zhou and Chen 2013), or calculated by combining these two methods (Chen and Gao 2013).

Some scholars obtain population data for selected decades and use the backward survival method to reverse calculate the number of newborn infants and the total fertility rate (Guo 2011; Li and Li 2012; Zhu 2012). However, some question whether population census data are scientific, and these data have serious omission problems (Goodkind 2004; Yi 1996; Zhang and Cui 2003). The estimated total fertility rate as calculated directly based on population census data is usually smaller than 1.5. To overcome the shortfalls in the population census, some scholars first check and amend the population census data and then use the data to estimate the total fertility rate (Chen 2016; Chen and Zhang 2015; Cui et al. 2013; Mi and Yang 2016; Wang 2003; Wang and Ge 2013; Wang et al. 2004; Zhao 2015). The estimated total fertility rate based on amended census population data usually falls between 1.5 and 1.6. Some scholars believe that data from educational institutions or household data are more scientific than data from the population census. They estimate the number of children and fertile women based on education data and residential data from the education
Fig. 3.2 The determinants affecting the total fertility rate
Table 3.5  Estimations of China’s total fertility rate since 2000

| Estimated year | Study                     | Data                                                                 | Method                                      | Findings                                                                                                                                 |
|----------------|---------------------------|----------------------------------------------------------------------|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| 2000           | Wang et al. (2004)        | The 2000 population census data                                     | Statistical Analysis                        | There are significant provincial differences in China’s 31 provinces in terms of the total fertility rate. The total fertility rate of the 31 provinces ranges 0.8–2.5 |
| 2006           | Zhou and Pan (2010)       | Agricultural and non-agricultural population data from the Household Sector of the Ministry of Public Security in 2006 | Estimating the family structure in cities, towns, or villages of different provinces, and then estimating the total fertility rate | Under the strict one-child policy, the total fertility rate is estimated to be 1.452, and the ideal total fertility rate is 1.65 at most |
| 2000–2009      | Zhu (2012)                | The 2000 and 2010 population census data                            | Using the population difference to reversely calculate the total fertility rate | The average total fertility rate was 1.48 during the years 2000–2009                                                                 |
| 1982–2010      | Chen (2015)               | The age distribution data in the population census                  | Integrated approach and variable-r method   | China’s overall total fertility rate in the 2000s is around 1.6                                                                     |
| 2000–2010      | Guo (2011)                | The 1990, 2000, and 2010 population census data                    | Using the population difference to reversely calculate the total fertility rate | China’s total fertility rate is smaller than 1.5, and even smaller than 1.4 in some years                                           |

(continued)

and household sectors and use that to calculate the total fertility rate (Chen 2014, 2016; Chen and Yang 2014; Yang and Zhao 2013; Zhou and Pan 2010). The estimated total fertility rate based on education or residential data is usually approximately 1.6 or even higher. The estimated total fertility rate based on the population census data is significantly smaller than that based on education and residential data.

In addition to obtaining these official statistical data, some scholars estimate the total fertility rate by conducting surveys (Wei et al. 2018). In 2017, China conducted an official fertility survey, and the estimated that the total fertility rate based on
### Table 3.5 (continued)

| Estimated year | Study | Data                                                                 | Method                                | Findings                                                                                                                                 |
|---------------|-------|----------------------------------------------------------------------|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| 2000–2010     | Hao and Qiu (2011) | The population statistical data from China Statistics Bureau | Estimated based on the population statistical data | During the years 2000–2010, China’s overall total fertility rates fall into the range 1.22–1.47; the total fertility rates in China’s cities and villages fall into the range 0.94–1.22, and from 1.43 to 1.73, respectively |
| 2000–2010     | Li and Li (2012) | The 2000 and 2010 population census data | Using the population difference to reversely calculate the total fertility rate | The average total fertility rate was 1.57 during the years 2000–2010 |
| 2000–2010     | Chen (2014) | The 2000 and 2010 population census data, the education data from 2000 to 2010, and the household data from 2000 to 2010 | Estimating the number of children by using the education data and estimating the number of fertile women by analysing the population census data | From 2000 to 2010, the total fertility rate is smaller than 1.5 in the early period and is approximately 1.7 in the late period |
| 2000–2010     | Zhao (2015) | The 2000 and 2010 population census data and the annual fertility pattern sampling surveys by National Bureau of Statistics of China | Variable-r method | Chinese fertility between 2000 and 2010 is around 1.60 |
| 2008–2010     | Zhai et al. (2015) | The resident data in 2015 | Using the resident data to obtain the number of newborn infants and fertile women, and calculate total fertility rate | The estimated total fertility rate from 2008 to 2010 is at least 1.66, 1.66, and 1.63 |

(continued)
| Estimated year | Study | Data | Method | Findings |
|---------------|-------|------|--------|----------|
| 2010          | Chen and Yang (2014) | The 2010 population census data | Estimating the number of children and the number of fertile women by analysing the population census data | The estimated total fertility rate in 2010 is 1.66 |
| 1982–2012     | Mi and Yang (2016) | The 1982, 1990, 2000, and 2010 population census data, and the 1995, 2005, and 2015 small population census data with 1% sample | Linear regression analysis | China’s total fertility rate is estimated to be 1.595 in 2010 |
| 2000–2012     | Yang and Zhao (2013) | The 2000 and 2010 population census data, education statistical data, and the household resident data in 2011 and 2012 | Estimating the number of children and the number of fertile women based on the education and resident data and the population census data | The average total fertility rate was at least approximately 1.6 during the years 2000–2012 |
| 2000–2012     | Wang and Ge (2013) | The 1990, 2000 and 2010 population census data | Amend the population census data and then estimate the total fertility rate | The average total fertility rate was at least approximately 1.52 during the years 2000–2012 |
| 2000–2012     | Gu (2015) | The 2000 and 2010 population census data, and the 2005 small population census data with 1% sample | Regression model based on the data of the general fertility rate | China’s total fertility rate first decreases and then increases. The total fertility rate in 2012 is high, at 1.43 |
| 2005–2013     | Chen and Zhang (2015) | The 1990 and 2010 population census data | Amend the population census data and then estimate the total fertility rate | From 2005 to 2013, the estimated total fertility rate is at least 1.5, and most probably would be around 1.6 |

(continued)
### Table 3.5 (continued)

| Estimated year | Study            | Data                                                                 | Method                                      | Findings                                                                 |
|----------------|------------------|----------------------------------------------------------------------|---------------------------------------------|--------------------------------------------------------------------------|
| 2000–2014      | Chen (2016)      | The 2000 and 2010 population census data and the resident data from 2008 to 2014 | Generalized stable population model         | China’s total fertility rate is at least 1.5, and has an increasing trend |
| 2006–2016      | He et al. (2018) | The 2017 fertility survey data investigated by the National Health Commission of China | Statistical analysis                       | The total fertility rate between 2006 and 2011 was between 1.60 and 1.70, and fluctuated between 2012 and 2016, peaking in the years 2012 and 2016 |
| 2003–2018      | Wang (2019)      | China Statistics Yearbook                                            | Holt’s Exponential Smoothing model         | Population structure was ageing fast, fertility rates continued to decrease to a substantially low level, and three north-eastern provinces displayed notable socio-economic issues associated with low-fertility trap |

This survey is highly consistent with the estimated results based on education and residential data (Chen and Duan 2019). Although some scholars argue that education and residential data are more scientific, others think that education or residential data may have false report problems due to potential population subsidies.

As the indicators described in the above paragraph are hard to obtain, some scholars analyse the relationship between the total fertility rate and some easily obtained indicators and derive formulas for calculating the total fertility rate. For instance, Zhu and Qiao (2018) derived a formula for calculating the total fertility rate based on the birth rate (Qiao and Zhu 2018; Zhu and Qiao 2018). Some scholars adopt the variable-r method and use the growth rate in populations of different ages to estimate the fertility level (Chen 2015; Zhao 2015). To measure the total fertility rate, some scholars also use related indicators, such as the mean childbearing age at first birth (Wang and Zhong 2015) and the general fertility rate (Gu 2015).
3.4.2 *Estimated Total Fertility Rate in China*

When performing these estimations, most scholars are worried about the low total fertility rate in China. They believe that China’s total fertility rate is far smaller than the replacement level and thus suggest that the family planning policy should be further relaxed (Guo 2011; Li and Li 2012; Zhou and Pan 2010; Zhu 2012). New authoritative fertility data provided by the National Health Commission of the People’s Republic of China reveal that the total fertility rate between 2006 and 2011 was between 1.60 and 1.70 and fluctuated between 2012 and 2016, peaking between 2012 and 2016 (He et al. 2018).

The total fertility rate reported from the 2017 China fertility survey is relatively higher. In the 2017 China fertility survey, 12,500 investigators and 3128 supervisors obtained 246,840 samples from 12,500 village sample points representing 6078 towns in 2737 counties of 31 provinces (Zhuang et al. 2018). Because the report is new and authoritative, it is very important for fertility rate tracking and policy-making. The relatively high estimated total fertility rate shows that China’s total fertility rate has been significantly underestimated and that the strict family planning policy still plays an important role in controlling the total population number (Chen 2014, 2016; Chen and Yang 2014; Chen and Zhang 2015; Yang 2015).

There are significant differences between the cities, towns, and villages in different provinces in terms of the total fertility rate (Gu et al. 2019; He et al. 2018; Huang 2020; Jiang et al. 2019; Li et al. 2019b; Liang 2013; Shi et al. 2019; Wang et al. 2019a). The total fertility rate of the provinces with high populations of ethnic minorities has increased to a replacement level in the past 10 years and is higher than the national average (Yuan et al. 2019). The total fertility rates from 2006 to 2016 estimated from the 2017 fertility survey are presented in Table 3.6. The total fertility rate in villages is significantly higher than that in cities or towns, but there is a smaller difference in the total fertility rate between villages and cities or towns (Hao and Qiu 2011).

There is significant global spatial dependency and a significant local clustering trend for the provincial total fertility rate (Dorius 2008; Gu 2015; Guo et al. 2012; Li et al. 2017; Tan and Zeng 2014; Wang and Chi 2017; Wang et al. 2004, 2015; Wang 2019; Zhang et al. 2012). The total fertility rates are low in Beijing, Shanghai, Liaoning, Heilongjiang, Jilin, and Tianjin, which are developed municipalities or are located in the north-eastern regions. The provinces with low total fertility rates are concentrated in the north, north-eastern, and south-eastern provinces (Tan and Zeng 2014). Three north-eastern provinces displayed notable socio-economic issues associated with the low-fertility trap (Wang 2019). However, the total fertility rates are relatively high in Guangxi, Guizhou, Xinjiang, and Hainan, which are located in the western and southern regions, and particularly in the south-western regions. The total fertility rates in the western provinces are usually higher than those in the central and eastern provinces (Gu 2015).

Thus, we should not ignore the spatial effects of the total fertility rate, including interdependence and heterogeneity. More analyses of the spatial aggregation of the 31 provinces in terms of population indicators are conducted in Chaps. 7 and 9.
3.4 Estimation of the Total Fertility Rate

Table 3.6  Total fertility rate in China’s towns and villages from 2006 to 2016 (estimated from the 2017 fertility survey)

|               | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---------------|------|------|------|------|------|------|------|------|------|------|------|
| China         | 1.62 | 1.69 | 1.71 | 1.68 | 1.64 | 1.61 | 1.78 | 1.55 | 1.67 | 1.41 | 1.77 |
| Town          | 1.21 | 1.31 | 1.26 | 1.27 | 1.27 | 1.24 | 1.45 | 1.21 | 1.37 | 1.16 | 1.54 |
| Village       | 1.98 | 2.02 | 2.12 | 2.06 | 1.99 | 1.97 | 2.12 | 1.92 | 1.99 | 1.69 | 2.05 |
| Difference    | 0.77 | 0.71 | 0.86 | 0.79 | 0.72 | 0.73 | 0.67 | 0.71 | 0.62 | 0.53 | 0.51 |
3.5 Data Sources for Studying China’s Total Fertility Rate

As described in Sects. 3.3 and 3.4, I can summarize the data sources for studying China’s total fertility rate in Table 3.7.

Population census data have been widely adopted to study the total fertility rate. The small population census data and the yearly population data, both based on a 1‰ sample, are also adopted by many studies. In addition, some studies adopt provincial and regional data to analyse the population development differences among the 31 provinces in China or among counties. The significant population development differences in China are further analysed in Part II.

In addition to using statistical population data, some scholars use population-related statistical data, such as residential data and education data, to estimate China’s total fertility rate. To analyse various determinants affecting the total fertility rates, many studies use data from other fields, such as data on the labour participation rate, income, regional development index data, and even environmental data.

The fertility intentions of fertile women vary with time and cannot be directly calculated through any indicators. Thus, ongoing surveys are very important for analysing and estimating the total fertility rate. As authentic data have been provided by the National Health Commission of China, the 2017 fertility survey data have been widely used by many scholars to estimate the total fertility rate. Another important related survey is the Chinese General Social Survey (CGSS). The CGSS 2010, 2012, 2013, and 2015 data are widely used by scholars to study the total fertility rate. In addition to these two widely recognized datasets, some individuals and institutes also conduct their own surveys, such as the 2010 Chinese family monitoring survey, the multistage stratified cluster sampling survey, and the annual fertility pattern sampling survey. Some studies design experiments and conduct face-to-face interviews to study the total fertility rate in China.

3.6 Suggestions for Improving the Total Fertility Rate

After summarizing the influencing factors causing the low total fertility rate, this study offers some effective suggestions for improving the total fertility rate, specifically the fertility rate for the first birth. It is extremely important that the fertility level of the first birth be improved; otherwise, policy adjustment will only increase the number of second baby in the short term, and the overall fertility level will thereafter be reduced (Guo 2017). The suggestions include four main targets: economic support, maternity benefits, social welfare, and population policies.
### Table 3.7 Data sources adopted to study the total fertility rate

| Data categories                                      | Data information                                                      | Studies                                                                 |
|-------------------------------------------------------|-----------------------------------------------------------------------|-------------------------------------------------------------------------|
| Population statistical data                          | The 1982, 1990, 2000, and 2010 population census data                | Retherford et al. (2004), Wang et al. (2004), Retherford et al. (2005), Liang (2006), Guo (2011), Guo et al. (2012), Li and Li (2012), Zhu (2012), Fu et al. (2013), Liang (2013), Wang and Ge (2013), Yang and Zhao (2013), Chen (2014), Chen and Yang (2014), Chen (2015), Chen and Zhang (2015), Gu (2015), Yip et al. (2015), Zhao (2015), Chen (2016), Chen and Zhai (2016), Mi and Yang (2016), Guo and Tian (2017), Tao et al. (2017), Jiang et al. (2019), Li et al. (2019a, b), Zhang et al. (2019), Dong and Kang (2020) |
|                                                       | The 1995, 2005, and 2015 small population census data with 1% sample  | Gu (2015), Mi and Yang (2016), Guo and Tian (2017), Dong and Kang (2020) |
|                                                       | The yearly population data with 1‰ sample                            | Hao and Qiu (2011), Guo et al. (2012), Song et al. (2012), Xue (2016), Guo and Tian (2017), Guo and Jiang (2018), Li et al. (2019a, b), Wang (2019), Zhang et al. (2019) |
|                                                       | Historical birth data of the Que family from 1670 to 1996            | Li and Zhen (2015)                                                      |
|                                                       | Population data from Sichuan Statistics Yearbook 2009                | Jiao et al. (2019)                                                     |
|                                                       | The 1991, 2001, and 2011 Hong Kong population statistics            | Yip et al. (2015)                                                     |
|                                                       | Chinese floating population monitoring and dynamic survey in 2012 and 2014 | Li and Guo (2014), Guo et al. (2019)                                   |
| Population statistical data                          | The national prefecture-level city matching data                      | Guo et al. (2019)                                                     |
|                                                       | Geocoded 2010 county-level census data                              | Wang and Chi (2017)                                                   |
|                                                       | The population statistical data from 109 countries                   | Yang et al. (2007)                                                    |

(continued)
Table 3.7  (continued)

| Data categories                             | Data information                                                                 | Studies                                      |
|---------------------------------------------|----------------------------------------------------------------------------------|---------------------------------------------|
| The population statistical data from 70 countries in four income categories from 1973 to 2011 | Wang and Sun (2016)                                                             |
| Data of 109 countries with over 5 million people in 2010 | Zhou (2015)                                                                     |
| Related data of China and countries of ASEAN from 1989 to 2013 | Wang and Liu (2015)                                                             |
| Population- related statistical data        | The household/residence data                                                     | Zhou and Pan (2010), Yang and Zhao (2013), Chen (2014), Zhai et al. (2015), Chen (2016) |
|                                             | The education data                                                               | Yang and Zhao (2013), Chen (2014)           |
|                                             | The data with labour participation rate and income                                | Sasser (2005)                                |
|                                             | The human development index from the United Nations Development Programme        | Chen and Zhai (2016)                         |
|                                             | The income data of the 31 provinces from 1978 to 2013                             | Li (2016)                                    |
|                                             | Air pollution index PM2.5 collected by the Green Peace Organization               | Guo et al. (2019)                            |
| Survey data                                 | 2017 fertility survey data investigated by the National Health Commission of China | He et al. (2018), Ding et al. (2019), Li et al. (2019a, b), Chen (2019), Shi et al. (2019), Wang et al. (2019a, b) |
|                                             | 2010 Chinese family monitoring survey                                            | Guo and Yu (2017)                            |
|                                             | A multistage stratified cluster sampling survey with 2,516 women respondents in rural Shaanxi | Wei et al. (2018)                            |
|                                             | The annual fertility pattern sampling surveys by National Bureau of Statistics of China | Zhao (2015)                                  |
|                                             | Chinese General Social Survey (CGSS) 2010, 2012, 2013, and 2015 data              | Chen and Zhang (2019), Wang et al. (2019a, b), Zhu (2020) |
|                                             | Experiments with a total of 396 participants                                     | Chen et al. (2019)                            |
|                                             | Interview data                                                                  | Wu et al. (2016)                              |
3.6 Suggestions for Improving the Total Fertility Rate

Table 3.7 (continued)

| Data categories                          | Data information                  | Studies       |
|------------------------------------------|-----------------------------------|---------------|
| Twenty-five semi-structured, in-depth interviews | Adams (2016)          |               |

3.6.1 Economic Supporting

The implementation of the two-child policy and the changing form of the future population require not only a scientific assessment of the cost of the second baby but also a reasonable mechanism for allocating reproductive cost. Reducing childbearing costs can increase fertility intentions and the total fertility rate. There are two main paths for reducing childbearing costs.

First, the government can provide monetary support to help families raise their children. In many countries or regions, including France, Finland, Belgium, Italy, England, Australia, Singapore, and the Taiwan Province of China, governments offer a one-time birth subsidy for newborn babies (Yang 2016). The size of this one-time monetary reward ranges 150–1500 U.S. dollars. Such one-time monetary reward would be a powerful motivator for changing the fertility intentions of fertile women (Wang and Sun 2017).

Second, ongoing child allowances are also very important for encouraging fertility willingness. Children’s allowances can be provided through various methods. First, children could be provided a regular monthly allowance. Some countries, such as France and Sweden, provide the monthly allowance until the children grow to a certain age. The second way for providing an allowance for children is the education allowance. Governments can not only reduce and even eliminate education fees but also provide allowances for children in school. The third way of providing an allowance is tax reduction and exemption. Families experience greater costs to raise children, so their taxes can be reduced and even exempted. Since 2019, China has already implemented a completely new tax mechanism, in which some costs of children can be deducted from the tax base. A tax benefit policy is difficult and complex to introduce and maintain and requires sophisticated targeted moderating (Wang and Sun 2017).

3.6.2 Maternity Benefits

When having a child, family members, especially the mother, experience far greater workloads. If they still need to work and expend effort to balance work and family, they will have very low willingness to have a new baby and may even experience stress. To help families enjoy raising children and even to be willing to have a new child, governments should provide sufficient maternity benefits.
First, maternity leave should be sufficient. As women’s bodies present new challenges with increasing age, some countries or regions provide maternity leave related to the number of births. The salaries of fertile women during maternity leave can be provided by both governments and employers.

Second, yearly parental leave can encourage families to have more children. In some countries, family members can obtain parental leave to spend time with their children. Having sufficient time to provide companionship to their children can bring happiness to both the parents and the children, help children grow in a healthy manner, and help parents experience better moods to increase their willingness to have more children.

Third, most maternity benefits are designed for the mothers, but fathers should also have leave to take care of their children and wives. Even though fathers can take holidays to spend with their wives and children, leave for fathers is currently limited. Increasing leave time for fathers can also increase the fertility intentions of families.

Fourth, designing flexible working hours and workspaces can offer fathers and mothers sufficient time to spend with their children. During the period of the coronavirus disease 2019 (COVID-2019), most people had to work from home, but the efficiencies gained were found to be ideal for some kinds of work. Therefore, for families with new babies, employers could provide fathers and mothers with flexible work hours and workspaces. Advanced technologies can help promote the development of this mechanism.

3.6.3 Social Welfare

Families would have higher fertility intentions if they could enjoy superior social welfare. Therefore, to encourage the fertility intentions of fertile women, we should continuously improve social welfare.

First, governments need to provide sufficient education and facilities for developing children. If the children cannot obtain a good education from society, families will have a low willingness to have a new child. In addition to governments, employers can establish some facilities for children in their offices.

Second, families with more children experience high housing pressure. As described in Sect. 3.3, high house prices restrain the development of the total fertility rate (Guo and Jiang 2018). In some countries or regions, families with more children are prioritized to receive the housing welfare provided by governments. If families do not need to worry about the housing conditions for their children, they will have higher willingness to have more children.

Third, improving maternal health services is very important for fertile women. Many puerperae have postpartum health problems. If women cannot experience a pleasant recovery process after childbirth, they will have a relatively low willingness to have new children.
3.6.4 Population Policies

Suitable population policies are very important for controlling the total fertility rate. Family planning policies should match the national situation, including economic levels, traditional cultures, social developments, and population.

China’s family planning policies help China control the total population number but have destroyed the demographic structure. Currently, China faces a low total fertility rate and has prioritized relaxing its strict family planning policy. A more detailed analysis of the adjustment of China’s family planning policy is conducted in Chap. 6.

When relaxing family planning policies, governments should also continuously improve public services, reasonably allocate educational and medical resources, and strengthen basic education and medical facilities.

3.7 Conclusions and Discussions

A comprehensive understanding of the determinants of the low total fertility rate and an accurate estimation of China’s total fertility rate are very important for the scientific adjustment of population policies in China. Although the importance and significant effects of the total fertility rate have been widely recognized, existing studies are limited.

In this study, I identified 71 relevant journal articles, comprising 55 Chinese journal articles and 16 English journal articles published as of May 31, 2020. We first conduct descriptive statistical analyses and obtain some general findings regarding overall growth and publication sources. A total of 31 determinants affecting the total fertility rates are identified, and these 31 determinants are divided into three groups: demographic determinants, social determinants, and economic determinants.

Then, the estimations of the total fertility rate are summarized and evaluated. The methods and data adopted to estimate China’s total fertility rate are also summarized. By reviewing these 71 relevant journal articles, the data sources for studying China’s total fertility rate are examined.

The main contribution of this study is its summary of the determinants of the total fertility rate in China, which can allow a better response to China’s total fertility rate. Moreover, this study helps us better evaluate China’s current total fertility rate and determine how to choose suitable data sources for studying the total fertility rate. This study also informs academicians and practitioners in this research field of the current research situation, the implications and limitations of existing studies, and the prospective research directions in this area.
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