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Introduction

According to the latest government report, South Korea's fertility rate has dropped to a record-low 0.70 in the second quarter of 2023, putting the nation, which has already been the country with lowest birth rates in the world for years, in pressure to address the low birth rate issue. This literature review explores the background of low childbearing intention issue among South Koreans, including young adults, married heterosexual couples and international couples. First, we look at the overview of South Korea's fertility situation including gender differences in fertility intention, multiple birth rate, mother's education level and childcare resources provided by South Korean government. Next, we discuss the socioeconomical, regional and technological factors that affect South Koreans' childbearing intention. Lastly, knowing that women have higher education level and greater freedom to work outside instead of being housewives in modern days, we look specifically into double-earner couples and their concerns about childbearing.

1.Overview of South Korea's fertility situation

1.1 Gender differences in fertility intention among young adults

Study shows that female students show lower willingness for childbirth, fertility knowledge, and value of parenthood compared to male students among college students in South Korea (Kim & Kim, 2023). This can be explained by the non-egalitarian framework in division of housework and childcare between men and women in South Korea (Lee, 2016). Under South Korea's patriarchal societal framework, men tend to provide material support for the family by undertaking paid work in the labor market, while women provide care work in the family without any material compensation (Lee, 2016). Due to this arrangement, men in South Korea can escape actual caregiving by providing material support and delegating the practical physical tasks to women (Lee, 2016). Hence, the differences in gender roles within the household, of which mothers usually take on the more supressed role and often need to sacrifice more to take care of children as mothers than fathers, leads to the difference in willingness for childbirth between the two genders.

1.2 Rise in multiple birth rate and relationship with mothers' education level

Study shows that the total twinning birth rate has shown an upward trend over time, despite the rise in the average maternal age (Hur, 2021). This suggests that a delay in childbearing contributed to the increase in the twinning rate. Besides, the percentage of mothers of multiples who completed a college or higher degree has increased by 1000% from 1981 to 2019, this sharp increase in the level of education of females explains the general delay in childbearing (Hur, 2021). As mentioned in section (1.1), females tend to sacrifice more in the childrearing process in the household. Hence, they opt to pursue higher education before having children to prevent sacrificing their education opportunity to take care of the children in the future. Lastly, the rise of multiples in the South Korean population suggests that attention should be called on the government to provide support towards households with multiples to alleviate their childcare burden.

1.3 South Korea's state childcare provision

Since 2005, the South Korean government has picked up the states' responsibility for childcare through reforming childcare systems (Lee, 2016). Yet, there is a lack of commitment to increasing public childcare services shown in the policies implemented. Study indicates the extensions in government subsidies have led to a higher proportion of childcare facilities being provided by private for-profit daycare centres (instead of public service providers), such as incorporated organizations or centres and home-based individuals (more than 90%) (Lee, 2016). The marketization of childcare services leads in an increase in childcare cost (Lee, 2022). Hence, the overall burden of paying childcare costs, especially among low-income families and multiple children families, increased steeply. Additionally, substantial governmental subsidies have resulted in loose regulation for monitoring the service quality offered by private childcare service providers and hence little apparent improvement in service quality (Lee, 2022). Childcare workers often experience poor working conditions (e.g. long working hours) and are paid with low salaries (Lee, 2016). Thereby, low levels of service quality and satisfaction were reported by parents, especially users of private sector facilities (Lee, 2022). With reference to parental attitudes towards childcare services in institutional settings (I.e. unaffordable and low quality), the burden of childcare lies back to the family, and often on women within the household as the main caregiver.

2.Factors affecting South Korea's fertility rate

2.1 Socioeconomic factors and child grant

Households' socioeconomic resources, stable housing arrangements and husband's employment security appear to be the most important factors for a married couple's fertility decisions (Lim, 2021). Yet, income inequality has always been a social issue in South Korea which leads to a divergence in family structure and behaviors according to socioeconomic status. Knowing that there is a lack of public childcare service provided in South Korea which results in high private childcare cost and low service quality (Lee, 2022), socioeconomically disadvantaged married families, which cannot afford private childcare services or quit their job to fully take care of their children, tend to delay their transition to parenthood. Although childbirth grants and child allowances are provided by the government to families with children to support the costs of childrearing up to a certain age, research shows that these family benefits may not be cost-effective since substantial amount of government funding is required to offset the high childcare cost despite they have been proven to have a statistically significant positive effect on fertility (Son, 2018).

2.2 Regional fertility variation

The relationships between local-level fertility rate and sociodemographic factors are spatially different in South Korea. Firstly, more urbanized and densely populated areas (e.g. Seoul and Busan) which experience higher costs of living that reduces people's disposable income, has lower birth rates (Jung et al., 2019). Secondly, higher women's educational levels, which causes the general delay in childbearing, affect fertility rates negatively in most areas (Jung et al., 2019). However, women's education has a positive impact on North Jeolla Province, where proportions of agricultural lands and elderly populations are high (Jung et al., 2019). This suggests agricultural families' conventional norms about marriage and fertility probably offset the effects of women's education in this area. Lastly, international marriage showed negative effects on local-level fertility rates in general, but positive effects were identified in areas with specialized industries which attract highly educated foreigners and more working-age population (Jung et al., 2019). This potentially suggest that international couples with higher education level migrating to certain areas of South Korea can boost fertility rate. The above findings reveal the fertility variation and the differences of factors between rural and urban areas in South Korea. Hence, South Korea's a one-size-fits-all fertility policy to address persistent low-fertility may be insufficient and local-specific population policies should be considered.

2.3 Rise in technology and son preference

Contemporary females seek to obtain completion of higher education prior to often led to increase in maternal age. Study shows that the availability of assisted reproductive technology (ART) and increase in maternal age may contribute for the remarkable increase in the rates of multiple births in South Korea in the last four decades (Lee & Smith, 2017). Since South Korea is a country with a strong son preference, parents may adjust their future fertility decisions depending on the ideal and achieved gender composition of children in their household (Kashyap & Villavicencio, 2016). In particular, households with only daughters deciding to have another child have a higher possibility to have another child (Kashyap & Villavicencio, 2016). Study shows that such effect is even stronger after the introduction of ultrasonic diagnostic technology (Kashyap & Villavicencio, 2016).

3.Double-earner couples

3.1 Work-Family balance differences between double-earning couples

The declining birth rate in South Korea is related to stress to attain work-family balance, which is known to affect family planning. Study shows that both working men and working women are more likely to belong to the "high-gain class", defined as group of individuals whose work-family gains are high, when they receive strong mental and social support (Ji & Jung, 2021). Among men, those who hold a temporary work position receive more work-family gains and hence have higher fertility intention (Ji & Jung, 2021). However, holding a temporary work position may imply that the husband's employment security is unstable. This is contradictory to the idea that husband's employment security has positive association with fertility intention mentioned in section (2.1) (Lim, 2021). Lastly, it is also found that having multiple children are deemed as gains to men while it is a strain on women (Ji & Jung, 2021). This is a reasonable result with reference to the gender roles in South Korean households where females act as the main caregivers (Lee, 2016).

3.2 Female workers childbearing intention factors

Childbearing age and number of children are highlighted as common factors affecting female workers' childbearing intentions, which implies that childcare is a highly significant burden (Yi, Jung, Kim, & Im, 2020). It is also shown that there is an increased in importance of occupational factors, such as guaranteed maternity leave and family-friendly organizational culture, in female workers' childbearing intention over the years while that of the individual factors have decreased recently (Yi, Jung, Kim, & Im, 2020). It is also revealed that a balanced division of chores increases

childbearing intention (Yi, Jung, Kim, & Im, 2020). Since the balance tends to be unequal for female workers in South Korea households, male family members also should be responsible in establishing a work-family balance for female workers.

3.3 Workplace policy and fertility intention

As mentioned above, occupational factors impact female workers' childbearing intention. Several workplace policies have been designed to increase workers' childbearing intention, such as maternity leave, childcare leave, family allowance, on-site childcare center, education expense subsidy, childcare subsidy and flexible working arrangement (Kim & Parish, 2022). According to study, the availability rate of these policies in companies ranged between 6% and 32% with maternity leave was provided the most, whereas flexible working hours and childcare-related subsidies were provided the least (Kim & Parish, 2022). It is also shown that the majority (63%) of women were deprived of all family provisions at their workplaces (Kim & Parish, 2022). Among all policies, maternity leave and childcare leave carry the most significantly positive associations with overall fertility intention (both first birth and non-first births) (Kim & Parish, 2022). This means that the more availability of maternity leave and childcare leave offered at their workplace, the more likely employees will consider having children. On the contrary, flexible working arrangement is associated with decreasing first-birth fertility intention (Kim & Parish, 2022). This suggests that paid parental leave is a more effective intervention than flexible working arrangement in increasing workers' childbearing intention, especially among those who do not have experience in childrearing and may not be able to handle both working remotely and caretaking at the same time.

Conclusion

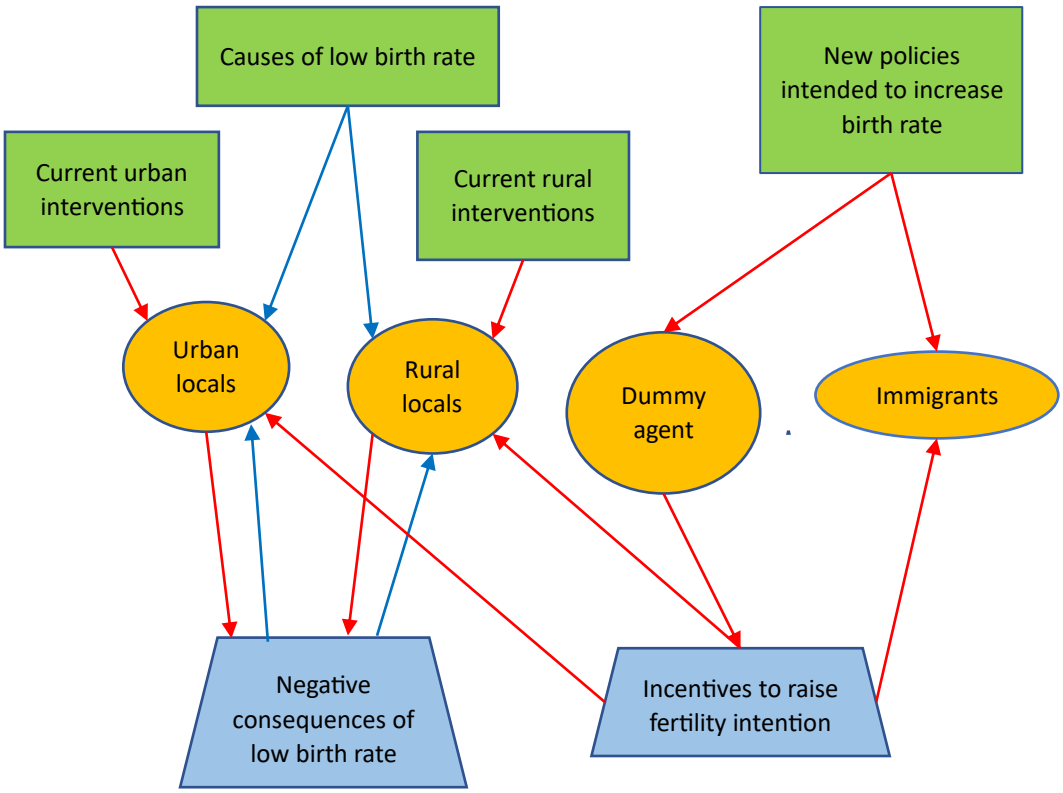
Due to non-egalitarian norm in division of housework between two genders, South Korea women tend to have lower fertility intention than men and often delay their motherhood to complete their education before considering having children. Higher socioeconomical status, improvement of technology and family-friendly policies has demonstrated a positive impact on fertility intention. Although the South Korean government has devoted significant effort in reforming the childcare system, childcare burden is still heavy. The highlighted issue is high childcare cost due to privatization of childcare services incentivized by government subsidy. Additionally, socioeconomical factors have varying impact on

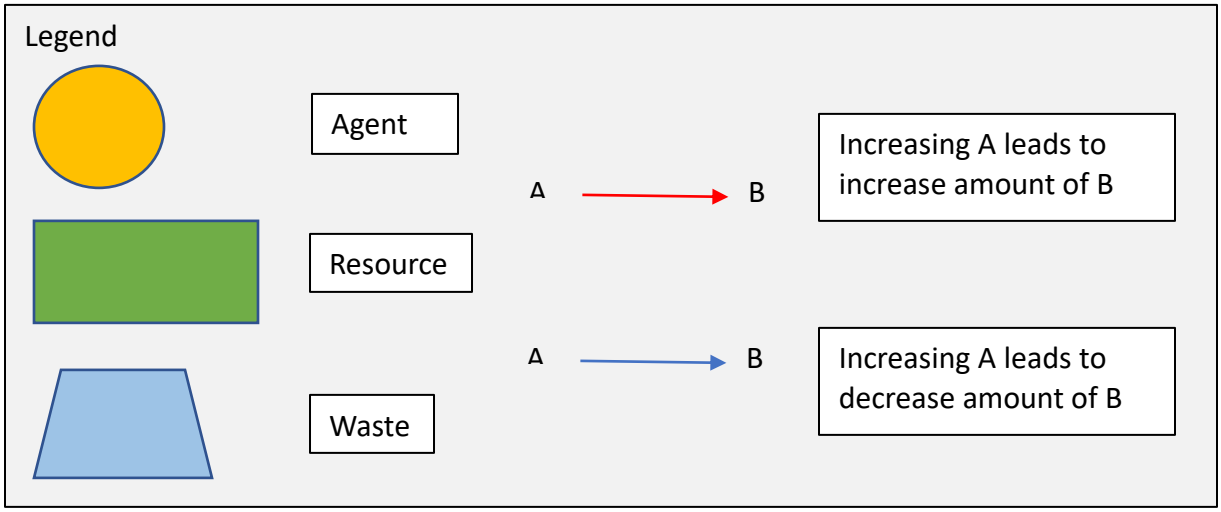
fertility intention across different regions. Hence, South Korea's national-level fertility policy to address persistent low-fertility should be adjusted to increase availability of public childcare and more locally specific policies should be introduced.

Research question

How do socioeconomical, cultural, technological and occupational factors influence South Korea’s low national birth rate? A simulation model approach to investigate how interventions should be adjusted or introduced to bring South Korea’s birth rate back to the safe zone.

System Diagram





Firstly, we want to simulate the current birth rate situation without imposing or adjusting any current intervention. We start with two agents, each representing urban locals and rural locals of the chosen country (South Korea in this case). Then, we will create zones to separate the space into urban area and rural area. In the urban area zone, we will introduce a resource Food 1 to simulate current resources that are available/

targeted for urban residents. In the rural area zone, we will introduce a resource Food 2 to simulate current resources that are available/ targeted for rural residents. Agents will gain energy by consuming resources and increase their lifetime hence breeding chance. Hence, Food 1 and Food 2 will increase the agent population. Both urban locals and rural locals can consume Food 1 and Food 2, but they will need to move across zones in order to consume resources that are not targeted for them. We will impose a requirement of step energy on agents when they try to move from urban zone to rural zone (and vice versa). Hence, this can simulate the design that Food 1 (urban resources) are more favourable to urban locals while Food 2 (rural resources) are more favourable to rural locals. Next, we will introduce "causes of low birth rate" as Food 3 which contains toxin. When agents consume Food 3, the toxin is likely to kill the agents and hence lower the agent population. The concept of "causes of low birth rate" basically represents all current (already-appearing) factors that contribute to low fertility intention such as low socioeconomic status, high childcare cost, gender inequality etc. Moreover, we will allow each agent to produce "bad waste" which represents the negative consequences of low birth rate including aging population, higher healthcare burden etc. Agents are allowed to consume these wastes, but the waste consumption energy will be set as a positive number so that every time agents consume these negative consequences wastes, it consumes the agents' energy and ultimately lower the agent population.

Now, we move on to simulate the situation where new policies are introduced. We will run the baseline scenario (as mentioned above) for a while and introduce a new resource Food 4 midway. Food 4 represents new policies that are intended to increase birth rate. Note that the

introduction of new policies is only a one-time event. To ensure the positive effect created by new policies is consistent over time, we create a dummy agent which will only consume Food 4 and produce "good waste" which represents the incentives bring by new policies. These "good waste" can be consumed by urban locals and rural locals agents. We will set the waste consumption energy of "good waste" to be negative so that

agents gain energy by consuming these “good waste” representing incentives to raise fertility intention and hence increase the local agent populations. In policies that favour immigrants such as loosening immigration policy or international marriage incentives, we will create an immigrant agent. These immigrants can consume the immigrant-friendly policy resources and the corresponding “good waste” produced through the dummy agent. This is to simulate the situation where immigrant population increase in size after introduction of immigrant-friendly policy.

We will only impose one policy each time to observe the individual effect created by each policy. If we see the local agent populations remain constant or increase over time, we consider the new policy as effective. After running individual policy simulations, we select all effective policies and run an additional simulation where all these effective policies are introduced as resources simultaneously and observe if this can create greater positive impact on the local agent populations.

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Glossary of technical terms

- Childcare provision: Care and supervision of children whose parents are working, provided by a childminder or local authority
- Patriarchal society: A social system in which positions of dominance and privilege are primarily held by men
- Total fertility rate: The average number of children that are born to a woman over her lifetime
- Twinning birth rate: The number of twin individuals per thousand maternities.
- Work-family balance: It is attained when individuals can perform the role of employees at work and the role of family members at home with equal involvement.