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On the Total Fertility Rate as an Indicator of Local Population Changes

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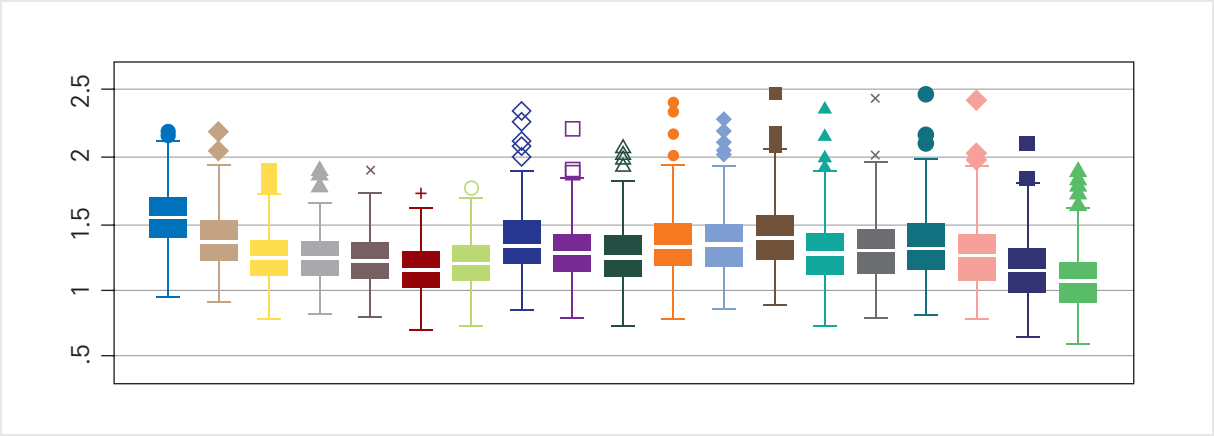
Introduction

Local total fertility rates differ conceptually from the national-level total fertility rate, due to a diverse range of population processes that occur at local levels. This study thus compares the population characteristics of localities with high total fertility rates and of those with low total fertility rates and, with evidence, analyzes why high fertility rates in many localities in Korea do not lead to high birth numbers or to a population increase. High local total fertility rates are found to have a close bearing on the size, migration and distribution of the female population aged 15~49, while not much correlated with the number of births or a local population increase. Local total fertility rates have been used widely, regarded as indicators that have closely to do with natural population changes and as outcome indicators of local-level population policies. The findings of this study suggest that there is a need to further consider whether it is valid to use local total fertility rates in the way they have been used.

The total fertility rate, defined in short as the average number of children women would have during their childbearing years (15~49 years of age), is also calculated as the sum of age-specific fertility rates. Localities in Korea over the years saw a continued decline in their median total fertility rate within the range of 1~2, in slightly varying degrees, with the magnitudes of the variations remaining largely

constant. A point worthy of attention here is that time and again there have occurred upper outliers in the distribution of total fertility across the observed years. To look at the characteristics of localities where those upper outliers occur can be meaningful as it is in a way an exploration of factors to which local fertility differentials are attributed.

[Figure 1] Distribution of total fertility rates for cities, non-urban counties, and sub-city districts (2000~2018)



Source: Author's reconfiguration based on Statistics Korea. (2020a). City/Gun/Gu/Total Fertility Rates, Age-specific Maternal Fertility Rates. http://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_ 1B81A17

As will be mentioned again in what follows, there is a need to examine factors that contribute to the tendency of localities with high total fertility rates having small populations. A discussion as such also concerns the utility of the total fertility rate as a widely used indicator of outcomes of local population policies. This study compares localities with high total fertility rates and those with low total fertility rates and, by means of examining the relations local total fertility rates have with the number of births, natural population changes (increase and decrease), and the size and distribution of the female population aged 15~49, discusses what implications its findings have for the use of the total fertility rate.

Characteristics of localities with high total fertility rates

This part examined the characteristics of localities whose total fertility rates were identified as extreme upper outliers—total fertility rates that lie beyond the upper outer fence (Q3-Q1). The years observed are 2000, 2005, 2010, 2015, and 2018. The localities with extreme-upper-outlier total fertility rates are as listed in Table 1.

[Table 1] Localities with an extreme-upper-outlier total fertility rate for selected years (2000~2018)

Year	Locality	TFR	Population	Net migration (In-Out)	Population 65+ (in %)	Financial self-sufficiency rate(in %)	GRDP (in KRW million)
2000	Yeongam-gun	2.179	65,268	-1,047	14.3	-	-
	Ongjin-gun	2.152	14,008	-57	18.7	-	-
2005	Hwacheon-gun	1.722	23,732	-633	15.1	12.7	-
2010	Gangjin-gun	2.339	41,624	221	26.7	9.2	620,717
	Boseong-gun	2.003	48,792	-580	29.5	8.9	756,964
	Yeongam-gun	2.172	60,082	-550	20.9	18.2	4,008,431
	Inje-gun	2.004	31,842	25	16.0	12.5	1,028,470
	Jinan-gun	2.410	27,543	-217	27.4	11.3	552,879
2015	Yeongam-gun	2.107	58,137	-763	23.2	16.7	4,126,680
	Inje-gun	2.161	33,255	656	16.8	11.5	1,287,796
	Jangseong-gun	2.101	46,360	123	26.8	15.5	1,328,550
	Haenam-gun	2.464	76,194	-753	28.0	8.9	1,542,308
2018	Sunchang-gun	1.816	29,209	-298	31.8	14.8	-
	Yeonggwang-gun	1.816	54,127	-431	27.8	19.6	-
	Jangseong-gun	1.778	45,794	-138	28.2	18.3	-
	Jinan-gun	1.714	25,963	-166	32.5	14.0	-
	Haenam-gun	1.886	71,901	-1,303	30.3	15.0	-

Source: Author's calculation based on Statistics Korea. (2020a). City/Gun/Gu/Total Fertility Rates, Age-specific Maternal Fertility Rates [Data File]. http://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_1B81A17; Statistics Korea (2020b). Number of Population by administrative territorial division (city, gun, and gu), by sex (Data File). http://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_1B040A3; Statistics Korea (2020c). Number of migrants by city, gun, and gu [Data File]. http://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_1B26001_A01; Statistics Korea. (2020d). Percentage of people aged 65 and older (Metropolitan city and providence/city/gun/gu) [Data File]. http://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_1YL20631; Statistics Korea (2020e). Financial self-sufficiency rate (Metropolitan city and province/city/gun/gu) [Data File]. http://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_1YL20921; Statistics Korea (2020f). GRDP (city/gun/gu) [Data File]. http://kosis.kr/statHtml/statHtml.doorgId=101&tblId=DT_1C65_03E&vw_cd=MT_GTITLE01&list_id=109&seqNo=&lang_\mode=ko&language=kor&obj_var_id=&itm_id=&conn_path=MT_GTITLE01.

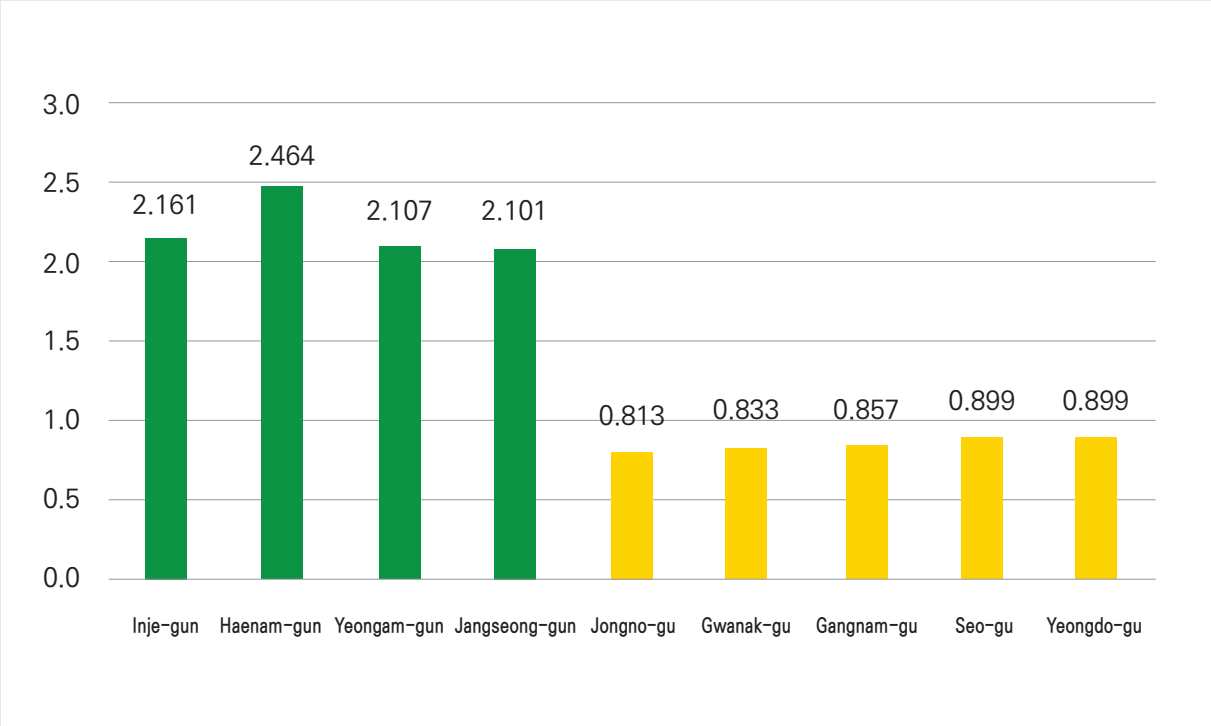
The localities with an extreme-upper-outlier total fertility rate were mostly non-urban counties (gun's). Their population size, financial self-sufficiency rate, and gross domestic product (GRDP) all hovered below the national averages, with a negative net migration. The proportion of those aged 65 and older in the total population in these localities was higher than the national average or the average for non-urban counties. These are hardly characteristics that are deemed conducive to increasing local fertility rates.

Comparison of countries with high total fertility rates to those with low total fertility rates

The question now to examine is one asking due to what factors the localities with high fertility rates have the high fertility rates they have. To address this question, a comparison was made between two groups of localities, Observed Group (OG) and Reference Group 1 (RG1). OG consisted of localities with

a total fertility rate of 2 or higher, including Haenam-gun (Jeonnam Province), Inje-gun (Gangwon Province), Yeongam-gun (Jeonnam Province) and Jangseong-gun (Jeonnam Province). RG1 included Jongno-gu (Seoul), Gwanak-gu (Seoul), Gangnam-gu (Seoul), Seo-gu (Busan), Yeongdo-gu (Busan), all with a total fertility rate of 0.9 or below.

[Figure 2] Comparison of total fertility rates between OB and RG1, for 2015

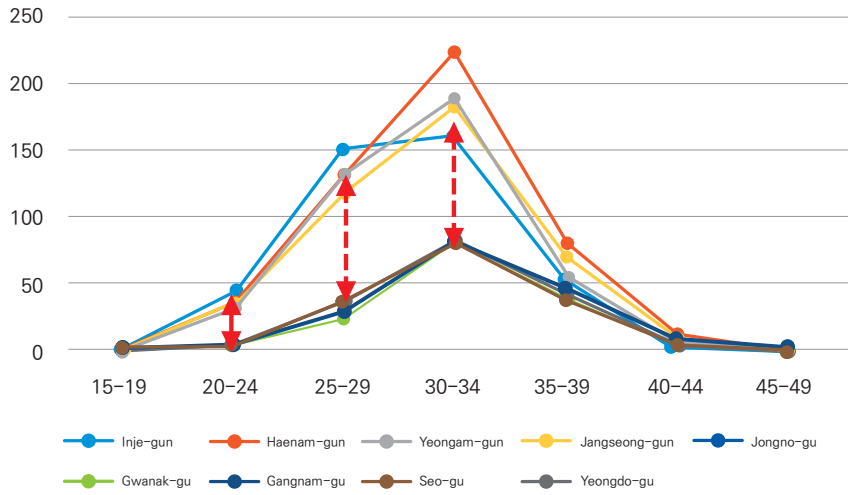


Note: OG localities (in green) are of a total fertility rate of 2 or higher as of 2015; RG1 localities are of a total fertility rate of 0.9 or lower as of 2015

Source: Author's reconfiguration based on Statistics Korea. (2020a). City/Gun/Gu/Total Fertility Rates, Age-specific Maternal Fertility Rates [Data File]. http://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_1B81A17.

To investigate in detail total fertility rates in OG and RG1, this study looked at age-specific maternal fertility rates for women aged 15~49. Marked differences were readily observed in maternal fertility rates between OG and RG1. To be more specific, those aged 20~24 in OG had maternal fertility rates of 33.3~46.3 births per thousand population, 5~8 times as high as the figures for women of the same age range in RG1 (4~8.8 births per thousand population). For women aged 25~29 and 30~34, maternal fertility rates were about 4 times and 2.5~3 times higher, respectively, in OG than in RG1. This suggests that total fertility rate differentials are explainable to a substantial extent by maternal fertility differentials in women in their twenties and early thirties.

[Figure 3] Comparison of maternal fertility rates between OG and RG1, for 2015 (in number of births per thousand population)

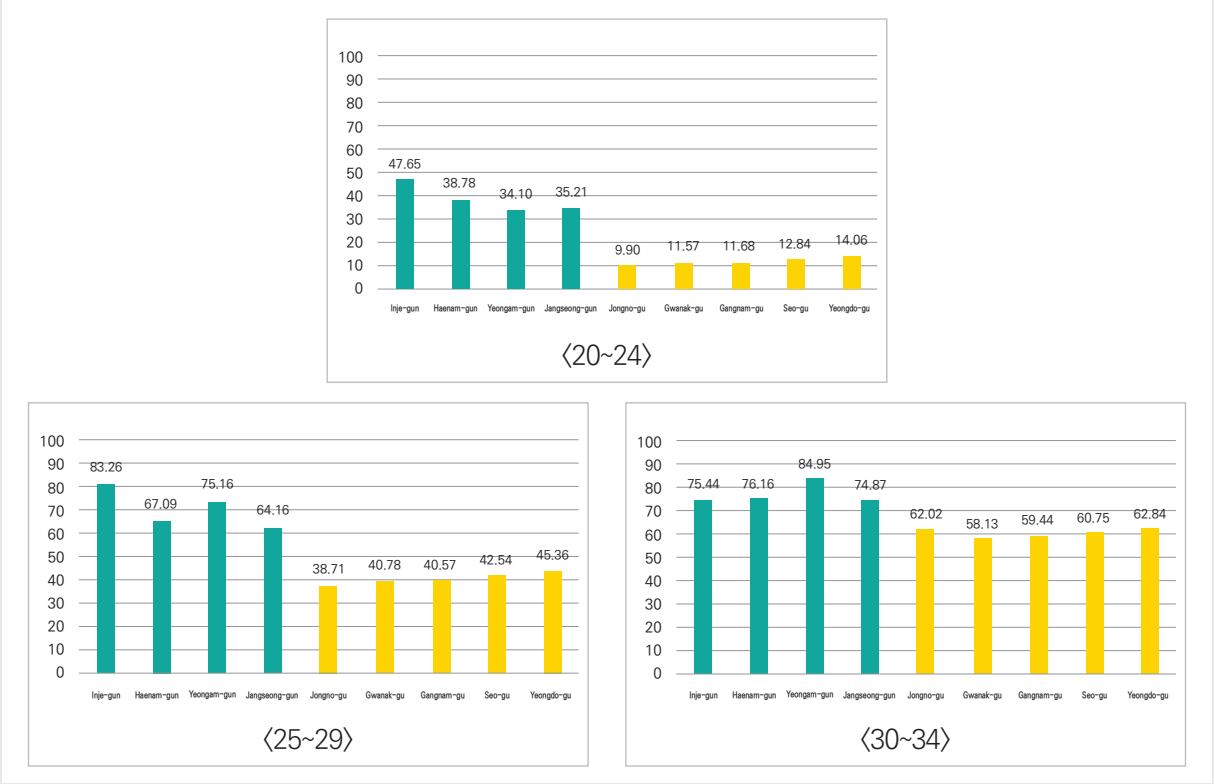


	Locality	15~19	20~24	25~29	30~34	35~39	40~44	45~49
OG	Inje-gun	5.0	46.3	152.1	162.8	55.9	7.4	1.0
	Haenam-gun	3.1	35.9	133.0	224.5	81.9	12.9	0.4
	Yeongam-gun	1.3	33.3	130.9	189.5	57.4	6.5	0.6
	Jangseong-gun	2.7	38.2	116.6	182.2	71.6	9.5	0.0
RG1	Jongno-gu	0.5	5.8	26.8	79.9	45.1	4.9	0.0
	Gwanak-gu	1.4	7.4	25.7	83.1	43.8	6.2	0.1
	Gangnam-gu	2.0	4.0	29.5	84.6	46.6	6.6	0.2
	Seo-gu	3.7	8.8	38.9	82.2	40.4	5.3	0.2
	Yeongdo-gu	0.6	8.3	39.5	83.1	44.4	4.6	0.0

Source: Author's reconfiguration based on Statistics Korea. (2020a). City/Gun/Gu/Total Fertility Rates, Age-specific Maternal Fertility Rates [Data File]. http://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_1B81A17.

As a way to attain an understanding of the age-specific maternal fertility differentials arising between OG and RG1, this study looked at the proportion of those with spouse present in women aged 20~34. The proportion of those with spouse present was higher in women aged 20~24, 25~29, and 25~29 in OG by 3~4 times, 1.5~2 times, and 1.25 times, respectively, than in their RG1 counterparts. These findings suggest that the differences in age-specific fertility rates are attributable in part to the differences in the proportion of women with spouse present in those age groups between OG and RG1. The high fertility rates observed in OG can be ascribed to some extent to the high age-specific fertility rates and to the high percentage of those with spouse present in women of these age ranges.

[Figure 4] Proportion of those with spouse present in women aged 20~24, 25~29, and 30~34 in OG and RG1, for 2015 (in %)

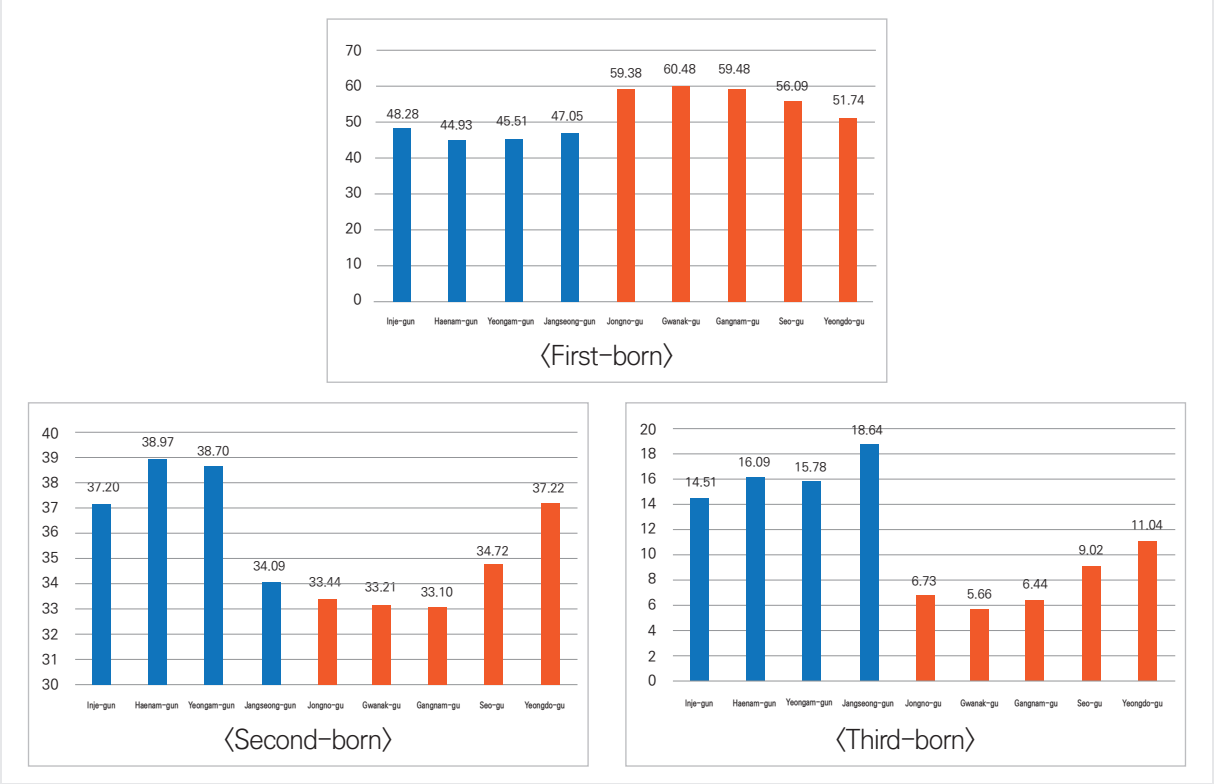


Note: women in cohabiting relationship are considered as "with spouse present"

Source: Author's calculation based on Statistics Korea. (2017). Population (aged 15 and older, Korean nationals) by age, sex, marriage status-city, gun, gu (Data File). http://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_1PM1503.

The percentage of births by parity also is construed as a factor having to do with the differences found in the total fertility rate between OG and the RG1. Across all localities, the proportion of first-order births was higher in RG1 than in OG. Conversely, second- and third-order births accounted for higher proportions in OG than in RG1. The proportion of third-order children, in particular, was 1.5~2 times higher in OG than in RG1. This is to say that women in the OG localities were more likely than their counterparts in RG1 to have two or more children, which can be said to have contributed to the differences in the total fertility rate between the two groups of localities.

[Figure 5] Births by parity in OG and in RG1 in %, for 2015



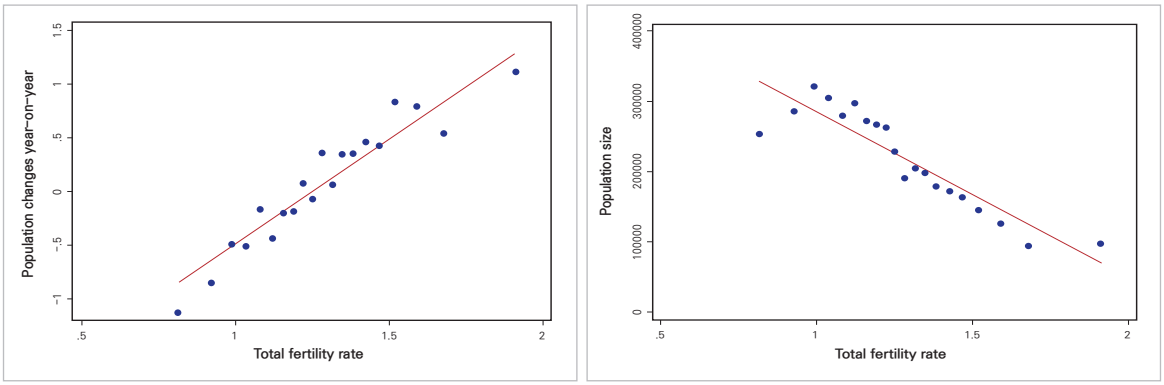
Note: women in cohabiting relationship are considered as "with spouse present"

Source: Author's calculation based on Statistics Korea. (2017). Population (aged 15 and older, Korean nationals) by age, sex, marriage status-city, gun, gu (Data File). http://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_1PM1503.

Correlation between total fertility rate and the number of births and between total fertility rate and national population changes

Although the total fertility rate showed a clear positive association with population changes year-on-year, the association it exhibited with the size of population turned out to be negative. The localities with some of the highest total fertility rates in the country mostly had a small population (as of 2015, cities in non-capital metropolitan had on average a population of 226,006 and the low-tier municipalities in non-urban counties each had an average population of 53, 810). The populations of these non-Capital localities have been on the decline for the past 10 years.

[Figure 6] The association of total fertility rate with population changes and with population size (2000~2018)



Source: Author's reconfiguration based on Statistics Korea. (2020a). City/Gun/Gu/Total Fertility Rates, Age-specific Maternal Fertility Rates [Data File]. http://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_1B81A17; Statistics Korea (2020h). Population growth rate (Metropolitan cities and provinces/ cities/ gun's/ gu's) [Data File]. http://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_1YL20621; Statistics Korea. (2020i). Registered resident population (Metropolitan cities and provinces/ cities/ gun's/ gu's) [Data File]. http://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_1YL20651E&vw_cd=MT_GTITLE01&list_id=101&seqNo=&lang_mode=ko&language=kor&obj_var_id=&itm_id=&conn_path=MT_GTITLE01

To further examine such trends, this study carried out a comparison between localities with highest total fertility rates (OG) and localities with a population of over 150,000 and a relatively high fertility rate (RG2). The localities selected for the two groups were compared in terms of the correlation between the total fertility rate and the number of births and between the total fertility rate and natural population changes, for the period 2000~2019. In most cases both correlations were lower in the localities in OG than in the localities in RG2. This suggests that the high total fertility rates of the localities in OG did not contribute to increasing the number of births. In fact, Haenam and Jangseong, both in OG, saw, if anything, a natural decline in population, with the number of deaths exceeding the number of births by 56 and 53, respectively. In contrast, the localities in RG2 all saw a natural population increase.

[Table 2] Correlation between the total fertility rate and the number of births and between the total fertility rate and national population changes, for OG and RG2, for 2015

	Locality	TFR	Correlation b/w TFR and the number of births	Correlation b/w TFR and natural population change
OG	Inje-gun	2.161	0.5105	0.4805
	Haenam-gun	2.464	0.4882	0.6763
	Yeongam-gun	2.107	0.5983	0.6829
	Jangseong-gun	2.101	0.0343	0.4169
RG2	Dangjin City	1.949	0.9550	0.9113
	Geoje City	1.911	0.9330	0.9589
	Sejong City	1.893	0.3883	0.4176
	Gwangyang City	1.835	0.8370	0.7978
	Seosan City	1.752	0.8147	0.7198

Source: Author's calculation based on Statistics Korea. (2020a). City/Gun/Gu/Total Fertility Rates, Age-specific Maternal Fertility Rates [Data File]. http://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_1B81A17; Statistics Korea. (2020j). Number of deaths (1997~) and mortality (1998~) by city, cun, gu/sex/age-specific group (5-year age group) [Data File]. http://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_1B80A18; Statistics Korea. (2021a). Number of births (metropolitan cities and provinces/cities/gun's/gu's) [Data File]. https://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_1YL20681&conn_path=I3

[Table 3] Number of births, crude birth rates, number of deaths, and natural population changes in OG and RG2

	Locality	Number of births (A)	Crude birth rate	Number of deaths (B)	Natural population change (A-B)
OG	Inje-gun	379	11.6	272	107
	Haenam-gun	839	11.0	895	-56
	Yeongam-gun	602	10.4	591	11
	Jangseong-gun	440	9.6	493	-53
RG2	Dangjin City	1,945	11.9	1,058	887
	Geoje City	3,533	14.1	985	2,548
	Sejong City	2,708	14.8	979	1,729
	Gwangyang City	1,680	11.0	746	934
	Seosan City	1,667	9.9	994	673

Source: Author's calculation based on Statistics Korea. (2020a). City/Gun/Gu/Total Fertility Rates, Age-specific Maternal Fertility Rates [Data File]. http://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_1B81A17; Statistics Korea. (2020j). Number of deaths (1997~) and mortality (1998~) by city, cun, gu/sex/age-specific group (5-year age group) [Data File]. http://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_1B80A18; Statistics Korea. (2021a). Number of births (metropolitan cities and provinces/cities/gun's/gu's) [Data File]. https://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_1YL20681&conn_path=I3; Statistics Korea. (2020j). Population processes data [Data File]. http://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_1B8000I&conn_path=I2

The female population aged 15~49 was larger, both in size and as a percentage of the total population, in RG2 than in OG (44~54 percent compared to 33~41 percent). These trends have to do with the fact that the total fertility rate was lower in RG2 even though the number of births was higher there than in OG. A given locality with a low number of births can still have a high total fertility rate if the number of women of childbearing ages living in it is low, as the total fertility rate, simply put, is the ratio of the number of births to the number of women of ages 15~49. This is to say that the high total fertility rate of OG localities may be attributed to the small number of women of childbearing ages present in it. Also, in 2015, whereas the localities in OG in most cases saw a negative net migration of women aged 15~49, RG2 on the whole recorded a positive net migration of women of the same age range.

When looked at in terms of its 5-year age groups, the female population aged 15~49 in the OG localities showed a V-shaped distribution, with the proportion of those aged 30~34 and older rising with age in most cases. In the RG2 localities, in comparison, women of the age range 30~34 and older had in general accounted for higher proportions in the female population aged 15~49. These characteristics can be seen, considering the age-specific probability of childbirth as presented theoretically and empirically, as having to do with the fact that crude birth rates for the most part have been higher in the RG2 localities than in the OG localities.

[Figure 7] The size, distribution and net migration of the female population aged 15~49, for 2015

Source: Author's calculation based on Statistics Korea. (2020c). Number of migrants by city, gun, gu [Data File]. http://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_1B26001_A01; Statistics Korea.(2021b). Age-specific registered resident population by city, gun, gu and by sex [Data File]. https://kosis.kr/statHtml/statHtml.do?org Id=101&tblId=DT_1B040M5

In sum, the high total fertility rates found in OG are not strongly correlated with the number of births or with natural population increase. They are ascribable rather to the fact that OG overall have a small female population aged 15~49 and to the characteristics found of the age-specific distribution of the female population in the OG localities. Limited though its findings are to only selected localities in the country, this study is meaningful in that it is an attempt to look in a concrete way into local-level total fertility rates in terms of their correlations with the number of births, natural population changes, and the size and migration of the female population aged 15~49.

Concluding remarks

This study examined why the total fertility rate is much higher in some localities than in others and, by means of looking at its correlations with the number of births, natural population changes (increase and decrease), and the size and distribution of the female population aged 15~49, discussed what implications it has as an indicator.

The characteristics of localities with high total fertility rates as examined in this study lacked longitudinal observation as they are limited to the baseline year of 2015. Still, it was readily identifiable that the OG localities have of late seen high fertility rates. This study found that these localities had high numbers of second- and higher-order births and high marital fertility rates in women aged 20~34. The question of how these characteristics can hold up as they do over a certain period of time needs to be taken up in depth in some other research attempts in the future. As regards the high fertility rates that were found among women aged 20~34 in the OG localities, in particular, there is a marked need to examine the underlying contexts of policy and culture, both regarded as exogenous factors, that are idiosyncratic to those localities.

There are many other questions to take into consideration in a continued and multifaceted manner, from whether those women living in a given locality have lived there the whole time or just have migrated from another, to what are their sociodemographic characteristics. This is to say that why certain localities have a high or low total fertility rate is a question that cannot be ascertained in terms merely of estimates such as the number and composition of births and of the female population aged 15~49. This much has been suggested also by de Beer & Deerenberg, who in their 2007 study have ascribed the local fertility differentials found across localities in the Netherlands more to cultural factors than to demographic and socioeconomic ones.

In light of the negative associations found between the highest total fertility and the size of population, this study also compared a group of localities with the highest fertility rates and another group of localities with a population of over 150,000 and relatively high fertility rates. The associations between the total fertility rate and the number of births and between the total fertility rate and natural population changes were lower overall in the first group (OG) than in the second group (RG2). The female population aged 15~49 was smaller in the OG localities than in the RG2 localities, both in size and as a share of the total population. Also, there was a negative net migration in women of childbearing ages in the OG localities.

Generally thought of as having closely to do with population changes, local total fertility rates have been used widely as indicators of local-level population policy outcomes. This study points to the need to further examine the utility of the local total fertility rate as an indicator of population policy outcomes and to consider various population processes, including population changes due to migration. It is important first to have the understanding that, due to the population processes that occur in varying ways in and across localities, local total fertility rates differ conceptually from the national total fertility rate.