Marital fertility during the Korean demographic transition:
An analysis of population-register data in rural area, 1920-1977

Abstract

We examine the marital fertility patterns during the Korean demographic transition. Demographic transition was a fundamental transformation in human history, and has been a key topic in demographic inquiries. However, our understanding of demographic transition in East Asia is limited largely due to the lack of adequate data. By using the population register data in a rural Korea between 1920 and 1977, we attempt to contribute to the literature. After describing the historical contexts and discussing data issues, we test a key exposition of demographic transition theory: mortality decline was a necessary condition for fertility decline. We found that 1) decrease in infant mortality was crucial for fertility changes across birth cohorts, 2) the relationship between infant mortality and fertility became weaker, and 3) parity-specific fertility control emerged as fertility declined. The implications for these findings for the Korean demographic transition will be discussed.

Introduction

Demographic transition was a fundamental transformation of human reproduction system that enabled human societies to transit to modern world. Transition from high mortality and fertility to low mortality and fertility regime was a basis of industrialization and urbanization. Without demographic transition, investment on children's education, which is essential for industrialization, would have been very difficult or even impossible. Urban development would have not been sustainable without mortality decline in urban areas, either (Dyson 2010). Hence, demographic research has extensively studied demographic transition, including theoretical expositions (Dyson 2010; Kirk 1997; Mason 1997; Notestein 1945), empirical analyses using the historical data (Coale & Watkins 1986) and development of statistical methods (Coale & Trussel 1974). Most empirical analyses had used European data. Studies on non-European countries are rare. In particular, there are just a few studies using micro-level data in East Asian countries. (Campbell & Lee 2004). The lack of research on demographic transition in East Asia, due to the lack of data, hinders our understanding of demographic transition in this region. Without empirical evidence, we may be at risk of erroneously concluding that the patterns in East Asia were similar to or different from the European patterns. This is unfortunate given the rising interest in rapid population aging in this region. Fertility in East Asia now is the lowest among the industrialized countries, and the pace of population aging in this region is much more rapid than Western countries. Historical legacies should be incorporated to explain such a distinctive pattern, but the lack of available data has hindered this enterprise. The current study uses civil register data, called *Unyang minjuk*, which contain individual-level information on marriage, fertility, mortality, and migration in rural Korea between 1920 and 1977. By comparing cohort's marital fertility, we attempt to fill in the gap in the literature.

Demographic transition theory and hypotheses

Demographic transition theory describes how human demographic behaviors changed over time. A key exposition is that mortality decline was a necessary condition for fertility decline. Mortality decline happened first, and fertility decline followed with some time lag during which population grew tremendously. Fertility decline without mortality decline would have endangered survival of human species. Real or conceived decline in infant mortality provided incentives to reduce family size. From the Malthusian perspective, increased family size exerted downward pressure to demand for children (Malthus 1953). Improved chance of child survival also reduced necessary numbers of children to make sure old age support. Reasons for mortality decline include socioeconomic development, improvement of public health and hygiene, and medical intervention including vaccination. Such improvement led to mortality decline, causing fertility decline later (Dyson 2010; Mason 1997). In particular, decline in infant and child mortality was crucial in fertility decline. Recognition that their children had a better chance of surviving up to adult was disseminated, which was likely to reduce demand for additional children. This conceived change led to fertility decline (Cleland & Wilson 1987).

This exposition emphasizes the role of make-up births in fertility decline. While people gave additional births to make up the loss of children before the demographic transition, such behaviors became no longer necessary because of improvement in children's survival chance. In statistical language, this suggests that controlling for the changes in infant or child mortality across birth cohorts during the demographic transition will explain away the cohort difference in fertility. Hence, we can draw the following hypothesis.

H1: After controlling for infant or child mortality, the cohort differences in fertility is significant reduced.

Then, we may ask how the relationship between the loss of children and fertility changed over time. Statistically, this is related with the interaction between birth cohort and infant/child death. Demographic transition theory seems unclear about the direction of interaction effects. On the one hand, we may expect that the loss of children became less influential on fertility because of general trend toward reduction in family size. This expectation is based on the assumption that fertility decline is an irreversible event. Once fertility started declining, the loss of children became less influential.

On the other hand, we may expect the opposite trend. Meaning of each child to parents' life might become more important as the number of children decreased. Then, make-up birth behaviors would have become more prominent during the fertility transition. These two competing stories can be empirically evaluated by looking at the interaction between birth cohort and infant/child mortality. Hence, we test the following competing hypotheses.

H2a: The positive association between fertility and infant/child mortality became weaker across birth cohorts because the loss of children became less influential as fertility declined.
H2b: The positive association between fertility and infant/child mortality became stronger across birth cohorts because parent-child ties became stronger as fertility declined.

Data: *Unyang* family-household registers

As previously mentioned, the lack of data is a key obstacle to studying demographic behaviors in historical populations. This issue is prominent in East Asian countries. The current study uses the unique data set that provides detailed demographic information in a rural area in Korea in the middle of the 20th century. The *Unyang minjuk* (family-household registers) contained rich demographic information in a village of *Unyang* between 1920 and 1977. Here, we present brief historical backgrounds for the data set.

Well-organized population registers already existed in pre-modern Korea. Here, we discuss three stages of changing population registers in pre-modern Korea. During the Chosun Dynasty (1392-1910), population registration system, called *hojuk*, recorded the resident population in every 3 year. The coverage, however, is known to be incomplete. The registers covered about 40% coverage rates during the Chosun Dynasty (Shin & Kwon 1977). This was the case because the registers was conducted for taxation purpose (Son 2005) and/or as rituals to show royal sovereign power (Seo 2007). Nonetheless, the registers during the Chosun Dynasty resembled the contemporary census in terms of basic form. The focus was given to other than enumerating population *per se*, and consequently the data quality was not sufficiently high. Responding to internal and international challenges since the port opening in 1876, the Chosun Dynasty executed extensive reforms in 1896, including population registration. The reform included conducting registration every year, increasing coverage, and conducting housing census. All these efforts aim at increasing population control (Lee 2005). Although this attempt was not perfectly successful, the reformed registration system resulted in substantial improvement (Son 2005). In essence, the old and the reformed registers can be regarded as a kind of household-based census. Although incomplete, they attempted enumerating population. In principal, non-family members as well as family members within household were enumerated in both old and reformed registration. Hence, the population registers during the Chosun Dynasty shared common features with contemporary census, although the quality differed. Another important change occurred in 1909 just before Japan occupied Korea in 1910. Japanese government introduced civil registers (*minjuk*) system that differed from the traditional population registers during the Chosun Dynasty. The new registration system was based upon radically different principles than the old registers. First, the new system was based on the registration rather than enumerating household population. Of course, the initial stage involved enumerating population. However, once the initial registration was completed, the records were updated via individuals (family-household heads)' reports about their demographic events such as birth, death, marriage, divorces, and migration. Second, the new registers excluded non-family members from the household list. A key element in the new registration is status change within family or kinship networks (Lee 2005). The new system, therefore, can be considered as *family registers*, not *household registers*. Third, under the new system, the registered address was not necessarily identical to the *de facto* place of living. Under the old registration system, the registered address was supposed to be the same as the place of living. This principle was more strictly executed in the reformed registration system since 1896 thanks to housing census (Lee 2005). By contrast, the registered address under the new registration system was just *de jure* address. In this sense, the new register was not based on household. In principal, one *'family household'* in the new registration can consist of family members actually residing in different households. In this sense, the new registers are *family registers* rather than *household registers*. The new system was based upon the Japanese family registration system that the colonial government attempted to implant to facilitate control over the Korean people. This change in household registration system had important implications for family life among the Korean, which is beyond the scope of the present study.

Our data are based upon the new registers, and we should consider the following characteristics to use them. First, we use the removal records, called *jejukbu*. Typically, a senior male in family was the head of family-household. His family members were recorded under his name. When this man died or took his records to another area (primarily long-distant permanent migration), the family records were removed (Son and Lee 2013). We use these removal records for our analysis. The removal records include information on birth, death, marriage, divorce, move-in and move-out of each family member. Without removal (mostly head's death), records would not be available for analysis. However, all these unremoved records or remaining records, called *jejaebu*, were collected between 1975 and 1977. Hence, selection due to removal does not cause any problems in our analysis. Second, the new systems were not fully functioning until the early 1920s. The Korean people were not familiar with the concept of *family registers* that were based upon the Japanese system. Consequently, the data quality was low before 1920. Hence, we use the data recorded after 1920. Third, our data provide information on *de jure* population, not *de facto* population. Our study site is *Unyang*, a rural village located in Southeastern area in Korea. Our target population is not the actual residents in *Unyang* but people who were registered to the *Unyang family register* regardless of their place of living. Fourth, concepts of move-in and move-out refer to the registered address rather than the actual address. Hence, the records of move-in and move-out do not adequately reflect residential mobility. Fifth, interestingly, the registers recorded the actual place for births and deaths. This is different from migration information.

Total of 65,154 individual records are available. An individual can have multiple records if he or she was linked to more than one family head. Total of 47,632 unique individual records exist. Our analytic data include women who ever-married to *Unyang* registered men and were born between 1895 and 1960. We exclude the cases whose birth year, husband's name, timing of entry and exit to the registers are missing. We ended up with 4,560 cases. Exclusion of women married to men registered to *Non-Unyang* registers, "marry-out", is a primary reason for reduction of data size. Cohort restriction is another reason. In addition, missing in husband name and date of events are also responsible for exclusion. Birth years of matched children are used to determine the timing of fertility. In terms of birth records, it is likely that many infant deaths were not recorded as births. In this sense, the data are likely to underestimate marital fertility.

Methods

We conduct the following analyses by focusing cohort changes. In analyses, the women entered the risk set at the time of marriage or move-in, whichever came last. The women exited from the risk set at the time of death, husband' s death, divorce, move-out, or age 49, whichever came first. In other words, the analyses considered fertility among women currently married to *Unyang-registered* husbands. First, we estimate the Coale-Trussel parametric marital fertility model (CT-model) (Coale and Trussel 1974). This model is good to examine age pattern of marital fertility in pre-transitional societies when the direct information on parity-specific birth control is not available. Second, we estimate Poisson regression to see how the fertility rates depend on birth cohorts and infant/child mortality. Third, we plan to use hazards models to see the timing of fertility, but this analysis has been completed.

Results

Table 1 shows descriptive characteristics of data. Several patterns are worth discussing. First, we can see the fluctuation in the age at entry. Although age at entry is determined by move-in as well as marriage, it mostly represents the age at first marriage. The trends are non-monotonic. Women born in the 1920s entered the risk set earlier than their older counterparts, and timing of entry delayed for the cohorts born later. Second, age at exit for the last birth cohort (1940-60) is much younger than the other cohorts. This reflects the fact that non-removed records were censored in 1977 when most of these women were still younger than age 49. Combined with the higher age at entry, the years of exposure among the youngest cohort are considerably shorter than the previous cohorts. Third, the number of births stayed stable until the cohort born in the 1920s and then decreased. But, this number should be interpreted with caution. This is likely to underestimate the fertility because underreporting of births that ended up with infant/child deaths. In addition, the later cohorts did not complete their reproductive period as indicated in young age at exit. Fourth, proportion of women who experienced child death under age 1 or 5 steadily decreased across birth cohorts. While 39 percent of the oldest cohort (1895-1909) had at least one child dead before age 1, this number was just 1 percent among the youngest cohort. Steady decrease in infant mortality, according to demographic transition theory, would exert downward pressure on demand for children, leading to fertility transition. Figure 1 shows another descriptive pattern, age-specific marital fertility rates by birth cohorts. Cohort comparison tells us an interesting story. Age-specific fertility rates in their 20s were higher for the youngest two cohorts (1930-39 and 1940-60) than the older cohorts. After reaching the peak during their early- or mid-20s, their fertility rates decreased much faster as they became older than did the previous cohorts. This rapid rate of decrease suggests that these cohorts were likely to use birth control after reaching a certain parity, which was not practiced by previous cohort and led to fertility decline. The rapid decrease was particularly pronounced for the youngest cohort (1940-60).

<Table 1> and <Figure 1> about here

Table 2 shows results from the CT-model. The *M* represents the level of natural fertility, and the *m* is a parameter for fertility control. Interestingly, the two parameters move to the same direction. Both *M* and *m* tend to increase across birth cohorts: both the level of natural fertility and fertility control increases across birth cohorts. Increasing level of natural fertility reflects the trends of improvement in nutrition and socioeconomic conditions over time. At the same time, the increasing fertility control reflects that married women were more actively exerted fertility control when reaching certain parities. Together with Figure 1, the results from the CT-model suggest that parity-specific fertility control became widely adopted among the younger cohorts.

<Table 2> about here

Table 3 presents the Poisson regression results. In this analysis, we use the years of exposure as exposure in estimating the number births. Hence, the results compare the overall fertility rates across birth cohorts. Model 1 compares overall fertility rates by cohorts without any controls. Overall fertility rates decreased up to the third birth cohorts (1920-29), then increased afterwards. This is the case because younger cohorts were censored at earlier age when fertility is concentrated. Hence, Model 1 is not appropriate to test cohort changes in overall fertility rates. Model 2 controls for infant death. As expected, infant death increased the fertility. The coefficient suggests that overall fertility rates among women with deceased infants were 26 percent higher than those without deceased infants. This is sizeable difference. In addition, accounting for infant death makes cohort coefficients more positive. This means that fertility among the younger cohorts would have been higher if there had been no decrease in infant mortality. This is consistent with Hypothesis 1: decline in infant mortality was a driving force for fertility decline. Model 3 adds interaction between cohort and infant mortality. Interaction terms are negative, and tend to become more negative. This means that the association between infant mortality and fertility became weaker across birth cohorts. This is consistent with Hypothesis 2a, suggesting that the loss of children became less influential once fertility started declining.

<Table 3> about here

Future plans

This paper is incomplete and we plan to do the following in the future. First, we do not provide sufficient historical contexts including the execution of new registration and pre-transitional Korean fertility. Second, we do not fully discuss model specifications. Third, interpretation of results is somewhat technical short of substantive discussion. Fourth, we need to examine changing timing of fertility by using hazards models. By completing these works by the time of 2015 PAA meeting, we hope that this study contributes to our understanding of fertility in non-Western historical populations.

References

Campbell, C., & Lee, J. (2004). Mortality and household in seven Liaodong populations, 1749–1909. In T. Bengtsson, C. Campbell, J. Lee, et al. (Eds.), *Life under pressure: Mortality and living standards in Europe and Asia*, 1700–1900 (pp. 293–324). Cambridge: MIT Press.

Cleland, J. & Wilson, C. (1987). Demand theroeis of the fertility transition: An iconoclastic view. *Population studies*, 41(1): 5-30.

Coale, A. J. & Watkins, S. C. (1986). (eds). *The Decline of Fertility in Europe: the Revised Proceedings of a Conference on the Princeton European Fertility Project*. Princeton University Press,

Coale, A. J., & Trussell, T. J. (1974). Model fertility schedules: Variations in the age structure of childbearing in human populations. *Population Index*, 40(2), 185–285.

Dyson, T. (2010). *Population and Development: The Demographic Transition*. New York: Zed Books.

Kirk, D. (1996). Demographic transition theory. Population Studies 50(3): 3671-387.

Kwon, T., & Shin, Y. (1977). On population estimates of the Yi Dynasty. *East Asian Culture*, 14, 289–330. (in Korean).

Lee, S. (2005). The Joseon Governor General Offices' policy of Jeseon people registration: Changes occurred during the 1910s, in terms of the basic registration units which comprised the Civilian Registers and residence registration charts. *Society and History* 67: 6-40. (in Korean).

Malthus, T. R. (1953). A summary view of the principle of population. In D. V. Glass (Ed.), *Introduction to Malthus* (pp. 115–181). New York: Wiley.

Mason, K. O. (1997). Explaining fertility transitions. *Demography*, 34(4), 443–454.

Notestein, F. W. (1945). Population—The long view. In T. W. Schultz (Ed.), *Food for the world* (pp.36–57). Chicago: University of Chicago Press.

Seo, H. (2007). Population and governing in the late Joseon Dynasty: A study on Heonminsu record in Ilseoungrok. *Society and History*, 74, 215–250. (in Korean).

Son, B & Lee, S. (2013) Rural migration in Korea: a transition to the modern era, *The History of the Family*, 18(4), 422-433.

Son, B. (2005). The census policy of the Daeban Empire period: The case of Baeyang-ri Danseong and Sudeok-ri in Jeju. *Great East Asian Culture Study*, 49, 197–237. (in Korean).

Table 1 Summary measures

	1895-1909		1910-19		1920-29		1930-1939		1940-60		All	
	Mean	s.d.	Mean	s.d.	Mean	s.d.	Mean	s.d.	Mean	s.d.	Mean	s.d.
# of births	4.8	2.7	5.1	2.6	4.5	2.4	3.5	1.8	2.5	1.3	4.1	2.4
yrs. of exposure	21.7	9.7	23.3	9.4	23.2	9.2	16.1	6.7	8.2	4.2	18.4	9.9
age at entry	19.3	3.8	19.5	3.2	18.5	3.4	21.9	3.7	22.8	2.6	20.5	3.8
age at exit	41.0	9.6	42.8	9.1	41.7	8.8	38.1	6.0	30.9	4.3	38.8	8.8
proportion experiencing child's death before age 1	0.39	-	0.31	-	0.18	-	0.04	-	0.01	-	0.18	-
proportion experiencing child's death before age 5	0.51	-	0.47	-	0.29	-	0.09	-	0.03	-	0.27	-
N	846		848		916		1,074		876		4,560	

Table 2 Coale-Trussel model paramters estimates

	Index	
Cohort	M	m
1895-1909	0.543	-0.351
1910-19	0.632	-0.088
1920-29	0.631	0.316
1930-39	0.829	1.078
1940-60	0.952	1.473

M: Level index, m: fertility control index

Table 3 Poisson regression results

	Model 1			Model 2			Model 3		
Variables	b	s.e.	exp(b)	b	s.e.	exp(b)	b	s.e.	exp(b)
Cohort (1895-1909 ref.)									
1910-19	-0.019	0.022	0.981	0.003	0.022	1.003	0.029	0.029	1.030
1920-29	-0.127	0.022	0.880	-0.072	0.022	0.930	-0.025	0.028	0.975
1930-39	-0.021	0.023	0.979	0.070	0.024	1.072	0.103	0.027	1.108
1940-60	0.312	0.026	1.367	0.409	0.028	1.506	0.443	0.031	1.557
Infant death				0.231	0.018	1.260	0.294	0.031	1.341
Interaction (1895-1909)*Infant death ref.									
(1910-19)*Infant death							-0.053	0.044	0.948
(1920-29)*Infant death							-0.142	0.049	0.867
(1930-39)*Infant death							-0.120	0.080	0.887
(1940-60)*Infant death							-0.209	0.149	0.811
Intercept	-1.500	0.016	-	-1.603	0.018	-	-1.633	0.022	-

N=4,560. Used exposure option: incident rates estimated

Figure 1 Age-specific marital fertility rates, by birth cohort