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Model Construction Using a Prospective Approach Based on the Demographic Transition Theory

Aguru Ishibashi[a]

Abstract

Model construction using a prospective approach, a new method in social mobility research, has been conducted in an arbitrary manner in previous research and has not yet been established. This study insists that models should be constructed in accordance with the Demographic Transition Theory (DTT). A review of existing studies in different regions and times from an analytical perspective based on the DTT suggests three challenges and opportunities in the prospect approach. First, the rapid demographic transition in non-Western and developing countries makes it difficult to identify the essential factors affecting the reproduction process in different cohorts. Second, the lack of essential variables and information on the demographic structure in the existing datasets prevents us from constructing an appropriate model for each societal and demographic stage. Third, a model unique to each society should be constructed using the framework of the DTT. Finally, this paper argues that models in social stratification and mobility studies should be specified differently in each society and time, yet based on basic frameworks such as the DTT.

Keywords

prospective approach, demographic transition theory, social mobility research

This study aims to examine possible model selection in a prospective approach, which is a new method in social mobility research. Research using this approach is still in its primary stage, and only a few studies have been undertaken. Furthermore, while data limitations exist, models employed in previous prospective approach studies have been constructed in an arbitrary manner, with little explanation regarding whether each factor should be included. Accordingly, this study discusses the adequate combinations of factors affecting mobility indicators in a prospective approach through a review of previous research.

This paper strongly presents its position that models should be constructed in accordance with the Demographic Transition Theory (DTT), which is an insight from the field of demography. This is because the prospective approach is the product of applying a demographic approach to social stratification research. While reproduction mechanisms transform in response to the particular social structures and social changes of the country in question, all societies should experience these changes sooner or later. In other words, there must be some regularity in this process. Studies with a prospective

[a] Graduate School of Humanities, Senshu University

Corresponding Author:
Aguru Ishibashi, Graduate School of Humanities, Senshu University. 2-1-1 Higashi-mita, Tama-ku, Kawasaki-shi, Kanagawa-ken 214-8580, Japan.
Email: ishi14.a@gmail.com

approach aim to illuminate how the social distribution of a certain generation affects that of the next generation. Since the analysis focuses on the demographic distribution of a certain social class, these studies should follow the tenets of demographic theory. Therefore, this paper proposes the use of the DTT (Kono 2007), which is one of the few "grand theories" in demography.

The discussion is divided into four sections with the first one concerning the meaning of the "prospective approach." This approach is discussed through a comparison with the conventional "retrospective approach" in social mobility research. The problem of how best to construct models is presented with the use of the DTT as its solution. Second, the DTT is explained, and the four models are derived therefrom to elucidate the mechanisms of reproduction that should be integrated when the DTT is introduced in prospective approach research. Third, previous studies were reviewed based on these models, and the problems therein were identified. Specifically, three problems are discussed: the fact that the intensity of social change hampers analysis, the argument that models specific to each society should be constructed through the framework of the DTT, and the issue of lack of data. Finally, the study is summarized and its arguments are presented.

WHAT IS THE PROSPECTIVE APPROACH?

To date, much research on social stratification has focused on offspring generation, analyzing it in relation to the parental generation. This research includes mobility table analysis and path analysis (Blau and Duncan 1967) as well as log-linear modeling (Erikson and Goldthorpe 1992).

However, the methods used in conventional studies for intergenerational analysis are problematic as they introduce selection bias due to fertility. This is because conventional approaches use offspring generation as the unit of analysis, thereby excluding members of the parental generation who have no children. This has been identified as a problem of data reliability and validity due to fertility by Mukherjee (1954), Yasuda (1964, 1971), and Duncan (1966). Conventional social stratification research is also problematic as the processes of intergenerational reproduction remain unknown. This problem is critical because, as Mare (2011) notes, mobility studies should consider fertility differentials, child–parent mortality rates, assortative mating, and migration.

The prospective approach is a new method that aims to overcome these problems. In recent years, prospective approaches have attracted attention as research methods. Its uniqueness with regard to conventional research methods is that it focuses on the parental generation, analyzing it in relation to offspring generation. The term "prospective approach" reflects the fact that this method looks forward to the offspring generation from the parental generation. In contrast, the conventional approach is referred to as "retrospective," since it looks back on the parental generation from the offspring generation.

This prospective approach has some advantages over the retrospective one. Because the analysis focuses on the parental generation, the selection bias introduced by conventional approaches can be avoided. Therefore, the reliability and validity of the prospective approach were superior to those of the retrospective one. Another advantage is that the processes of demographic change can be integrated into the reproduction model. Reproduction of status is determined by mechanisms such as marriage, fertility, mortality, and educational attainment. It is possible to study how social positions in the parental generation are transmitted to the offspring through a combination of these mechanisms. In other words, this approach allows us to understand the mechanisms that contribute to intergenerational mobility and reproduction. This is important because even if the degree of reproduction of social positions is the same across various countries, the mechanisms of reproduction may still

differ (Hillmert 2013).

There are also some drawbacks to this prospective approach. First, data collection in this approach is more difficult than in a retrospective approach. This is because certain attributes of the participants' offspring—such as their social position, educational attainment, and occupation—may not yet be determined at the time of the study. There is also the problem of determining which child to include in the analysis in cases where parents have multiple offspring (Yasuda 1964, 1971).

It is thought that researchers should choose between the two approaches according to the nature of their study (Yoda 2018). According to Yoda (2018), the prospective approach is well-suited for research on intergenerational reproduction. This is because it foregrounds the issues of relative differences between fertility differentials and the level of attainment of certain social positions, focusing on the theme of social class dynamics. The retrospective approach is suited to research that examines inequality of opportunities, as the degree to which the social position attained is influenced by the position at birth cannot be understood unless that position is the central component of analysis.

However, the prospective approach, a new methodology, presents a problem that is not an issue when designing retrospective approach studies. That is, as the demographic approach was integrated into the study design, enabling researchers to add mechanisms such as fertility, marriage, and mortality to models of intergenerational reproduction, choices have arisen with regard to the kinds of models to construct. In previous studies using a prospective approach, the analysis was performed using various models. Undoubtedly, since the studies focus on different societies, it is natural that different models are used. Nevertheless, the choice of mechanisms to use in these models is somewhat arbitrary. It would seem that the context and structure of the society in question should be accounted for when constructing the model, and certain rules are necessary to inform this process.

For the reasons presented above, this paper addresses the question of how best to construct models for studies that employ a prospective approach. This question is important when we study various countries with the prospective approach on which much less studies have been done.

Furthermore, in response to this question, it is argued that the DTT should be used. Since the prospective approach emerged as a result of applying the demographic approach to social stratification studies, similarly, demographic insights can also inform the construction of models in the approach. In addition, by introducing the DTT, which describes changes in social structure on the basis of changes in fertility and mortality over time, mechanisms such as those that are critical to the prospective approach can be linked to the social structure and changes in the country of the study. This enables the researcher to consider whether to incorporate each mechanism in the model.

CONSTRUCTION OF MODELS FOR THE PROSPECTIVE APPROACH BASED ON THE DEMOGRAPHIC TRANSITION THEORY

The Demographic Transition Theory (DTT) is a theory that refers to changes in birth and death rates to explain the process of population growth in modern times, which is thought to encompass three social transitions. The theory is not the work of a single scholar; it has been developed by several individuals (Kono 2007). According to Frank Notestein, a leading exponent of the theory, population growth occurs as birth rates fall following the decline of death rates (Notestein 1953). As the population grows, the social structure progresses through the following four stages: before demographic transition, in premodern society, birth and death rates are high; next, the death rate begins to fall as the demographic transition begins, resulting in a society with a high birth rate and moderate death rate; as the transition further progresses, the birth rate

begins to fall, culminating in a society with a moderate birth rate and a low death rate; and finally, the society enters the post-transition stage in which both the birth and death rates are low. Past insights into why demographic growth occurred are summarized below in relation to changes in social structure.

In premodern societies, both fertility and mortality are high. Fertility was high because societies were primarily agricultural, and children were regarded as productive assets. Children's education was simple, and they began working at an early age. Furthermore, at this time, women received no economic support and had no opportunities to achieve personal fame or fortune with their primary role being to produce children (Notestein 1953). The reason for the high death rate was that endemic diseases continued to thrive due to primitive medical care and low awareness of hygiene, coupled with malnourishment caused by food shortages (Coale 1984). In addition, the norms enduring through the high death rate—that is, the attitudes and roles ascribed to women and children—were formalized as religious principles and deeply embedded in society. This has resulted in the slowing of social change. In short, since birth and death rates were high and in balance, population growth was stagnant.

However, with the Industrial Revolution and the Agricultural Revolution of the 18th century, death rates began to fall. This happened for three reasons: food supplies increased because of the Agricultural Revolution, income and production increased owing to the Industrial Revolution, and it became possible to control the illnesses affecting young children because of increased awareness of hygiene and developments in the field of medicine (Notestein 1945). While there was a fall in death rates owing to the modernization associated with the Agricultural and the Industrial Revolutions, the birth rates, on the other hand, remained unchanged. The gap between birth and death rates has led to population growth; notably, this was the beginning of the transition stage in the DTT.

As industrialization progressed, and manufacturing replaced agriculture as the core industry, birth rates began to fall. According to Notestein (1953), the reason for the decline in birth rates is the change in the core industry caused by urbanization as populations began to move into cities. The core industry in the cities was manufacturing, which did not require individual labor but instead skills and division of labor. Therefore, it became necessary to educate children whose status changed from productive assets to costly items. To reduce costs, people began to restrict childbearing by means of contraception, particularly in cities. This happened first among upper-class urbanites before gradually spreading to the provinces. The roles of women—which had previously centered on childbearing—saw a change, as more women gained independence from household duties to take on new economic roles that had little to do with childrearing. Specifically, industrialization gave rise to a new family structure with smaller family sizes. Furthermore, those who were secular or less religiously inclined tended to restrict their childbearing (Coale 1984). As birth rates began to fall, deaths due to infectious diseases fell as a result of further improvements in hygiene awareness and medicine, further driving the decline in the death rate. Thus, despite the demographic transition, population growth continued because of the differing degrees by which the birth and death rates fell.

Although this series of transitions began in Europe, a demographic transition was initiated in Asia and other developing countries as well. This development had also been predicted by Notestein (1945), and demographic transition in Japan has, in fact, been shown to have begun in the late 19th century (Hirschman 1994). It has also been noted that after birth rates in some parts of East Asia dropped to the same level as other developed nations, the same pattern continued in Southeast Asian countries (Hirschman and Guest 1990), and demographic transition has been observed in other developing countries (Coale 1984; Hirschman 1994).

However, there was one difference

between the demographic transitions of Europe and those in Asia and developing countries: the pace of change. In Europe, the death rates began to decline in the wake of the Industrial Revolution in the late 18th century (Notestein 1953), and demographic transition was completed as birth rates fell between 1870 and 1930 (Hirschman 1994). On the other hand, the pace of demographic transition in many Asian countries was less gradual than that in Europe. For example, after the demographic transition began in many developing countries in the 1960s, intense changes ensued (Hirschman 1994). This was because medicine, agriculture, hygiene, communication, and shipping technology were transferred from Europe, causing a dramatic decline in death rates. Another reason for the intensity of this change was that effective contraceptive methods that were non-existent in 19th century Europe, along with the expansion of education systems, contributed to a drastic decline in birth rates (Coale 1984). Research has also shown that the expansion of education systems caused birth rate decline as educated women with knowledge of contraceptive methods led to their restricting of their childbearing (Hirschman and Guest 1990). Specifically, the demographic transition in Asia and developing countries proceeded at a rapid pace as a consequence of sudden social changes.

It was predicted that demographic transition would proceed throughout the world, ultimately leading to a leveling off of population growth as the birth rate decline was completed—however, this was not the case. This is because, starting in Europe from the 1950s to the 1970s, total fertility rates dropped below 2.1 and then began to fall below the replacement level. In other words, birth rates fell below death rates, and in some developed nations, populations began to decline. In response to this situation, a second demographic transition was proposed by van de Kaa (1987) and Lesthaeghe (1991), revising the DTT. The initial demographic transition is referred to as the "first demographic transition" in contrast to the second transition. The biggest difference between the two demographic transitions is that the first began with falling death rates, whereas the second began as birth rates dropped below the replacement level (van de Kaa 2002).

The second demographic transition, which describes how population decline began after population growth, explains the causes of this transition through changes in family structure owing to contraceptive revolutions and shifting values (Lesthaeghe 1991; van de Kaa 1987). The following indicates these two causes.

First, while the initial birth rate decline was also the result of contraceptive behaviors, there were folk methods of contraception (Notestein 1953), which were imperfect insofar as they led to "shotgun" marriages (Lesthaeghe 2010). In contrast, the methods of contraception that contributed to the falling birth rates in the second demographic transition, centered on the use of the pill or intrauterine devices, which are almost fully reliable. Moreover, contraception, once male-oriented, became female-oriented (van de Kaa 2002); this not only caused birth rates to decline but also enhanced the reproductive rights of women who had previously been subservient to men (Lesthaeghe 1991).

Second, "changes in family structure due to shifting values" refers to a series of developments in which changes in social structures caused people's values to change, giving rise to new kinds of family structures such as unmarried couples, late marriages, childless couples, and later changed the traditional system of childbearing. Society saw a transition from modern to postmodern and from industrial to post-industrial. Post-industrialization and dematerialization gave rise to new value orientations, reduced dependence on traditions such as religion (Lesthaeghe 2010), and ushered in lifestyle changes in conjunction with the expansion of education and changes in education systems. Family structures began to change, including non-traditional common-law marriages, cohabitation, and living independently at an early age (Lesthaeghe 2010). As

non-traditional marriages became more common, the number of children born out of wedlock also increased. Moreover, with the contraceptive revolution, having children became an individual choice as well as a means of self-fulfillment (van de Kaa 1987). In addition, developed countries have become increasingly dependent on immigration, leading their societies to become ethnically and culturally diverse (Lesthaeghe 2010).

This second demographic transition predicts that birth rates, having fallen below the replacement level, will not return to their previous levels. The model also predicts that since value orientations are changing because of changes in social structure, this second demographic transition will be experienced not only in Europe and developed nations but also in currently developing nations (Lesthaeghe 2010; van de Kaa 1987).

The DTT and the second demographic transition discussed above are summarized below from the perspective of constructing models for the prospective approach, which is the purpose of this study. It is possible to envisage four models: the high-fertility/high-mortality model, high-fertility/moderate-mortality model, moderate-fertility/low-mortality model, and low-fertility/low-mortality model. The following eight mechanisms have been included in models of reproduction constructed for previous social stratification studies with a prospective approach: whether the respondent marries, whom they marry, when they marry, whether they have children, how many children they have, when the children are born, the mortality rate up to the point when the first generation comes of age, and the child mortality rate. The DTT was formulated to indicate which mechanisms need to be included in each model (Table 1).

First, the society envisaged in the high-fertility/high-mortality model is a premodern traditional society. Fertility was high because the family was a unit of production. Therefore, since the primary concern was childbearing, and marriage was a given, there was no need to include mechanisms related to marriage in this model. Furthermore, since having children was also a given, the question of the number of children is important; there is no need to consider whether and when children are born. Moreover, since mortality was high due to the prevalence of infectious diseases and limited food supplies, mortality rates for the respondents and children must be accounted for.

Second, the society envisaged in the high-fertility/moderate-mortality model is a post-Industrial Revolution early modern society, such as those in developing countries around the 1960s. Although the industrial structure changed, the fertility remained high. Therefore, since the tendency to view marriage as a given still existed as it did in the high-fertility/high-mortality model, there is no need to include mechanisms such as whether and when the respondent marries. Nevertheless, it may be necessary to consider the question of whom the respondent marries. This is because this question—whether there is a tendency toward assortative mating—serves as an indicator of the level of openness in society (Ultee and Luijkx 1990). Additionally, it is reasonable to assume that mobility, both geographical and social, is likely to occur during the transition from a traditional society to an industrialized one. The model is the same as the high-fertility/high-mortality model with regard to the mechanisms pertaining to birth. This is because, as explained by Notestein (1945), fertility remains unchanged during this stage. Although the mortality rate is falling, it is also an important factor in this stage, since awareness about contraception had spread from the upper classes and those with advanced education, the same logic applied to knowledge of hygiene, which is a factor of mortality.

Third, the society envisaged in the moderate-fertility/low-mortality model is an industrialized society, such as those found in Europe until the 1930s as well as Asia and developing countries since the 1960s. The important point here is that fertility has declined. Although the fertility rate began to fall, since non-traditional marriage was not yet an issue during this stage, there is no

Table 1. Prospective Approach Models Based on Demographic Transition Theory

Phase	Marriage	Marriage timing	Assortative mating	Having children	Birth timing	Number of children	Mortality of respondents	Mortality of children	Sex
I. High-fertility/high-mortality	---	---	---	---	---	v	v	v	---
II. High-fertility/moderate-mortality	---	---	v	—	---	v	v	v	---
III. Moderate-fertility/low-mortality	---	---	v	v	---	v	---	---	Two-sex model
IV. Low-fertility/low-mortality	v	v	v	v	v	---	---	---	Two-sex model

need to include mechanisms such as whether and when the respondent marries. However, assortative mating should be included in the model, since the rapid development of education in developing countries during this period also led to improvements in women's attainment of higher education. Therefore, it is necessary to incorporate assortative mating in the model as a measure of the ease with which respondents marry partners whose attributes resemble their own. On the other hand, since fertility was beginning to fall, issues arising might include not only how many children to have but also whether to have children in the first place; hence, these two factors should be included in the model. Nevertheless, there is no need to account for mortality, since the death rate has already stopped falling during this stage due to improved hygiene awareness and medical technology. In addition, since many of the Asian and other developing countries caught up with the developed countries at a swift pace, incorporating European technology causing mortality and fertility to rapidly fall, for similar reasons, one would expect the norms related to the social position of women to be transferred. Therefore, a model that considers both genders is preferable to a single-gendered model.

Finally, the society envisaged in the low-fertility/low-mortality model is the kind that existed in Europe and America from the 1930s on as well as in Asia and developing countries. As mentioned above, the fertility rate continues to decline, culminating in sub-replacement fertility. This is a result of changes in the family structure owing to contraceptive revolutions and shifting values. In other words, the family formation procedure, known as marriage, is changing. Therefore, questions such as who marries, whom they marry, and when they marry enter the picture. Moreover, since fertility continues to decline, the primary concern is not the number of children, but whether to have children in the first place. The question of when the respondent has children also becomes important because of changes in family structure and the fact that contraception is now female-oriented. There is no need to account for mortality as it remains unchanged from the moderate-birth/high-death period.

In a modern society, where fertility and mortality are low, a number of other issues must also be considered. For example, since further advancements in medical technology have increased life expectancy, it may become necessary to take a multigenerational view of intergenerational reproduction, rather than a two-generation one (Mare 2011). As people live longer owing to increasing life expectancy, it is conceivable that the grandparental generation might influence their grandchildren. Furthermore, more women attain higher levels of education. In many societies, the university enrollment rate is higher among women than men (Maralani 2013); therefore, models should consider not only men—the main focus of analysis in social stratification research to date—but both genders. In addition, behaviors around the restriction of childbearing vary depending on religious orientation. Immigration issues in developed countries may give rise to social groups with different levels of fertility owing to differences in religious orientation.

Having formulated the four models based on the DTT already introduced, the next section will examine how previous studies with a prospective approach correspond to these models. To this end, the time span of each study was determined. The corresponding stages of the DTT are determined based on infant mortality and total fertility rates, and the validity of the choice of mechanisms for models used in previous studies is examined through comparison with the models presented above.

EVALUATION OF MODELS USED IN PREVIOUS STUDIES

Previous Studies of Countries Where Social Change Is Intense and the Study Time Span Encompasses Periods of Demographic Transition

Indonesia.

The main studies on reproduction in Indonesia were conducted by Maralani and Mare (2005) and Mare and Malarani (2006). Both studies drew on panel data from the Indonesian Family Life Survey (IFLS) conducted from 1993 to 1997 and from 1998 to 2000, respectively; however, different samples and models were used. The two studies were examined in comparison with the models formulated above.

The Maralani and Mare (2005) covers the period from 1953 to 1977. The data used in the study pertain to women aged between 15 and 64 years, as of 1997. If we assume that these women began having children from the age of 20, and that their children had been at least 20 years old at the time of the study to have attained a higher education, the lower boundary of the time span encompassed by the study was 1953 (1997 [year of study] − 64 years [maximum age in the sample] + 20 years [age when respondents began having children]); the upper boundary was 1977 (1997 [year of study] − 20 years [age when educational outcome of a child is determined]). This implies that the time span should begin at the point when the rate of childbearing starts increasing, since fertility and infant mortality, which influence intergenerational reproduction, do not have an effect unless children are born. Moreover, since the educational outcome attained by the child needs to be determined, it is necessary to subtract the corresponding number of years from the year of the study.

The study's time span indicates that the analysis corresponds to the high-fertility/high-mortality and high-fertility/moderate-mortality models. This is because, according to data from the United Nations, the infant

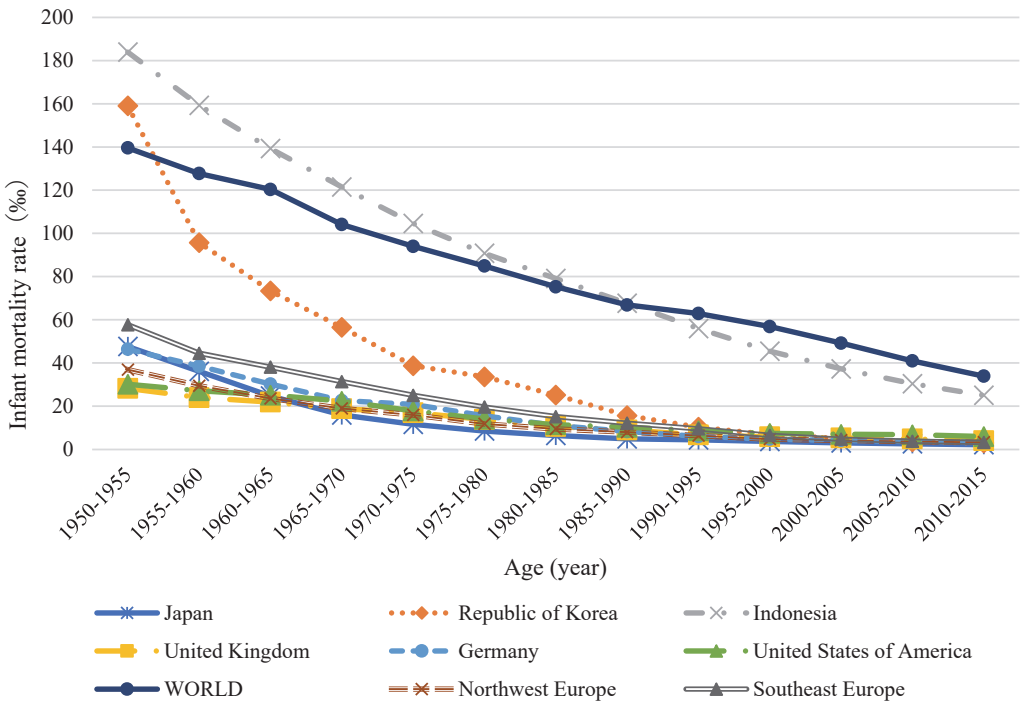

Figure 1. Infant Mortality Rates (Infant Deaths per 1,000 Live Births)
Source: The 2019 Revision of World Population Prospects

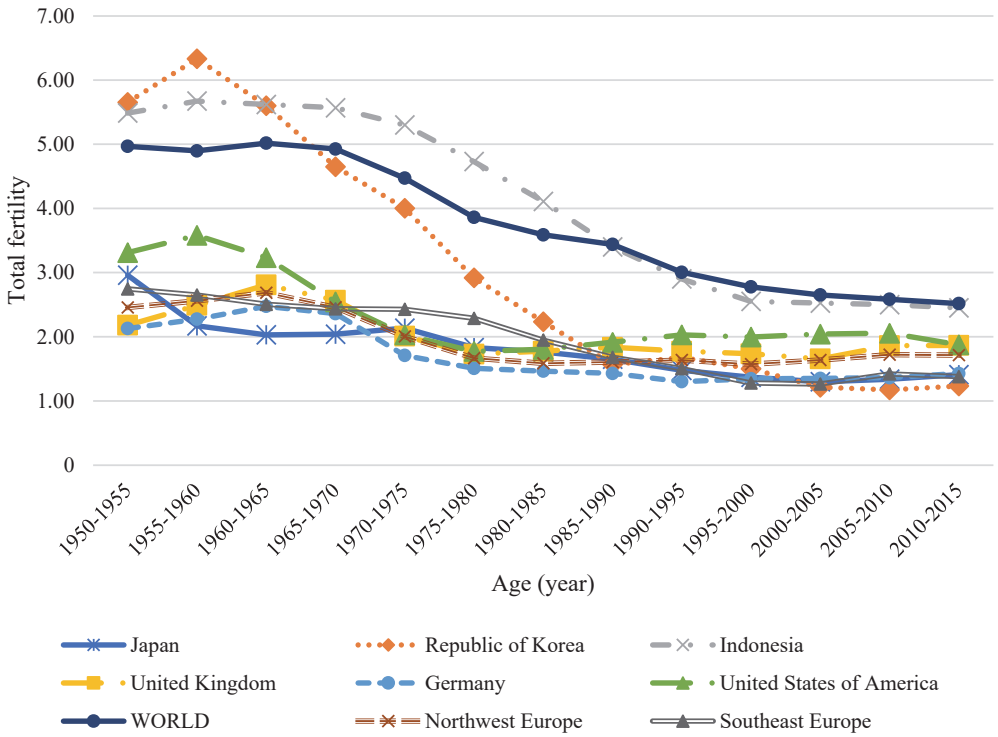

Figure 2. Total Fertility (Live Births per Woman)
Source: The 2019 Revision of World Population Prospects

mortality rate in Indonesia between 1950 and 1955 was 184‰ (Figure 1), which is higher than the world average of 140‰ (Figure 1) After that, the rate of infant mortality fell, reaching 91‰ (Figure 1) between 1975 and 1980, but remained slightly higher than the world average at that time. The total fertility rate in Indonesia between 1950 and 1955 was 5.49 (Figure 2), which is higher than the world average of 4.97 (Figure 2). Total fertility began to decline in the 1970s, reaching 4.73 (Figure 2), between 1975 and 1980, which is still higher than the world average. Given these figures, it is reasonable to assume that the time span of the study covers at least two different models of demographic transition. Initially, Indonesia had a high-fertility/high-mortality structure, but as mortality began to decline, the country progressed to a high-fertility/moderate-mortality structure. Then, during the latter part of the time span, although Indonesia was not, strictly speaking, a low-death society, total fertility had begun to fall.

The model used in the 2005 study can be considered comprehensive, as all mechanisms were included, as shown in Table 2. As seen in Table 1, it is necessary to employ three models and account for almost all mechanisms. However, it was not necessary to include the timing of childbearing, given that the study did not include a low-fertility/low-mortality structure. Nevertheless, this study was an early attempt at the prospective approach and deserves credit for its use of a comprehensive model, insofar as it provided a direction for subsequent research with the model.

Although the second study by Mare and Maralani (2006) used a different sample and model from the 2005 study, the time span remained unchanged. The study used the same data as the 2005 study, but restricted its sample to married women aged 41 years or older as of 1997. Despite this, the time span encompassed by the study remained

Table 2. Model Constructions in the Literature

The literature	Country	Time span	Phase	Marriage	Marriage timing	Assortative mating	Having children	Birth timing	Number of children	Mortality of respondents	Mortality of children	Sex
Maralani and Mare (2005)	Indonesia	1953-77	I, II, III	v	v	v	v	v	v	v	v	Female
Mare and Maralani (2006)	Indonesia	1953-77	I, II, III	---	---	v	v	---	v	---	---	Female
Kye and Mare (2012)	Korea	1947-86	I, II, III, IV	---	---	v	v	---	v	---	---	Female
Maralani (2013)	United States	1939-83	IV	v	v	v	v	v	v	---	---	Female
Hillmart (2013)	Germany	1945-88	IV	v	---	v	v	v	---	---	---	Female
Lawrence and Breen (2016)	United States	1959-84	IV	v	---	v	v	v	v	---	---	Female/ Male
Breen and Ermich (2017)	United Kingdom	1956-88	IV	v	---	v	v	v	---	---	---	Female/ Male
Song and Mare (2017)	United States	1946-91	IV	v	---	v	v	---	v	---	---	Female/ Male
Yoda (2018)	Japan	1955-95	IV	---	---	---	v	v	---	---	---	Female/ Male
Breen et al. (2019)	Europe	1950-87	IV	v	---	v	v	v	v	---	---	Female/ Male

the same. This study incorporated assortative mating and the number of children in the model (Table 2). To simplify this process, other mechanisms are not included. Mortality should have perhaps been considered, as the time span of the study encompassed the high-fertility/high-mortality and high-fertility/moderate-mortality periods (Table 1). However, according to the 2005 study, reproduction of educational attainment changed by only 2% when mortality was taken into account; therefore, the decision not to consider mortality also seems sound.

Changes in developing countries such as Indonesia were intense since demographic transition progressed at a rapid pace, and this intensity of change may have hampered attempts to measure the level of reproduction. In the United States and Europe, where changes more gradually occurred than in developing countries, data are confined to a single social structure since demographic transition is already complete. However, in the case of developing countries, although the period covered by the data is short, the degree of change in social structure is large, and the data span multiple structures. Thus, depending on the social structure, mechanisms such as mortality may be necessary, and mechanisms considered unnecessary may need to be included. In these cases, the results may be misinterpreted without identifying changes in the social structure and controlling the cohort. Thus, it can be said that the speed of change hampers the analysis.

Moreover, parameters inferred from data based on a certain degree of intensity will only ever reflect the society in question; consequently, in order to understand class reproduction using the prospective approach, it would be preferable to conduct studies that examine various countries and periods. Even when simulations are performed with different educational distributions based on the obtained estimates, they can only help us understand the mechanisms of reproduction at play, or make predictions about the future in the society of that particular country and cannot inform our understanding of reproduction in other developed countries (Maralani and Mare 2005). Accordingly, it seems necessary to conduct reproduction studies for each individual country and period while considering the social structures delineated by the DTT.

South Korea.

The data used in the study of class reproduction in South Korea by Kye and Mare (2012) were drawn from the first wave of the Korean Longitudinal Study of Aging (KLoSA). The respondents were at least 45 years old as of 2006; the sample consisted of married women aged between 45 and 79 years old. When calculated in the same way as described above, the time span of the study was from 1947 to 1986.

This time span encompasses all models, from the high-fertility/high-mortality model to the low-fertility/low-mortality model. Infant mortality rates from 1950 to 1955 were 159‰ (Figure 1), which is higher than the world average. Infant mortality continued to decline thereafter, reaching 16‰ (Figure 1) for the period of 1985 to 1990. In addition, total fertility was 5.65 (Figure 2) between 1950 and 1955 (higher than the world average). After a subsequent increase in total fertility, the rate continued to decline, reaching 1.57 (Figure 2) from 1985 to 1990. South Korea had a high-fertility/high-mortality structure early in the time span and then moved to a low fertility/low mortality toward the end of the time span. Specifically, since multiple social structural changes occurred within a short period, South Korea also underwent intense changes.

The model used in the study only considers assortative mating and the number of children born (Table 2); however, it is necessary to add several mechanisms, since the corresponding social structures encompass all of the models (Table 1). Since the study exclusively focuses on married women because of the nature of the dataset, there is, of course, no alternative but to ignore the mechanism of marriage. However, although the study mentioned the timing of marriage and childbearing, it would have been better to

integrate these mechanisms into the model. As previous research (Kye 2011) showed that the effects of mortality on educational reproduction were low in the case of Korea, mortality was omitted from the model. Nevertheless, as mentioned above, where changes are intense and data encompass multiple social structures, results may be skewed by differences in model construction. Therefore, while mechanisms should be added to models with care, it is reasonable to conclude that several mechanisms should be added to this particular model.

Although Kye and Mare (2012) pointed out that intergenerational effects are lower in South Korea than in Indonesia owing to differences in educational expansion, it is possible that this educational expansion may result from differences in the stage of demographic transition in the first place. Although the models employed by Mare and Maralani (2006) and Kye and Mare (2012) include the same mechanisms, the studies encompass different time spans and social structures; therefore, they are considered to correspond to different periods of educational expansion. This suggests that reproduction of educational outcomes has less to do with characteristics of individual countries, such as the state of educational expansion, and more with whether the period of educational expansion has arrived as a result of social structural changes.

Previous Studies of Countries Where Social Change Is Gradual and the Study Time Span Falls After Demographic Transition

Japan.

Prospective approach studies in Japan include Yoda (2018), who used data from the 2015 Social Stratification and Social Mobility Survey (SSM). Since the analysis is restricted to the cohort that had completed the birth process, The birth cohort was from 1935 to 1964. Accordingly, when calculated as above, the time span of the study was from 1955 to 1995.

The DTT that corresponds to this time span is a low-fertility/low-mortality model. The infant mortality rate from 1955 to 1960 was 36‰ (Figure 1), much lower than the corresponding world average of 128‰ (Figure 1) and similar to that of Germany at that time. Infant mortality continued to decline thereafter, reaching 4‰ (Figure 1) for the period of 1990 to 1995. Furthermore, the total fertility rate between 1955 and 1960 was 2.17 (Figure 2), and continued to decline thereafter, reaching 1.48 (Figure 2), between 1990 and 1995. These figures indicate that Japan had a low-fertility/low-mortality structure as of 1955.

Given this low-fertility/low-mortality structure, there is room to reconsider the model because, as mentioned above, lifestyles and family structures are changing due to various shifts in values. The model employed by Yoda incorporated questions on whether and when the respondents had children (Table 2). While this is described as a simplified model (Yoda 2018) with reference to Breen and Ermisch (2017), when the social structure is considered, it would seem necessary to include mechanisms related to marriage behaviors (Table 1). Nevertheless, the study deserves merit for its consideration of whether and when the respondents had children and the fact that both genders were analyzed.

Germany.

One prospective study conducted in Germany was by Hillmert (2013). Since the dataset used in this study lacked appropriate information, it was combined with multiple data from surveys conducted in West Germany between 1970 and 2008. While the dataset includes a cohort born between 1895 and 1978, the data used in the research covers the period from 1925 to 1950. When the period when respondents began having children was calculated as above, the resulting time span was 1945 to 1988.

This time span seems to correspond to the low-fertility/low-mortality model. As explained above, the demographic transition was completed as fertility declined in European countries between 1870 and

1930 (Hirschman 1994). For the period of 1950 to 1955, infant mortality and total fertility were 46‰ (Figure 1) and 2.13 (Figure 2), respectively, much lower than the corresponding world averages. Furthermore, from 1985 to 1988, corresponding to the latter part of the time span, infant mortality was 11‰ (Figure 1), and although total fertility increased between 1955 and 1985, it ultimately fell to an extremely low level of 1.46 (Figure 2). Thus, it can be concluded that the DTT for this time span is a low-fertility/low-mortality model.

Since we can assume that, with the low-fertility/low-mortality structure, lifestyles and family organizations are changing because of various shifts in values; as in the Japanese study, there is room to reconsider this model. This is because although the model for this study accounted for whether the respondents married, whether they practiced assortative mating, and whether they had children (Table 2), the timing of their marriage and childbearing were not considered (Table 1). However, because of the lack of appropriate data and the fact that multiple datasets were combined, it may have been difficult to incorporate data on the timing of marriage and childbearing. That said, the analysis exclusively focuses on women, and although more women attain higher education in a low-fertility/low-mortality society, it seems necessary to consider gender differences. Therefore, it is necessary to reconsider this model.

United States.

Three studies focus on the United States, each of which has a different birth cohort. The first study was conducted by Maralani (2013), using data from the Panel Study of Income Dynamics (PSID) conducted between 1968 and 2003. The birth cohort was from 1919 to 1968. When calculated as above, the time span was from 1939 to 1988. The second study was conducted by Lawrence and Breen (2016), using data from the Wisconsin Longitudinal Study (WLS) conducted between 1957 and 2004. The study examined students who graduated from Wisconsin high schools in 1957. Therefore, the time span of the study was from 1959 to 1984. The third study was carried out by Song and Mare (2017) using data from the PSID. This study used the same data as Maralani (2013) but extended the period up to 2011. The analysis cohort was aged 25 to 65 years old. Thus, the time span of the analysis was between 1946 and 1991.

Despite their different time spans, all three studies corresponded to the low-fertility/low-mortality model. According to Notestein (1953), fertility in the United States began to decline in the early 19th century, even more so than in Europe. Therefore, since the lower limit of the time span encompassed by the three studies was 1939, it is clear that a low-fertility/low-mortality structure had already been reached. However, from the figures, we can see that although total fertility was 3.31 (Figure 2) in the period between 1950 and 1955, slightly increasing to 3.58 (Figure 2) between 1955 and 1960, it continued to fall thereafter, reaching 1.77 in the period from 1975 to 1980 and remained below 2.00 until 1990. The infant mortality rate for 1950 to 1955 was 30‰ (Figure 1) and had fallen to 10‰ (Figure 1) by the period of 1985 to 1990 in the later part of the time span. Although the total fertility rate was on the high side for a time, by the early 19th century, fertility had already fallen to a level similar to that seen in Europe; thus, the studies can, in fact, be seen to correspond to the low-fertility/low-mortality model.

Let us first examine Maralani's (2013) model. The mechanisms incorporated in the model are when and whether the respondents married, whether they practiced assortative mating, when and whether they had children, and the number of births. Mortality was not included in this model (Table 2). The model can be regarded as seamless insofar as it encompasses all of the necessary mechanisms in the low-fertility/low-mortality model (Table 1). The model also incorporates the dimension of race, and although samples of Latinos and immigrants are omitted from the analysis from the data limitations, the study analyzes white and black respondents.

This is extremely important not only in terms of racial differentials but also because religion may differ by race, and differences in religious doctrine may affect fertility rates.

The model used in the second study by Lawrence and Breen (2016) considers whether the respondents were married, whether they practiced assortative mating, whether they had children, the timing of births, and the number of births (Table 2). Tested against the low-fertility/low-mortality model, the timing of marriage is not included, whereas the number of births is included (Table 1). However, the number of births was examined in an additional analysis, and the results indicated that the number of siblings did not impact the rate of reproduction of higher education outcomes, which suggests that there is no need to include the number of children in the low-fertility/low-mortality model. The analysis also considers religious orientation—that is, whether any of the respondents were Catholic.

The model used in the third study by Song and Mare (2017) included marriage, assortative mating, and the number of children (Table 2). This model is different from the low-fertility/low-mortality model in that it does not include the timing of marriage (Table 1). However, the model includes both male and female respondents as well as a parameter that considers the educational outcomes of the grandparental generation. The study is, therefore, outstanding in its consideration of the possibility that senior generations can exert an influence beyond the next generation in a low-fertility/low-mortality society where healthcare is advanced and life expectancy is extended.

United Kingdom.

A study on the United Kingdom's societal structure by Breen and Ermisch (2017) used the British Household Panel Survey conducted from 1991 to 2008 to examine a cohort born between 1936 and 1961. Accordingly, when calculated as above, the time span of the study was from 1956 to 1988.

This time span seems to correspond to the low-fertility/low-mortality model. As explained above, the demographic transition was complete in Europe in 1930. Furthermore, when matched against the data, between 1955 and 1960 infant mortality and total fertility were 24‰ (Figure 1) and 2.49 (Figure 2) respectively, much lower than the world averages. Although total fertility increased to 2.81 (Figure 2) from 1960 to 1965, as of 1985 to 1990 it dropped below the replacement level to 1.84 (Figure 2). Therefore, the low-fertility/low-mortality model seems to be suitable.

When the model used in this study was tested against the low-fertility/low-mortality model, although most of the mechanisms were the same, marriage timing was not included (Table 1 and 2). However, the model is remarkable in that it analyzes both genders as well as in its consideration of whether the respondents lived outside the United Kingdom and their regions of origin accounted for the possibility that fertility may differ as a result of immigration.

European Countries.

A study of European societies carried out by Breen et al. (2019) used two waves of the Survey of Health, Ageing and Retirement in Europe (SHARE) panel dataset, conducted from 2004 to 2005 and 2006 to 2007, respectively. The study analyzed 12 countries, namely Denmark and Sweden in Northern Europe; Austria, Belgium, Germany, the Netherlands, and France in Western Europe; the Czech Republic and Poland in Eastern Europe; and Spain, Italy, and Greece in Southern Europe. The focal cohort was born between 1930 and 1950, and the time span of the analysis was from 1950 to 1987.

This time span can be seen to correspond to the low-fertility/low-mortality model, and as presented above, the demographic transition was complete in Europe by 1930. Since the countries were geographically grouped into northern/western and southern/eastern regions, the data were also divided in a similar manner, obtaining average values for each region. First, infant mortality in Northern and Western Europe was 37‰

(Figure 1) between 1950 and 1955, much lower than the world average, and continued to decline thereafter, reaching 8‰ between 1985 and 1990. Total fertility was 2.46 (Figure 2) between 1950 and 1955, much lower than the world average. Subsequently, fertility continued to decline, dropping below the replacement level to 1.61 (Figure 2) between 1985 and 1990. Infant mortality in Southern and Eastern Europe was 58‰ (Figure 1) between 1950 and 1955, lower than the world average, but higher than that in Northern and Western Europe, and continued to decline thereafter, reaching 12‰ (Figure 1) between 1985 and 1990. Total fertility was 2.75 (Figure 2) between 1950 and 1955, which was much lower than the world average but slightly higher than that of Northern and Western Europe. It then continued to decline thereafter, dropping below the replacement level to 1.68 (Figure 2) between 1985 and 1990. In view of this information, both regions can be considered within the low-fertility/low-mortality model.

The model used in the study included whether the respondent was married, assortative mating, whether the respondent had children, and the timing of birth (Table 2). Although the timing of marriage is not included, this appears to be because the use of an older target population made it difficult to consider the timing of marriage. This can be inferred from the fact that the authors point to a lack of adequate data for prospective approach studies and mention that while these studies have typically used panel data, they collected data through a survey of older respondents (Breen, Ermisch, and Helske 2019). Furthermore, although the model also considers the number of children, the results indicate that it does not influence the rate of educational reproduction, reflecting the results obtained by Lawrence and Breen (2016).

DISCUSSION

Three main points can be drawn from the above review of models constructed in previous studies for individual countries/regions. First, it is difficult to analyze societies that are undergoing intense change using a prospective approach. Second, estimates obtained from models reflect the social structures and changes of the focal country and can only simulate the particular society in question; thus, it seems necessary to conduct reproduction studies for each individual country and period while keeping in mind the social structures delineated by the DTT. Finally, since a lack of adequate data for prospective approach studies requires researchers to take steps such as combining multiple datasets, there is a possibility that important variables might be unavailable; this may hamper the construction of models.

Changes in developing countries were intense as demographic transition progressed at a rapid pace, and this intensity of change may hamper attempts to measure the level of reproduction. Because this speed of transition requires multiple models for a single data set, and the mechanisms required in each model will vary, without discerning the changes in social structure and controlling the cohort, the results may be misinterpreted. Thus, it is fair to say that the intensity of change hampers the analysis.

Regarding the second point, since parameters inferred from data based on a certain degree of intensity of change will only reflect the society under analysis, in order to understand class reproduction using the prospective approach, it is preferable to conduct studies that examine various countries and periods. There needs to be a study of various countries separately coinciding with Kye and Mare's (2012) assertion that we ought to apply the same model to other countries to study whether differences in educational distribution are caused by the differing magnitudes of intergenerational effects. Nevertheless, while the ideal model will vary depending on social structures and changes, the question of educational distribution may also be determined by differences in the stage of demographic transition. Accordingly, it seems necessary to conduct reproduction studies for each individual country and

period while considering the social structures delineated by the DTT.

Finally, there is a problem with insufficient data. In the study by Hillmert (2013), it may have been difficult to incorporate data on the timing of marriage and birth because datasets were pooled owing to a lack of adequate data. Since prospective studies use the parental generation as the unit of analysis, there is, from the outset, a lack of adequate data. This can also be perceived from the attempts to use retrospective data to obtain estimates of expected outcomes in prospective models (Kezuka, Shirahase, and Takikawa 2018; Skopek and Leopold 2020; Song and Mare 2015). The issue of inadequate data for prospective studies has also been noted by Breen et al. (2019). In other words, a lack of data gives rise to the possibility that adequate variables might be unavailable, which may hamper the construction of models.

This study discussed the selection of models for prospective studies; however, it is not without limitations. The discussion has not dealt with studies in which non-prospective data were corrected to obtain the same results as the prospective approach (Kezuka et al. 2018; Skopek and Leopold 2020; Song and Mare 2015). This is because, at the point where it becomes necessary to correct for fertility, it is already clear that the mechanisms are insufficient, which would present difficulties.

Moreover, as a problem for stratification research as a whole, when selecting models, researchers should determine what kinds of mechanisms should be included in accordance with the social structures and changes seen in the society in question while referring to the DTT. This raises the question of whether the same framework of analysis should be used, not only when constructing models for prospective studies but also for other social stratification research, given that each society has a different structure. This also applies to other research; rather than focusing simply on the society at hand, the analysis should be conducted within a broader framework, such as the DTT.

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References

Blau, Peter M., and Otis Dudley Duncan. 1967. *The American Occupational Structure*. New York: Wiley.

Breen, Rechard, and John Ermisch. 2017. "Educational Reproduction in Great Britain: A Prospective Approach." *European Sociological Review* 33(4):590–603.

Breen, Richard, John Ermisch, and Satu Helske. 2019. "Educational Reproduction in Europe: A Descriptive Account." *Demographic Research* 41:1373-400. doi: 10.4054/DemRes.2019.41.49.

Coale, Ansley J. 1984. "The Demographic Transition." *The Pakistan Development Review* 23(4):531-52.

Duncan, Otis Dudley. 1966. "Methodological Issues in the Analysis of Social Mobility." Pp. 51-97 in *Social Structure and Mobility in Economic Development*, edited by N. J. Smelser and S. M. Lipset. Chicago: Aldine Pub. Co.

Erikson, Robert, and John H Goldthorpe. 1992. *The Constant Flux: A Study of Class Mobility in Industrial Societies*. Oxford, UK: Clarendon Press.

Hillmert, Steffen. 2013. "Analysing Intergenerational Transmissions: From Social Mobility to Social Reproduction." *Comparative Social Research* 30: 131–57. doi: 10.1108/S0195-6310(2013)00000300093.

Hirschman, Charles, and Philip Guest. 1990. "The Emerging Demographic Transitions of Southeast Asia." *Population and Development Review* 16(1):121-52.

Hirschman, Charles. 1994. "Why Fertility Changes." *Annual Review of Sociology* 20:203-33. doi: https://doi.org/10.1146/annurev.so.20.080194.001223.

Kezuka, Kazuhiro, Sawako Shirahase, and Hiroki Takikawa. 2018. "Class Differences in the Intergenerational Attainment of Education: Focus on the Number of Children Achieving Higher Education Despite the Decline in Fertility Rates." Pp. 27-43 in *2015 SSM Research Report 2: Population and Family*, edited by S. Aramaki. Tokyo: The 2015 SSM Research Committee.

Kono, Shigemi. 2007. *Jinkogaku He No Shotai* (A Primer for Demography). Tokyo: Chuo Koron Sha.

Kye, Bongoh. 2011. "Intergenerational Transmission of Women's Educational Attainment in South Korea." *Demographic Research* 24:79-112. doi: 10.4054/DemRes.2011.24.3.

Kye, Bongoh, and Robert D. Mare. 2012. "Intergenerational Effects of Shifts in Women's Educational Distribution in South Korea: Transmission, Differential Fertility, and Assortative Mating." *Social Science Research* 41(6):1495-514.

Lawrence, Matthew, and Richard Breen. 2016. "And Their Children after Them? The Effect of College on Educational Reproduction." *American Journal of Sociology* 122(2): 532–72.

Lesthaeghe, Ron. 1991. "The Second Demographic Transition in Western Countries: An Interpretation." IPD-Working Paper 1991-2. https://www.researchgate.net/publication/257928736_The_Second_Demographic_Transition_in_

Western_Countries_An_Interpretation.

Lesthaeghe, Ron. 2010. "The Unfolding Story of the Second Demographic Transition." *Population and Development Review* 36(2):211-51.

Maralani, Vida, and Robert D. Mare. 2005. "Demographic Pathways of Intergenerational Effects: Fertility, Mortality, Marriage and Women's Schooling in Indonesia." *UCLA: California Center for Population Research.* https://escholarship.org/uc/item/0mn0j4w6.

Maralani, Vida. 2013. "The Demography of Social Mobility: Black-White Differences in the Process of Educational Reproduction." *American Journal of Sociology* 118(6): 1509-58.

Mare, Robert D., and Vida Maralani. 2006. "The Intergenerational Effects of Changes in Women's Educational Attainments." *American Sociological Review* 71(4):5542-564.

Mare, Robert D. 2011. "A Multigenerational View of Inequality." *Demography* 48(1):1-23.

Mukherjee, Ramkrishna. 1954. "A Further Note on the Analysis of Data on Social Mobility." Pp. 242-59 in Social Mobility in Britain, edited by D. V. Glass: Routledge and Kegan Paul.

Notestein, Frank W. 1945. "Population: The Long View." Pp. 36-57 in *Food for the World*, edited by T. Schultz. Chicago: University of Chicago Press.

Notestein, Frank W. 1953. "Economic Problems of Population Change." Pp. 13-31 in *Proceedings of the Eighth International Conference of Agricultural Economists*. New York: Oxford University Press.

Skopek, Jan, and Thomas Leopold. 2020. "Educational Reproduction in Germany: A Prospective Study Based on Retrospective Data." *Demography* 57:1241–70.

Song, Xi, and Robert D. Mare. 2015. "Prospective Versus Retrospective Approaches to the Study of Intergenerational Social Mobility." *Sociological Methods and Research* 44(4):555-84.

Song, Xi, and Robert D. Mare. 2017. "Short-Term and Long-Term Educational Mobility of Families: A Two-Sex Approach." *Demography* (54):145-73.

Ultee, Wout C., and Ruud Luijkx. 1990. "Educational Heterogamy and Father-to-Son Occupational Mobility in 23 Industrial Nations: General Societal Openness or Compensatory Strategies of Reproduction?" *European Sociological Review* 6(2):125-49.

United Nations, Department of Economic and Social Affairs, Population Division. 2019. "*World Population Prospects 2019, Online Edition. Rev. 1*." https://population.un.org/wpp/DownloadStandard/Population/

van de Kaa, Dirk J. 1987. "Europe's Second Demographic Transition." *Population Bulletin* 42(1):3-55.

van de Kaa, Dirk J. 2002. "The Idea of a Second Demographic Transition in Industrialized Countries." Paper presented at the Sixth Welfare Policy Seminar of the National Institute of Population and Social Security, Tokyo, 29 January

Yasuda, Saburo. 1964. "A Methodological Inquiry into Social Mobility." *American Sociological Review* 29(1):16-23.

Yasuda, Saburo. 1971. *Shakai-Ido No Kenkyu* (A Study of Social Mobility). Tokyo: Tokyo University Press.

Yoda, Shohei. 2018. "Fertility and Educational Reproduction in Japan:A Prospective Approach." Pp. 13-25 in *2015 SSM Research Report 2: Population and Family*, edited by S. Aramaki. Tokyo: The 2015 SSM Research Committee.

Aguru Ishibashi is a graduate student in Graduate School of Humanities, Senshu University. His scholarly interests are in intergenerational mobility, multigenerational mobility, and educational attainment. The title of his master thesis which is to be submitted in January 2021 is "The Mechanism of Educational Reproduction in Japan: A Comparison between Prospective Approach and Retrospective Approach."