Article

The Reconsideration of the Census Survival Ratio Method: Focusing on Decomposability of Net Migration

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Abstract

The census survival ratio method is valuable for estimating the volume of migration from only static statistics, i.e., census data. However, since estimators calculated using the method are net migration and cannot be decomposed into in- and out-migrations nor into short- and long-distance migrations, the results of its application often disappoint us. Although the method has such a disadvantage, it has scarcely been modified or generalized since its frame was established in 1940s and 1950s. Thus, this paper attempts reconsideration of the method and discussed decomposability of net migration through the reconsideration. The results of the discussion is summarized as follows:

First, it is theoretically proved that we can decompose internal net migration into intraregional and interregional components in a specific case. Second, it is empirically proved, by using the Japan census data, that we can decompose internal net migration into those two components for young cohorts in a general case. Third, the parameter required for decomposition in a general case varies according to region for each cohort, and therefore, regrettably by using only census data, we cannot always decompose internal net migration into the above two components.

1. Introduction

The census survival ratio method (hereafter, referred to as CSR method) is

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valuable for estimating the volume of migration from only static statistics, i.e., census data. Particularly, in the case of areas where or in the case of periods when we cannot obtain migration data, this method has a high utility value. However, since estimators calculated using the method are net migration and cannot be decomposed into in- and out-migrations nor into short- and long-distance migrations, the results of its application often disappoint us. For example, if the volume of in-migration into an area is the same as that of out-migration from the area, no matter how large it is, it is not observable at all because the volume of net migration in the area becomes a zero value. Although CSR method has such a disadvantage, it has scarcely been modified or generalized since its frame was established by some studies in 1940s and 1950s (e.g., Hamilton and Henderson, 1944; Siegel and Hamilton, 1952). CSR method has been discussed chiefly from the viewpoint of its reliability by many demographers (e.g., Zachariah, 1962; Hamilton, 1966; Sivamurthy, 1969; Kintner and Swanson, 1993; Morrison et. al., 2009), and has been so widely applied to census data in the world since 1960s, whereas a method proposed by Mazurkewycz (1977) is almost only a modified one of CSR method as far as the author knows. Furthermore, Mazurkewycz's method is not regarding decomposability of net migration.

Thus, this paper attempts to generalize CSR method by reconsidering its preconditions, and to enable us to decompose net migration calculated using the generalized method. This paper generalizes the method in Chapter 2, discusses decomposability of net migration in a specific case in Chapter 3[1)], considers decomposability of net migration in a general case and to examine it using the Japan census statistics in Chapter 4, and refers to conclusion in Chapter 5.

2. Reconsideration of the Two Preconditions

Although CSR method is classified into three types, i.e., the forward, reverse, and average methods according to how to calculate survival ratios, there is no essential difference among these three methods. Accordingly, this paper has all discussions on the basis of the forward method, which is the most standard of them. As is well known, the following two preconditions are required for using

1) The author has partly treated the discussion in Chapter 3 (Inoue 2017).

CSR method: 1) the population of an object area is closed, i.e., there is no migration between an object area and its outside; and 2) death rates show a uniform distribution in an object area. This method is how to estimate the volume of net migration in a subarea of the object area under these two preconditions. To formulate the frame of the method, the object area and subareas are considered to be one nation and municipalities constituting the nation, respectively, and some variables are defined for a certain cohort as below:

$p_i(t)$: the population of municipality i at time t;

$p_i(t+1)$: the population of municipality i at time $t+1$;

$d_i(t,t+1)$: the number of deaths in municipality i in the period from time t to time $t+1$;

$m_i(t,t+1)$: the volume of net migration in municipality i in the period from time t to time $t+1$;

$m_i^{\mathrm{INT}}(t,t+1)$: the volume of internal net migration between municipality i and all the other municipalities in the period from time t to time $t+1$;

$m_i^{\mathrm{INTL\_I}}(t,t+1)$: the volume of immigration into municipality i from the outside of a nation in the period from time t to time $t+1$;

$m_i^{\mathrm{INTL\_E}}(t,t+1)$: the volume of emigration from municipality i to the outside of a nation in the period from time t to time $t+1$;

$m_i^{\mathrm{INTL}}(t,t+1)$: the volume of international net migration between municipality i and the outside of a nation in the period from time t to time $t+1$;

N: set of area numbers of all municipalities constituting a nation.

As is obvious from the above definitions,

$$m_i(t,t+1)=m_i^{\mathrm{INT}}(t,t+1)+m_i^{\mathrm{INTL}}(t,t+1), \tag{1}$$

$$m_i^{\mathrm{INTL}}(t,t+1)=m_i^{\mathrm{INT\_I}}(t,t+1)-m_i^{\mathrm{INTL\_E}}(t,t+1). \tag{2}$$

The two preconditions that the population of a nation is closed and death rates show a uniform distribution in a nation are expressed by the following two formulas:

for a certain cohort and all i,

$$m_i^{\mathrm{INT\_I}}(t,t+1)=m_i^{\mathrm{INTL\_E}}(t,t+1)=0, \tag{3}$$