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研 究 論 文

On the quantum and tempo of cumulative net migration

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This paper examines the theoretical and empirical validity of using cumulative net migration rate for the analysis of metropolitan experience and return migration among non-metropolitan natives. Several hypothetical models show that the timings of out- and return migration influence the level of cumulative net migration rate so that the estimates of metropolitan experience and return migration based on cumulative net migration rate do not always match the values calculated from in- and out- migration data. When we compare the estimated rates based on the data of the Population Census to the rates obtained from The Fifth National Survey on Migration, the estimated rates of metropolitan experience and return migration are much lower than the survey values. In addition, although the trends of the estimated and survey rates are roughly parallel, some disjunction exists, especially in the case of return migration rates for females. The survey data also shows that the timing of first out-migration to the metropolitan prefectures differs by cohort. The tempo factor would thus partly explain the disparity between the trends in the estimated and survey rates.

I Introduction

Compared to other demographic data, statistics on migration are limited in their variety and quantity in Japan. As is widely known, the national and local governments have provided various migration data based on the national census and basic resident registers. These data, however, often lack sufficient information for detailed, time-series analysis using migrants' basic attributes, such as age and cohort. Some demographically-oriented migration scholars thus turn to net migration for their analytical indicator since the age-specific numbers of net migration can be calculated easily by the cohort survival method.

A relatively long history exists in the study of age-specific net migration in Japan (e.g. Kawabe 1961; Ueda 1967; Hama 1978), but during the last two decades, we have witnessed a new development of cohort analyses based on net migration or related indicators (Kawabe 1983, 1985, Nakagawa 2001, Inoue 2002; For an overview of the development of post-war migration studies in Japan, see Nakagawa 2000). In particular, the concept of "cohort cumulative net migration[1]",

1) Kawabe(1985) uses the word "accumulated" in his English abstract. However, considering the fact that the term "cumulative (e.g. fertility)"seems to be popular in demography, we translate the original Japanese *ruiseki* as "cumulative" in this paper.

developed by Kawabe (1985) and refined by Inoue (2002), has been a major contribution to the study of migration. By using this analytical tool, Kawabe and Inoue clarified a number of characteristics of internal migration between the metropolitan and non-metropolitan regions, and questioned commonly-held presumptions on the trend of postwar migration in Japan[2)].

However, some scholars have criticized the use of net migration for migration studies. The most crucial point of such criticism relates to the fact that net migration is only the outcome of in- and out-migration (e.g. Otomo 1996 p.110, Ogasawara 1999 p.72; For such criticism in other countries, see Rogers 1990). By definition, net migration is the difference between in- and out-migration, which measures the relative preponderance of in-migration or out-migration over the other. The problem is that this indicator offers no information on the level of in-migration or out-migration. This flaw posits a problem especially when we analyze migration in specific places. With regard to migration between the metropolitan and non-metropolitan regions, for instance, not only the level of net migration but the direction of migration and its quantity have drawn wide social attention. Numerous papers and reports have thus focused on return migration to the non-metropolitan regions (e.g. Futagami 1971, Institute for Social Engineering 1976, Institute of Population Problems 1988, National Institute of Population and Social Security Research 1998, 2005, Okazaki, et al 2004). The analysis of net migration, however, is incapable of showing either the trends of in- and out-migration or their contributions to the change in overall net migration. Some studies using net migration, including those of Kawabe and Inoue, often go so far as to make statements on the trends of in- and out-migration. Nevertheless, these assertions, founded either on the analysis of ordinary net migration or that of cumulative net migration, appear to be baseless, at least theoretically, and thus need to be carefully evaluated.

This paper examines the concept of cumulative net migration developed by Kawabe (1985) and Inoue (2002), and evaluates the theoretical and empirical validity of estimating the trends of in-, out-, or return migration by observing cumulative net migration. In the following analysis, we consider the ideas of the "quantum" and "tempo" of migration. In demography, various demographic events are considered to have quantum and tempo aspects[3)]. Although the peculiarity of migration as a demographic event hinders us from readily applying these ideas in the same way as we do in fertility and mortality studies, we try to explore the relationships among net, in- and out-migration at the cohort level by focusing on these two aspects. Section II overviews the concept of cumulative net migration and sees how Kawabe and Inoue interpret the value of cumulative net migration. Section III illustrates some hypothetical models of in- and out-migration, and examines their relationships with cumulative net migration in terms of quantum and tempo aspects. Section IV uses the data of The Fifth National Survey on Migration 2001 and observes the actual migration

2) For example, Kawabe(1985) criticizes the overestimation of the role of reverse migration flowing into the non-metropolitan regions. He shows that every cohort exhibits declining but ever continuing net in-migration in the metropolitan regions.

3) Obviously, the title of this paper borrows the expression from Bongaarts and Feeney (1998). However, this paper is not on the relationship between cohort and period indicators, but on cohort quantum and cohort tempo.

experiences of non-metropolitan natives. Here we try to observe how well Kawabe and Inoue's statements based on cumulative net migration fit the survey data[4].

II The concept of cumulative net migration

1. Equation

First, we will review the concept and calculation procedure of cumulative net migration. According to his paper, Kawabe (1985 p.3) created "the rate of cohort cumulative net migration" for the purpose "of observing migration career by cohort[5]." Cumulative net migration rate is basically given as "the accumulation of age-specific net migration rates for each cohort" (ibid p.3), and is expected to demonstrate "how the cumulative outcome of past migration at a certain age would change" (ibid p.3). In the actual calculation procedure, one needs to calculate the age-specific numbers of net migration first. However, one does "not simply add up the number of age-specific net migration but accumulates the number of survived net migration expected under the condition of closed population, which one acquires by multiplying the past net migration by survival ratio" (ibid p.3). To calculate the rate of cumulative net migration, one divides cumulative net migration by the expected closed population at each age, which one obtains, as in the case of cumulative net migration, by multiplying the initial population by survival ratios. For the initial population, Kawabe uses population at ages 10-14.

While Kawabe's paper does not show mathematical equations for calculation, cumulative net migration and its rate would be expressed as follows if we use the forward survival method;

①Crude number of cohort cumulative net migration at ages i-i+4 ($CNM_{i\text{-}i+4}$):

$$\begin{aligned} CNM_{i\text{-}i+4} = {} & M_{10\text{-}14\sim15\text{-}19} \times S_{15\text{-}19\sim20\text{-}24} \times S_{20\text{-}24\sim25\text{-}29} \times \ldots \times S_{i\text{-}5\text{-}i\text{-}1\sim i\text{-}i+4} \\ & + M_{15\text{-}19\sim20\text{-}24} \times S_{20\text{-}24\sim25\text{-}29} \times S_{25\text{-}29\sim30\text{-}34} \times \ldots \times S_{i\text{-}5\text{-}i\text{-}1\sim i\text{-}i+4} \\ & \ldots \\ & + M_{i\text{-}5\text{-}i\text{-}1\sim i\text{-}i+4} \end{aligned}$$

②The rate of cohort cumulative net migration at ages i-i+4($CNMR_{i\text{-}i+4}$)[6]:

$$CNMR_{i\text{-}i+4} = CNM_{i\text{-}i+4} \div (P_{10\text{-}14} \times S_{10\text{-}14\sim15\text{-}19} \times S_{15\text{-}19\sim20\text{-}24} \times \ldots \times S_{i\text{-}5\text{-}i\text{-}1\sim i\text{-}i+4}) \times 100,$$

where

$M_{i\text{-}i+4\sim i+5\text{-}i+9}$: net migration from ages i-i+4 to ages i+5-i+9,

$S_{i\text{-}i+4\sim i+5\text{-}i+9}$: survival ratio from ages i-i+4 to ages i+5-i+9

$P_{10\text{-}14}$: population at ages 10-14

4) This attempt, i.e., evaluating cumulative net migration rate by using the survey data of migration career, was mentioned by Kawabe (1985 p.12) as a topic for future research.

5) Quotations in this paper are all translated by the present author.

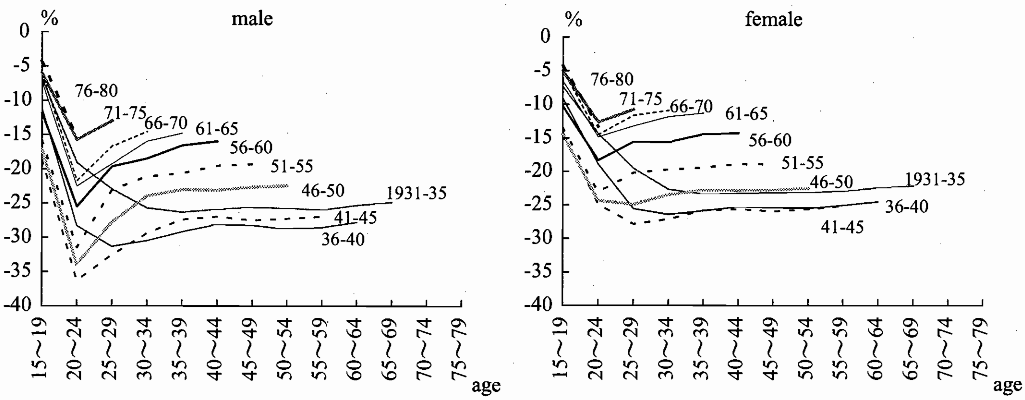
6) If we use the relationship between population and net migration ($M_{i\text{-}i+4\sim i+5\text{-}i+9} = P_{i+5\text{-}i+9} - P_{i\text{-}i+4} \times S_{i\text{-}i+4\sim i+5\text{-}i+9}$), we can rewrite *CNMR* in simpler form: $CNMR_{i\text{-}i+4} = (P_{i\text{-}i+4} \div (P_{10\text{-}14} \times \cdots \times S_{i\text{-}5\text{-}i\text{-}1\sim i\text{-}i+4}) - 1) \times 100$.

Inoue's cumulative net migration *ratio* (Inoue 2002) uses a slightly different formula, in which $M_{i\text{-}i+4\sim i+5\text{-}i+9}$ and $P_{10\text{-}14}$ are not multiplied by survival ratios. $M_{i\text{-}i+4\sim i+5\text{-}i+9}$ is instead multiplied by -1 to facilitate our focus on net out-migration. Inoue (2002 p.69) believes that the multiplication of survival ratios obscures the validity of the indicator. However, since recent survival ratios have reached very high levels (close to 1) at least for the population up to middle age, the absolute values of the two indicators are likely to be nearly identical for those, say, aged 35-39. Along with Inoue's indicator, the cohort-specific proportion of metropolitan residents used by Nakagawa (2001) is also an indicator of similar type. Considering the fact that age-specific population distribution is directly related to age-specific net migration, cohort-specific change in the proportion of metropolitan residents naturally shows a trend that is virtually identical to the case of cohort cumulative net migration rate in the metropolitan regions[7].

2. Interpretations

We now look at the actual trends in cumulative net migration rates and how prior studies have interpreted them. Figure 1 illustrates cumulative net migration rates in the non-metropolitan prefectures[8], according to the above equations. Population data are based on the Population Census[9]. Survival ratios are inter-censal survival ratios.

Figure 1 Cohort cumulative net migration rate (base: ages 10-14)



Source: author's calculations based on the data of Population Census.
Numbers in the graph denote birth years.

7) This is true especially when the level of international migration and mortality differences among concerned regions remain trivial.

8) In this paper, the metropolitan prefectures consist of 10 prefectures: Saitama, Chiba, Tokyo, Kanagawa, Gifu, Aichi, Mie, Kyoto, Osaka and Hyogo. The non-metropolitan prefectures are composed of the remaining 36 prefectures (Okinawa is excluded because of data limitation before 1972).

9) For the population in 1945, we use the data of Population Survey (November, 1945), since the Census was not undertaken in this year. Age in this survey is *kazoe-doshi* (counted age) so we have converted it to normal age (age at the last birthday). Population in 1945, as in the Population Census in the prewar period, is *de facto* population, while those in 1950 and after are *de jure* population.

The main characteristics of these graphs can be summarized into two points. First, the 1931-35 male cohort shows a different curve pattern from those born in the 1940s and after[10]. For the 1931-35 male cohort, cumulative net migration rate declines comparatively slowly up to ages 35-39, where it basically levels off. In contrast, the cumulative rate of the 1941-45 male cohort declines more rapidly up to ages 20-24, then recuperates in higher ages (especially at ages 25-39). Since the latter cohort reached their prime ages of migration (their late teens and 20s) during the late 1950s and 1960s, these periods may have been one turning point of postwar male migration. As for the cumulative rate of females, we may say that a somewhat similar pattern of change exits, but the recuperation is far less clear for those born in the 1940s.

Second, for both males and females, the rates at ages 20-24 increase continuously from the 1941-45 to the 1976-80 cohorts. The rates at the middle ages also increase from the 1941-45 cohort onwards. These trends suggest that for those born in the postwar period, the cumulative net loss of population in the non-metropolitan prefectures has basically become smaller for younger cohorts, either at lower or higher ages.

As for the sharp recuperation of cumulative net migration for those in their late 20s, Kawabe and others seem to have interpreted it as a reflection of the trend of return migration. While not making an entirely clear-cut statement on the relationship between the recuperation and return migration, Kawabe writes, for example, that "the S25 cohort [=cohort born in 1936-40] and other [=later] cohorts seem to show different migration careers, especially in their late 20s and after" (Kawabe 1985 p.5. Words in [ ] are supplemented by the present author). "[Similar to migration trends in the prewar period,] return migration to the non-metropolitan regions at ages 25-29 and after was small for the S25 cohort. Accordingly, net in-migration rates were also small, and the change in cumulative net migration rate toward 0 was not large" (ibid p.9). Nakagawa seems to agree with Kawabe. Examining cohort-specific change in the proportion of metropolitan residents, he describes the 1936-40 male cohort as one where "few return migrations [to the non-metropolitan regions] were observed" (Nakagawa 2001 p.37).

Further interpretation is given by Inoue. First, he proclaims that "under the assumption that migrants between the metropolitan and non-metropolitan regions are all non-metropolitan natives, cumulative net migration *ratio* shows the percentage of non-metropolitan natives who reside in the metropolitan regions at a certain time point. Therefore, in reality, the maximum value[11] [of cumulative net migration *ratio*] is considered roughly to represent ... the proportion of non-metropolitan natives who have ever resided in the metropolitan regions, i.e., the proportion of those who have ever out-migrated to the metropolitan regions" (Inoue 2002, p.64). Inoue then argues that "for the 1946-50 cohort and after, the decline [in the cumulative net migration *ratio* from its maximum] to the value at ages 35-39 shows a tendency to stabilize at around 6% [points] .... [This

10) In this paper, the 1931-35 cohort, for example, indicates those born between October, 1930 and September, 1935.

11) The maximum of the *ratio* roughly corresponds to the minimum of the *rate*.

stabilizing tendency] strongly implies that the proportion of non-metropolitan natives who undertake U-turn migration after out-migration [from the non-metropolitan regions] comes to be relatively stable…" (ibid p.65).

As far as we can tell from their papers, the above interpretations have been constructed exclusively on the data of cumulative net migration (or the proportion of metropolitan residents), and no additional data or indicators of age-specific migration have been provided[12]. The claims thus seem to assume that the recuperation of cumulative net migration *rate* - or the downturn in the case of *ratio* - corresponds to the level of return migration[13]. Small and large recuperation should mean small and large return migration, respectively. As is suggested above, however, the trend of net migration does not always match those of in- and out-migration (including return migration) on a one-to-one basis. An examination of in- and out-migration, almost non-existent in the above studies, would offer various possibilities for the interpretation of recuperation, some of which are given in the next section.

III Model cases

1. Assumptions

To grasp the relationships among in-, out- and cumulative net migration, we have constructed several model cases of hypothetical migration patterns of certain cohorts. The main issue is to see whether the recuperation of cumulative net migration rate sufficiently matches the level of return migration calculated by the data of in- and out-migration. In particular, we pay attention to the quantum and tempo aspects of migration. Here we loosely define quantum as the volume of in-, out-, or cumulative net migration, either at each time period or for the entire periods observed. Tempo is to indicate the timings of in- and out-migration. In the case of tempo in cumulative net migration, we would consider it to be different when the shapes of the graph (especially the periods of the minimum value) vary from cohort to cohort. In the graphs such as Figure 1, the quantum aspect is thus represented by the level at the vertical axis, while the tempo aspect is illustrated by variation along the horizontal axis.

We make several assumptions to simplify our analysis in the model cases. First, the area in focus is the non-metropolitan region, where outflow to the metropolitan region is the dominant migration flow. Second, the initial population of a cohort of non-metropolitan natives is set as 1,000, and is to change through in- and out-migration over time. We assume deaths do not to occur in the models[14], so that the change in population at each time period corresponds exactly to the level of cumulative

12) Nakagawa (2001) also uses the data of The Fourth National Survey on Migration, but he does not examine cohort migration *per se*.

13) I have encountered some difficulty in evaluating their statements because they sometimes seem to use migration and net migration interchangeably. "Migration" in their papers might have been used to indicate "net migration," although I could not find such a definition in their discussions.

14) Under this assumption, the absolute values of cumulative net migration *rate* and *ratio* are identical.

net migration. Third, migrations are undertaken solely by non-metropolitan natives, and they occur only between the metropolitan and non-metropolitan regions. Since metropolitan natives do not move, migrations from the metropolitan to the non-metropolitan regions are all return migrations by non-metropolitan natives.

In the analysis below, we use two indices, *metropolitan experience rate* and *return migration rate*. The former indicates the proportion of non-metropolitan natives who have ever migrated to the metropolitan region. The latter is return migrants' proportion to those with metropolitan experience. When we use in- and out-migration data, these values are often easily measured under the above assumptions. When we use the data of cumulative net migration rate, these two rates must be estimated. In this paper, we employ the following definitions. The *metropolitan experience rate* is defined as the highest value of cumulative net *out*-migration rate. Operationally, it is the lowest value of cumulative net migration rate multiplied by -1. This definition basically follows Inoue's idea (2002 p.64), quoted in the former section. The *return migration* corresponds to the level of recuperation from the lowest to the end-period value of the cumulative net migration rate. We obtain the *return migration rate* by dividing the difference between the lowest and the end-period values by the lowest value. In the following explanation, we denote these estimated rates with an asterisk (*) to distinguish them from the rates based on in- and out-migration.

2. Examination

First, we present a basic pattern. Case 1 in Figure 2 illustrates a case where out-migration and in-migration (=return migration) take place in different periods. In period t_1, 200 people (Group A) move out to the metropolitan region. In the next period t_2, an additional 100 people (Group B) go out. A fraction of Group A and B (100 people in total) then return in period t_3. No migrations occur in period t_4. On the one hand, the metropolitan experience rate for this cohort is 30% at t_4 (= 300 people who have ever out-migrated ÷ 1,000 people × 100). The return rate is 33.3% (= 100 return migrants ÷ 300 people who have ever out-migrated × 100). On the other hand, the estimated metropolitan experience rate is 30%*, that is, the cumulative net migration rate at t_2 multiplied by -1. The estimated return migration rate is given by the difference between the cumulative net migration rates at t_2 and t_4 (= -30% - (-20%)) divided by the rate at t_2 (= -30%), i.e., -10% ÷ (-30%) × 100 = 33.3%*. In Case 1, the actual and estimated values of the two indices are identical. The data of cumulative net migration rate allow us to estimate correctly the metropolitan experience and return migration of this cohort.

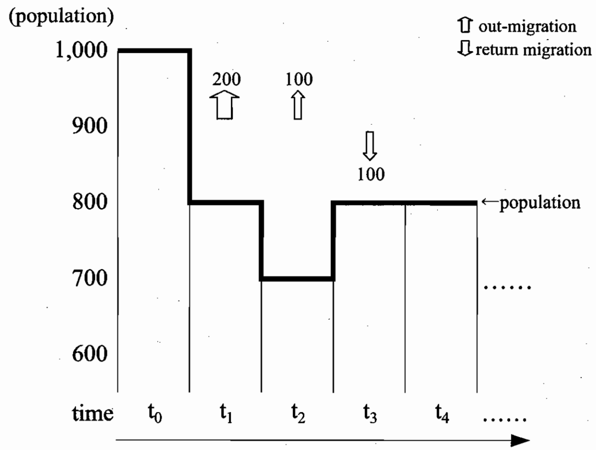
The next case presents a different story. Case 2 shows a pattern in which parts of out- and return migration occur in the same period. Group A (200 people) moves out in period t_1. Then Group B (200 people) follows in t_2. Unlike Case 1, however, some of the out-migrants in Group A already come back in t_2, followed by an additional 100 returnees from Group B in period t_3. Under these assumptions, metropolitan experience rate and return migration rate reach higher levels than in

Figure 2 Model pattern of migration 1: the same pattern of population change

Case 1.

time	t_0	t_1	t_2	t_3	t_4	total
out-migration	-	A:200	B:100	-	-	300
return migration	-	-	-	AB:100	-	100
population	1,000	800	700	800	-	-

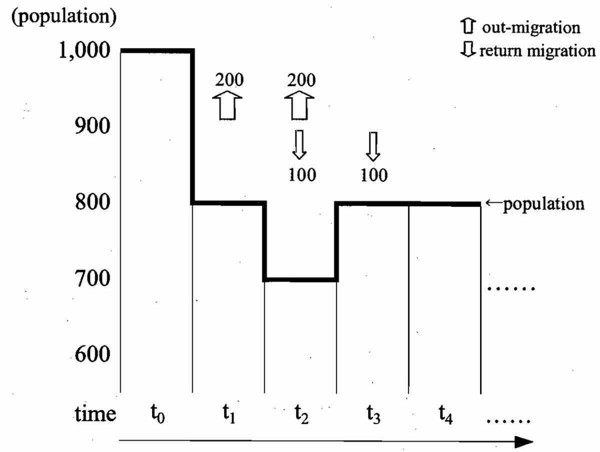
metro experience 30.0% (actual) <=> 30.0% (estimated)
return migration 33.3% (actual) <=> 33.3% (estimated)



Case 2.

time	t_0	t_1	t_2	t_3	t_4	total
out-migration	-	A:200	B:200	-	-	400
return migration	-	-	A:100	B:100	-	200
population	1,000	800	700	800	-	-

metro experience 40.0% (actual) <=> 30.0% (estimated)
return migration 50.0% (actual) <=> 33.3% (estimated)



Case 1, 40% and 50%, respectively. However, the estimated rates based on cumulative net migration remain the same, as is shown by the pattern of population change, which is identical to that of Case 1. The reason why the estimated values differ from the actual ones is that return migration cancels out a part of out-migration at t_2, mitigating the level of net out-migration in that period and subsequently affecting the estimation of the rates. This suggests that even if the patterns of cumulative net migration are the same for two cohorts, their rates of metropolitan experience and return migration could vary. In other words, not only the numbers (quantum) but also the timings (tempo) of out- and in-(return) migration affect the trend of cumulative net migration and the relationship between the actual and estimated values of the two indices.

Figure 3 portrays two cases where in- and out-migrations reach the same level as in Case 2, but their tempos differ. In Case 3, people out-migrate only in period t_1, and returnees all come back in period t_2. Metropolitan experience and return migration rates are the same as in Case 2, but the estimated rates of metropolitan experience and return migration both amount to higher levels, 40%* and 50%*, respectively. As in Case 1, completely separate timings of in- and out-migration result in the agreement of the actual and estimated values.

Case 4 demonstrates a more dispersed pattern of migration. At first, 160 people move out in period t_1. Then the number of out-migrants gradually decreases in later periods, down to 40 people in period t_4. As for return migration, a fraction of each group comes back from period t_2 to t_5, again in smaller numbers in later periods. In this case, the estimated rates of metropolitan experience and return migration turn out to be very low, namely, 22%* for metropolitan experience and 9.1%* for return migration. Cases 2-4 confirm that if the tempo of migration varies, the same volume of in- and out-migration (and thus the same experiences of metropolitan residence and return migration for certain cohorts) could exhibit diverse patterns of cumulative net migration (the timing and the level of minimum value in particular).

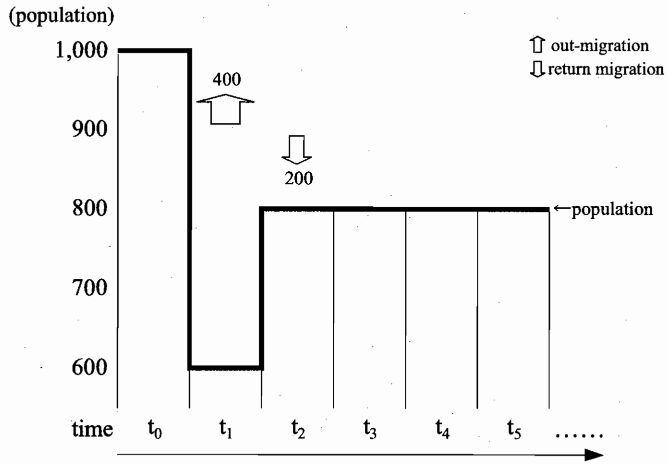
Finally, we consider a more complex case where some migrants out-migrate (or return) more than once (Figure 4). In Case 5, 160 people (Group A) out-migrate in period t_1, followed by 120 people (Group B) in period t_2. In period t_2, 80 people from Group A also come back. In period t_3, 40 people among those 80 Group A returnees move out for the second time along with Group C out-migrants (40 people). A fraction of these two groups, 20 people each, come back in t_4. Some members of Group B also out-migrate repeatedly. In period t_3, 60 people return from their first out-migration. In period t_4, 30 of these returnees move out again with Group D members (10 people). Half of them come back in t_5, 15 for Group B and 5 for Group D. As the table shows, the number of out-*migrations* and return *migrations* are identical to that of Case 4. However, the number of out-*migrants* and return *migrants* are smaller because of the existence of repeat migrants. Metropolitan experience rate is 33%, and return migration rate is 50%. Since the numbers of in- and out-migrations do not differ, the estimated rates are the same as those in Case 4. Thus, Case 5 suggests that the existence and the degree of repeat migration also affect the relationship

Figure 3 Model pattern of migration 2 : different patterns of population change

Case 3.

time	t_0	t_1	t_2	t_3	t_4	t_5	total
out-migration	-	A:400	-	-	-	-	400
return migration	-	-	A:200	-	-	-	200
population	1,000	600	800	800	800	800	-

metro experience 40.0% (actual) <=> 40.0% (estimated)
return migration 50.0% (actual) <=> 50.0% (estimated)



Case 4.

time	t_0	t_1	t_2	t_3	t_4	t_5	total
out-migration	-	A:160	B:120	C:80	D:40	-	400
return migration	-	-	A:80	B:60	C:40	D:20	200
population	1,000	840	800	780	780	800	-

metro experience 40.0% (actual) <=> 22.0% (estimated)
return migration 50.0% (actual) <=> 9.1% (estimated)

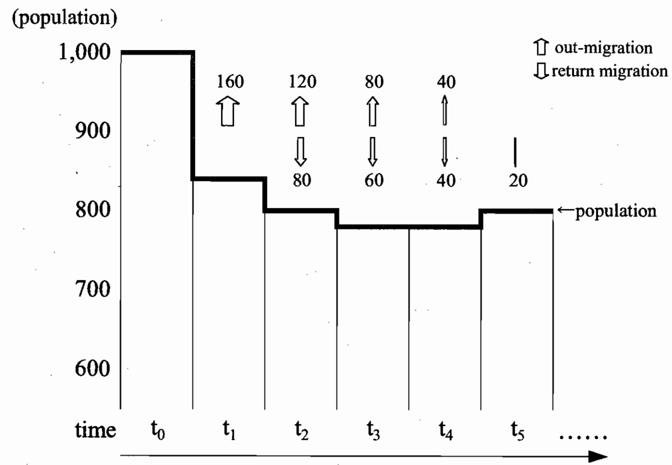


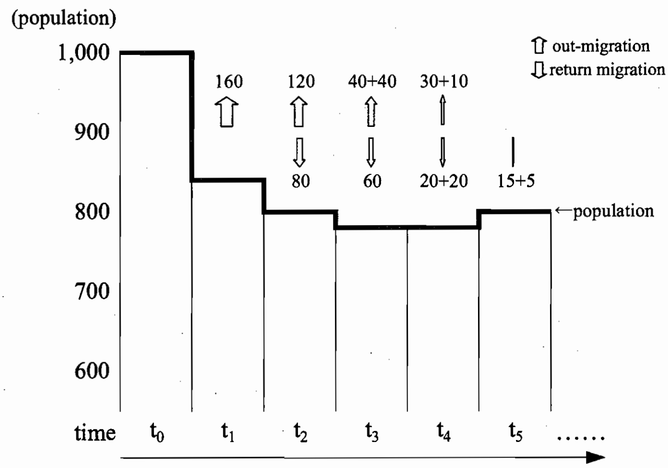
Figure 4 Model pattern of migration 3 : with repeat migration

Case 5.

time	t_0	t_1	t_2	t_3	t_4	t_5	total
out-migration	-	A:160	B:120	A:40,C:40	B:30,D:10	-	400(330)*
return migration	-	-	A:80	B:60	A:20,C:20	B:15,D:5	200(165)*
population	1,000	840	800	780	780	800	-

*the number of migrants

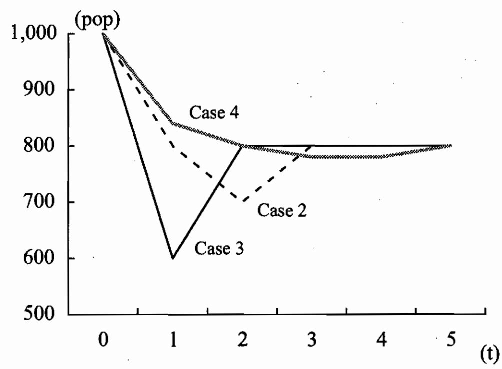
metro experience 33.0% (actual) <=> 22.0% (estimated)
return migration 50.0% (actual) <=> 9.1% (estimated)



between the actual and estimated rates.

In sum, the estimated rates of metropolitan experience and return migration do not always correspond to the actual rates. As a summary graph shows (Figure 5), a cohort with gradually declining cumulative net migration may show the same rates of metropolitan experience and return migration as a cohort with steep changes in cumulative net migration. In a sense, the shape of the trend in cumulative net migration rate and the minimum value of that rate could have diverse meanings. The above models imply that those who use cumulative net migration rate to estimate the trend in return migration assume, consciously or unconsciously, quite strict conditions under which migration occurs, including completely different timings of in- and out-migration[15]. In real world situations, we should take into account the tempo of migration, repeat migration and the migration of

Figure 5 Cumulative net migration rates of Cases 2-4



15) Inoue refers to the timing of return migration (2001, p.69), but he seems to focus only on migration patterns where the timings of in- and out-migration completely differ, such as in Cases 1 and 3.

metropolitan natives (neglected in the models), which would surely prevent us from making a simplified guess at the relationships between the actual and estimated rates of metropolitan experience and return migration.

IV Comparison

Based on the observations of the model cases above, we go on to examine the relationships between the actual and estimated rates of metropolitan experience and return migration by using empirical survey data. Our main interests are 1) how well the estimated rates correspond to the survey values of metropolitan experience and return migration, and 2) if the estimated and survey values considerably differ from each other, in what way the effects of tempo or repeat migration relate to such a difference. Due to a matter of space, the remaining section mainly deals with the first question.

1. Data

The estimated and survey values of metropolitan experience and return migration are obtained as follows.

The estimated rates are calculated just as we explained in Section II and III. First, we calculate cumulative net migration rates up to year 2000 for each cohort, as in Figure 1, by using the data of the Population Census. We then estimate the rates according to their definitions in Section III.

As for the survey rates, we use the data of The Fifth National Survey on Migration 2001. This survey, conducted in July, 2001, is a questionnaire survey which collected a variety of migration data from respondents selected through random sampling[16]. To calculate the rates of metropolitan experience and return migration, we refer to the data of respondents' places of residence at the time of various life events. The survey asked respondents to indicate their places of residence at birth, graduation of junior high school, graduation of their last school, the time when they found their first jobs, just before and right after their first marriages, along with places of residence 5 years ago and 1 year ago. Based on these data, we define a set of terms in the following way: *non-metropolitan natives* are those who resided in a non-metropolitan prefecture at the time of graduation from junior high school. The number of non-metropolitan natives examined here varies by cohort, ranging from 159 (born in 1921-25) to 709 (born in 1946-50) for males, and from 234 (born in 1921-25) to 691 (born in 1946-50) for females. People are considered to have *metropolitan experience* if they have

16) This survey targeted all residents living in 300 survey districts randomly selected from 5,240 survey districts used in the Comprehensive Survey of the Living Conditions of People on Health and Welfare (the Ministry of Health, Labor and Welfare), which were also randomly selected as representative samples of Japan. Out of a total sample of 14,735 households to which questionnaires were distributed, 12,594 households provided valid responses (85.5%). At the individual level, the survey collected valid responses from 35,292 respondents. For more information on the survey, see National Institute of Population and Social Security Research (2005).

once lived in a metropolitan prefecture after graduating from junior high school, or if they currently live there. *Return migrants* are non-metropolitan natives who have metropolitan experiences and are currently living in a non-metropolitan prefecture. Consequently, the rates in question are calculated as follows; *metropolitan experience rate* = (non-metropolitan natives with metropolitan experience) ÷ (population of non-metropolitan natives) × 100, and *return migration rate* = (the number of return migrants) ÷ (non-metropolitan natives with metropolitan experience) × 100.

Some qualifications about these rates need to be noted. First, the quality of the estimated rates is not the same for all cohorts. As we have indicated in footnote 9), the definition of population has changed from *de facto* population in the pre-1950 periods to *dejure* population in the later periods. Therefore, the calculation of cumulative net migration rates for cohorts born before October, 1935 requires us to use population based on two different definitions. The following part thus basically focuses on the rates of the 1936-40 and later cohorts.

Second, the survey values are underestimated because the data on places of residence at various life events do not cover all the information on residence changes. In the survey, there is another question in line with our interest, which asks respondents to cite all prefectures they have lived in. While this question makes the data of metropolitan experience and return migration complete (at the prefecture level), it was asked only to household heads and their spouses. Therefore, we have to use the data based on life events, but we also present, tentatively, the rates adjusted by the complete data of household heads and their spouses (survey rate (for all respondents) multiplied by the ratio of the rate based on the complete data to the one based on the life event data (for household heads and their spouses))[17].

Third, the original survey data contains some bias. While the survey used the random sampling method, the response rate was lower for the metropolitan prefectures (National Institute of Population and Social Security Research 2005 p.1). To correct such bias, the survey data were weighted so that the distribution of respondents by place of residence at the time of the survey (metro/non-metro) and household size (1 person/2 persons or more) matches that of the Population Census of 2000 for each sex and cohort[18]. Values shown in the following analysis are all weighted values.

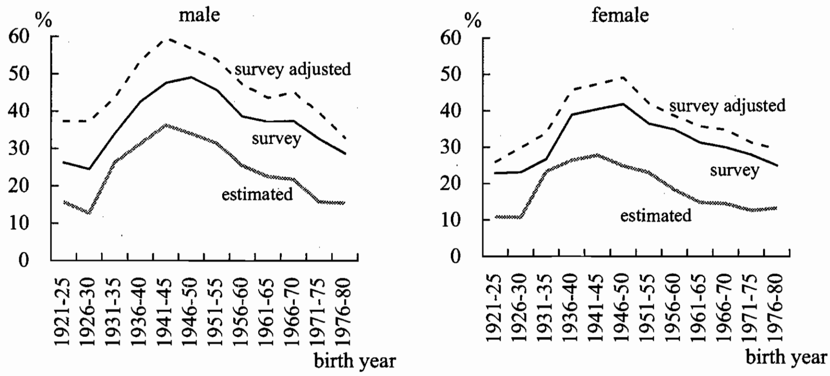
17) The complete data do not allow us to discern respondents' residence experiences before graduation from junior high school. We thus compare the complete data with life event data including place of birth. Furthermore, these data are unweighted (see below) because the Census does not provide population distribution by place of residence and household size exclusively for household heads and their spouses.

18) The number of respondents categorized according to cohort, sex, household size, place of residence and migration pattern sometimes amounts to zero. This certainly causes a problem. Unfortunately, we could not solve this problem in this paper. The average difference (percent points) between the weighted and unweighted values is: 2.4 (male) and 2.0 (female) for metropolitan experience, -4.0 (male) and -2.8 (female) for return migration.

2. Result

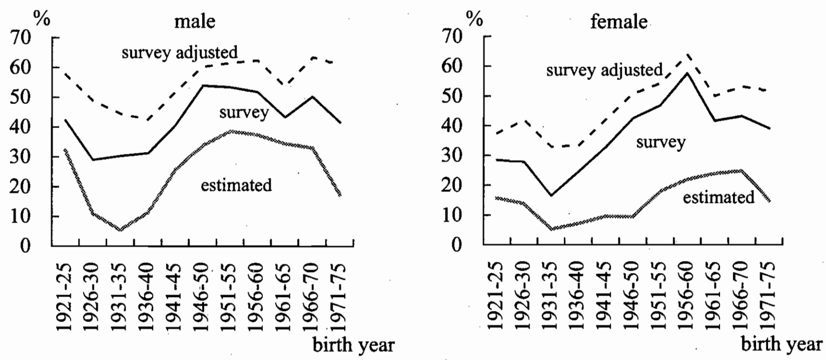
Figures 6 and 7 show the survey and estimated values of metropolitan experience and return migration rates for the 1920-25 and later cohorts. Return migration rates for the 1975-80 cohort are omitted because the respondents of this cohort were still in their early 20s at the time of survey. As for the rates of metropolitan experience, three features are to note. First, the estimated rates are much lower than the survey rates for both sexes and for all cohorts. This seems clearly to demonstrate that estimation based on cumulative net migration rates underestimates the actual metropolitan experience of non-metropolitan natives. Second, while the absolute levels of the rates differ, the estimated rates show a very similar trend to that of the survey rates. Cumulative net migration gives us a fairly good estimate of the relative level of a certain cohort's metropolitan experience in comparison to other cohorts. Third, although they basically parallel each other, the trends in the estimated and survey rates exhibit some disparity. For both males and females, the

Figure 6 Metropolitan experience rate



Source: author's calculations based on the data of Population Census and The Fifth National Survey on Migration

Figure 7 Return migration rate



Source: author's calculations based on the data of Population Census and The Fifth National Survey on Migration

1941-45 cohort shows the highest estimated rates. It is, however, the 1946-50 cohort that records the highest survey values. In addition, the decline in the estimated rates from the 1951-55 to 1961-65 cohorts looks somewhat sharper than that of the survey rates for both sexes. When we adjust the survey rates (dotted line in Figure 6), these differences between the survey and estimated rates become less conclusive for males. In the case of females, however, the trend of adjusted survey rates also exhibits some disparities from that of the estimated rates.

Return migration rates in Figure 7 demonstrate that, as in the case of metropolitan experience, the survey rates of return migration are higher than the estimated rates. However, the nature of disparity between the trends differs. For example, the survey rates show irregular ups and downs for younger cohorts, while the estimated rates change rather smoothly. For females, the widening gap from the 1936-40 to the 1946-50 cohorts is also notable. As for the first point, the irregularity in the survey rates could have been caused by sampling error. With regard to the second point, however, the mal correspondence between the two trends seems to be more remarkable than in the case of metropolitan experience. Therefore, the estimated rate of return migration may be a less reliable indicator of actual migration behaviors, at least for females.

The differences between the estimated and survey rates, either in the absolute or relative level, could result from tempo factor or repeat migration. As was mentioned, however, migration behaviors of metropolitan natives may also be the cause. To see whether tempo really differs by cohort, we examine the timing of metropolitan-ward out-migration among the non-metropolitan natives. Table 1 shows the proportions of respondents who report their first appearance in a metropolitan prefecture at the time of each life event[19]. These proportions differ by cohort. For example, the 1936-40 cohort exhibits a high percentage at "before first marriage" (22.0% for males, 26.0% for females). But the 1946-50 and later cohorts show lower percentages at that stage, and high percentages at the stages of "last school graduation" and "first job." These figures seem to imply that the pattern of the timing of out-migration has changed from a dispersed to a more concentrated pattern[20]. While the effect of tempo difference is not yet entirely clear, the data shown here allow us to surmise that the tempo factor plays some role in creating mal correspondence between the trends in the estimated and survey rates.

Finally, we suggest a few implications from our study in relation to the work of Kawabe and Inoue. First, analyses based on net migration such as those of Kawabe and Inoue tend to focus only on the difference between in- and out-migration, so that they are likely to underestimate the level of mobility *per se* (see Kawabe 1985 p.5). However, the disparity between the estimated and survey values suggests that the experiences of metropolitan residence and return migration have been more widespread among non-metropolitan natives than Kawabe and Inoue implies.

19) The timing of the "first appearance" was judged by the life event data, so that for some respondents, the actual timing of metropolitan-ward out-migration could be earlier.

20) Studies on home leaving also show that the timing of leaving parents' home has changed for both males and females (National Institute of Population and Social Security Research 2001, 2005; Suzuki 2003).

Table 1 The timing of first out-migration to the metropolitan area (%)

cohort	life event					total
	last school graduation	first job	before first marriage	after first marriage	other	
male						
1921-25	26.9	46.1	16.6	0.0	10.3	100
1926-30	28.7	45.3	14.4	1.5	10.2	100
1931-35	18.3	44.1	26.5	3.5	7.6	100
1936-40	21.6	47.6	21.0	0.9	9.0	100
1941-45	28.4	56.0	10.2	0.7	4.7	100
1946-50	32.4	55.2	6.8	0.9	4.7	100
1951-55	34.1	51.7	6.6	0.7	6.9	100
1956-60	44.6	42.2	4.8	0.0	8.5	100
1961-65	44.0	42.0	6.2	1.1	6.6	100
1966-70	40.6	44.6	2.3	1.2	11.3	100
1971-75	41.1	43.0	3.5	0.6	11.8	100
female						
1921-25	6.2	35.2	16.1	17.1	25.4	100
1926-30	6.0	34.9	16.1	21.9	21.1	100
1931-35	7.6	27.5	17.0	25.0	22.9	100
1936-40	10.5	36.4	24.4	18.7	9.9	100
1941-45	12.8	44.7	19.3	14.9	8.3	100
1946-50	20.9	45.2	16.0	12.0	5.9	100
1951-55	31.5	43.3	8.4	12.4	4.4	100
1956-60	40.6	33.6	6.9	11.2	7.7	100
1961-65	39.5	33.4	8.0	10.2	8.9	100
1966-70	52.6	29.6	3.7	8.2	5.9	100
1971-75	55.9	23.1	4.2	6.1	10.7	100

Source: author's calculations based on The Fifth National Survey on Migration
Note: "First" means first out-migration suggested by the life event data. We assume that last school graduation precedes finding a first job, which precedes first marriage. We have excluded respondents whose ages at last school graduation were higher than their ages at finding their first jobs or at first marriage, as well as those whose ages at finding their first jobs were higher than their ages at first marriage.

Second, Inoue (2002 pp.61-62) emphasizes the role of cohort size in "migration turnaround" in the 1970s, but those who were at that time in their 20s (e.g. the 1946-55 cohorts) show much higher rates of return migration than the members of the previous cohorts (e.g. born in 1936-45)[21]. Not only the change in cohort size, but a stronger likelihood of return migration to the non-metropolitan prefectures seems to have accelerated the process of migration turnaround in the 1970s. Particularly, the rise in return migration rate for females is notable. In fact, tables presented by Inoue (2002) also indicate the increasing trend of return migration rate, although he does not analyze this point sufficiently. The lack of analysis may have been caused by the fact that cumulative net migration data leads one to estimate the level of return migration substantially lower than the actual level.

21) Esaki, et al (2000) estimates that return migration rate among non-metropolitan natives is generally higher for males who graduated from high school between 1976 and 1978 than for those who graduated ten years before. According to the data of The Fifth survey on Migration, the difference between return rates of the 1946-50 and 1956-60 male cohorts remains small (Figure 6).

Third, Kawabe (1985 pp.8-12) and Inoue (2002 p.66) point to the change in the number of siblings as one important cause of the change in cohort migration patterns. In a traditional society where one child (usually eldest son) becomes the sole successor to a family estate, the siblings of the successor (except for those who would marry other successors) are often considered to be a surplus population or potential out-migrants. Therefore, the level of out-migration can be influenced by the number of siblings. To explore the validity of the relationships between the number of siblings and out-migration, Kawabe and Inoue scrutinize the trend of cumulative net migration. The problem is, however, that cumulative net migration does not represent the actual out-migration experiences of the population. Their findings thus need to be reexamined. As for the demographic determinants of cohort migration patterns, the timing of migration may also have played an important role. The effect of the timing may have been large especially in the 1960s and 1970s, when the 1936-1950 cohorts, which have shown large cohort-by-cohort variations in the timing of first out-migration to the metropolitan prefectures, constituted the majority of migrants and thus determined the general trend of metro-bound and non-metro-bound migration.

V Conclusion

This paper examined the concept of cohort cumulative net migration and evaluated the theoretical and empirical validity of using that indicator to measure the levels of metropolitan experience and return migration among non-metropolitan natives. Several hypothetical models showed that since differences in the timings of out- and return migration could produce various patterns in the trend of cumulative net migration, the estimates of metropolitan experience and return migration based on cumulative net migration rate do not always match the actual values calculated by in- and out- migration data. When we compared the estimated rates based on the data of the Population Census with the survey rates obtained from The Fifth National Survey on Migration, the estimated rates were much lower than the survey rates. The largely parallel trends of the estimated and survey rates of metropolitan experience suggest that the estimated rates basically represent the relative level of a certain cohort's metropolitan experience in comparison to other cohorts. In the case of return migration, however, the trends of the two rates correspond with each other less satisfactorily, especially for females. We also showed, using the survey data, that the timing of first out-migration to the metropolitan prefectures differs by cohort. The tempo factor may thus partly explain the disjunction between the trends in the estimated and survey rates.

The use of net migration in the analysis of migration is an inevitable consequence of the paucity of age-specific in- and out-migration data. Since this limitation is likely to remain unchanged in the near future, some researchers will keep on using this indicator in their demographic studies of migration. In such studies, we need to evaluate carefully how well this indicator reflects the actual migration behaviors of a population. As for the correspondence between the estimated and actual rates of metropolitan experience and return migration, it is necessary further to explore the quantitative aspects of the contribution of tempo of migration, repeat migration, migration of metropolitan natives, and other related factors.

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累積純移動の量とテンポ

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本論文では，累積純移動の概念を検討し，非大都市圏出身者の大都市圏居住と帰還移動の経験の推定にこの指標を用いることが，理論的・実証的に妥当であるかどうかを評価した．仮説的なモデルを検討したところ，転出と帰還移動のタイミングが累積純移動率の推移に影響を与えることが示された．そのため，累積純移動率のデータに基づいた大都市圏居住経験率と帰還移動率の推定値は，転出入のデータから得られる実際の値と，必ずしも一致するわけではない．国勢調査のデータから計算した累積移動率に基づく推定値と，第5回人口移動調査から得られる値とを比べると，大都市圏居住経験率や帰還移動率の推定値は，調査値よりはるかに低い．大都市圏居住経験率については，推定値と調査値のコーホート間の推移傾向がほぼ平行であることから，累積純移動率による推定値は，他のコーホートと比べた場合の各コーホートの相対的な大都市圏居住経験の水準をかなりよく表していると思われる．しかし帰還移動率の場合，推定値と調査値の推移傾向は，とくに女性において，大都市圏居住経験の場合ほどには対応していない．本論文ではまた，大都市圏への最初の移動のタイミングが，コーホートごとに異なることも示した．以上の結果から，推定値と調査値の推移傾向の違いには，ある程度までテンポ要因が関係していると考えられる．