They came and went.

An exploratory journey into the mathematics of return migration.

Adrien Remund*

Abstract

In this article, I apply the principles of formal demography to a little-studied aspect of migration, return migration. I exploit certain similarities with mortality settings to propose some key indicators such as rates of return-migration and migration prevalence and incidence. These indicators are applied to the case of 19th-century Geneva, and prove to be especially useful to highlight alternative expectations of the migrants toward the city, as well as long term trends of the schedule of migration. I conclude that migration studies, and particularly migration history, would profit from the adoption of such measures by a larger audience.

*University of Geneva
Institut d'études démographiques et du parcours de vie
40, bvd du Pont-d'Arve
1211 Genève 4
Switzerland
adrien.remund@unige.ch

I. Research framework

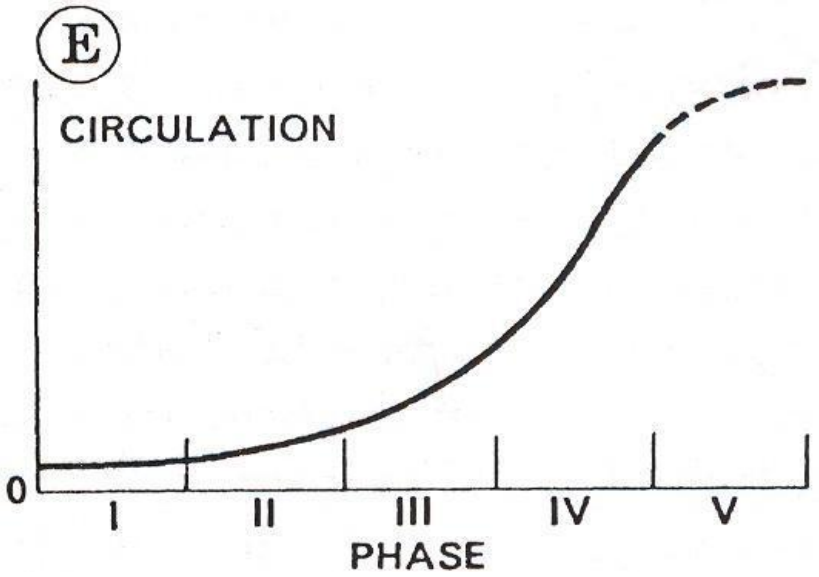
There seems to be a widespread attitude about formal demography which considers that only mortality, and to a lesser extend fertility, are suitable to deep mathematical analysis. From the first life tables in the seventeenth-century to the most recent biodemography research, the tools available to demographers in the field of mortality have reached a level of sophistication that their counterparts working on migration often envy them. The reasons why formal research on migration is persistently lagging behind are numerous, and it is not our aim here to explore them. Let us simply mention the difficulties of definition (both of the event and of the population under exposure), a lack of sources of good quality, and a fragmented theoretical background. Where such a formalization was attempted, the broad ambitions of the authors, who often try to tackle several aspects of migration at once, sometimes made them lose in efficiency what they gained in audience (e.g., Bell, Blake, Boyle, Duke-Williams, Rees, Stillwell, and Hugo 2002).

Still, a large variety of issues on migration, and more particularly migration history, remains yet inaccessible because of this weakness in the methodological framework. Among those topics, the study of return migration, defined here as the propensity to leave a place which one had previously migrated to, is a good candidate for a development of formalization. Two reasons favor this particular focus. Firstly, it allows a clear definition of both the event and the population under exposure. Secondly, it opens the door to yet underdeveloped questions in migration studies. The former statement shall be discussed below in the methodological part. For the time given let us focus on the reasons that make return migration a particularly promising field of research.

When Notestein published what is now considered as the *classical* version of demographic transition theory, his posture toward the reasons of the decline of fertility included a so-called modernization of the society. Among the elements of this process, he argued that the "new mobility of young people was the source of the slow disaggregation of traditional behaviors" (Notestein 1953). If migration was not in the very center of the demographic transition theory, but was rather treated on its margin, the idea that the transitions of mortality and fertility were accompanied by a parallel shift in mobility patterns gained a growing popularity over the years. This process probably culminated in the hypothesis of the mobility transition developed by the American geographer Wilbur Zelinsky, in which he argued that "there are definite, patterned regularities in the growth of personal mobility through space-time during recent history, and these regularities comprise an essential component of the modernization process" (Zelinsky 1971:221-222). Consequently, Western societies experienced a shift from "a relatively sessile condition of severely limited physical and social mobility toward much higher rates of such movement" (Zelinsky 1971:222). This idea of a mobility transition can be better expressed in a set of graphs of the evolution of mobility over time proposed by Zelinsky, among which the representation of *circulation*[1] is of particular interest for its familiarity to the concept of return migration. Figure 1 confirms this belief in a historically immobile society in which, roughly, peasants were born, grew up, married, lived and died in their village.

[1] "Circulation denotes a great variety of movements, usually short-term, repetitive, or cyclical in nature, but all having in common the lack of any declared intention of a permanent or long-lasting change in residence" (Zelinsky 1971 :226).

Figure 1: The mobility transition represented by Zelinsky



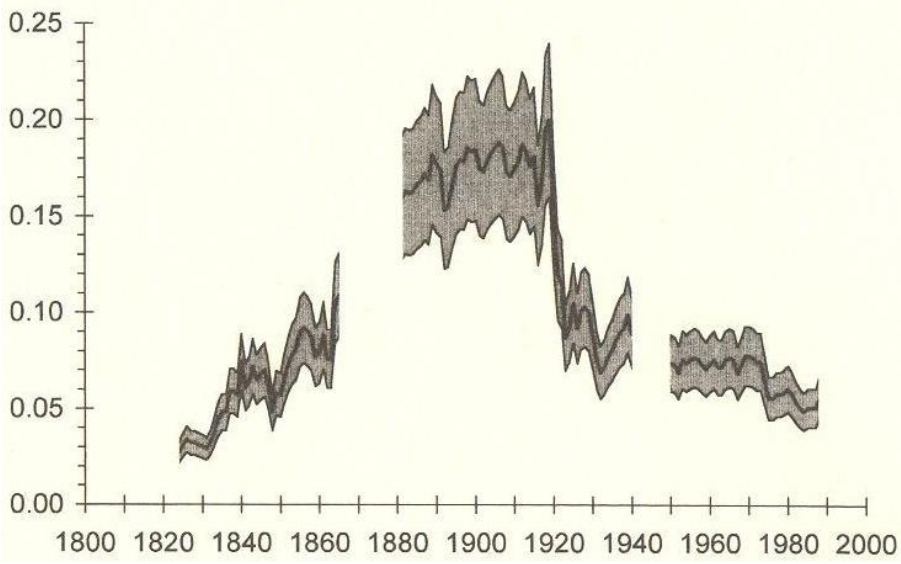
Source: (Zelinsky 1971:233)

This point of view was rapidly challenged by historians of the family who had rediscovered a cornerstone of the European system of late marriage (Hajnal 1965), namely the *life cycle service*. Peter Laslett was one of the first scholars to highlight the importance of this tradition in the demographic *Ancien Regime* when he wrote that "Western servants in fact were, to a very large extent, young, unmarried persons – indeed, sexually mature persons waiting to be married (…). Service in England and the West was a stage in the life cycle for large number of people. "Life cycle servants" is the distinctive title we shall use for them" (Laslett 1977:34). Since those life cycle servants accounted for roughly 10 to 20% of the total population (Laslett 1977:32), it is reasonable to conclude that a very important share, perhaps the majority, of the population experienced at least once an episode of mobility in their lives.

A few years later, a group of historians finally gathered a sufficient amount of data to put into question Zelinsky's arguments. The results were surprising enough to draw skepticism on the reality of the mobility transition. Among those scholars, Steve Hochstadt played a central role by collecting *migration rates*[2] for a selected number of German cities in the early nineteenth century. He proved doing so that the level of mobility in the 1830s was already as high as in the end of the twentieth century, before the premises of the Industrial Revolution and the demographic transition, as highlighted by figure 2. This new position was first confirmed by other scholars (Bade 2003; Lucassen 1997; Moch 1992), although they acknowledged later that "there was indeed a sharp jump in the level of migration after 1850" (Lucassen and Lucassen 2009:374). It remains though that migration concerned the majority of the population already before the nineteenth century and that it was then a key component of people's life. The representation of historically sessile societies must be discarded.

[2] "Rates must be calculated for sets of communities. This has been done by totaling migrations over many communities and dividing by summed populations." (Hochstadt 1999 :51).

Figure 2: Migration rates in Germany according to Hochstadt



Source: (Hochstadt 1999:277)

At this point of the literature review, it is important to underscore that most of the studies that led to this scientific overturn based their conclusions on aggregated data. This might not seem surprising considering the need at that time to raise the debate to the highest geographic scale in order to challenge the very general mobility transition theory. It is however necessary to understand the implications of this new light shed on historical migration for the individuals who actually experienced it. The first remarks on this issue were brought to the public already in the nineteenth century by one of the founder of migration studies, the German-English geographer Ernst Georg Ravenstein (1834-1913). Among his *laws of migration*, he pointed already to a main characteristic of migration in nineteenth-century England, namely their circularity. He formulated it in the now famous terms “each main current produces a compensating counter-current” (Ravenstein 1885:199). What this assertion induces is that the presence of migrants at one given moment in time is much less important than the in- and out-flows of migrants who enter and leave each regions simultaneously.

One of the major conclusions of Hochstadt’s book, along with the recognition of early importance of mobility patterns, was to show that "German migration in the nineteenth century was overwhelmingly a temporary phenomenon. (…) In- and out-migrants were usually the same people” (Hochstadt 1999:89). This pattern explains why historical migration has been greatly underestimated by cross-sectional sources and in particular during the period during “the transition from preindustrial to industrial society”, i.e. from the beginning of the nineteenth century until First World War. Hochstadt indeed underscored what should have been already emphasized by Ravenstein, had he got other data sources than censuses, that each current and its counter-current were actually composed by the same people traveling back and forth from their first residence to the labor markets, or from one labor market to the next.

A major consequence of the recognition of the importance of temporary migrations was to force historians to change their vision of the dichotomy between cities and their rural hinterlands. “**Most**

migrants came and went. (...) The recognition that a substantial proportion of city dwellers in the recent past were soon to leave the urban environment must be written into urban history. The relationship between a city and its migrants is not exhausted by the concept of assimilation" (Hochstadt 1999:268-269).

There are therefore strong indications that important parts of our understanding of people's experience about urban life and the relationship between urban and rural worlds would immensely gain from a stronger focus on the temporality of migration, i.e. the schedule of return migration. Fortunately, the way is already partly paved by decades of development in formal demography. The fact that those tools were meant to be used on mortality settings is just a minor problem, since we are about to see that dying and out-migrating are just the same in the mathematical world.

II. Definitions and conceptual issues

Just because survival analysis took its name from the study of how individuals or objects survive over time, does not mean that it cannot be applied to other concepts, particularly in social sciences. This flexibility is well known by demographers who use it, for instance, to study fertility. It is remarkable though, that very few migration scholars have underscored the similitude with return migration. The adaptation to migration requires however to clarify some definitions and conceptual issues.

A usual problem with the formalization of migration processes has often been the definition of both the event observed and the population under exposure. Although none of them can be claimed perfect and universal, we would like to suggest one in particular which allows a quite handy mathematical manipulation. Return migration is often defined as returning home after a certain migration episode. We suggest to extend this definition to the propensity, for a migrant who has already arrived to a certain destination (*place B*), to leave this first destination to a second one (*place C*). No specification is set about this second destination, leaving it free to be the point of departure (*place A*), or a third location. Doing so, we are conscious of the impossibility to distinguish circular and stage migration, although in a second time, a generalization of the model could be achieved, for instance by working in cause-specific setting. The event observed becomes then *leaving the location*, and the population under exposure *the migrants still present in the location after time t*.

In the end, return migration as defined above becomes nothing else than a classical attrition process such as mortality. When an immigrant arrives in place B, he[3] enters the population under exposure like a new born enters the world of the livings. The longer he stays in place B, the further he moves along a virtual residence line, just like humans grow up along the Lexis diagram in mortality studies. The population under exposure is then composed by all the people who have arrived in place B and have not left it yet. When this immigrant leaves place B, i.e. he re-out-migrates or, according to our definition, he proceeds to a return migration[4], disappearing from the population under exposure, which is the equivalent of dying in the mortality world.

[3] All pronouns are to be understood for both sexes. That is to say that all "he's" can be replaced by "she's".
[4] To my knowledge, there is no alternative terminology capable of describing the event in question.

Let us now see the practical implications of this methodological framework. The basic data source required must indicate at least the dates of entry and departure, so it cannot be cross-sectional but rather longitudinal. If the first indication lacks, it might be a case of left truncation, whereas if we lose track of someone during his sojourn it would force to apply a right censoring. Moreover, it should indicate the cases of death before completion of the sojourn so that they can be treated as right censoring. By combining those pieces of information it should be possible to recreate the total life course (or, to continue the analogy, the course of the *migration episode*) of a cohort of migrants. In addition to those elements, covariates can bring additional and extremely useful information to distinguish migrants by sex, age, civil status, origin, or occupation for instance. This description of the data source leads to choose either a population register or, as we will see later, a register of residence permits.

III. Research questions

The previous discussion on the state of research led us to underscore the need for more thorough investigation on the relationship between urban and rural worlds, and between migrants and the city. Hochstadt argued that “the relationship between a city and its migrants is not exhausted by the concept of assimilation” (Hochstadt 1999:269), and suggested to "recast temporary urban dwellers not as failures, but as rational consumers of certain urban goods" (Hochstadt 1999:269). This point of view is shared by French historians who have criticized the idea that “l’échec de l’intégration urbaine se manifesterait par le départ de la ville qui viendrait sanctionner une trajectoire brève et erratique dans la cité”[5] (Pinol 1999:12). It seems indeed of a major importance to deconstruct the idea that a successful migration experience lasted longer and led eventually the migrant to settle in his host location, and therefore that short migration episodes reflected failure, incapacity to integrate in the host community. Consequently, more efforts should be devoted to redefine the usual distinction between short term and long term migrants, between which the temporality is set arbitrary and often in the aim of distinguishing the attempts that failed from the ones that were successful. This first argument will provide the point of departure of the first part of the following discussion.

A second and nonetheless crucial argument in migration history is the nature of the relationship between rural flight and urban growth (or urbanization). Those concepts are often considered as the flip-sides of the same coin, but the story is more complex than what it seems. Two causes can explain the urban growth observed in the nineteenth century: an augmentation of the incidence of migration (i.e. the migration rates calculated by Hochstadt, or the force of the rural flight), or/and the duration of each migration episode. The urban growth, that is to say the actual number of people transferred from their home countryside to the developing industrial centers, is then the resultant of those two factors. It is therefore of major interest to know better the past evolution of the average time spent in the host communities. The assumption that former seasonal and temporary migrants progressively turned into permanent city dwellers is indeed commonly accepted but has almost never been confirmed by a long term study.

[5] “failure of urban integration manifested itself by the departure of the city, which imposed a sanction on a brief and erratic trajectory within the city” (own translation)

Those two questions, the distinction between short term and long term migrants, and the study of long term trends in the duration of migration episodes will provide the basis for our discussion.

IV. Data sources

As mentioned earlier, the type of analysis we aim to perform requires longitudinal data. Censuses, as the primary source of migration data since Ravenstein, are typically biased due to the influence of the seasonality of the migration and the impossibility to capture the time spent in the host location. On the other hand, family reconstitution, the usual tool of historical demography, was not designed to this task. Migration, in this case, was considered a disturbing event and, since in the early days of the discipline censoring and truncation were not mastered, Louis Henry and his scholars never dared to tackle a excessively *mobile* nineteenth century. Even the Princeton project in the 1970s ignored migration which was "considered to be a distorting element in parish register research, rather than a crucial object of interest" (Hochstadt 1999:11).

Luckily, alternatives exist but are only available through in-depth analysis of individual records. In the field of migration, this is typically the case of population registers that follow the residence of people over the administrative borders. Unfortunately, these registers were not introduced everywhere early enough to be of a good use. To be able to tackle the question of long term trends of migration patterns, a major advantage is to possess data covering the preindustrial period. This is rarely the case. One of the rare examples of such a study is again Hochstadt's book, although he only used aggregated tables based themselves on individual records. This situation is due to the relatively late implementation of population registers in most of European countries. A previous research led us to the conclusion that only Sweden, and maybe Spain, Hungary and Czechoslovakia, offered early enough population registers compared to the time of their industrialization to permit an investigation of preindustrial mobility (Remund 2010a:16).

An alternative to population registers can be the residence permits. Multiple forms of residence permits have existed in the past, which originate almost always in the desire of the local authorities to control the population streams crossing their walls. This was the case for Basel in the nineteenth century (Lorenceau 2001), and for the city of Geneva since the late eighteenth century (Remund 2010a:18). In the later case, they were issued by a chamber on the presentation of certificates of origin, of good conduct, and of self subsistence. They concerned both Swiss and foreigners, until the foundation of the modern Swiss confederation in 1848, and had to be renewed every three months. Between 1816 and 1837, domestic servants were the only people released from the obligation to obtain a permit. This restriction was then eliminated for married servants and for males the following year. Female servants remained uncovered until the new 1844 law (Schumacher 2010), which constitutes probably the most important weakness of the source.

As we have seen previously, longitudinal sources covering preindustrial periods are very scarce. In the case of the residence permits of Geneva, this limitation is clearly lifted thanks to the early introduction of system of permits. Moreover, economic historians have highlighted the very late industrialization of the city. The majority of them agree that Geneva kept a protoindustrial type of production oriented toward textiles until the early nineteenth century and later turned to watch

making as the textile industry collapsed. Mass production never really took off, although some signs of mechanization were perceptible in the 1880s (Babel 1938). Whatever the precise date kept for the onset of the industrialization of Geneva, one thing is sure: it did not happen before the second half of the nineteenth century. This specific context offers thus the opportunity to study urban migration in preindustrial settings with data of high quality.

Another advantage of this source is the richness of the information it offers on the migrants. Additionally to their name, age, origin, civil status, occupation, and time spent in town, all their successive addresses and their destination are mentioned. However, besides the under-recorded domestic servants, one can identify two major problems in terms of completion of the entire migration life course.

Firstly, the permits do not provide any information regarding the previous migration history of immigrants. In these conditions, it is not possible to determine if Geneva is the first or the twentieth city that the migrants meet on their way, if the time an individual spends in town represents a unique event or is part of an endless pilgrimage over Europe.

Secondly, in the absence of information about the populations of origin, it is not possible to test which kind of selection process is working. In other words, all research questions that require comparing the migrants to their counterparts who stayed in their home regions are strongly limited, if not totally forbidden.

The data source that will be used in the first part of this paper is a sample of the register of residence permits for the city of Geneva between 1837 and 1843, i.e. between the two last local censuses that preceded the first national census in 1860. In order to reduce the work load to a supportable amount, an alphabetic sampling strategy was adopted by recording only people whose last name started with the letter “B”. This common technique is recognized in the field as being socially and geographically unbiased, while keeping samples large enough to be representative of the population as a whole (Dupâquier 1984:115; Schumacher 2010:253). In this case, 1903 permits were computed, which corresponds to 13.1% of the permits issued during the six-year period.

A few additional technical points should be mentioned before starting the discussion. First, the dates of entrance and departure were sometimes not trustable because the former was rather the monthly reunion of the chamber during which the permit was issued, and the later was sometimes missing due to failure by the migrants to announce their departure. Fortunately, the number of renewals of the permits is much more reliable since it was noted by the public servants each time that the migrants paid for another three month renewal. It is the number of renewal multiplied by three months that has been used to calculate the total time spent in town. This figure might overestimate slightly the real time spent in town if the migrants left before the end of their right to stay, but it is sufficiently trustable to perform a discrete time analysis[6]. Secondly, if the migrants obtained another type of permit (which is mentioned then in the register), their migration episode is considered right censored. More time in the archives would have probably made us able to retrace their trajectories

[6] The overestimation can be estimated to 1.5 months if the risk of leaving is equally distributed over the interval, but is rather inferior than superior to this figure since the migrants were probably not prone to leave right after having paid for a renewal.

in the other registers, but this has not been possible yet. Finally, for all permits a right censoring is applied in December 1844 because of the application of the new law on foreigners that forced all of them to apply for a new permit[7].

In conclusion, the data base contains the number of months (by multiples of three) between the entrance and the departure of the immigrants. It also indicates if this time corresponds to an actual departure or the moment when we lose track of the migrant (in the event indicator). Finally, it contains a large number of variables that allow distinguishing the migrants according to sociodemographic criterions.

V. Discussion

i. On the distinction between short and long migration episodes

Instinctively, it is common to distinguish short and long term migrants. This has been done since the beginning of migration studies and is still present both in common speech and scientific discourse. However, there is clearly no agreement on the threshold that should be used to make this distinction. For instance, whereas some use one year as a benchmark (Hatt-Diener 2004), others use 100 days (Lorenceau 2001). It might seem absurd in both cases to believe that the characteristics of the migrants will change overnight, but still, the first intuition that people who stay only a short time are somehow different in their background and their expectations than the ones who stay longer is certainly valid.

Let us step back and try to resituate the real reason why researchers desperately want to classify migrants in short and long term categories. In fact, the real question that everyone wants to answer is not "how long did this person stay", but rather "what were the motivations of this person that made him stay this long". The change of focus from the time spent in town to the motivations of the migrants is crucial as soon as one acknowledges that staying only for a short while might be just as much the mark of a success as of a failure: "le départ n'est pas forcément un échec, il s'inscrit dans une trajectoire personnelle qu'il faut étudier pour en comprendre les raisons"[8] (Hatt-Diener 2004:158).

The concept of migratory project was developed by Paul-André Rosental in his study of French migrants in the nineteenth century. According to him, the project of a migrant overcomes rational choice made on traditional push-pull factors, following his personal experience: "leur comportement ne doit pas être traduit seulement en termes d'actes, mais aussi, simultanément, en terme de perspectives et de projets"[9] (Rosental 1999:79). Indeed, what this short detour in the literature teaches us is that behind the time that each migrant spends in his host location, we should try to read his intentions, his expectations toward the host community. In other words, while we were

[7] As a confirmation of the efficiency of the method, there was no additional censoring added at this step because all permit changes had already been recorded in the previous step.
[8] "departure is not necessarily a failure, it is part of a personal trajectory that has to be studied to understand its reasons" (own translation)
[9] "their behavior should not only be understood in terms of actions, but also, simultaneously, in terms of perspectives and project" (own translation)

looking at the consequence, we were actually interested in the causes. If studying the duration of the migration episode is not enough, I suggest using the risk of leaving as a better indicator.

The definition of the risk of return migration is based on the one of the force of mortality. It is therefore the probability to leave the host location for the people that are still present. Mathematically, we shall define it with the following expression.

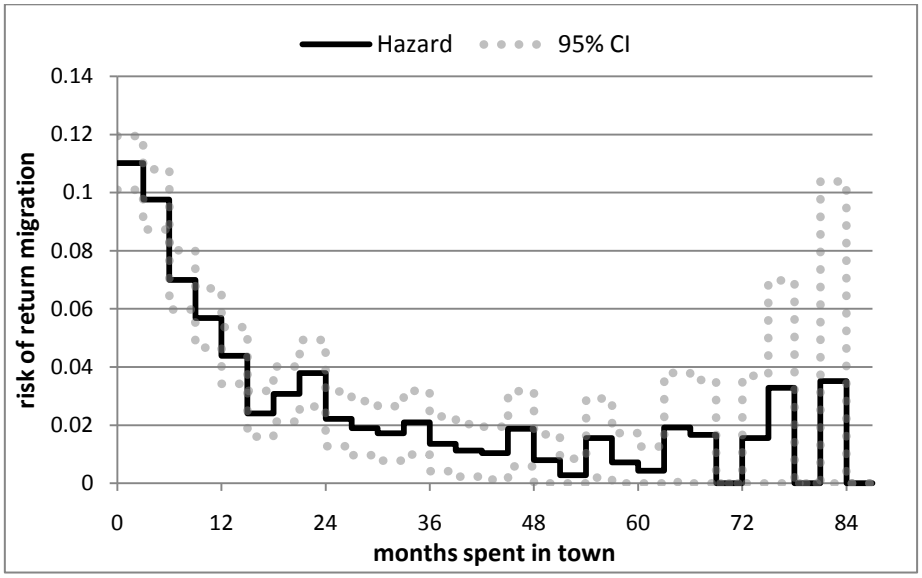
$$\mu(y) = \frac{f(y)}{l(y)} \textit{ where f(y) is the distribution of departures, and}$$
$$\textit{l(y) the "survivor" function}$$

In the formulas above, *y* stands for the *time spent in the host location*, i.e. time since migration, which is known among economists as *ysm* (years since migration). $\mu(y)$ is therefore a hazard that depends on time since migration, that is to say the exact equivalent of the force of mortality in a mortality setting. One might want to call it the *risk of return migration.*

Let us picture ourselves alternative scenarios for this risk and the logical consequences that they would draw on the behaviors of the migrants. One could imagine a constant risk, known as exponential in statistics, which implicates that no matter the time people spent in the host location, their risk of leaving remains constant. In other words that would describe a memory less process. Another option, maybe more realistic, is to assume that the force of departure follows a monotonic decreasing pattern. In this case, the turn-over is high in the first months and then decreases over time until the ones who have made it through settle in the long term. One could speak of a progressive selection, or progressive settlement process, depending if we take the point of view of the migrants who eventually leave or stay.

Figure 2 indicates that the second assumption is the closest to the reality in nineteenth-century Geneva. During the three first months of sojourn, the average monthly risk of leaving the city reaches slightly over 0.1, which means that about 30% of the migrants are gone after only three months. This very high turnover decreases in intensity quite steeply until about 4 years when the monthly risk of leaving is below 1%. The data are too scarce to draw solid conclusions on the later periods, as the 95% confidence interval shows. The hypothesis of a progressive settlement / selection seems to hold.

Figure 3: Risk of return migration, Geneva 1837-1843 (all migrants)



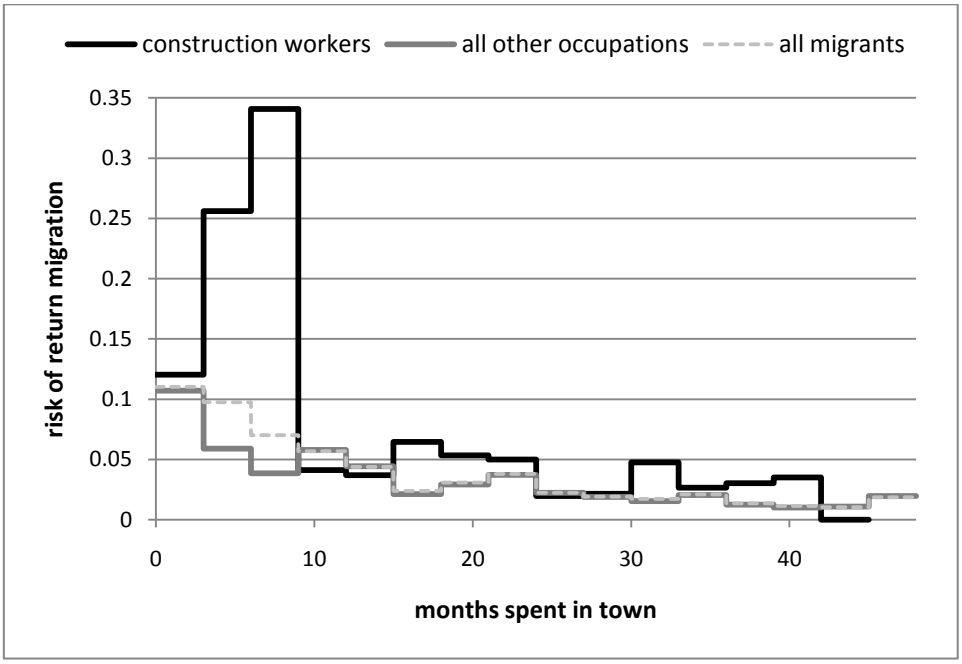
Source: own calculation based on 1903 residence permits[10]

However, this general trend might hide an important heterogeneity. The same way heterogeneity's ruses can be misleading in mortality studies, they are potentially confusing concerning return migration (Vaupel and Yashin 1985). There are good reasons to argue that heterogeneity might even be more important in return migration, in the sense that whereas everyone hopes to live as long as possible, not everyone's goal is to stay in town. Therefore, the decreasing pattern observed at the population level could be generated from a set of stable risks associated to different groups. For this reason, it is safer to look deeper into the shape of the risk of return migration over different groups.

Figure 4 gives a particularly striking example of how this heterogeneity can appear. After sorting the immigrants by occupation, we notice the very peculiar behavior of a group of seasonal workers whose risk of return migration increases over time until reaching a peak after 9 months and then hitting and holding a very low level. This pattern suggests that they arrived in Geneva with a precise targeted time to spend in town, and the closer they moved to this limit, the higher their risk of leaving. This is a clear sign of the presence of people with *fixed time strategies* (Remund 2010b).

[10] The risk was computed in the Stata software, using a Kaplan-Meyer procedure.

Figure 4: Risk of return migration by occupation, Geneva 1837-1843



Source: own calculation based on 1903 residence permits

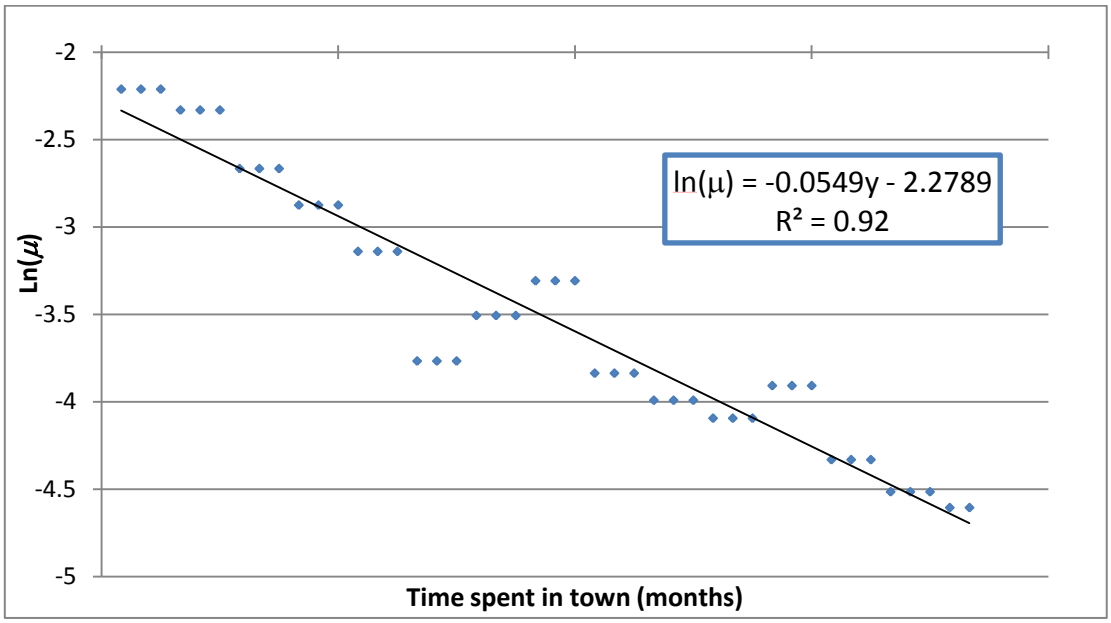
What the two previous figures offer is nothing else than a glimpse into the expectations of the migrants toward their host community. Whereas the majority of the migrants arrived in town with the simple ambition of looking for an income and staying as long as possible, others already knew before coming when they would be leaving. Although the later attitude is clearly the sign of seasonal workers, it is possible to experience an overall high risk of leaving (and therefore a short time spent in town in average) without following this peak pattern. This is the case for instance of the German migrants known to travel from town to town in a sort of tour of European cities (Bade 2003; Hatt-Diener 2004). In Geneva, temporary workers moved fast but they did not know what would be their destiny in town, unlike seasonal workers who had everything planed. If there is a dichotomy it is here, in the expectations of migrants toward their host community, and not in the time they spent in town which is only the output of those expectations confronted with the reality of the labor market.

This first step allowed us to overcome the artificial boundary that was traced between short term and long term migrants and suggested a different distinction between individuals involved in a progressive settlement process or a fixed time strategy. The majority of migrants fell into the first category. It is very likely that this behavior will be found in other contexts and therefore a measure of this settlement / selection process that could be repeated over time and space would be a precious tool. More specifically, the shape of the risk of return migration should be examined more thoroughly in order to highlight possible regularities. Figure 5 represents the natural logarithm of the risk of return migration. It is obvious from this graph that the risk decreases at an exponential pace. Just like mortality follows biological rules such as the Gompertz function, return migration seems to show regular patterns. In a mathematical expression:

$$\mu(y) = \alpha \cdot e^{\beta y}$$

In this model, α becomes a measure of the turnover right after arrival, and β is the pace of the decline of the odd ratio of return migration (β is then negative, unlike in the original Gompertz function). In the case of Geneva, the model seems to hold (R2 up to 0.92, p-values<0.000), even though the risk is assumed constant over the 3 month intervals. The β coefficient indicates that the hazard odd ratio decreases by 5.5% every month.

Figure 5: Regularities in the risk of return migration



Source: own calculation based on 1903 residence permits

Of course, one case is not enough to prove a rule universal, but this result surely calls for more attention and the application of such an analysis on other contexts in time and space.

ii. Urban growth and the pace of return migration

Urban growth is measured by the number of people who have immigrated to a city and have remained there. It is often misleadingly assimilated in the nineteenth century to the rural flight, which describes the massive migration flows from rural areas to urban centers. Very often, those two concepts are confounded by historians who consider only the size of the flow to urban centers, i.e. the rural flight, as the cause of urban growth. However, the overall number of non-native urban dwellers is as much influenced by the number of people who arrive in town, as by the mean duration of the migration episodes in town. Studying urban growth, in this sense, is very similar to studying the spread of a disease.

Let us consider an imaginary disease, whose symptoms are to be a migrant in town. Epidemiology tells us that "the incidence of a disease can be defined as the ratio of new cases of the disease diagnosed in a particular period divided by the person-years lived in the population during that period. The prevalence of a disease can be defined as the proportion infected at a moment in time. If the number having the disease at a moment in time is H, and the annual number of the new diagnoses of the disease is I^H, then in a stationary population:

(Equation 1) $\underset{prevalence}{\frac{H}{T_0}} = \underset{incidence}{\frac{I^H}{T_0}} \cdot \underset{\substack{expected\ duration \\ of\ the\ disease}}{\frac{H}{I^H}}$ " (Preston, Heuveline, and Guillaut 2000:91)

In our case, the number of migrants in town at a certain point in time divided by the population under exposure (T_0)[11] can be compared to the prevalence of the imaginary disease. Besides that, the incidence of our imaginary disease is measured by the flow of new migrants, i.e. the number of residence permits given every year over the population under exposure (T_0)[12]. Based on the relationship above, it is possible to argue that those two figures are related to each other through the mean duration of each "infection", which, in our case, is the mean time spent in town (i.e. $\bar{y} = mean(y)$, according to the definitions given above in this article). The longer the migrants stay in town, the more the urban population will increase. This point highlights a very important consequence of the mechanisms of return migration that is often discarded by historians: urban growth due to migration can be generated either by more people coming into town, or by those people to stay longer. French historians Jean-Luc Pinol and René Laurenceau already mentioned in their study of Basel (Switzerland) that the duration of the migration episodes was more important than the incidence of migration to explain urban growth (Pinol 2003:104). Moreover, Pinol argues that one of the causes of the augmentation of the duration of stay might be the Long Depression of the 1870s and 1880s, which "contribua à rompre les relations que les migrants temporaries entretenaient avec leur terre natale et à les transformer en migrants définitifs"[13] (Pinol 2003:103).

There are two different ways of measuring the mean time spent in town, i.e. the mean duration of the migration episodes: directly or indirectly. Firstly, the direct method consists in recording the time spent in town for each of the migrants (y) and taking their average ($\bar{y}$). Because of the importance of censored trajectories, calculating a simple average would lead to greatly underestimate $\bar{y}$. One could think then of using the attritional nature of the process to apply the idea of the life table and compute a "sojourn expectancy" which would take account of the censored migration episodes. This would be however an misuse of the life table, since return migration is not a event with probability 1 (a certain event), whereas death is certain eventually. In other words, it is impossible to close the life table in a way that respects the fact that a certain number of people eventually settle in town and never leave. It is however possible to use alternative measures that are strongly correlated to $\bar{y}$. One could think for instance of the proportion of migrants that are still present after one year, i.e. l_1 in the mortality world.

There are good reasons to think that l_1 is a good substitute for $\bar{y}$. If long term changes have occurred in the pattern of return migration, they very probably took place during the first months of the sojourn. In other words, the increase in the mean time spent in town is probably mostly due to the vanishing of the numerous short trajectories, rather than a prolongation of the already longest episodes. Therefore, similarly as the first phase of the demographic transition during which the decrease in infant mortality explains most of the gains in life expectancy, $l_1$very likely reflects most of the changes in $\bar{y}$ at least in the nineteenth century.

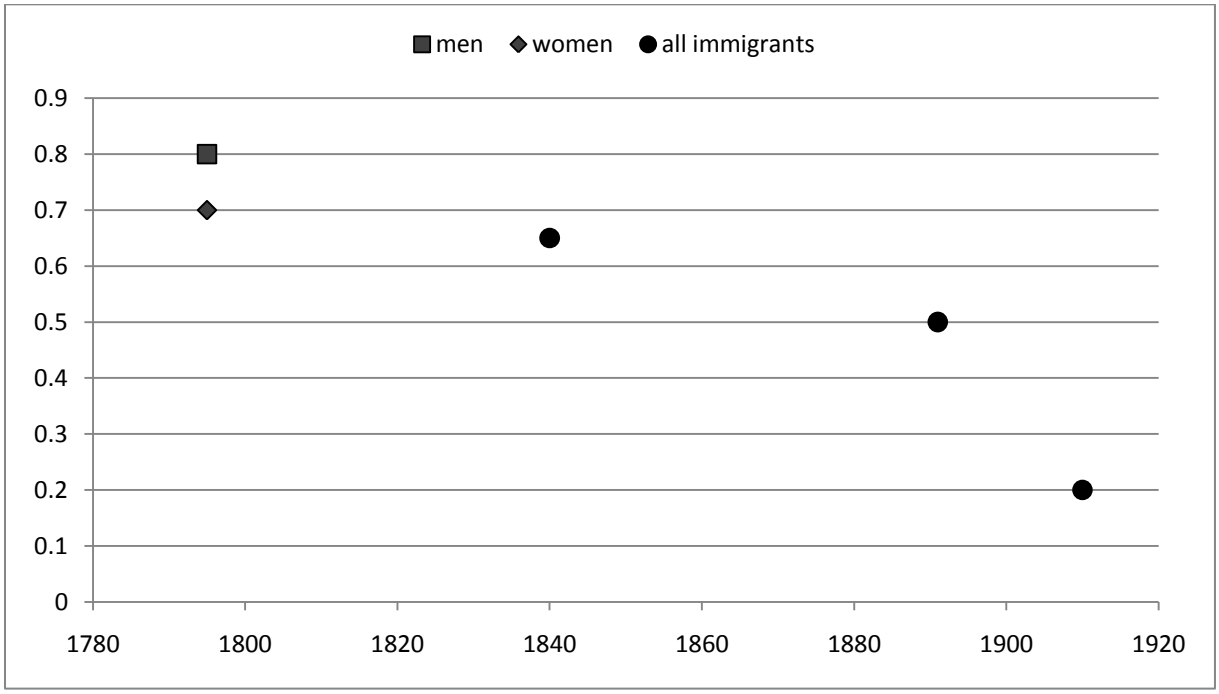
[11] For the sake of the explanation, let us imagine that the population exposure is here undetermined. Since our goal is not to actually calculate this prevalence, as we will see further, this is not a problem here.

[12] The same remark as above is valid here as well.

[13] "contributed to break the relationships that temporary migrants maintained with their homeland and to transform them into definitive migrants" (own translation)

Unfortunately, there are no available individual data sets that cover a period of time long enough to see long term trends appear. However, a collection of results obtained in several master theses based on the residence permits of Geneva offers an interesting general vision. Figure 6 displays the evolution of the cumulative risk of leaving after one year ($H_1 = 1 - l_1$) in Geneva over a selection of years during the nineteenth century. Although the figures cannot be precisely compared due to the absence of a common methodology, the general trend is clear enough to conclude that migrants who came to Geneva stayed longer and longer over the nineteenth century.

Figure 6: Proportion of immigrants staying less than one year in Geneva (1789-1910)



Sources: (Engeli and Marin 1974; Gille 2009; Magnenat-Luthy 1988; Remund 2009)

There is an alternative indirect method to evaluate the mean time of the migration episodes. It requires using the dynamics of epidemiology. From Equation 1 we can isolate the expected duration of the disease, which in our case is $\bar{y}$. We can then deduce that "the expected number of years spent with morbidity from a newly-diagnosed disease would equal the number of persons suffering from the disease at a moment in time divided by the annual number of new diagnoses of that disease" (Preston, Heuveline, and Guillaut 2000:91).

(Equation 2)
$$\bar{y} = \frac{prevalence}{incidence} = \frac{\frac{H}{T_0}}{\frac{I^H}{T_0}} = \frac{H}{I^H}$$

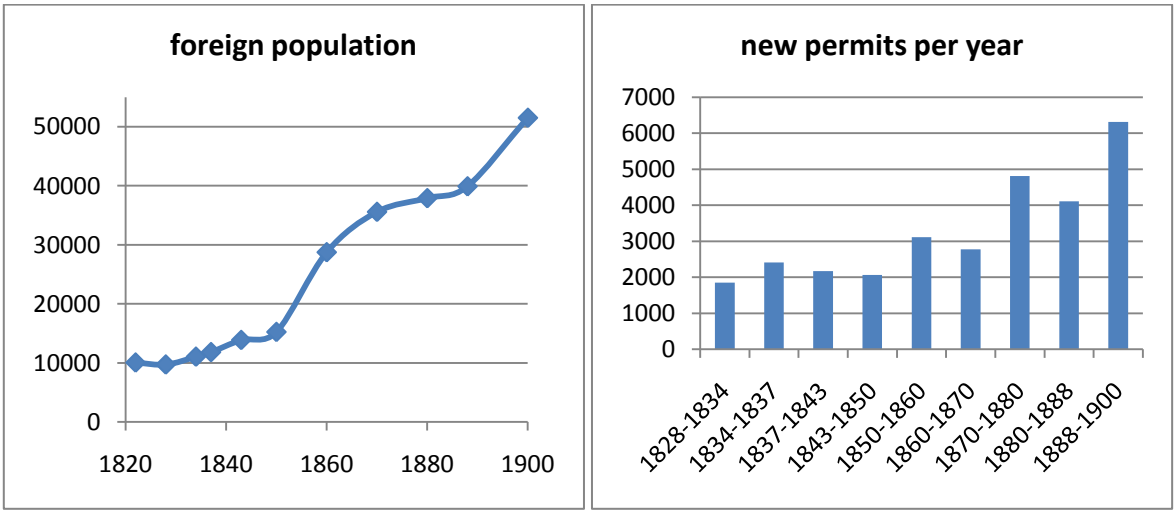
In the return migration world, the mean duration of the migration episodes is equal to the ratio of the number of migrants present in town at a certain moment in time over the annual number of new permits issued[14]. This relationship is valid under two conditions. First, the number of new permits has to be roughly stable over time (equivalent to the stationary population in the mortality world).

[14] As mentioned above, a specific definition of the population under exposure is not required since it cancels out in Equation 2.

Secondly, the migrants that were present in town before the start of the record of the new permits have to be ignored (equivalent to the *newly diagnosed disease* condition).

Those two conditions suggest that the computation of $\bar{y}$ should be made on short intervals, so that the number of new permits does not vary too much over the period, and that the number of migrants in town can be reset at the end of each period. For those reasons, the intercensus intervals seem to be a reasonable choice. It leaves one bias though, if $\bar{y}$ is not constant over the intervals. The migrants who arrived in the second interval and do not leave before its end might not be totally (or over) compensated by the migrants who arrived in the first interval and only left in the second one. Nevertheless, this indirect method should give a rough image of the long term evolution of the mean duration of the migration episodes without having to compute all the individual trajectories.

Figure 7: Long term evolution of foreign population and number of permits issued in Geneva

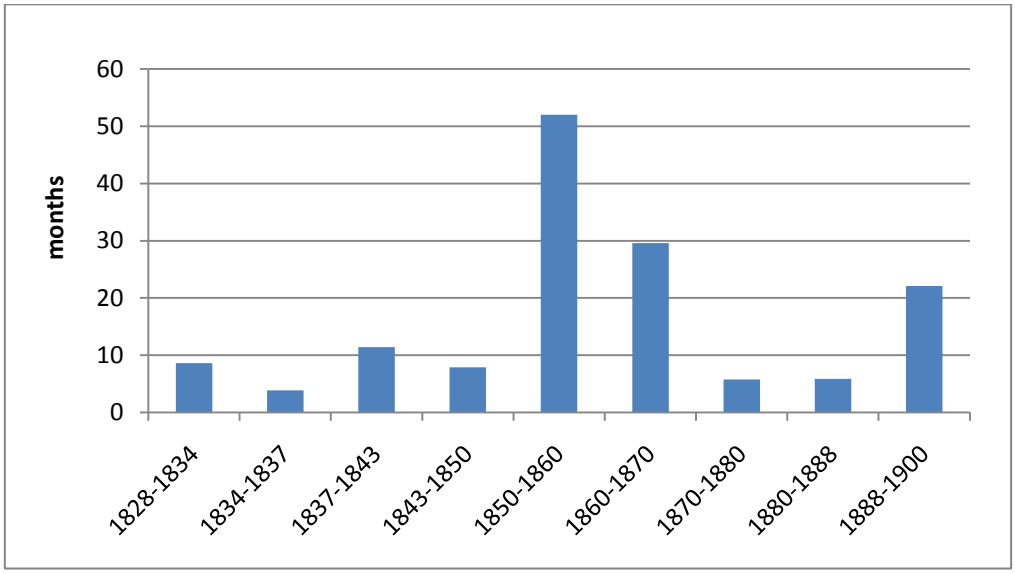


Source:(Bairoch and Bovée 1986; Schumacher 2010)

Figure 7 gives the inputs of Equation 2, namely the number of foreigners at each census, and the number of new permits issued annually in each intercensus interval in Geneva[15]. These intervals range from 3 years (1831-1834) to 12 years (1888-1900). The $\bar{y}$ estimated for each interval was calculated following Equation 2, by the number of new foreigners present in Geneva compared to the previous census, over the mean annual number of new permits issued in the interval. The final estimated $\bar{y}$ shown in figure 8 is quite surprising with respect to figure 6.

[15] For this exercise, the whole state (canton) of Geneva was considered due to the restriction of availability of the number of new permits for the city itself. Moreover, only the non-Swiss migrants were considered, due to the difficulties generated by the integration to the Swiss Confederation in 1848. The stationary aspect of the number of permits issued over each intercensus interval was measured with the help of the Coefficient of Variation (CV). It indicates a persistent but rather modest fluctuation, with CV ranging from 0.022 to 0.176.

Figure 8: Indirect measure of the mean duration of the migration episodes, Geneva (1828-1900)



Source: own calculation based on figure 7

The indirect measure of $\bar{y}$ as proposed in Equation 2 does not support the hypothesis of a prolongation of the mean time spent in town over the nineteenth century. It suggests in contrary a rather stable pattern fluctuating between 5 and 10 months, with the single exception of the period between 1850 and 1870. This peak is due to the fact that the number of new permits cannot explain the skyrocketing increase of the foreign population in this period. Is this an artifact of the experimental method or a real pattern? Further analyses, not only on Geneva, but also on other cities and on a larger scale are required to answer this question.

VI. Conclusion

Over the last decades it has become obvious that more effort must be allocated to the study of temporary migration in the nineteenth century, and the role of the thousands of people who shared their lives between rural and urban worlds. This task requires formalizing more precisely the study of the re-out-migration, here defined as return migration, which is made easier thanks to the similarities of this process with the classical attrition process observed in mortality studies.

Using those similarities led to the definition of the rate of return migration and its evolution over the time spent in the host location. The analysis of its shape suggested two alternative forms of expectations of the migrants toward the city of Geneva. Whereas some migrants followed a progressive selection process, i.e. they stayed in town as long as their income allowed it, others adopted a more utilitarian attitude. They were rational consumers of the income provided by the city for short periods of time and knew precisely how long they would stay before arriving.

Pushing forward the methodological comparison between return migration and mortality, we demonstrated that the movement of urbanization can be mathematically compared to the spread of a disease. Rural flight was only one element of urbanization: "huge numbers of migrants did not

automatically lead to permanent city growth. Most migrants came and went. (…) *Urban* at a particular moment did not necessarily mean *urbanized*" (Hochstadt 1999:268). The case of Geneva does not offer a clear pattern though. It is probable that this issue could be tackled more efficiently from a larger point of view, for instance at the national level, by evaluating the amount of people moving to cities and their actual growth not attributable to natural increase.

In conclusion, if return migration is considered as a classical attrition process, many applications can be brought to the study of migration history and, more generally, to migration studies.

References

Babel, Antony. 1938. *La Fabrique genevoise*. Neuchâtel & Paris: V. Attinger.

Bade, Klaus J. 2003. *Migration in European history*. Malden, MA: Blackwell Pub.

Bairoch, Paul and Jean-Paul Bovée. 1986. *Annuaire statistique rétrospectif de Genève*, Edited by D. d. H. Economique. Genève: Université de Genève.

Bell, M., M. Blake, P. Boyle, O. Duke-Williams, P. Rees, J. Stillwell, and G. Hugo. 2002. "Cross-National Comparison of Internal Migration: Issues and Measures." *Journal of the Royal Statistical Society. Series A (Statistics in Society)* 165:435-464.

Dupâquier, Jacques. 1984. *Pour la démographie historique*. Paris: Presses universitaires de France.

Engeli, Renée and Josiane Marin. 1974. "Les émigrés à Genève 1789-1798." Department of Economic History, University of Geneva, Geneva.

Gille, Yannick. 2009. "Genève comme carrefour migratoire an tournant du XXe siècle : une analyse des registres des permis de séjour et d'établissement suisses et étrangers (1891-1892)." Department of Economic History, University of Geneva, Geneva.

Hajnal, J. 1965. *European marriage patterns in perspective*.

Hatt-Diener, Marie-Noèl et al. 2004. *Strasbourg et strasbourgeois a la croisee des chemins. Mobilites urbaines, 1810-1840.* Strasbourg: Presses universitaires de Strasbourg.

Hochstadt, Steve. 1999. *Mobility and Modernity: Migration in Germany, 1820-1989*, Edited by G. Eley. Ann Arbor: The University of Michigan Press.

Laslett, Peter. 1977. *Family life and illicite love in earlier generations*. Cambridge: Cambridge University Press.

Lorenceau, René. 2001. "Bâle de 1860 à 1920 : croissance et mobilités urbaines." Université de Tours, Tours.

Lucassen, Jan & Leo. 1997. *Migration, Migration history, History : Old paradigms and New perspectives*, Edited by P. Lang. Bern.

Lucassen, Jan and Leo Lucassen. 2009. "The mobility transition revisited, 1500-1900: what the case of Europe can offer to global history." *Journal of Global History* 4:347-377.

Magnenat-Luthy, Catherine. 1988. "L'immigration des Confédérés à Genève en 1910, d'après les permis de séjour et d'établissement suisses." Department of Economic History, University of Geneva, Genève.

Moch, Leslie Page. 1992. *Moving Europeans: Migration in Western Europe since 1650*. Bloomington: Indiana University Press.

Notestein, Frank W. 1953. "Economic problems of population change." Pp. 13-31 in *Conference of Agricultural Economists*. New York.

Pinol, Jean-Luc. 1999. "La mobilité dans la ville, révélateur des sociétés urbaines." *Annales de démographie historique*:7-16.

Pinol, Jean-Luc et al. 2003. "Histoire de l'Europe urbaine." Paris: Ed. du Seuil.

Preston, H.S., P. Heuveline, and M. Guillaut. 2000. *Demography. Measuring and Modeling Population Processes*, Edited by O. B. P. Ltd. Oxford.

Ravenstein, E. G. 1885. "The Laws of Migration." *Journal of the Statistical Society of London* 48:167-235.

Remund, Adrien. 2009. "Les chemins de la migration: analyse de la mobilité étrangère à Genève (1837-43)." Département d'Histoire Economique, University of Geneva, Genève, www.unige.ch/ses/demog/Equipe/AdrienRemund/MA_thesis.pdf.

Remund, Adrien. 2010a. "The contribution of the registers of residence permits to the study of pre-industrial European migrations." in *Asociación de Demografía Histórica*. Sao Miguel, Açores, www.unige.ch/ses/demog/Equipe/AdrienRemund/azores.pdf.

Remund, Adrien. 2010b. "Refreshing the typology of migration systems. A reformulation based on the case of early nineteenth-century Geneva." in *European Population Conference*. Vienna, www.unige.ch/ses/demog/Equipe/AdrienRemund/EPC2010.pdf.

Rosental, Paul André. 1999. *Les sentiers invisibles, espaces, familles et migrations dans la France du 19ème siècle*, Edited by EHESS. Paris.

Schumacher, Reto. 2010. *Structures et comportements en transition: La reproduction démographique à Genève au 19e siècle*. Bern: Peter Lang.

Vaupel, James W. and Anatoli I. Yashin. 1985. "Heterogeneity's Ruses: Some Surprising Effects of Selection on Population Dynamics." *The American Statistician* 39:176-185.

Zelinsky, Wilbur. 1971. "The Hypothesis of the Mobility Transition." *Geographical Review* 61:219-249.