Observing migrations in Niakhar DSS (Senegal)

Daniel Delaunay, IRD
Valérie Delaunay, LPED

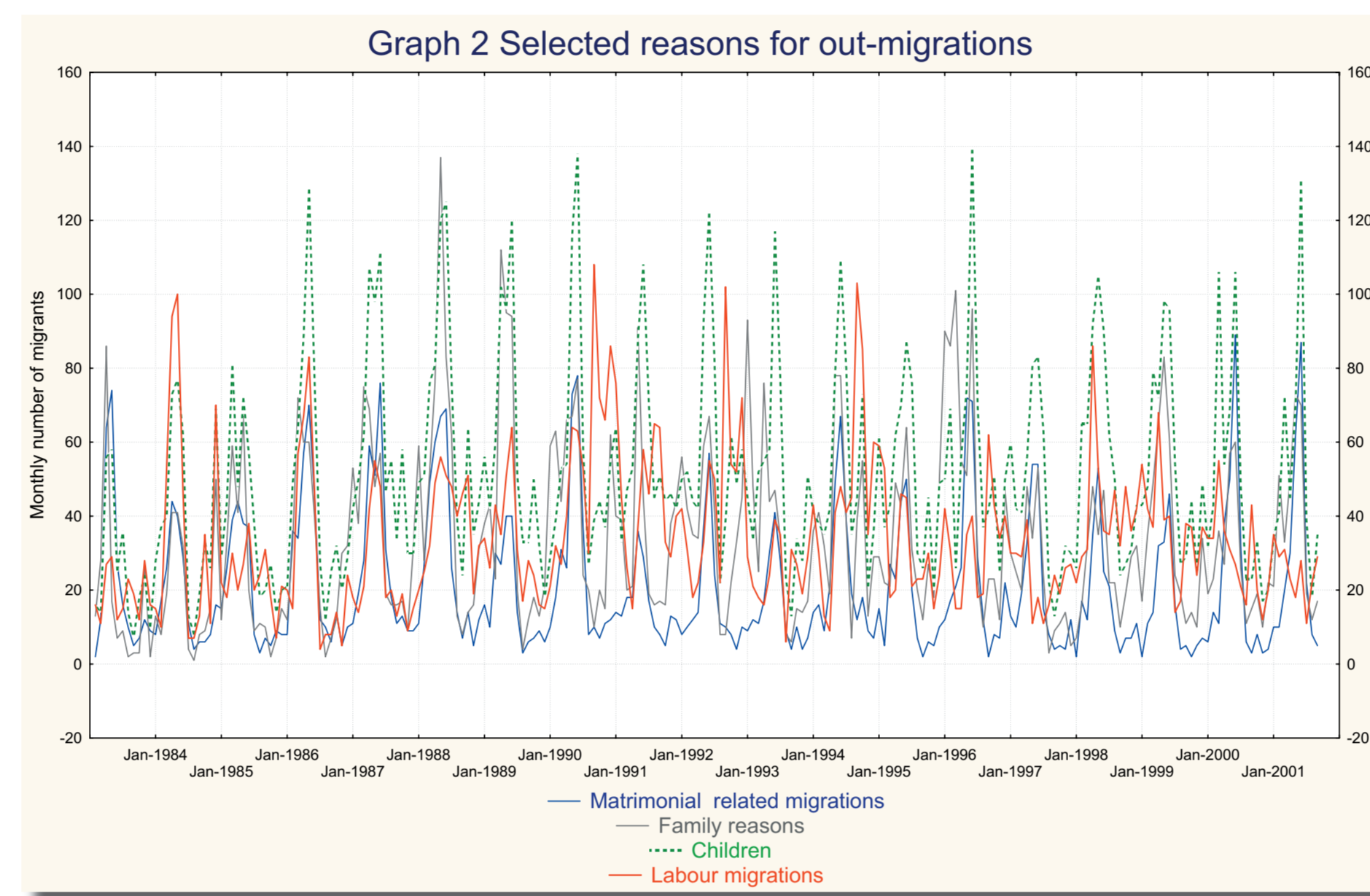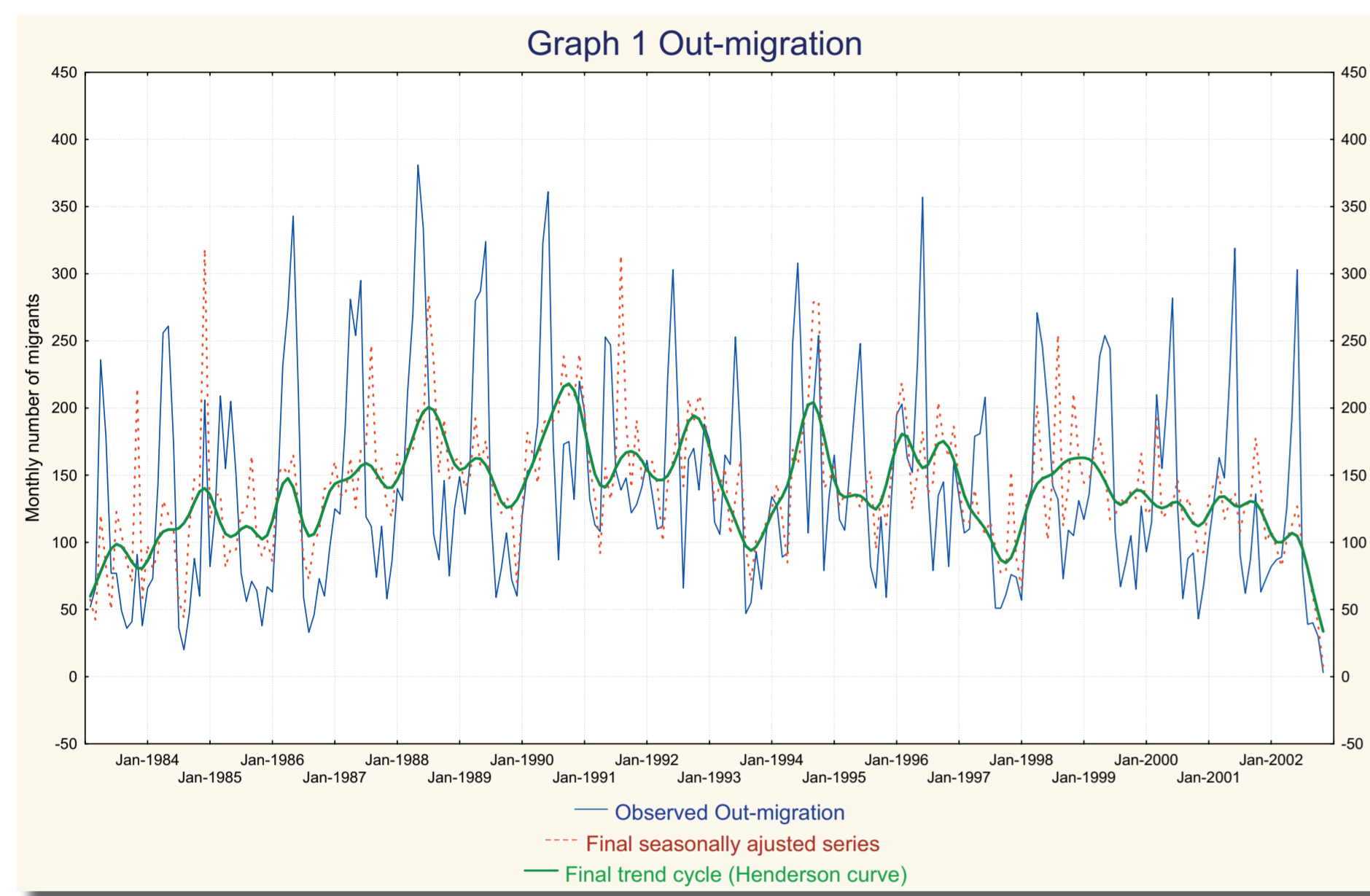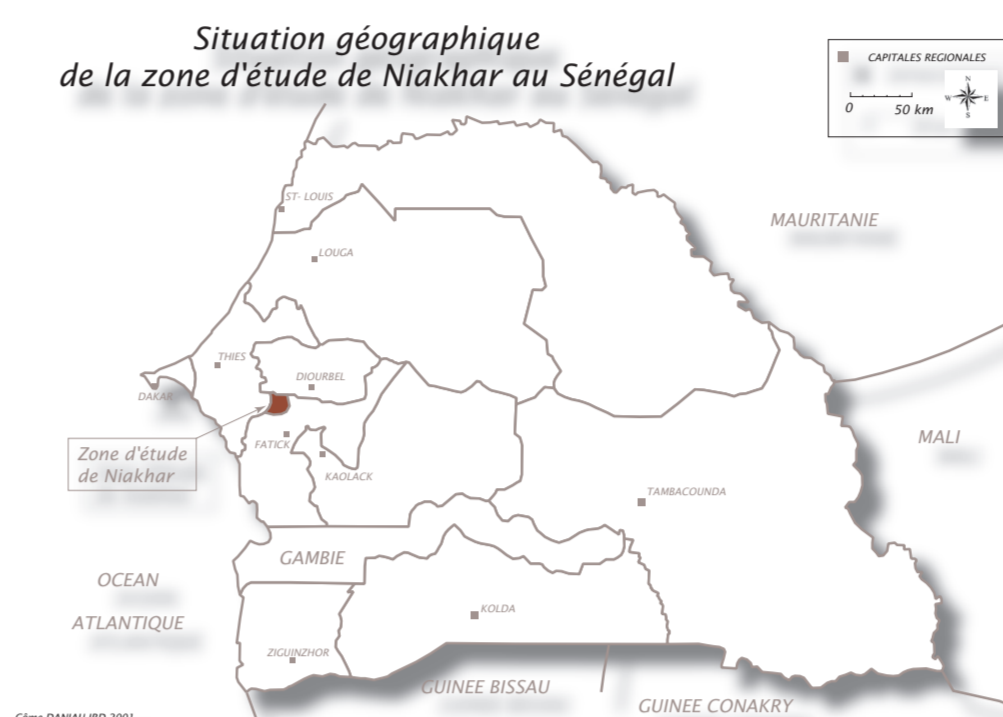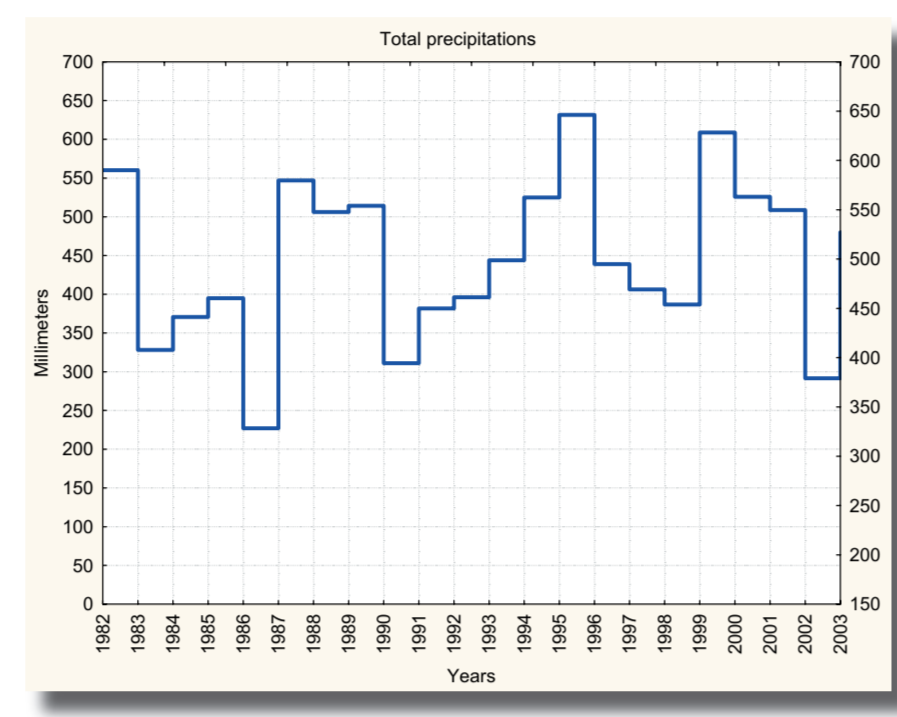Niakhar Demographic Surveillance System (DSS) has been producing migration data on approximately 30000 inhabitants in 30 villages from 1983. Rules of residency have not changed during this period. Individuals are considered as migrants if they declare their intention to migrate or if they are absent/present during 6 months. However, two important exceptions have to be notified: children absent for schooling and seasonal workers remain residents if they come back at least one month a year to the village.

In/out-migrations are characterized by the date of entry/exit, the reason of the movement and the place of origin/destination. It is therefore feasible to compute the time-series of migratory flows which take place within, to and from the Niakhar zone, according to these characteristics. The exceptional precision of the time schedule highlights the seasonal character of the migrations, but also multiannual cycles and long-term trend. The X/11/2000 method of the census, for example, is applied to immigration and emigration flows (graphic 1 & 3) to isolate each of these components. Severals methods of analysis and forecasting are available: autoregressive integrated moving average models, autoregressive conditional heteroskedasticity estimators, as well as many diagnosis tools. The apparent impact of climatic cycles on migrations suggests the use of multivariate models.

The nature of DSS data also allows us to conduct survival analysis of migration. Dates of entry and exit actually delimit individual stays, which timespan is to be analysed by duration models. Some entries are recorded at the moment of the initial registry of the Niakhar population (a left-censored observation). At the end of the observation period (2002 in the present analysis) every subject goes out of observation (right-censored survival-time). An example will be given of such evaluations of DSS data for continuous observation of migration flows.

Total precipitations

Situation géographique de la zone d'étude de Niakhar au Sénégal

Graph 1 Out-migration
- Observed Out-migration
- Final seasonally ajusted series
- Final trend cycle (Henderson curve)

Graph 2 Selected reasons for out-migrations
- Matrimonial related migrations
- Family reasons
- Children
- Labour migrations

Graph 3 In-migration
- In-migration
- Final seasonally ajusted series
- Final trend cycle (Henderson curve)

Graph 4 Family in- and out-migrations (female)
- Family in-migration (female)
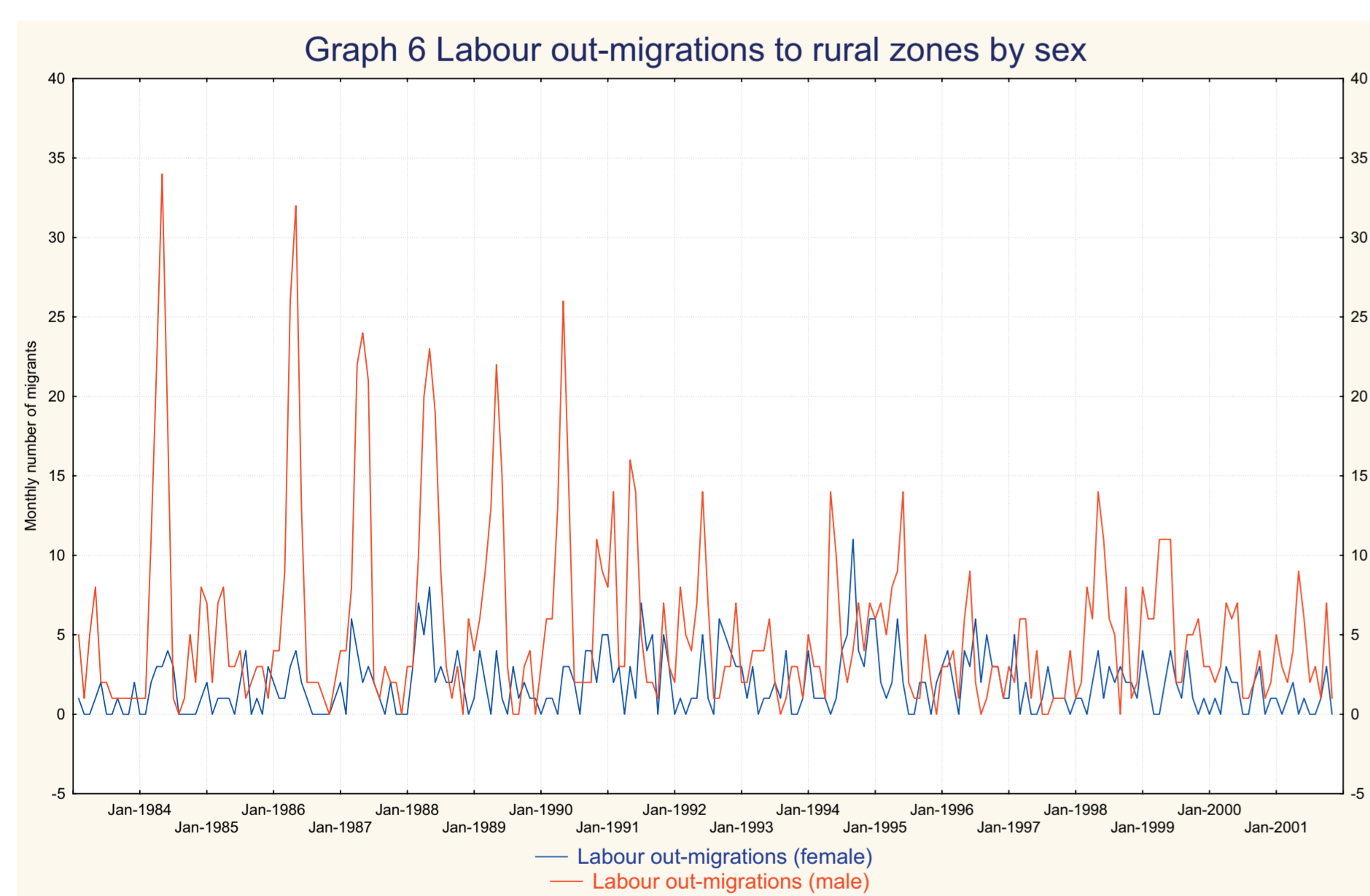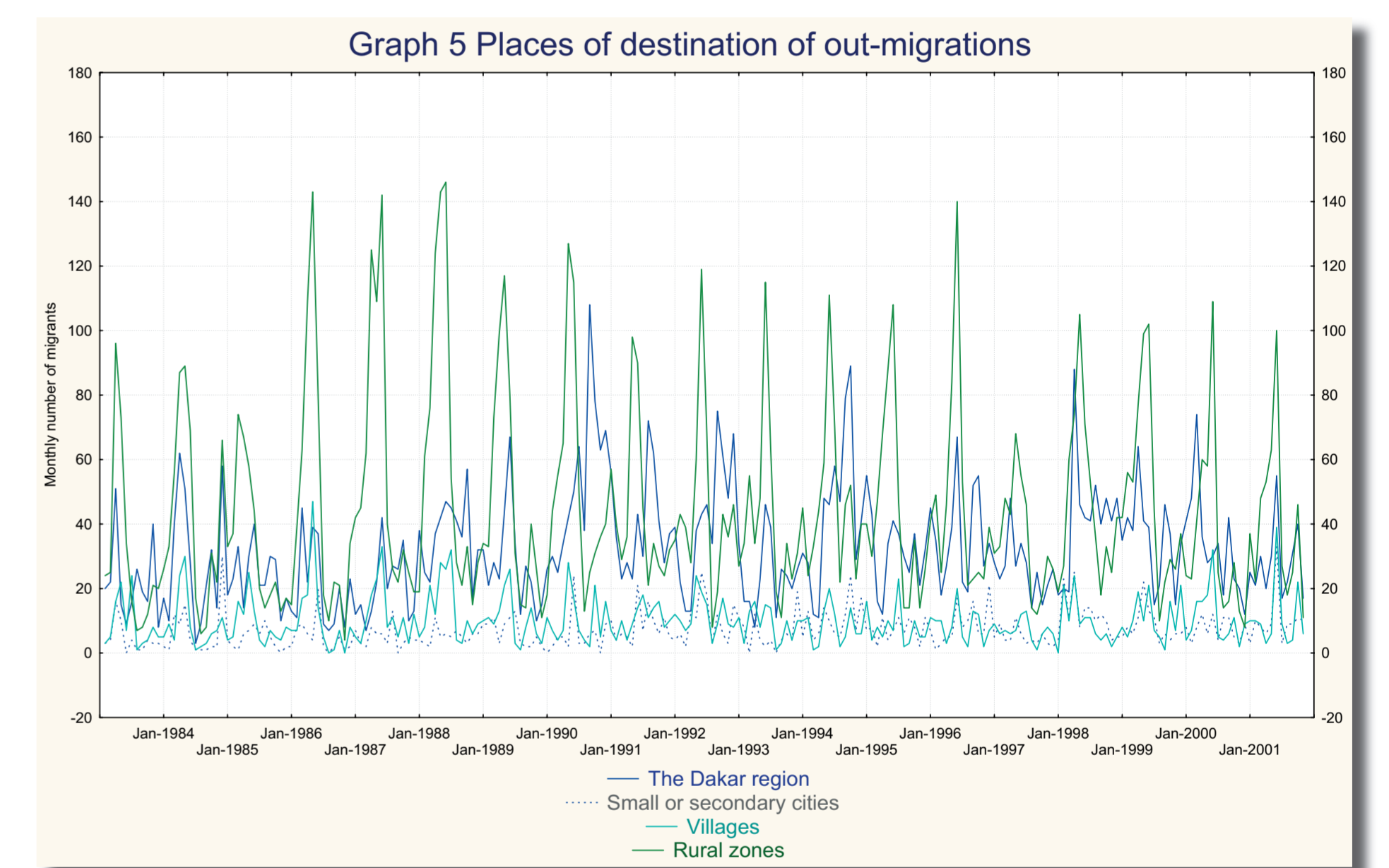- Family out-migration (female)

Out- and in-migrations

The seasonal character of migrations is outstanding. Graph 1 and graph 3 show a peak of out- and in-migrations from March to July, that gathers about 60% of the yearly flows. This seasonality applies to each reason for migrating (graph 2). This period of the year is the dry season, during which peasants do not work in the field and people have time to celebrate family events, visit family or go into town to find a job. During the Eighties, precisely since 1983, we observe a substantial increase (in a proportion of 1 to 3) of migration flows. During the Nineties, the trend becomes stabilized, with no manifest long-term increase or decrease. Conversely, especially during the first half of the decade, we observe relatively exceptional migration during the rainy season, especially in 1990, 1992, 1994, also in 1998. This phenomenon is partly due to women who state to leave in search of a job. From 1999, one notes a downward trend of out-migrations, due in particular to the reduction of "emergency" departures during the rainy season. Family migrations remain on the same level, whereas labour migrations drop.

Selected reasons for out-migration

Matrimonial and family migrations (including children) represent three-quarters of total departures, which leaves a little under one quarter for labour migration. Family related mobility accounts for approximately one hundred persons monthly, on a total population of 30000, concentrated over the dry season. Matrimonial migration is practically non-existent during farmwork. This seasonality suffers some exceptions; mainly labour migration during years of insufficient rainfall: like in 1984 or 1990, which was the first of three consecutive bad years.

Destination of out-migration

The most common place of out-migration are rural areas (47%). That concerns mostly family motivated migrations, women and children. The second place of destination is Dakar region (Cap Vert Peninsula), which, since 1990 has been gaining in importance and undergoing a different seasonality pattern. This destination is mostly related to labour migration (60% of out-migrations)

Graph 5 Places of destination of out-migrations
- The Dakar region
- Small or secondary cities
- Villages
- Rural zones

Graph 6 Labour out-migrations to rural zones by sex
- Labour out-migrations (female)
- Labour out-migrations (male)
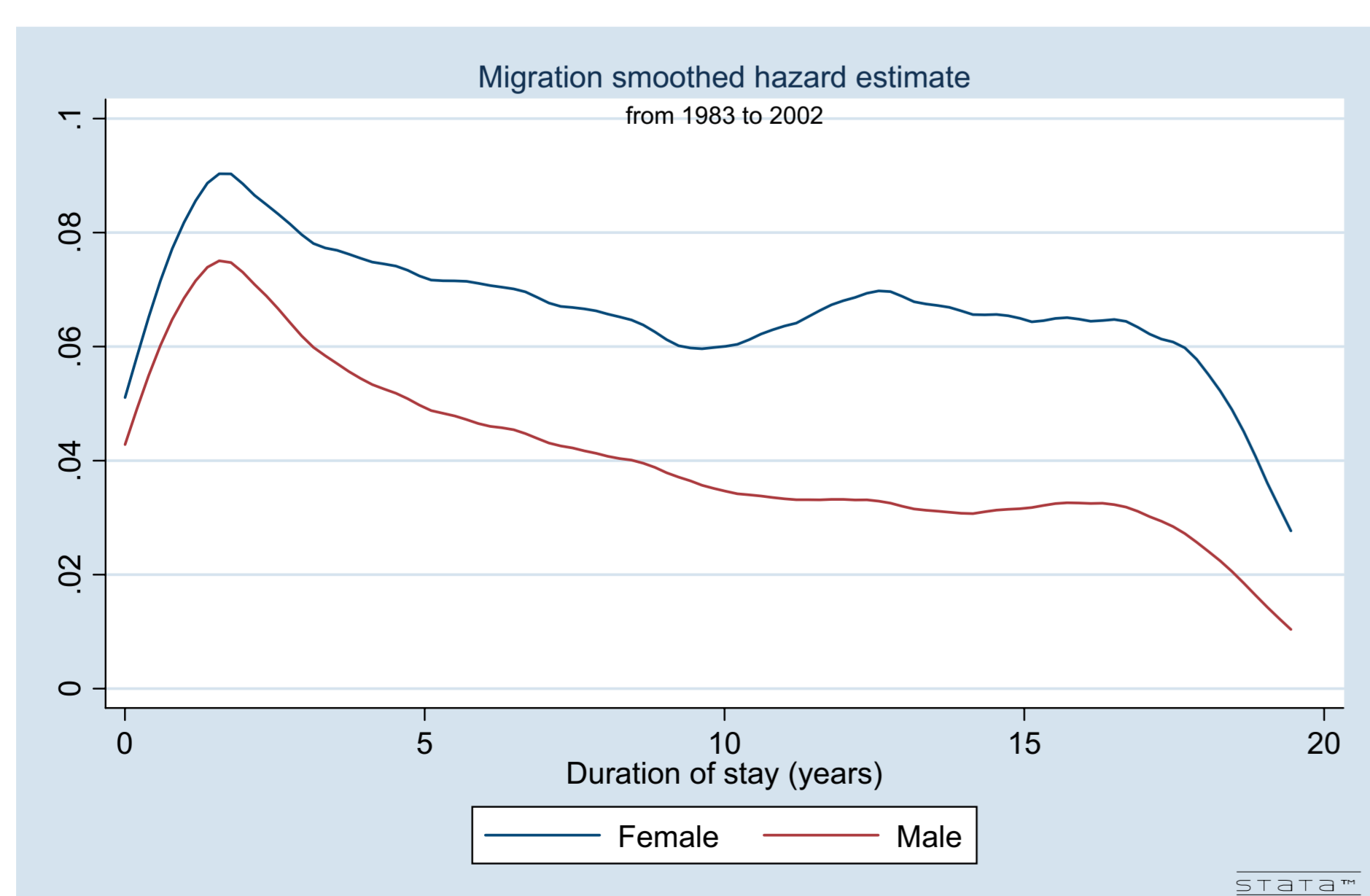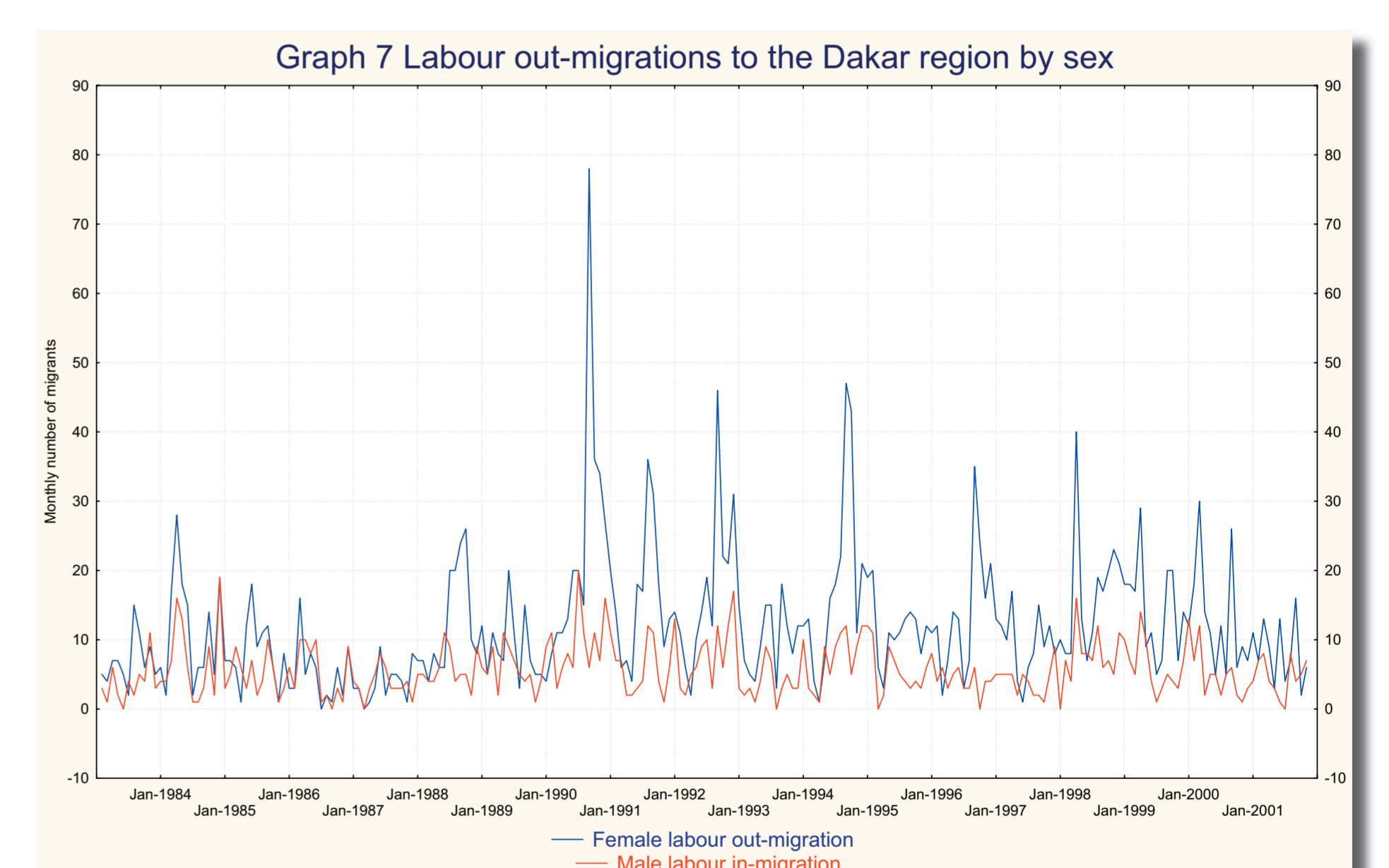
Family in and out-migration (female)

The most surprising fact in this time-series is the exact monthly balance of in- and out-migrations. They are not short journeys, because temporary migrations are excluded from these statistics. In this regularity, that we cannot explain, an exception is all the more remarkable: during the 1993-96 period, immigration exceeds departures. This positive net migration could be the by-effect of the female departures at the beginning of the Nineties, motivated by the search for a job in a bad agricultural context. Their return is apparently due to family reasons.

Labour migration to rural zones by sex

Towards rural zones, the preponderance of male labour migration is manifest at the beginning of period. It decreases brutally after the bad rainy season of 1990, without really recover afterwards: at the most ten or so migrants monthly. Let us point out that this male rural migration occurs before the rainy season, perhaps for the preparation of the fields. This migration is supposed not to be temporary and may be new rural settlements.

Labour migration to the Dakar region by sex

Until 1990, the labour migration towards the Dakar region is moderate, with little or no gender difference, and less seasonal than the rural flows. Since 1990, a bad crop year, labour migration to Cap Vert Peninsula has been dominated by a female pattern: the monthly number of women migrants exceeds male out-migration. Seasonal cycle is becoming more marked but is on the end of the rainy season that the main migration flow takes place. Actually, an important female migration network is effective in Dakar, accommodating migrants and helping them to find a job. This phenomenon is not new, because most of the young generations have experienced temporary labour migration. But, according to the residency rules of Niakhar DSS, these temporary migrations are not recorded as out-migration until they exceed one year. It seems that from 1990, some of temporary female labour migrations have become long enough to figure as out-migrations.

Graph 7 Labour out-migrations to the Dakar region by sex
- Female labour out-migration
- Male labour in-migration

Migration smoothed hazard estimate
from 1983 to 2002
- Female
- Male
Duration of stay (years)

Survival analysis of migration

In the introduction, we considered the possibility of a "survival analysis" of mobility. In the case of DSS data, the statistical processing is complex for several reasons. On the one hand, the same individual frequently moves several times (migrations with returns), which leads to an event-history analysis with gaps. Contrary to what happens in a retrospective observation, the majority of individuals are observed only during one period of their life course (left- and right-censored observations) and the death withdraws them from the risk of a migration. These technical complications solved, we must be aware of certain limitations of the DSS data for the survival analysis of migrations. One residential stay cannot be observed beyond the duration of the DSS, so the analysis only can reasonably start at the end of one long period of overall surveillance. In the case of Niakhar, hazard estimates stop a little before twenty years of stay (graph 8). It is a strong constraint. A second requirement is the continuity of information throughout the period of observation. In the case of Niakhar, some individual characteristics were recorded since 1991; they are consequently known for people who did not migrate outside the DSS territory. The missing responses are associated with early migrants, a biased information.

Two graphs illustrate the analysis of migration flows with duration models (survival analysis). One represents the distribution of the smoothed hazard estimate for a departure, according to duration of stay and gender. The other one plots the Kaplan-Meier failure (migration) estimate according to religion. Female migration is always higher because of matrimonial migrations making the difference in a virilocal society. For women, we note an increase of the "hazard" of departure at about 15 years of stay in the same place, this span of time corresponding to the age of puberty for the young women having not migrated since birth. The following graph confirms the perfect similarity of migration patterns among Muslims and Christians. For the persons who declare a "traditional religion", half have never migrated after approximately 20 years of stay.

Kaplan-Meier failure estimates, by Religion
from 1983 to 2002
- Traditional Muslim Christian
Duration of stay (years)