Migrants mortality advantage: Investigating the social determinants using classification trees

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Abstract

The migrant mortality advantage has been widely identified in Western countries. In Switzerland, it concerns the whole foreign population although migrants become more and more heterogeneous. There isn't probably only one explanation about the process which leads to a lower mortality rate among migrants. Therefore, the social determinants of mortality – demographic, migratory and socioeconomic factors – should not have the same impact among all individuals. Applying model-based recursive partitioning on a census cohort of the whole Swiss population followed between 2001 and 2008, we detect interactions between the social determinants of mortality in order to disentangle the paths to migrant longevity. In this paper, We will emphasis the differential impacts of social factors between migrants and natives, and among migrants. We will be able to assess the conjunction of factors which leads to vulnerability or, in the opposite, which brings high probability of survival.

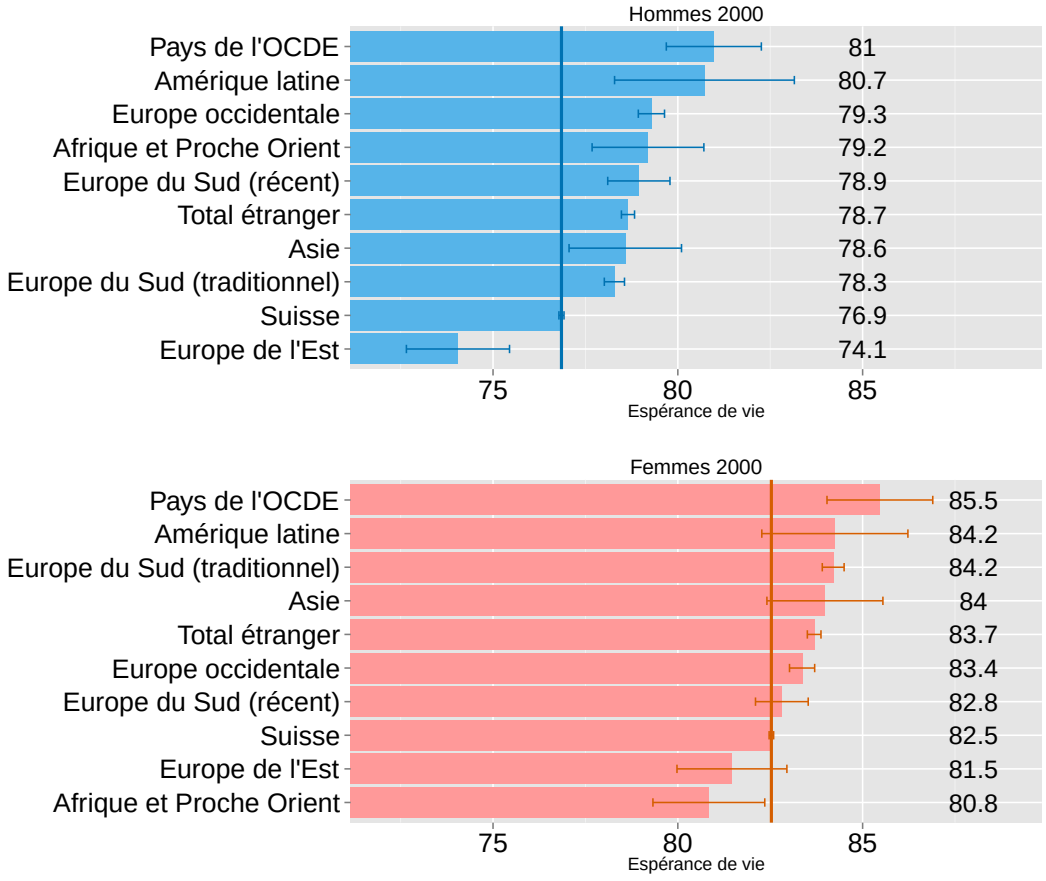
Observed for the first time about 35 years ago (Markides and Coreil 1986), the migrant mortality paradox has been widely studied in Western countries. A paradox emerges as the mortality among migrants is lower than the natives although they have a lower socioeconomic status too. This matter was first depth in the United States, where it is called the Hispanic mortality paradox because of the large population of Latin America who emigrates and lives *peculiarly* longer than the natives. In Europe, there are fewer studies but Khlat and Darmon (2003) seek if, like Hispanics in the USA, there is a Mediterranean paradox touching migrant populations originating from around the Mediterranean Sea. Some researches demonstrate that the migrant mortality advantage affects not only one origin but the whole migration phenomenon (Uitenbroek and Verhoeff (2002) in Netherlands, Deboosere and Gadeyne (2005) in Belgium and Kohls (2010) in Germany for example).

This longer longevity among migrants was problematic for academics who tried to decrypt it. Many papers focus in establishing if the migrant mortality advantage was real, namely if some direct or indirect factors could explain it, or if it has to be explained by biases in the data or in the measurement. It still remains today difficulties to have the last word and the good answer is probably nuanced. Actually, there are some important biases in selective migration for in-migration as much as out-migration but these biases are not sufficient to explain the whole mortality advantage (Abraido-Lanza et al. 1999; Palloni and Arias 2004; Deboosere and Gadeyne 2005).

Until today, only little attention was paid on migrants individual determinants of mortality. Socioeconomic factors are indeed widely used in regression models, in the purpose of control, to define, *ceteris paribus*, if migrants have more risky behaviors, are in worse health or have a higher propensity to die than the natives. But these factors aren't interpreted for themselves and, more important, aren't taken in their whole complexity. Detecting interaction effects, this paper aims to disentangle the differential impacts of the social determinants on one hand, between migrants and natives, and on a second hand, among migrants.

With today more than 23% of foreigners, Switzerland is a country with one of the most important proportion of migrant populations. Since the second world war, most of the migratory flows were workers and their family who answered to the need of the Swiss economy for low skilled workforce: first of all from Italy and Spain and later from Portugal, Yugoslavia and Turkey essentially. During the last two decades, the flows diversified, the purposes of migration as well. Today, immigrants come more and more for high skilled occupation but still fill the jobs at the bottom of the social scale. The diversification of the origins and the polarization of the working world turn the migrants in more heterogeneity.

Figure 1: Life expectancy with a 90% confidence interval among foreigners groups living in Switzerland, 2000



Sources: OFS/SNC

However, the mortality advantage measured in Switzerland takes place in (almost) the whole foreign populations (figure 1). But as we said, migration flows evolve and different dynamics govern the migrants who became more heterogeneous as the figure 3 exemplifies it. Using data mining methods, this paper aims to detect the interactions between individual factors which

leads to vulnerability or, in the opposite, which brings high probability of survival. This paper is an opportunity to understand differentiated paths to migrant longevity.

Data

The data used come from the Swiss National Cohort (SNC), a longitudinal research platform based on the linkage of individual data from the national census. Probabilistic record linkage methods were used to assign each death or emigration record (2000-2008) to a record in the census data set (Bopp et al. 2009). Our population of interest is resulting from a migration and will be measured by the foreigners permanently residing in Switzerland. It's a fairly large subpopulation with approximately 1'495'000 individuals counting for 20.5% of the whole Swiss population in 2000.

Table 1: Variables used in the analysis.

Demographic	
	Age
	Sex
	Marital status
	Living with a partner
Socioeconomic	
	Highest completed education
	Employment status
	Socio-professional category
	Learned trade
Migration	
	Nationality
	Country of birth
	Nationality of the partner
	Used language at home (only for foreigners)
	Length of stay (only for foreigners)
	Naturalization (only for Swiss)
	Second nationality (only for Swiss)
Context	
	Region
	Urban

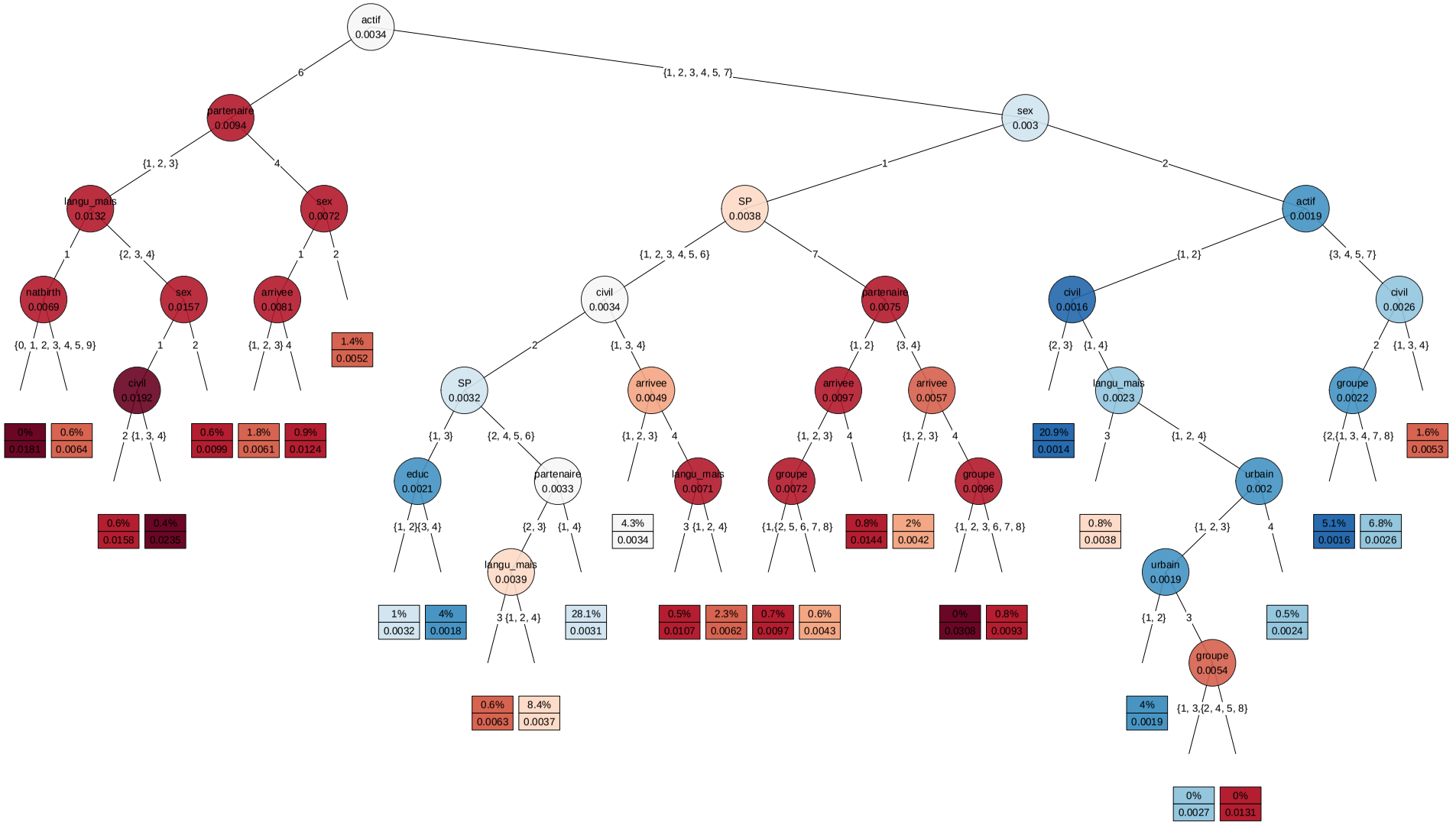
We exclude for the analysis the people who were less than 20 years and above 85 in 2000. We also had to exclude 8% of the foreigners who have not been linked with the statistics for foreign resident and whose we don't know if they survive the observation time or leaved the country. So we followed between 2001 and 2008 a whole Swiss cohort who lived 53'888'823 person-years and knew 480'686 deaths. For the foreigners only, it represents 9'456'945 person-years and 30'779 deaths. Among the foreigners, about 9% leaved Switzerland before the end of 2008. The census is a gold mine for social variables, we choose to select in our models the variables listed in table 1. There are demographic, socioeconomic, migration and contextual dimensions. All of them play in overall a significant role in explaining migration. Migrant groups are defined according to table 2.

Methods

Using quasi-poisson rate models (Cameron and Trivedi 1998), we first model the mortality risk according to individual factors. Regressions models, especially when there are many explanatory variables, aren't appropriate to highlight interactions. Adding all possible interactions is time consuming with large datasets and the results are not easy to interpret. If we are not interested in the mean effect, interactions are yet essential.

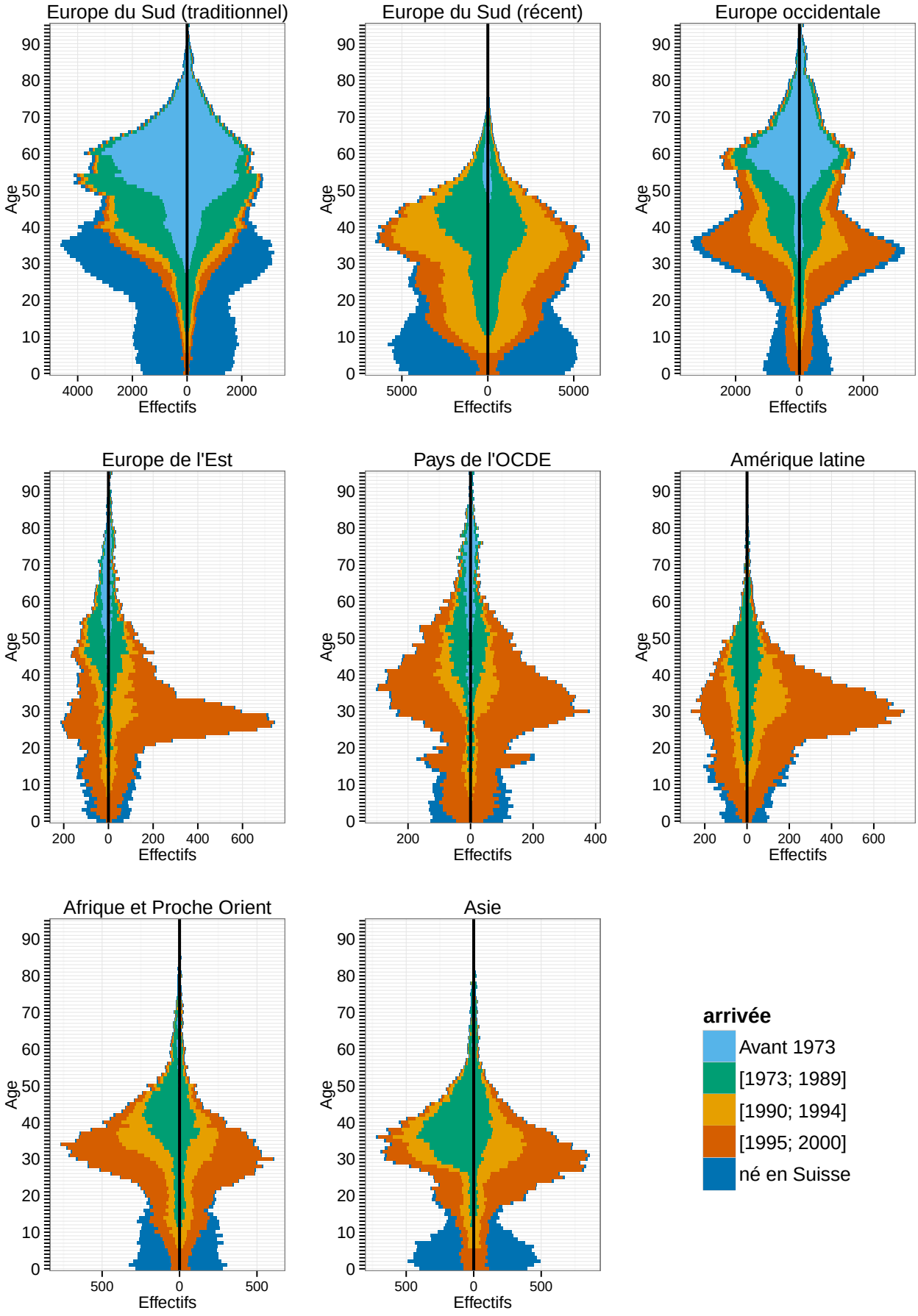
To detect interactions, we use a data mining method, classification trees. These trees are usually used to predict an issue according to input variables but, they actually emphasis interactions. At each node, the dependent variable splits into two subsets depending to the more discriminant variable: it creates a hierarchical structure in which each leaf depends on previous splits. The «classification and regression tree» (CART) is the mainly used method but as, mortality depends highly on age, and we don't want every split be caused by age. We therefore use model-based recursive partitioning (Zeileis et al. 2008) which can deal with control variables. The figure 2 is an example of the trees we can build. It classes the foreign population according to a conjonctions of most discriminant factor influencing the mortality rate: there isn't one way to high or low mortality, interactions brings out some factors which plays together a determinant role in explaining longevity.

Figure 2: Example of a preliminary classification tree of factors determining death for foreigners aged 45 to 64 living in Switzerland in 2000.



Sources: OFS/SNC

Figure 3: Population pyramids of foreigner groups by years of arrival, Switzerland 2000.



Sources: OFS/SNC

Table 2: Foreigner groups used in the current analysis (ordered by the size of the population living in Switzerland).

1	**Migration traditionnelle d'Europe du Sud**
	Italie, Espagne, Grèce.
2	**Migration récente du Sud de l'Europe**
	Ex-Yougoslavie (Serbie, Bosnie-Herzégovine, Croatie, Slovénie, Monténégro, Macédoine), Portugal, Turquie.
3	**Europe occidentale et du Nord**
	Allemagne, France, Autriche, Royaume-Uni, Pays-Bas, Belgique, Suède, Danemark, Finlande, Liechtenstein, Norvège, Irlande, Luxembourg, Islande, Malte, Saint-Marin, Andorre, Monaco, Cité du Vatican.
4	**Europe de l'Est**
	Ex-Tchécoslovaquie (République Tchèque, Slovaquie), Pologne, Ex-URSS (Russie, Ukraine, Biélorussie, Estonie, Lettonie, Lituanie, Moldavie, Arménie, Azerbaïdjan, Géorgie, Tadjikistan, Ouzbékistan, Kazakhstan, Kirghizistan), Hongrie, Roumanie, Bulgarie, Albanie.
5	**Autres pays de l'OCDE**
	Etats-Unis, Canada, Japon, Australie, Israël, Corée (Sud), Nouvelle-Zélande.
6	**Amérique latine**
	Brésil, Chili, République dominicaine, Colombie, Pérou, Argentine, Mexique, Uruguay, Equateur, Bolivie, Cuba, Venezuela, Haïti, Jamaïque, Paraguay, El Salvador, Guatemala, Costa Rica, Dominique, Honduras, Panama, Nicaragua, Trinidad-et-Tobago, Guyana, Barbade, Bahamas, Sainte-Lucie, Belize, Antigua-et-Barbuda, Grenade, Saint-Kitts-et-Nevis, Suriname, Saint-Vincent-et-les-Grenadine.
7	**Afrique et Proche-Orient**
	Maroc, Algérie, Congo (Kinshasa), Ouganda, Jordanie, Tunisie, Iran, Angola, Ethiopie, Yémen, Oman, Cameroun, Irak, Liban, Egypte, Afrique du Sud, Cap-Vert, Maurice, Ghana, République centrafricaine, Kenya, Soudan, Nigéria, Côte d'Ivoire, Seychelles, Afghanistan, Syrie, Madagascar, Libye, Rwanda, Congo (Brazzaville), Tchad, Burundi, Guinée, Namibie, Qatar, Togo, Somalie, Sénégal, Zimbabwe, Chypre, Bénin, Burkina Faso, Gambie, Arabie saoudite, Koweït, Libéria, Mali, Sierra Leone, Palestine, Tanzanie, Mozambique, Guinée-Bissau, Gabon, Niger, Mauritanie, Zambie, Emirats arabes unis, Lesotho, Malawi, Swaziland, Djibouti, Bahreïn, Guinée équatoriale, Botswana, Sahara occidental, Comores Sao, Tomé-et-Principe.
8	**Reste de l'Asie**
	Sri Lanka, Vietnam, Chine, Inde, Thaïlande, Philippines, Cambodge, Pakistan, Malaisie, Indonésie, Laos, Taïwan, Bangladesh, Singapour, Corée (Nord), Népal, Myanmar, Mongolie, Maldives, Bhoutan, Brunei.

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