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The migrant mortality advantage: The effects of nationality, nativity and social characteristics on the mortality risk of the Brussels population, 1991-1996

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Abstract

Past research indicates that migrants have lower mortality than host populations, but leaves open the question of whether this is inherent in the migrant status, or reflects particular properties of the migrant population. We attempt to disentangle these two elements, focussing on the population of Brussels, as enumerated in the Belgian census of 1991, linked with all deaths over almost 6 years. Fewer than half this population was locally born of Belgian nationality, and over a third were either born abroad, or of non Belgian nationality, or both. Most non-Belgian and foreign-born populations had a lower mortality risk than the native Belgian population. Controlling for social characteristics lead to a further reduced relative risk for non-Belgians, but the effect of nativity remained unchanged. Comparing these rates with the relative risks of migration suggests that it is unlikely that these results can be explained through administrative loss due to unrecorded emigration.

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1. Introduction

Geographically, socially, and today also politically, Brussels is at the crossroads of Europe. Not surprisingly, the Brussels population is characterised by a large and very heterogeneous immigrant population. Yet unlike many other European capitals, few of these migrants have reached Brussels because of specific historical ties between their locations of origin and destination, as for instance, in the case of former colonial country residents migrating to the *soi-disant* "mother country". Rather, migration to Brussels has been far more directly related to work opportunities and pre-existing migration chains. In the present analysis, we seek to follow the fortunes of these migrants with respect to their survivorship in their new land. In particular, we shall consider the mortality risks of migrants from different countries of origin, in comparison with their locally born Belgian counterparts, and consider to what extent such differential risks may be accounted for by differences in the social conditions in which they live.

Brussels is a particularly propitious location for such an analysis. The concentration in Brussels of so many international institutions (European Community, NATO, etc.) has led to the growth of a large and very heterogeneous international population, across a broad range of social locations, ranging from unskilled job seekers at one end of the scale to well-established career officials at the other. Of the population of close to 1 million living in the Brussels region at the time of the 1991 Census (March 1st, 1991), over a quarter (28 per cent) were non-Belgian, of whom two thirds (68 per cent) were born abroad; and of the Belgian nationals, too, almost one tenth (9 per cent) were born abroad. Thus, only 65 per cent of the resident population were native born Belgians, and of these only two-thirds were actually born in Brussels. Of the other 35 per cent, almost half were of European origin; a third were from Morocco or Turkey, and the remaining fifth were from the rest of the world, including Africa, Middle East, Asia and North America.

Nonetheless, the analysis of mortality in such a population is necessarily problematic. Any attempt to analyse mortality risks must necessarily focus on the number of deaths relative to a known base population, over a time period long enough for a consistent estimate of the rate to be made. Yet a population with such a large proportion of migrants is liable to be a very changeable population, as people enter and leave over relatively short periods, and such mercurial and volatile populations, though they may make for a lively city, are a demographer's nightmare! To deal with this problem, we shall consider the group-differential probabilities of emigrating, as well as those of dying. Although we cannot register or impute unrecorded migration of residents, we hope that by such a comparative analysis, in which we can identify groups with a high propensity to emigrate, we shall be able to evaluate the reliability of our estimates of the relative risks of dying for the different population groups.

Although a number of recent mortality studies have been able to follow up large scale populations over a long time (see for example Rogers, 1995; Oman & Reed 1998; Hummer, Rogers et al.1999; Koenig et al., 1999) the number of persons in the initial cohort followed up has usually been no more than a few thousands. Some, indeed, have followed up over an extremely long time (Strawbridge et al. 1997) and the English OPCS longitudinal survey has been able to base itself on a very large sample (Fox & Goldblatt, 1982; Harding, 1995) over

a long period of time, but rarely have mortality analyses been able to follow up whole populations (for a review, see Fox, 1989). The present analysis is able to base itself on precisely such a follow up of the full population enumerated in Brussels at the time of the 1991 census, through linking with the death records in the Belgian national population register (Deboosere & Gadeyne, 1999) over almost six years, from March 1st 1991 to 31st December 1996.

2. Migrants in Belgium: a historical overview

The demographic history of Belgium is the history of migration, and of migrant settlement. Indeed, as Lambert (1992) points out, to think of Belgium without migrants would be quite preposterous (*sagrenue)*. Belgium, and Flanders in particular, has been a trading centre for the last millennium at least, and the same geographic conditions which made the Southern Netherlands a natural route for armies crossing Europe, not only facilitated trade, but also made it a natural passageway, and point of settlement, for migrants. There has, however, been a qualitative growth in the number and concentration of migrants in the past two centuries, both in Brussels and in Belgium as a whole, and it is these which have largely formed the present native population and, of course, the current migratory population.

Although Brussels has long been the provincial capital for the area approximately covered by today's Belgium, its population growth only began with the creation of the Belgian state in 1830. De Schaepdrijver (1990, reviewed by Lynch, 1997) notes that the population of Brussels, which was only 76,000 in 1800 had grown to 235,000 by 1856. This tripling of the population implies an annual average growth rate of 20/1000. If we assume growth at the national annual growth rate before 1830, the Brussels annual rate exceeds 35/1000 per year after independence, compared with an annual growth rate for Belgium as a whole of about 7/1000 (Lesthaeghe, 1977, pp.7-8). By 1842, de Schaepdrijver notes, migrants made up 43 per cent of all the Brussels population. Of these migrants, about one sixth were of non-Belgian origin (7.5 per cent of the total population), mostly educated Francophones attracted in to staff and manage the burgeoning state services. Belgian migrants, by contrast, were mainly Flemish artisans and peasants pushed off the land, and were thus divided both by class and culture from the Francophone élite (which suggests that Flemish Brussels became Francophone as much by lower class Flemings taking on the language of the Francophone élite as by the influx of Walloons). The smallness of the country, and the rapid growth of the rail network led to the growth of Brussels and Antwerp as the main commercial centres (Lesthaeghe, 1977) and the growth of industrialisation in Wallonia further fuelled the growth of Brussels as its commercial and service centre. It is to be noted, however, that Brussels never grew to be a primal city as have other capitals (London, Paris, etc.). Rather, the later development of Belgium at a time of far better communications, coupled with the relatively short distances, has led to a far more gradual distribution of city sizes (Brussels, with almost a million inhabitants, has about 10 per cent of the Belgian population, but Antwerp, 50 kilometres away, has close to half a million residents; Charleroi, Gent and Liège have about 200,000 and Namur and Brugge have about 100,000 each, see NIS, 1992, pp. 14-35).

In the twentieth century both the country of origin, and social standing, of the migrants to Belgium changed dramatically. Between the world wars most migration was of contract labour, in particular Italian, recruited for the mines and heavy industries of Wallonia and Limburg (in Flanders). After 1945 these industries began to decline, to be replaced by a growth in the service sector and more modern industries, mainly in Flanders, and migration, still mainly European, moved with the economy (Grimmeau, 1984; Lesthaeghe, 2000). However, the post-war boom was felt across Europe, and employers looked further afield for recruiting cheap labour, mainly to Turkey and Morocco. In 1961 immigrants from these countries numbered only a 1,000, but by 1991 their number had grown to a quarter of a million (Lodewijckx, 1995). As with the Italian recruits of the 1920's, what began as temporary recruitment soon became circular and then more permanent as contracts were repeatedly renewed (Reniers, 2000). Active worker recruitment ceased in the late 1960's with the economic slowdown, and new immigration has been restricted to family reunions since the early 1970's. Nonetheless, the strong localisation of these populations, in particular the Turks, together with the maintenance of strong ties with the towns and villages of origin, has led to a large movement of imported brides and grooms (Lievens, 2000). At the same time, Zairean (Belgian Congo) independence led to an influx of migrants from Africa; and the setting up, and expansion, of the European headquarters in Brussels led to the growth in migration of white collar European workers, many, but not all, on a short term basis.

Over the past 200 years, then, Brussels has grown more than tenfold. In the process, it has become a heterogeneous centre of international migration in which first and second generation immigrants make up over a third of the population. Our aim in the following pages is to consider how their mortality experience differs from that of the native, Belgian residents of Brussels.

3. Social Correlates of Mortality

3.1 The Mortality of Migrants

There is a consistent finding, in most of the literature, that adult migrants have lower mortality than the host population, although their children may have a higher level of mortality (Maffenini, 1980; Peters & Van der Veen, 1990; Rosenwaike, 1990; Sharma et al., 1990; Young, 1991; Choinière, 1993; Abraído-Lanza et al., 1999). Only Wild and McKeigue (1997) report a higher level of mortality for migrants. In Belgium, Maffenini (1980) reported that immigrants to Belgium, around 1970, showed lower mortality, for both sexes and at all ages except males under 5, and Peters and Van der Veen (1990) reported a greater risk of stillbirths and perinatal deaths for Turkish and Moroccan mothers in Belgium. Choinière (1993) showed that life expectancy at birth in Montreal census tracts rose as the proportion of migrants rose, controlling for wealth, but so did infant mortality, and Sharma et al., (1990) reported that all immigrant groups to Canada have higher life expectancy than the native Canadian population and, except for Africans, higher life expectancy than their populations of origin; Rosenwaike (1990) reported lower cancer and circulatory mortality for Puerto Ricans in the United States than US whites, but higher levels of external-cause mortality; and Young (1991) showed the same result for immigrants to Australia. Abraído-Lanza et al., (1999) consider the possibility that this reduced mortality is a statistical artefact deriving

from migrants' undocumented return home ("salmon bias," reflecting a salmon-like tendency to return in old age to one's place of birth) but reject this explanation on the grounds that Cubans and Puerto Ricans, two groups to which the salmon bias could not apply, also show reduced mortality. They also reject a selection of healthy migrants effect, arguing instead for a healthier life-style among Latino migrants to the United States, an advantage that is lost with acculturation, although Browning and Feindt (1969) did report, for instance, that migrants to Monterey, CA were educationally advantaged compared with their region of origin. By contrast, Wild and McKeigue (1997), comparing standardised mortality ratios for migrants into England and Wales around the 1971 and 1991 censuses, report a higher level of mortality for all except Caribbean migrants, who have lower mortality, particularly from ICD and cancer. Here too, however, this advantage cannot be attributed to social class, given the overwhelming concentration of Caribbean immigrants in blue-collar occupations.

This English evidence is not to be treated lightly, but the weight of the evidence does appear to be in the other direction, namely, that adult migrants show *reduced* mortality in comparison with the native population, but children of migrants, especially young children, show a higher level of mortality. Previous research has indicated this to be the case for Belgium in previous decades, and we may expect the same to be true for migrants' experience in the 1990's.

3.2 Other Social Correlates

Migration is but one of many social statuses and conditions which affect the risk of dying, and may not necessarily be the most important. In order to see the effects of migration on mortality, and to identify specific affects attaching to different migrant groups, it is important to allow for the different social conditions under which the different populations live. We shall focus on three particular aspects of these social conditions:

i. the effects of *household structure* on mortality risks is well established (Gove, 1973; Kobrin & Hendershot, 1977; Trovato, 1998), with married people, and those with parental responsibilities, tending to have lower levels of mortality than the unmarried. The census data enable us to identify couples living together *de facto*, whether married or not, as well as those couples and single adults who are parents tio children living at home. There is, naturally, a certain fluidity in these self-definitions, particularly for households with adult children leaving home, but in general they should be sufficient to capture the major effects of these living arrangements on mortality risks.

ii. the relationship between *material resources* and mortality is too well documented to require extensive justification (see for example Antonovsky, 1967; MacIntyre, 1997). From our brief review of the history of Belgian immigration, above, it is clear that migrants from different waves, and different geographic origins, are likely to live in very different social circumstances, with respect to the material resources at their command and their working conditions, and if not controlled statistically, these different distributions are liable to cloud the direct effects of migration status on mortality.

iii. *education* is an important indicator of mortality risks, though often an indirect one. On the one hand, education is a key to social rewards, in particular steady employment and high income (Wright, 1978), and education also directly affects patterns of behaviour, in particular the use and access to medical information and services (Caldwell, 1993; Schrijvers et al., 1999). But educational is more than a correlate of material welfare and learned behavioural patterns. Education, and in particular educational certification, also creates socially meaningful membership categories by ritually certifying individuals as members, and legitimates the social rights and meanings associated with these categories (Kamens, 1977). It is (using the terminology of Borocz and Southworth, 1996) an individualised cultural capital which grants the holder a certain role (prestige, rights, obligations) irrespective of his/her ability to realise the implied material potential in the labour market (Apodaca, 1998). Indeed, when this realisation is seriously impeded, as for instance by discrimination, the result may be to *reverse* the normal association between higher social status and lower mortality (Anson, J., 1992).

4. Migrants in Brussels: social locations

4.1 The Migrant Populations

Before analysing the effects of particular migrations statuses on mortality, we commence with a brief overview of the social location of various migrant populations in the Belgian capital. This overview is necessarily cursory, and is designed to give the reader a brief sense of who the different groups of migrants are, and how they are distinguished from their native Belgian counterparts. Any definition of migrant status is problematic, and begs many questions as to who is a migrant, or a Belgian, or both. For the purpose of this analysis we have considered three separate issues:

1. Declared nationality at the census, Belgian or non-Belgian;
2. Place of birth, in Belgium or abroad[1];
3. Origin, by national affiliation and place of birth:
    i. Brussels for Belgian nationals born in the city of Brussels;
    ii. Flemish for Belgian nationals born in Flanders[2];
    iii. Walloon, for Belgian nationals born in Wallonia;
    iv. Major population groups, by nationality, or place if birth if nationality is Belgian or unknown:
        a. France
        b. Italy
        c. Spain
        d. Northern European
        e. Southern European (Mediterranean littoral and Israel)
        f. East European (ex Communist)
        g. Africa (South of Sahara, excluding South Africa)[3]
        h. Asia
        i. Morocco
        j. Turkey

k. Middle East (Iran, Arab West Asia, North Africa)
l. Other and unknown (all other countries with fewer than 1 per cent of the population: North and South America, South Africa, Oceania)

Table 1 About Here

Table 1 presents the breakdown of the population by these categories. Overall, 42.3 per cent of the Brussels population at census were Belgians native born in Brussels, and a further 23 per cent were Belgians born in Flanders or Wallonia who had moved into Brussels. A further nine per cent were locally (mostly Brussels) born but of non-Belgian nationality, of which Moroccans made up almost half, and Italians and Turks more than 10 per cent each. The largest group of non-native origin is the Moroccans, followed by a number of European groups, in particular the Italians, the French and the Spanish, and then the Turks. Some comparisons between the columns are also instructive indicators of the patterns of migration. For the population of East European origin and those of African origin, over half the population are Belgian nationals born abroad, but note this also includes expatriate Belgians who came to Belgium after the African colonies became independent; for the French and other North Europeans almost a third, and for Middle East and Others, close to a quarter are Belgian nationals born abroad. For the Southern Europeans, the Moroccans and the Turks, by contrast, fewer than five per cent are in this category. On the other hand, the ratio of non-Belgians locally born to those born abroad is almost at parity (9:10) for the Moroccan population, is slightly lower for the Turks (2:3),and is lowest for the North Europeans (1:5), suggesting clear differences not only in the fertility patterns of the different groups of migrants, but also in their stages of family life cycle. Table 1 also presents mean ages for the different population groups, from which it can be seen that the Flemish and Walloon population are considerably older[4] than the rest of the population, as are the Eastern and Northern Europeans, while the Mediterranean, African and Asian populations are considerably younger.

4.2. Age Distributions

Figure 1 About Here

Figure 1 presents the age distribution of the Brussels population at the time of the census, broken down by nationality (Belgian or Other) and place of birth (Belgium or Other). The central columns, representing the Belgian born Belgian nationals, shows a typical European pyramid, with a baby-boom bulge in ages 25-44 (birth years 1947-1966), a decline in subsequent cohorts, particularly those born 1972-1982, and a slight increase in the last decade, largely reflecting births to the larger age cohorts in the reproductive years. Above age 70 there is a dramatic decline in the proportion of males, a combination of heightened mortality, war losses and sex-selective migration. The current low level of indigenous fertility can be judged from the observation that from age 20 to age 84 there are actually more Belgian born Belgian national women in each age group than in the youngest, age 0-4 cohort. The second layer, of Belgian nationals born abroad, very much follows the pattern of those

locally born (the correlation between the two columns=0.96), and offers no special insights. The third layer, of children born locally to foreign parents, indicates that they make up a third of locally born children, though the proportions decline dramatically after age group 15-19. Foreign nationals born abroad, by contrast, the fourth layer, are predominantly to be found in the working age groups 20-44, in which ages they constitute up to a third of the population; and to a lesser extent in ages 45-69. From age 60, however, there are clear signs of a decline in their proportion in each age group, reflecting variations in the period of migration, as well as a probable return home of pensioners to their home countries.

4.3. Household Type and Composition

The census data present a variety of information on the type of household, its composition, and the individual's position within the household and the amenities available. In part these data may be taken as directly indicative of the person's health and other statuses, as in the 1.4 per cent of the population who were not living in private households, almost one half (49.6 per cent) of whom had died and 5.3 per cent emigrated by the end of the study period, compared with 6.2 per cent died and 4.7 per cent emigrated in the rest of the population. As we shall see, this is a difference which cannot be accounted for just by the difference in ages between those not in private households (median age 79.5) and the rest of the population (median age 36.7).

The census also provides information on the household composition and individuals' role within the household. Almost a quarter of children were living in single-parent households, one sixth of parents were single parents, and over a third of adult householders were living alone. For the purpose of this analysis, we designated individuals by their household role: whether they were children living in an adult-headed household; whether they were living in partnership (married or cohabiting) or single-adult household; whether they were parents to children in the household, and whether they were single parents (interaction of parent and single-headship). We also distinguish between those who are, and are not, living in private households.

Table 2 About Here

Table 2 presents the proportion of each of these dichotomies, by population group. Children are heavily under-represented in the Flemish and Walloon groups, and they are also a relatively small proportion of the North and East European populations. They are over-represented, on the other hand, in the Moroccan and Turkish groups. These two groups, as well as the Southern Europeans, have a relatively high proportion of adults living in partnership, whereas the North Europeans and Africans have relatively few. The Turks, Moroccans and Southern Europeans also have a high proportion of the adult population as parents, whereas the Flemish, Walloon and North European populations have a relatively low proportion. Indeed, for Moroccans, Turks and Africans the more than three out of four partnerships are parents, whereas for the Flemings and Walloons, by contrast, less than a half of those living in partnership are parents with children at home. This suggests that the small proportion of Flemish and Walloon children may not just be a matter of Brussels born children being assigned away from their parents, but that there is a real difference in fertility

level between the Brussels-born and the other-born Belgians. Single parenthood is fairly similar across all groups, except for the Africans, among whom the proportion is relatively high. There is a also a relatively high proportion of Flemings, Walloons and East Europeans not living in private households (mainly institutions and old-age homes), and a relatively low proportion of Moroccans, Turks and Southern Europeans. We thus see a clear distinction between the more family centred Moroccan, Turkish, and Southern European (including Italian and Spanish origin) populations on the one hand, and the more independent North European (including Belgian) populations on the other.

4.4. Material Resources

Although the census does not provide information on household income, it does provide a variety of information on household amenities, sources of household income, and work. Between them, these data enable us to broadly identify the physical quality of life of the various sectors of the population. The distribution of some of these variables, by population group, is provided in Table 3.

Table 3 About Here

4.4.1. Household Amenities: One major reflection of individuals' physical quality of life is to be found in the quality of housing, here defined by the amenities at the household's disposal. The census asked a number of questions concerning basic household amenities, on the basis of which we constructed a scale of physical quality of housing. The items do not scale perfectly, but their order does reflect, in an intuitive way, a ranking of essentials for modern living. It is to be noted that this scale is similar to, but not identical with, the Housing Comfort scale constructed by the Belgian National Institute of Statistics. Our scale was built as follows:

* one point for running water, a flushing toilet, and a kitchen
* one point for a bathroom
* one point for a telephone
* one point for a car *or* a dining room
* one point for a car *and* a dining room

The scale itself was the sum of points for the household, ranging from 0 (below minimum standards) to 5, which may be termed middle class comfort. For the last two items (car and dining room) we allowed for various different preferences and needs among the population, though car ownership was considerably more prevalent than a dining-room. The scale itself is skewed (the modal category is 4, and 57 per cent are in category 4 or 5) indicating that more information at the upper end of the scale is required, and over 10 per cent of the population report no amenities. Most of this last group also report no income information, a combination that is almost certainly indicative of missing data rather than a total lack of resources. An indicator variable was therefore created to identify this group. The first column of Table 3 presents mean values of the amenity scale, by population group, excluding the 91,988 (9.6 per cent of the population) for which this information is assumed missing. The Brussels born population has higher values than other groups, and the Turkish and Moroccan populations, as well as the Southern and Eastern Europeans, have lower values.

4.4.2. *Owner occupancy* was not combined with the amenities scale, as it is very possible that a large proportion of foreign nationals temporarily in Brussels are renting, and not buying, their homes. Proportions living in owner-occupied housing are presented in the second column of Table 3, from which we can see that, as expected, Belgians are more likely to be owner-occupiers than other groups, and in particular the non-European groups (but not the Turks and Moroccans) are particularly low on this variable.

4.4.3. *Income* The third column of Table 3 indicates the proportion of each population group living in a household with at least one full time income. Again, the Brussels population, of which over half the population live in such households, is better endowed than the other groups, in particular the North and East Europeans. As this proportion refers to the whole population, not excluding those identified earlier as probably having missing data, this column should be read as a lower bound, giving the proportion *known* to have at least one full time income. In practice, this is almost certainly an underestimate.

4.4.4 *Work* The final three columns of this table provide information on the work situation. Column 4 presents the proportion not working among the population under age 65 who are not full time students, effectively the proportion unemployed or not in the labour market. As this is a condition that is likely to mean very different things to men and to women, we present the distribution of this variable separately for each. As is to be expected, the proportion of labour force participation is considerably higher among the men, but for both men and women the major contrast is between the Belgian population groups and the rest. Among both groups, the level of non-employment is relatively high among the Moroccan, Turkish, and Middle East populations. For women, Asian and South Europeans also have a high level of non-employment, and African women have a relatively low level (higher than the Belgians, but lower than most other immigrant groups).

4.4.5. *Work-Control* Finally, Column 6 presents the proportion of the working population in each group who have managerial responsibility for the work of others. The two main groups with a high level of managerial responsibility are the North Europeans and the Others, and to a lesser extent, the Flemish and the Walloons. On the other hand, Moroccans, Turks and South Europeans have particularly low levels of managerial responsibility.

Taken overall, we can see clear differences between the population groups in their levels of material endowment, with a clear contrast, in particular between the Belgians and the North Europeans on the one hand, and the South and non-European populations on the other. Clearly, there are other factors which need to be taken into account in interpreting these gross characterisations – the length of time in the country; individuals' status as student, refugees or short term worker in the European bureaucracies – but it is clear that geographic origins say much about the material conditions under which people live in the Belgian capital.

4.5 Education

Census information on education relates to the age at which the person stopped studying; the current education status (whether studying or not, full or part time), and the highest certificate obtained. By subtracting six from the age at which studies ended we obtain an estimate of the years of education, but this is not without its problems. There are a number of people still studying at age 30 or above who have no certificate, not even primary education, and, on the other hand, there are others with a higher education degree who have fewer than 10 years education. There are also a large number for whom the number of years education is unknown. We restricted the number of years education to a maximum of 20, but apart from that, we prefer to assume that for most of the population the data (obtained by declaration and in no case cross-checked against certificates) is reliable. By combining four pieces of information: the present education status (studying or not studying); number of years education (set to zero if unknown); a dummy variable for unknown years of education, and the highest certificate so far obtained (secondary or tertiary) it is hoped that most of the misinformation will cancel out and we shall obtain a fair estimate of the effect of education on the risks of mortality. It is to be noted that the indicator for unknown years of education, and that for no amenities or income, while not independent, are not identical: although about 10 per cent of the population are missing on each of amenities/income and years of education, fewer than 1.5 per cent are missing on both.

Table 4 About Here

Table 4 presents proportions of each population group age 18-25 who are studying (education is compulsory up to age 18); and for the population age 25 and over, the proportion who have a secondary or higher (tertiary) education certificate; the mean years of education and the proportion with years of education unknown. The highest proportion studying are the Africans, and the lowest proportion are the Turks, but this is more than just the reflection of student populations. The African population also has the highest proportion over 25 with a secondary or tertiary diploma and the Turks the lowest. The Moroccan population, on the other hand, has almost 40 per cent of people of student age studying, but is second only to the Turks in the small percentage with secondary or tertiary diplomas, and also has a low mean years of education. There is a high correlation between these three education variables (the first principal component accounts for 81 per cent of the variation) and within this three dimensional space the populations clearly cluster into three groups: Italy, Spain, Southern Europe, Morocco and Turkey with low levels of education; Brussels, Africa, Asia, Middle East and Others with high levels, and the rest (Flanders, Wallonia, France, Northern and Eastern Europe) who differ from the top group by dint of having fewer current students. In many ways, this reflects the previous distributions on occupation, income and managerial status, but not entirely – note, in particular, the anomalous status of the African population, with a very high level of education, but a potential which is not fully realised on the labour market.

5. Basic Survivorship

The Census was enumerated on the 1st of March, 1991, on which date there were 954,038 residents of known age living in the Brussels Capital region. By combining census information with the recording of death and international migration in the population register (Deboosere & Gadeyne, 1999), we estimated the mortality risk by person-days of exposure, from the date of the census and up to 31st December 1996 inclusive. During this period, 64,112 people were reported as having died, and 43,916 as having left Belgium. Altogether there were 5,250,375 years of exposure, making for a annual mortality rate of 12.2‰ and a migration rate of 8.36‰.

5.1 Definitions

1. *Age:* Age at census was defined by subtracting the date of census (1 March 1991) from the recorded day of birth, and dividing by 365.25, to give an age in years. Where month or day of birth were missing (approximately 2.5% of the population) the date of birth was imputed to 1st July, the median day of the year. For the analysis, we centred all ages at age 40 (approximately equivalent to the total mean age, see Table 1).
2. Duration: Duration to event was defined as the number of days from the census to 1st January 1997, or the date of a terminal event recorded in the population register, whichever came first. The relevant events were:
    a. deceased;
    b. emigrated to known foreign country;
    c. administratively removed from register.

The register also records migration to another commune (in Brussels or elsewhere in Belgium). However, as this is only the *last* recorded entry, we have no indication of population movement between communes, and in particular, we cannot know when the individual left the commune in which s/he was enumerated at the census. *For purposes of this analysis, all individuals who were not known to have died, migrated abroad or been administratively removed, were treated as still resident in their commune of enumeration.* Similarly, the recorded date of emigration, whether recorded as such or administratively removed, must be regarded as recording an upper bound on the exposure duration. It is very possible that the actual recording was made some time after the actual emigration, so that for part of the exposure time the person was not actually living in Belgium.

5.2 Cox regressions: Effects of Age, Sex Nationality and Nativity

The Cox model (Cox & Oakes, 1984; StataCorp, 1997) estimates a non-parametric baseline hazard, or risk, of failure on day(t), conditional on survivorship up to and including day(t-1). Censored cases are removed from the calculation at the end of the recorded day of censoring. Individuals who had not died, migrated or been administratively removed by 31st December 1996 were recorded as censored on the following day.

For each covariate, the model estimates the multiplicative effect of a unit increase in the covariate on the hazard. If h(t) is the hazard at time (t), then the model for the hazard, conditional on covariates $x_1, x_2, \ldots x_n$ can be represented as:

$$h(t|x) = h(t)\exp(\beta_1 x_1 + \beta_2 x_2 + \ldots \beta_n x_n) \quad (1)$$

In the tables below, we present the raw and the exponentiated coefficients ($\exp(\beta_i)$) thus indicating the multiplicative, or proportional, effect of each variable on the baseline hazard (relative risks).

Table 5 About Here

Table 5a presents the baseline analysis for the risk of mortality. In this and subsequent tables we have nested the effects within sex, so that each column shows the coefficient and the relative risk for that group, relative to the native born Brussels baseline, with a global adjustment for males relative to females. Thus, for instance, the expected mortality risk of a 60.2-year old male, of non-Belgian nationality and born abroad, relative to that of a 40-year woman of Belgian nationality and born in Belgium, is:

$$\exp(0.780+0.0759*20.2+0.000215*20.2^2-0.149-0.170) = \exp(2.08) = 8.02$$

His expected risk, relative to a that of a locally born Belgian man of the same age would be:

$$\exp(-0.149-0.170)=\exp(-0.319)=0.727$$

As can be seen, the effects are not only significant, but also substantive. For men the risk is more than double the risk for women; and the positive coefficient for age-squared indicates that the risk increases faster at higher ages (replacing continuous age with five-year age categories did not improve the goodness of fit, and did not change the other parameters significantly). The age coefficients for men and women are almost identical, but the male age-squared coefficient is significantly smaller, indicating a slower mortality increase for men at older ages. Non-Belgians have a lower risk of dying than the Belgians, as do those born abroad relative to the locally born. For men, this advantage is split between nationality (being non-Belgian) and nativity (being born abroad), but for women the substantive advantage is concentrated in nationality. The net effect is that a non-Belgian woman born abroad had an almost 25 per cent net reduced expected risk of dying (0.822*0.938=0.771) in comparison with a locally born Belgian woman. For men the relative risk is 0.728 (=0.862*0.844). The more recent, non-naturalised migrants thus have a considerably smaller mortality risk (allowing for sex and age) than does the rest of the population. However, substantive as some of these relative effects may be, it is to be noted that the model χ^2, at 169,404 is less than 10 per cent of the baseline value without coefficients, indicating that the risk of death over the six years is very much a chance event whose occurrence remains largely unexplained, even when these critical factors are taken into account.

These results for the relative risk of dying should be contrasted with Panel b, in which we present results for the risk of migrating. As is to be expected, men have a higher risk, 56 per cent higher than for women, and the effects of age are negative, but far less than the positive effect for mortality. The differences between the male and female age effects are both significant, indicating a lesser reduction for men than for women in middle age, and a greater reduction in old age. The most dramatic effect is for the foreign born women, who had almost four and a half times the chance of migrating out than did those locally born, an

effect that is slightly less for men; and the foreign nationals, with women showing an almost three times greater chance of migrating than that of Belgian nationals, though this effect, too, is reduced for the men. Overall, the net effect is a more than 12-fold greater risk (2.83*4.45=12.6) of migrating for non-Belgian women who have come from abroad, and 9.38 (=2.34*4.01) for men. Our attention is thus drawn, in particular, to the more recent, non-naturalised migrant population, who are *more* likely to migrate out, but *less* likely to die. Given the problems of registration of emigrants, is it possible that the low mortality risk of foreign nationals reflects unregistered loss of a part of this group from the base population?

Figures 2 and 3 About Here

5.3 Population Origin Groups

To assess the effects of specific origin groups on mortality and migration risks, we reran the analysis, comparing the non-Belgians born abroad; the Belgians born abroad and the non-Belgians born in Belgium with the Brussels base-line population and the natives of Flanders and Wallonia. Figures 2 and 3 present the hazard coefficients (log relative risks) for the different population groups, by sex, nationality and nativity, controlling for age, relative to the Brussels born Belgian population. Each vertical line represents the nested coefficient plus and minus twice its standard error. There is a strong correlation between the male and female risks ($r = 0.706$) and an even stronger correlation between the male and female propensities to migrate in the different origin groups ($r = 0.971$). The mortality risk is generally lower than for the native Belgian population, in most cases significantly so, with the exception of the African population, and most of the locally born foreign nationals. For Flemings and Walloons, the mortality risks do not differ significantly from that of the native born Brussels population. The migration risk is high for all the non-Belgians except the locally born Moroccans, Turks and female East Europeans, and even for the Flemings and Walloons it is higher than for the native Brussels population. As may be expected, the risk of migration is particularly high for the non-Belgians born abroad. The correlation between the mortality and migration risks are negative, but considerably lower ($r = -0.314$, $0.1 > p > 0.05$ for females; $r = -0.267$, $p > 0.1$ for males). For non-Belgians born abroad and for male Belgians born abroad, there is actually a non-significant, positive correlation between the mortality and the migration coefficients. If we assume that unrecorded emigration is an extension of the same processes leading to recorded emigration, and there is thus a high correlation between the two, then it is unlikely that the mortality risks are seriously biassed by unrecorded migration. We may thus conclude that the lower mortality of migrants is in all probability real, and not a statistical artefact.

6. Social locations and mortality

6.1 Household Role and Composition

Table 6 About Here

Table 6 adds in household roles and living arrangements to the basic mortality analysis of Table 5. The comparison group is single (females) living alone in private

households. The relative risk for males is greater than in the baseline equation but the age effects remain largely unaffected, though age-squared, the increase in mortality at the upper and lower ends of the age distribution, are now considerably smaller. There is also little change in the effects of Belgian nationality and nativity. Being a parent significantly reduces the mortality risk, as does living in partnership (married or cohabiting), particularly for males. Being a single parent, by contrast, is risk enhancing, for females more than cancelling out the benefits of parenthood. Individuals in non-private households, mainly old-age homes, have a particularly high risk of mortality, almost twice that of others of the same age and sex living in private households, though we cannot, on the basis of this data, estimate how much of a selectivity factor is at work here. Thus, although there are considerable household effects which reduce the risk of mortality by up to a third (for parents living in partnership), these effects operate independently of nationality and nativity status.

6.2 Work and Material Conditions

Table 7 About Here

Table 7 considers the effects of work and material conditions, with a baseline condition of renting accommodation with no amenities, employed or retired but with no income. The sex coefficient is considerably enhanced compared with the baseline analysis of Table 5, but the age effects remain, again, largely unaffected. Nativity too is unaffected, but the mortality advantage of non-Belgian nationality increases when material conditions are allowed for: for males the coefficient almost doubles and for females it increases by almost 50 per cent. The most noticeable aspect of this table is the greater effect of material conditions on male than on female mortality. Household amenities reduce mortality as does being an owner-occupier, a manager and having a full time income. On the other hand, being unemployed, or having a social security or "other income" increases the mortality risk. However, with the exception of Other Incomes, all these effects are significantly greater for men than for women. For men with "welfare status unknown", i.e. no recorded household amenities or income, there is a negative coefficient equal to 2 points on the amenity scale, whereas for women the effect is small, positive and quite insignificant, suggesting that this lack of information refers to two quite different populations among men and women. Overall, the coefficients for work and material conditions are in line with theoretical expectations, but they also suggest that not allowing for these in the initial analysis has muted the effects of migration status which may actually be *greater* than originally estimated.

6.3 Education

Table 8 About Here

The effects of education on mortality (Table 8) are similar to those of the material and work conditions. Against a base rate of no education, we see that controlling for education increases the relative risk of males slightly, and significantly decreases that of the non-

Belgian population. Those who are currently studying and those that have high school or university diplomas have substantially reduced mortality risks, augmented by the reduced risk deriving from years of schooling (a university graduate with 15 years education has .55 (males) or 0.60 (females) the risk of a person with no education. Education effects are, in general, less for women than for men, except for the effects of actual years of schooling, in which the female effect is marginally (but not significantly) greater. Persons with unknown years of education have the equivalent of 4 years education (males) or 2 years (females), again indicating that this indicator may well mean different things for men and for women.

6.4 Combining the Effects

Table 9 About Here

Table 9 combines the three sets of social effects in order to uncover redundancies among them. The only variable to be dropped was the dummy variable for missing data on years of education. For the rest, we note that with all social variables controlled, the risk ratio for men is now 2.5 the risk for a women in the same situation. There is a significantly lesser relative risk for non-Belgians once social variables are controlled, but the effect of nativity remains effectively unchanged, relative to the baseline analysis in Table 5. With the other social variables included, partnership becomes less salient (but still significant) and single-parenthood has greater adverse effects than in Table 6. Being in a non-private household still increases the relative risk, but compared with Table 7, it would appear that about a half the risk associated with such accommodation derives from the lack of resources. For men, the effects of material and working conditions are reduced when combined with other effects, for women they are largely reduced to insignificance. The same reduction in effect sizes occurs for the education variables, with the difference that the female effect for years' education is now clearly larger than the male effect.

Combining the variables thus indicates that whereas the education and material welfare effects are partly interrelated, and considerably stronger for males than for females, the effects of household role and composition are largely, but not completely, independent.

6.5 Net Effects of Population Groups

Figure 4 About Here

Figure 4 repeats the analysis of Figure 2, presenting the group-specific logged mortality risk coefficients, nested within sex and nationality-nativity. The pattern is almost identical, with a rank correlation of over 0.95 between the gross and net coefficients. Most of the net coefficients (after allowing for the effects of social variables) are slightly lower (more negative) than the gross coefficients, indicating that the social conditions of the migrants are partly concealing their preferential mortality condition. There are certainly no grounds for arguing that migrants' mortality, in comparison with that of the native Belgian population, is an artefact of their particular social conditions within Belgian society. As before, the effect

is strongest for non-naturalised first generation migrants, and marginal, or non-existent, for the second generation migrants, born in Belgium.

7. Conclusion

The linking of records from the population census with death records from the national population register has enabled us to obtain an overview of the relative mortality risks to which the different population groups residing in Brussels were exposed during the final decade of the twentieth century. The general picture which emerges matches closely that depicted for Belgium and elsewhere in most of the literature, namely, a reduced level of mortality for most immigrant groups, in particular those of the first generation. Two important exceptions to this rule were the African populations, in particular the first generation female immigrants, and the second generation Turkish and Moroccan nationals born in Belgium, who also suffered a higher mortality risk. By comparing the pattern of mortality risks with that for recorded emigration risks, we have shown that it is extremely unlikely that these results can be explained by migrants having left the country unbeknown to the population register (salmon bias). Adult migrants thus appear, in general, to enjoy a lower mortality risk than does the indigenous population, but this advantage appears to be specific to the migrants themselves. Children of foreign origin, most of whom were born in Brussels, are much more susceptible to the local conditions in which they live. Further analysis must now consider how much of these mortality differences, particularly at adult ages, reflect living conditions of the populations in Brussels, and how much must be attributed to the particular selection processes which "sift" migrants on their road to Brussels.

8. Notes

1. The census asked two questions: place of birth, and mother's residence at time of birth. For 95 per cent of respondents the answer was identical. We used mother's residence as the definitive question, as being more likely to reflect the social location ion which the individual grew up. In practice, the difference between these two questions is unlikely to have any effect on the substantive results.

2. There is no longer a census question on mother-tongue or main language used. The present categorisation attempts to estimate lower bounds for the Flemish and Walloon populations.

3. Of whom approximately 70 per cent were from the ex-Belgian colonies of Zaire, Burundi and Rwanda.

4. Many of the children of Flemish and Walloon parents were born in Brussels and thus assigned to this latter category, but the opposite is also true. We had considered assigning children to parents' "household origin group" but this required too many arbitrary assignment rules. As our interest is in mortality, a rare event among children, it was felt preferable to leave matters as they stand.

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Table 1: Population Groups by Belgian Nationality and Place of Birth

Population Group	Non-Belgian Born Abroad	Non-Belgian Born in Belgium	Belgian Born Abroad	Belgian Born in Belgium	Total *Percent*	Mean Age
Brussels				64.6	403,342 *42.3*	37.4
Flanders				22.5	140,308 *14.7*	52.4
Walloon				12.9	80,855 *8.5*	53.8
France	11.6	6.3	18.1		37,283 *3.9*	42.2
Italy	11.2	12.7	3.0		33,401 *3.5*	35.4
Spain	9.6	8.8	2.6		26,880 *2.8*	37.0
Northern Europe	10.2	4.5	16.9		32,444 *3.4*	43.2
Southern Europe	9.0	5.5	2.4		22,741 *2.4*	33.0
Eastern Europe	3.1	1.1	12.2		13,694 *1.4*	48.3
Africa	5.0	2.0	21.9		23,646 *2.5*	31.3
Asia	4.1	0.7	6.6		11,934 *1.3*	31.6
Morocco	21.9	42.4	5.6		80,677 *8.5*	23.8
Turkey	7.6	10.9	1.9		24,551 *2.6*	24.5
Middle East	3.7	2.4	4.4		11,313 *1.2*	31.0
Other	3.2	2.9	4.5		10,969 *1.1*	30.4
Total	**183,546** ***19.2***	**88,039** ***9.2***	**57,948** ***6.1***	**624,505** ***65.5***	**954,038** ***100***	**39.5**

Table 2: Household Characteristics, By Population Group

Population Group	Children*	Proportion of population who are: Single Adult**	Single Parent**	Couples No Children**	Couple Parents**	Non-Private Households***
Brussels	36.7	33.6	7.0	28.4	28.2	1.3
Flanders	8.8	37.3	6.1	31.1	23.3	2.5
Walloon	7.1	37.1	5.9	31.9	23.0	2.7
France	20.3	39.9	7.4	22.3	27.9	1.6
Italy	31.8	26.0	6.2	18.3	46.6	0.4
Spain	29.7	22.5	6.1	20.1	47.5	0.3
Northern Europe	15.8	47.3	5.5	23.1	21.5	1.6
Southern Europe	30.6	23.8	5.9	18.0	48.4	0.3
Eastern Europe	14.7	32.8	6.0	26.7	31.6	2.0
Africa	24.2	38.3	9.4	10.0	35.9	1.5
Asia	28.7	31.2	4.2	15.8	43.5	0.7
Morocco	55.5	17.3	6.0	8.9	64.9	0.1
Turkey	49.9	10.8	4.1	9.7	72.6	0.1
Middle East	31.0	33.3	5.0	13.6	43.4	0.5
Other	36.8	38.8	6.7	20.7	30.2	1.3
Total	276,962	222,704	42,794	170,236	209,432	13,157
	29.4	33.5	6.4	25.6	31.5	1.4

Notes: *Children in adult-headed households, percent of total population in private households

** Of adult (non-child) population in private households

*** Of total population

Table 3: Access to Physical Resources, by Origin

	Median Amenities Score*	Percent in Owner Occupied Dwelling**	Percent in Households Full Time Income*	Percent of Working Age Not Working Male	Female	Percent*** Managers
Brussels	3.78	42.5	53.7	33.2	44.5	17.1
Flanders	3.63	42.3	41.1	35.7	49.6	19.3
Walloon	3.61	43.9	39.9	35.8	49.6	20.1
France	3.61	27.8	39.3	50.3	64.8	19.3
Italy	3.70	37.9	44.3	47.9	64.4	12.6
Spain	3.67	24.1	43.9	50.9	66.2	8.5
Northern Europe	3.74	26.7	37.6	51.1	64.3	26.0
Southern Europe	3.53	20.1	43.0	53.2	71.6	10.0
Eastern Europe	3.47	36.5	33.5	53.5	67.8	15.1
Africa	3.63	26.5	44.3	48.3	55.0	19.5
Asia	3.69	22.8	49.7	48.1	71.3	18.9
Morocco	3.33	35.6	41.7	57.0	82.1	5.1
Turkey	3.01	37.1	41.1	55.6	75.3	6.4
Middle East	3.44	24.5	41.8	55.2	75.6	14.5
Other	3.71	23.2	43.6	53.7	68.0	22.1
Total	**3.67**	**38.4**	**46.6**	**41.1**	**54.6**	**16.9**

Notes: * Excluding population with welfare status unknown

** Private households

*** Of working population

Table 4: Education, by Population Group

	Percentage Currently Studying Age 18-24	Percentage with secondary or tertiary diploma Age over 25	Mean Years of Education Age Over 25	Percent Education Unknown Age Over 25
Brussels	41.4	40.6	11.4	10.2
Flanders	32.2	40.2	11.4	12.7
Walloon	28.8	37.7	11.2	13.2
France	30.7	36.2	9.6	14.5
Italy	25.2	22.9	8.0	16.3
Spain	33.8	19.7	8.0	18.1
Northern Europe	29.5	41.6	9.5	12.9
Southern Europe	26.8	19.4	7.0	15.7
Eastern Europe	27.2	38.2	10.6	19.5
Africa	48.4	54.1	12.3	9.0
Asia	39.8	44.9	10.3	15.8
Morocco	38.8	16.4	8.9	36.6
Turkey	19.7	14.2	7.8	31.8
Middle East	44.0	39.5	10.5	16.8
Other	41.1	47.4	10.7	13.1
Total	**37.0**	**37.1**	**10.7**	**13.9**

Table 5: Basic Patterns of Mortality and Migration

a. Mortality

Variable	Parameter *(Standard Error)*	Relative Risk	Parameter *(Standard Error)*	Relative Risk
	Males		Females	
Sex	0.780 *(0.0216)*	2.18		
Age	0.0759 *(0.000742)*	1.08	0.0744 *(0.000926)*	1.08
Age-Squared	0.000215 *(0.0000157)*	1.00	0.000413 *(0.0000159)*	1
Non-Belgian	–0.149 *(0.0276)*	0.862	–0.196 *(0.0270)*	0.822
Born Abroad	–0.170 *(0.0237)*	0.844	–0.0642 *(0.0193)*	0.938

Note: All coefficients significant at $p < 0.001$
Baseline χ^2 (–2 Log likelihood) = 1,757,837
Model χ^2 (–2 Log likelihood) = 169,404 df=9

b. Migration

Variable	Parameter *(Standard Error)*	Relative Risk	Parameter *(Standard Error)*	Relative Risk
	Males		Females	
Sex	0.447 *(0.0243)*	1.56		
Age	–0.0119 *(0.000431)*	0.988	–0.0138 *(0.000408)*	0.986
Age-Squared	–0.000328 *(0.0000190)*	1.00	–0.0000644 *(0.0000171)*	1.00
Non-Belgian	0.851 *(0.0194)*	2.34	1.04 *(0.0200)*	2.83
Born Abroad	1.39 *(0.0201)*	4.01	1.49 *(0.0206)*	4.45

Note: All coefficients significant at $p < 0.001$
Baseline χ^2 (–2 Log likelihood) = 1,204,208
Model χ^2 (–2 Log likelihood) = 52,338 df=9

Effects are nested within sex. Each column thus represents the coefficient and relative risk for a particular effect and sex combination, relative to the baseline of Belgian national, Belgian born females aged 40 on the date of the census. The (expected) *relative risk* of dying for an Non-Belgian man, born abroad and aged 60.2 on the date of the census is thus:

$$\text{R.R.} = \exp(0.780+0.0759*20.2+0.000215*20.2^2-0.149-0.170) = \exp(2.08) = 8.02$$
$$= 2.18 \text{ (male)} * 5.06 \text{ (age)} * 0.727 \text{ (Migrant)} = 8.02$$

Similarly, the relative risk of emigration for a non-Belgian woman aged exactly 25, born in Belgium, would be:

$$\text{R.R.} = \exp(-0.0119*(-15)-0.000328*15^2+0.851) = \exp(0.956) = 2.60$$

Table 6: Effects of Household Role and Composition on Mortality Risks

Variable	Parameter *(Standard Error)*	Relative Risk	Parameter *(Standard Error)*	Relative Risk
	Males		Females	
Sex	0.862	2.37		
	(0.0301)			
Age	0.0806	1.08	0.0767	1.08
	(0.000989)		*(0.00120)*	
Age Squared	0.0000510	1.00	0.000252	1.00
	(0.0000189)		*(0.0000194)*	
Non-Belgian	−0.134	0.875	−0.186	0.830
	(0.0275)		*(0.0272)*	
Born Abroad	−0.143	0.867	-0.0570^{**}	0.945
	(0.0236)		*(0.0193)*	
Child	$0.0838^{\dagger}$	1.09	$0.128^{\dagger}$	1.137
	(0.0491)		*(0.0704)*	
Single Parent	-0.133^{**}	0.875	0.0284^{x}	1.029
	(0.0449)		*(0.0267)*	
Couple	−0.237	0.789	−0.120	0.887
	(0.0137)		*(0.0151)*	
Parent	−0.485	0.616	−0.332	0.717
(Couple)	*(0.0208)*		*(0.0304)*	
Other	$-0.0860^{\dagger}$	0.918	0.201	1.223
	(0.0490)		*(0.0256)*	
Non-Private	0.615	1.85	0.433	1.54
Household	*(0.0546)*		*(0.0284)*	

Note: All coefficients significant $p < 0.001$ except ^{x} $p > 0.1$; † $p < 0.1$; ** $p < 0.01$
Model $\chi^2 = 172{,}168$, df = 21
Net gain $\chi^2 = 2{,}764$, df = 12

Table 7: Effects of Work and Material Conditions

Variable	Parameter *(Standard Error)*	Relative Risk	Parameter *(Standard Error)*	Relative Risk
	Males		Females	
Sex	0.862 *(0.0301)*	2.57		
Age	0.0806 *(0.000989)*	1.08	0.0767 *(0.00107)*	1.08
Age Squared	0.0000510 *(0.0000189)*	1.00	0.000301 *(0.0000173)*	1.00
Non-Belgian	−0.134 *(0.0275)*	0.747	−0.271 *(0.0273)*	0.762
Born Abroad	−0.143 *(0.0236)*	0.848	−0.0744 *(0.0193)*	0.928
Amenities	−0.119 *(0.00475)*	0.888	−0.0843 *(0.00446)*	0.919
Welfare Status Unknown	−0.238 *(0.0340)*	0.788	0.0111^{x} *(0.0318)*	1.01
Owner Occupier	−0.217 *(0.0132)*	0.805	−0.154 *(0.0127)*	0.857
Working age Not working	0.226 *(0.0185)*	1.25	0.112 *(0.0204)*	1.12
Manager	−0.312 *(0.0387)*	0.732	−0.240** *(0.0899)*	0.787
Social Security Income	0.104 *(0.0229)*	1.11	−0.00350^{x} *(0.0217)*	0.997
Full Time Income	−0.171 *(0.0240)*	0.843	−0.0594* *(0.0252)*	0.942
Other Incomes	0.210 *(0.0286)*	1.23	0.368 *(0.0253)*	1.45

Note: All coefficients significant $p < 0.001$ except ^{x} NS; * $p < 0.05$; ** $p < 0.01$
Model $\chi^2 = 176{,}747$, df = 25
Net gain $\chi^2 = 4{,}321$, df = 16

Table 8: Education Effects on Mortality

Variable	Parameter *(Standard Error)*	Relative Risk	Parameter *(Standard Error)*	Relative Risk
	Males		Females	
Sex	0.819	2.25		
	(0.0379)			
Age	0.0745	1.08	0.0732	1.08
	(0.000999)		*(0.00123)*	
Age Squared	0.000211	1.00	0.000392	1.00
	(0.0000195)		*(0.0000198)*	
Non-Belgian	−0.263	0.768	−0.276	0.759
	(0.0279)		*(0.0272)*	
Born Abroad	−0.152	0.859	−0.0736	0.929
	(0.0238)		*(0.0193)*	
Studying	−0.235**	0.791	−0.121^{x}	0.886
	(0.0750)		*(0.0993)*	
Diploma (1=HS;	−0.123	0.884	−0.0444	0.957
2=U)	*(0.0126)*		*(0.0138)*	
Mean Years	−0.0239	0.976	−0.0285	0.972
Education	*(0.00211)*		*(0.00266)*	
Education	−0.105	0.901	−0.0467†	0.954
Unknown	*(0.0238)*		*(0.0258)*	

Note: All coefficients significant $p < 0.001$ except ^{x} NS; † $p < 0.10$; ** $p < 0.01$
Model $\chi^2 = 174{,}129$, df = 17
Net gain $\chi^2 = 1{,}703$, df = 8

Table 9: Combined Effects – Households, Material Conditions and Education

Variable	Parameter *(Standard Error)*	Relative Risk	Parameter *(Standard Error)*	Relative Risk
	Males		Females	
Sex	0.914	2.49		
	(0.0485)			
Age	0.0741	1.08	0.0759	1.08
	(0.00107)		*(0.00142)*	
Age-Squared	0.000134	1.00	0.000250	1.00
	(0.0000200)		*(0.0000213)*	
Non-Belgian	−0.294	0.745	−0.275	0.759
	(0.0280)		*(0.0274)*	
Born Abroad	−0.134	0.875	−0.0689	0.934
	(0.0238)		*(0.0193)*	
Partner	−0.143	0.867	−0.0818	0.922
	(0.0141)		*(0.0152)*	
Parent	−0.175	0.840	−0.241	0.786
	(0.0229)		*(0.0330)*	
Single Parent	0.171	1.19	0.297	1.34
	(0.0495)		*(0.0403)*	
Non-Private Household	0.274	1.32	0.358	1.43
	(0.0394)		*(0.0313)*	
Amenities	−0.0806	0.923	−0.0534	0.948
	(0.00505)		*(0.00468)*	
Welfare Status Unknown	−0.215	0.807	0.0108^{x}	1.01
	(0.0349)		*(0.0326)*	
Owner Occupier	−0.160	0.852	−0.106	0.900
	(0.0134)		*(0.0129)*	
Not Working	0.196	1.22	0.123	1.13
	(0.0190)		*(0.0212)*	
Manager	−0.232	0.793	−0.145^{x}	0.865
	(0.0391)		*(0.0904)*	
Social security Income	0.136	1.15	0.0203^{x}	1.02
	(0.0231)		*(0.0218)*	
Full Time Income	−0.121	0.886	−0.0296^{x}	0.971
	(0.0252)		*(0.0265)*	
Other Income	0.186	1.20	0.177	1.19
	(0.0349)		*(0.0336)*	
Studying	−0.151*	0.860	0.0789^{x}	1.08
	(0.0754)		*(0.105)*	
Diploma	−0.0941	0.910	−0.0527	0.949
	(0.0113)		*(0.0120)*	
Mean Years Education	−0.00795	0.992	−0.0149	0.985
	(0.00142)		*(0.00136)*	

Note: All coefficients significant $p < 0.001$ except ^{x} NS; † $p < 0.10$; * $p < 0.05$
Model $\chi^2 = 177{,}975$, df = 39
Net gain $\chi^2 = 5{,}549$, df = 30

Figure 1: Population Pyramid, By Nationality and Nativity

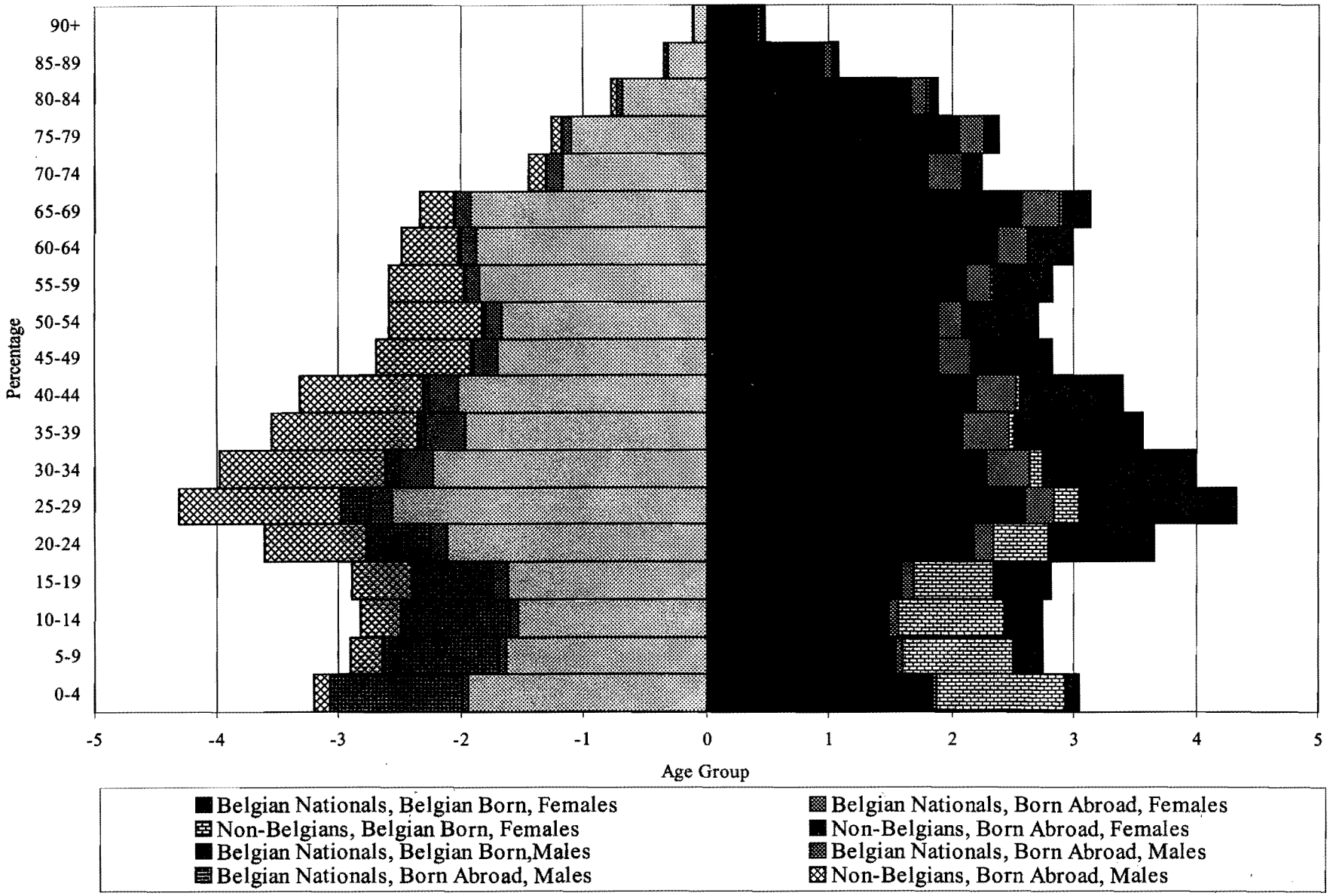
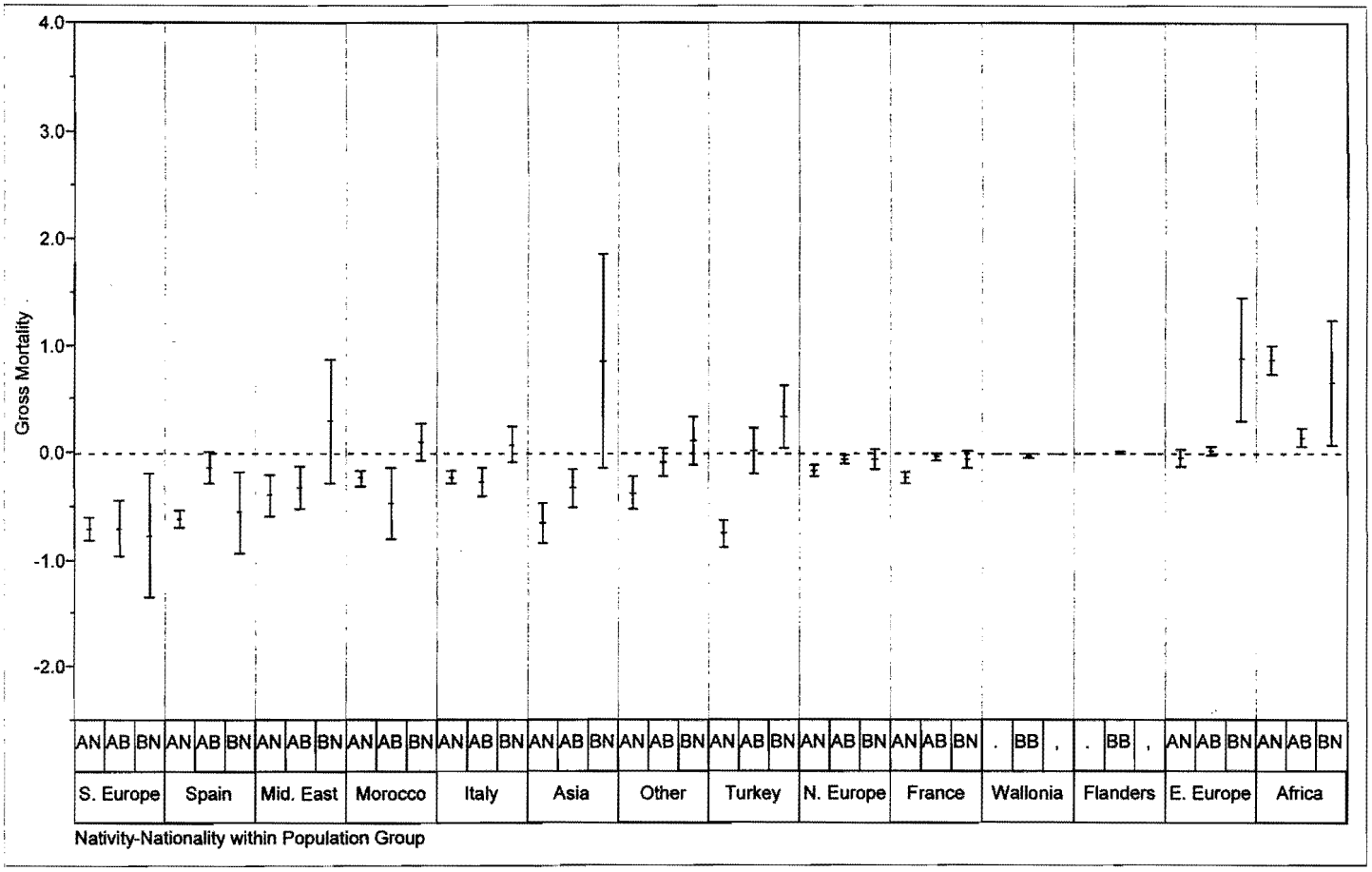
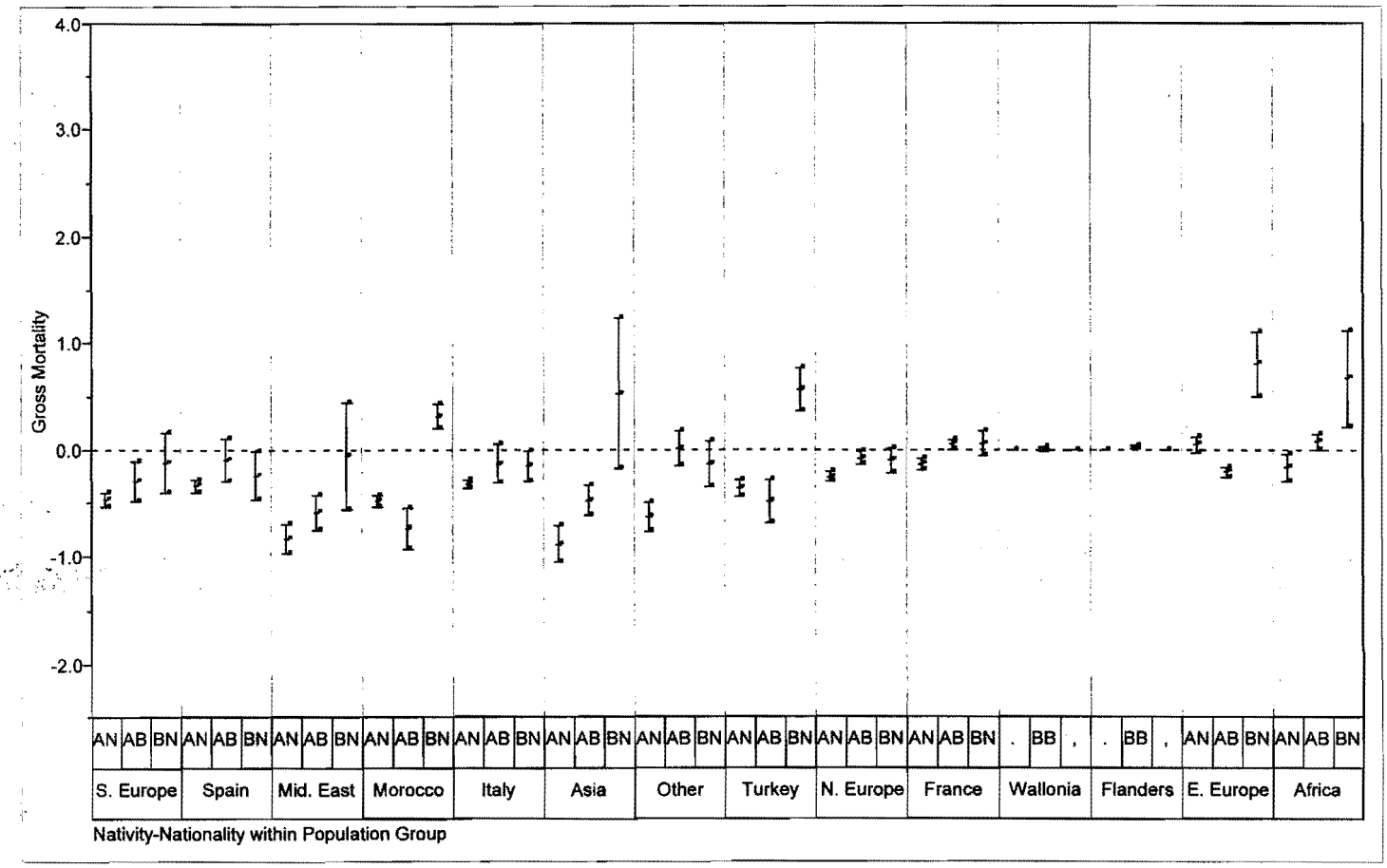


Figure 2: Gross Mortality Coefficients, by Population group, Nativity and Nationality

a: Females



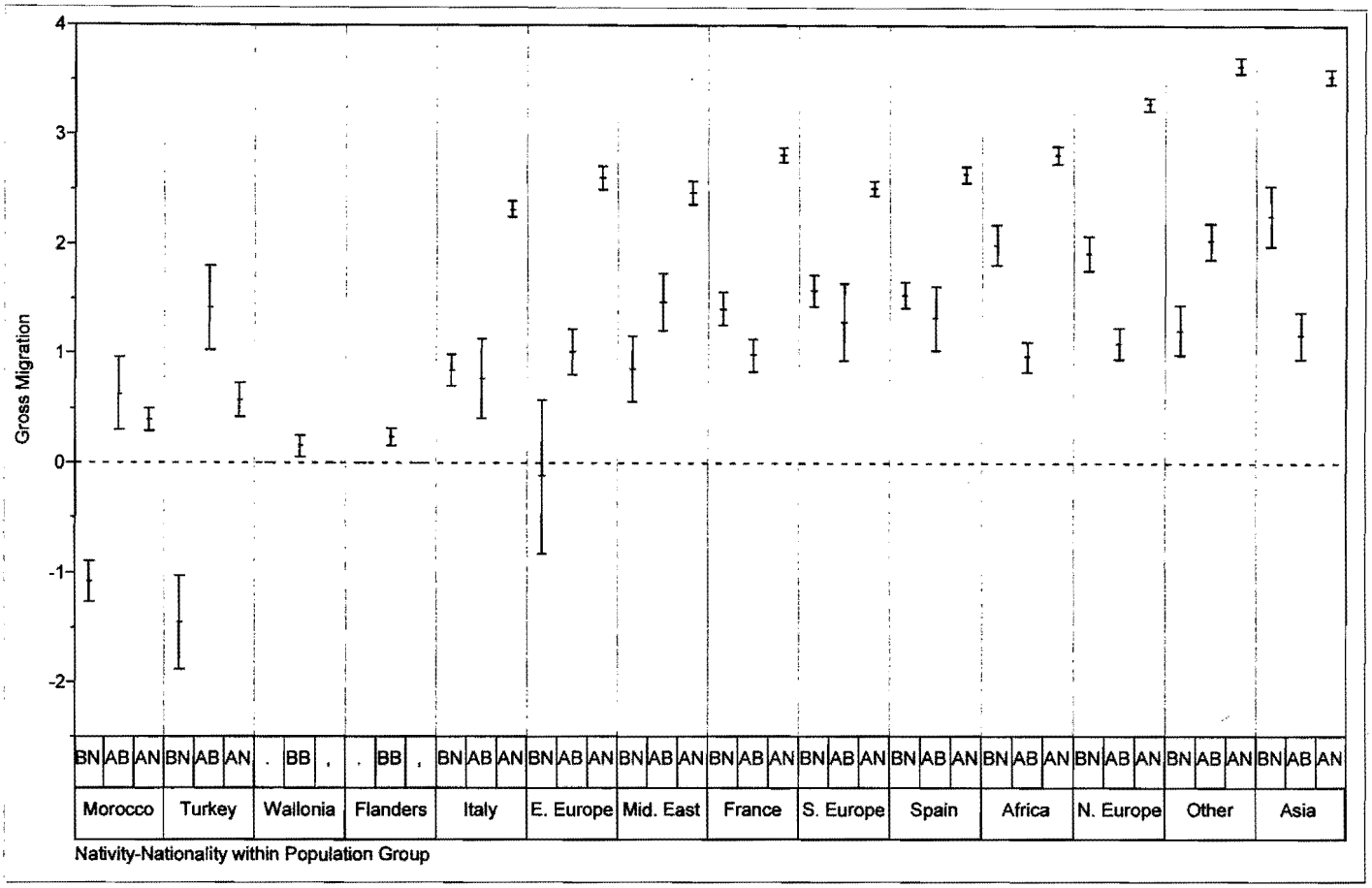
b: Males



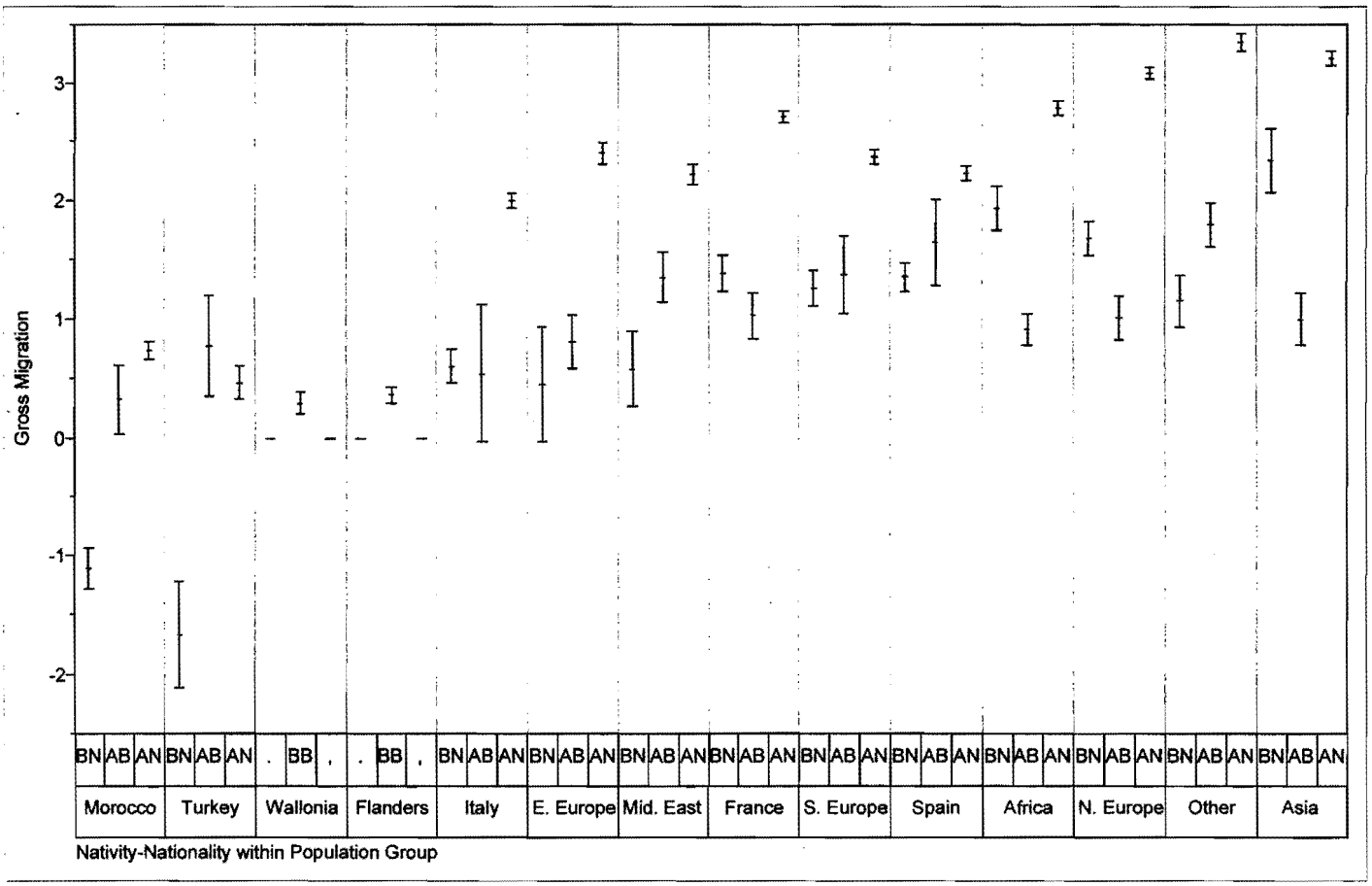
AX = Born Abroad; BX = Belgian Born; XB = Belgian nationality; XN = Non-Belgian Nationality

Figure3: Gross Migration Coefficients, by Population group, Nativity and Nationality

a: Females



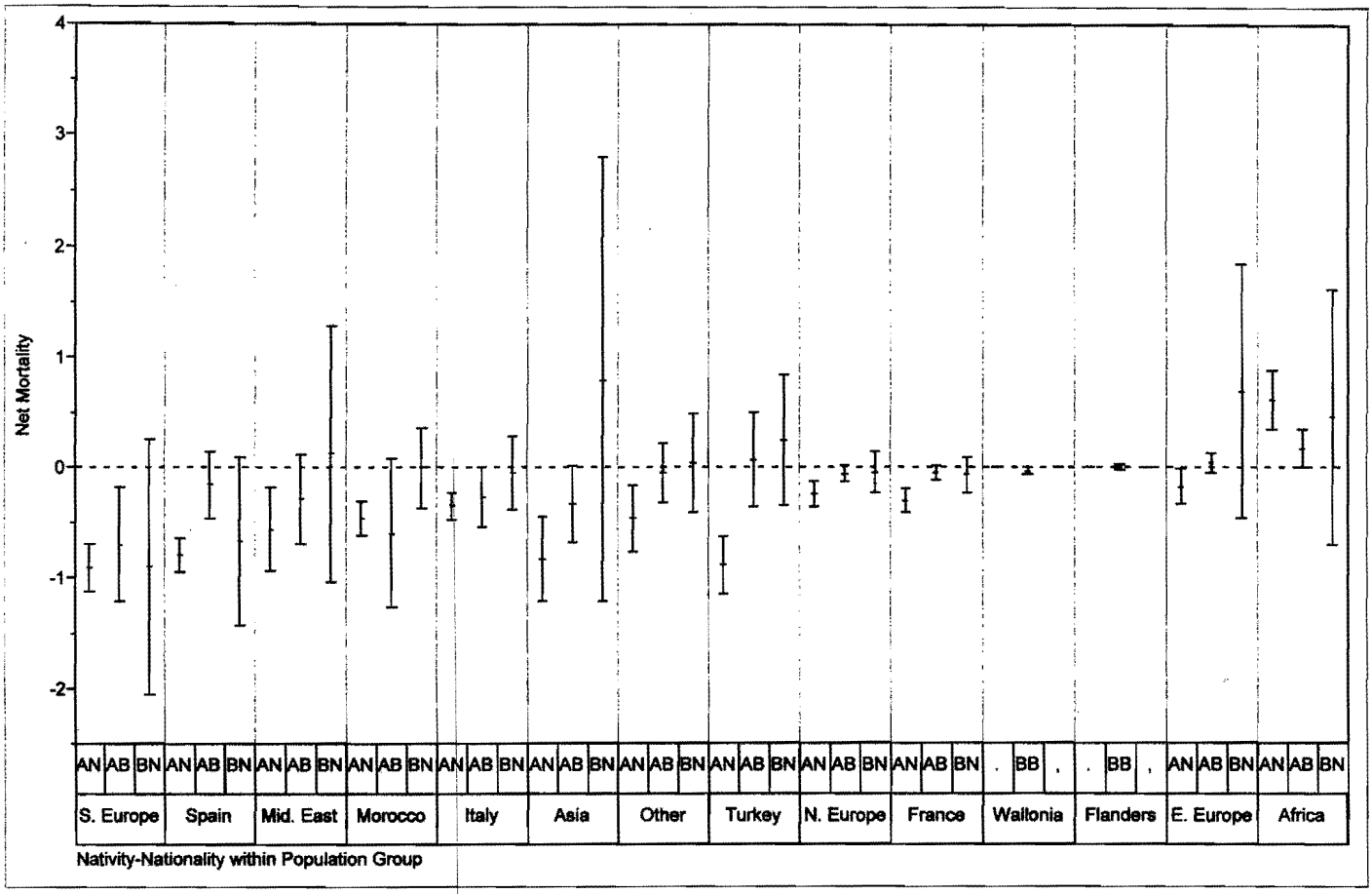
b: Males



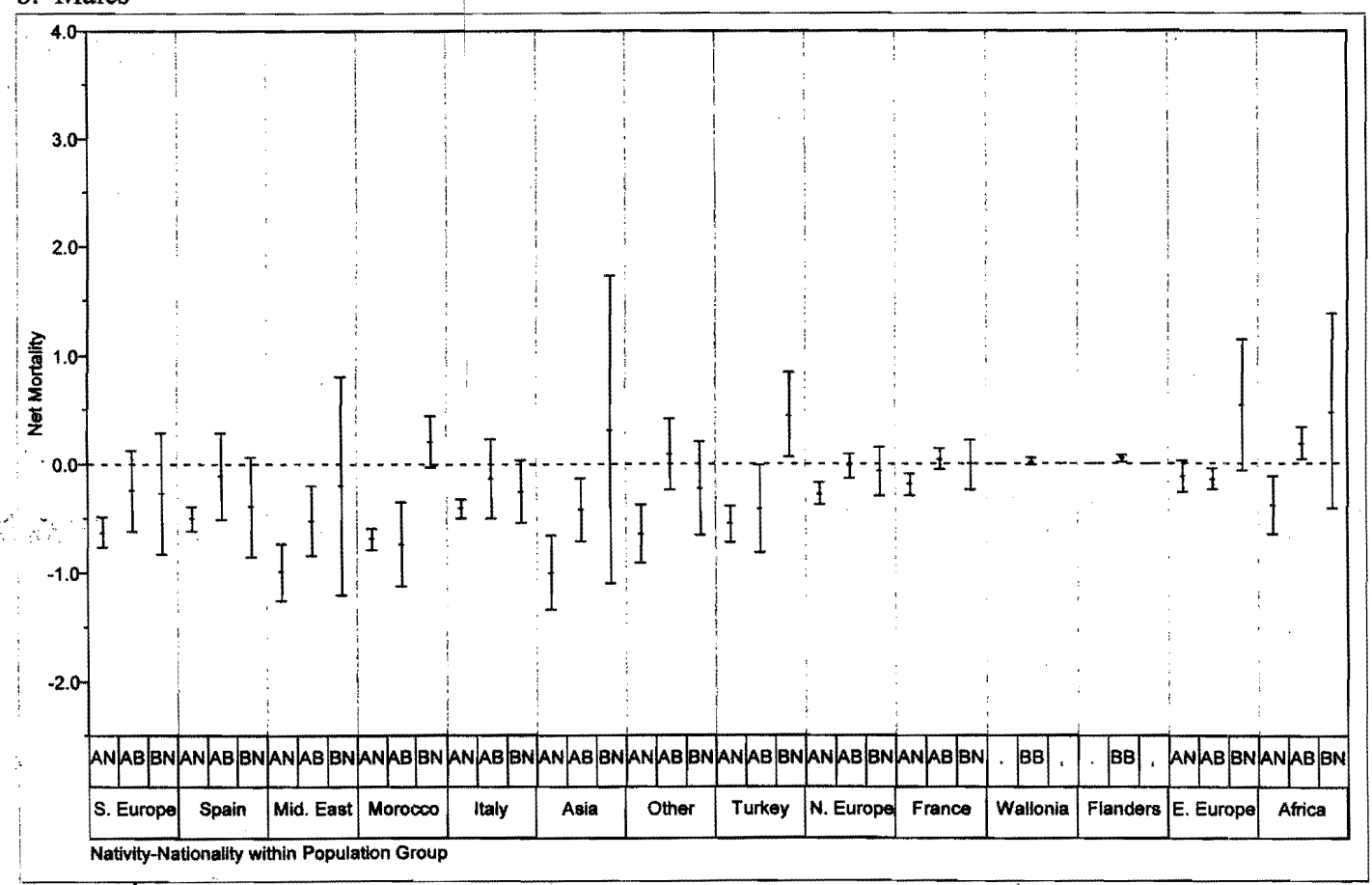
AX = Born Abroad; BX = Belgian Born; XB = Belgian nationality; XN = Non-Belgian Nationality

Figure 4: Net Mortality Coefficients, by Population group, Nativity and Nationality

A: Females



b: Males



AX = Born Abroad; BX = Belgian Born; XB = Belgian nationality; XN = Non-Belgian Nationality