A DYNAMIC APPROACH OF SES MORTALITY DIFFERENTIALS: RECENT EVIDENCES ON THE LINK BETWEEN MORTALITY AND OCCUPATIONAL CAREERS IN FRANCE

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This new study goes beyond the well-established correlation between mortality and occupational status, to focus on the impact of professional careers on mortality risk. It shows heterogeneity in the mortality risks within occupational classes, strongly related to the type of occupational moves experienced before. For men, the mortality risks of the movers are in-between the average risks in the class left and in the class joined ("social health gradient constraint"). For women, downward moves, or becoming inactive, are associated with higher mortality risks than the average in the class they left and often higher than those in the class they joined. But upward mobility is not well correlated with mortality. Becoming active also reduces the risks. The study confirms that a dynamic approach helps explaining social differences. Mortality heterogeneity within occupational classes is often linked to past professional mobility and this correlation has been reinforced with time.

INTRODUCTION

In France, massive mortality differences are observed between social groups. In the mid-nineties, there was a 7 year difference in life expectancy at age 35 between men in managerial occupations and manual workers (Monteil et al, 2005). Beyond this well-established correlation between mortality and occupational status, social epidemiology and the life course approach encourage us to focus on the impact of professional careers on mortality risk (Kuh *et al*., 1997). Indeed, based on longitudinal database, studies show that social groups are not homogeneous regarding health and mortality due to different life courses and experiences, having exposed some people to risk factors or prevented others from them. In the same line, mortality risks within occupational classes could be related to the type of occupational moves experienced before. In this field of occupational mobility, studies started to look at pathways from activity to inactivity, pointing out the "healthy worker effect". More recently, studies extend to other occupational moves, showing also correlation between "careers" and health or mortality (Goldblatt, 1989; Bartley *et al*., 1997; Blane *et al.*, 1999). These studies conclude that for men, the mortality risk of movers is comprised in between the average risks of the class they left and of the class they joined. This « social health gradient constraint » means that such moves are not systematically protective or damaging but rather an average of what is found in the class at both ends of the trajectory.

A first study based on the French longitudinal census follow up and using data on occupational mobility dating back to the 1970's, showed that mortality risks estimated for occupational classes as reported at in a census were dependent on occupational class reported earlier, confirming the link between "career" and mortality (Cambois, 2004). This study also showed that in several cases the mortality risks of movers were closer to the average risk in the latest class than to the average risk in the class reported earlier. For women, there was no

such a clear pattern: for most moves the mortality risk was not so different from the average risk of the class left or independent from it. But still some specific trajectories were associated with mortality as it is for men (from upper class or manual workers to inactivity). These findings applying for most men and some specific groups of women, might be explained by a selection effect on the movers, based on health and mortality determinants (education, skills…) or to an adaptation effect to the overall health conditions in the class joined (exposition, behaviors, access to care).

The French database has been recently updated with recent censuses and vital allowing to repeat such an analysis. We have computed new estimations to see whether or not in recent years, 1) mortality is still linked not only to occupational class but also to earlier occupational moves within each class; 2) the pattern is also found for women while their participation to labor force has been dramatically increased since the 1970's; 3) the social health gradient constraint is still prevailing or occupational moves is systematically as protective or damaging.

DATA AND METHODS

The *Echantillon démographique permanent* (EDP) or Permanent Demographic Sample was developed to give improved documentation of the pathways between different social and demographic status, and migration patterns. The EDP was based on a 1% sample of the 1968 population census and is followed up and repeated from census to census (1975, 1982, 1990, 1999). The new entrants are new-born and immigrants meeting the inclusion criteria (being born on one of the 4 reference days drawn from the 365 in the year). The sample also loses those who emigrated from the French territory and those who died. As a result, the EDP is a representative sample of the general French population at any census date, and also provides longitudinal information when focusing on sub-samples and following their development from census to census.

The present study was based on the part of the EDP with longitudinal information, adult men and women who were part of both the 1990 and 1999 censuses. Mortality risks were assessed based on deaths occurring during the 1999-2003 period. The sub-sample used for this study constituted a closed population, representative of the French population in 1999, identified in both the 1990 and 1999 census; those excluded are mainly recent immigrants who only entered the EDP at the 1999 census. EDP matching with the mortality data is made based on a national identification register. It consisted of 138 411 men and 157 061 women aged 30 to 84 years old in 1999. Starting at age 30 limits the inclusion of too many students who were

unclassified in 1990 (considered as inactive). The population was distributed according to the occupational class reported in the 1990 census and in the 1999 census and mortality risks were estimated over the period 1999-2003 for each of the 36 possible pathways: 1) *upper occupations* (intellectual occupations, upper managerial staff and administrators, medical doctors, independent professionals, engineers) and *intermediary occupations* (managerial staff, school teachers, skilled technicians, foremen, medical and social workers, intermediary managerial and administrators, clergy) fall into this class; 2) *Farmer class* only includes farm managers and not the farm workers; 3) *Craftsmen and trade related workers* (craft and trade) are independent shop or business owners; 4) *Clerk class* includes those employed in administrative departments, in the police or army, in craft and trade related businesses and people employed by private households; 5) *Manual workers* class includes skilled manual workers, farm workers, semi-skilled manual workers and unskilled manual workers; 6) *Inactive*, other than retired, are people who did not report any occupation: housekeeper, student, disabled…

To describe the mobility-mortality pattern, we first define the stable groups as those who report the same occupational class at both censuses. The stable groups are representing a large part in each class: 70% of total males and 63% of total females aged 30 to 84 years old. When limited to the active age groups in 1990 (eg 30-74 years old in 1999), the proportion of stable is similar: the impact of including retired people in the stable groups of each class does not modified the figures. Indeed, among retired people, who represent 10% to 15% of each class, a large part were actually previously stable. Even if they are not undergoing directly the work conditions, the retired of the classes are still socially close to their active counterparts. Beside the stable groups, the other members in each class came from classes in which mortality level is in average lower or in average higher compared to the risk prevailing in this class. Therefore, we can assess mortality disparities in each class associated with occupational moves and rank the risks regarding the situation at origin and the situation at destination: we define upward mobility as the moves towards a class in which mortality level is lower and downward mobility as the moves towards a class in which mortality level is higher). Whilst it does not strictly refer to social mobility, this definition gives a convenient picture of the heterogeneity of the risks within classes. Furthermore, even if it is not systematic, most of the moves defined in this way have a clear social representation.

Mortality risks are estimated for each occupational class in 1999, standardized for age, through annual mortality risks (AMR) for our 30-84 years old occupational classes (95% confidence intervals are based on 30-84 AMR and sample size for each class). Estimated

standardized mortality ratios (SMR) were chosen to compare mortality risks associated with each possible pathway (SMR=1 for the whole male or female population). This indirect standardization allowed for the handling of small population groups where the age groups are of such limited size that there are sometimes no or too few deaths recorded.

RESULTS

Mobility

Graph 1 shows the population distribution according to occupational classes in 1999 and within each class, according to the occupational class as reported in the previous census in 1990. Occupational classes in 1999 are made of people with different "careers": while the major part of the population report the same occupational class at both censuses, moves between classes represent 30% of the male and 37% of female populations in 1999.

Graph 1: Distribution of the population in the occupational classes in 1999 and within occupational classes according to occupation in 1990. Male in female aged 30-84 years old
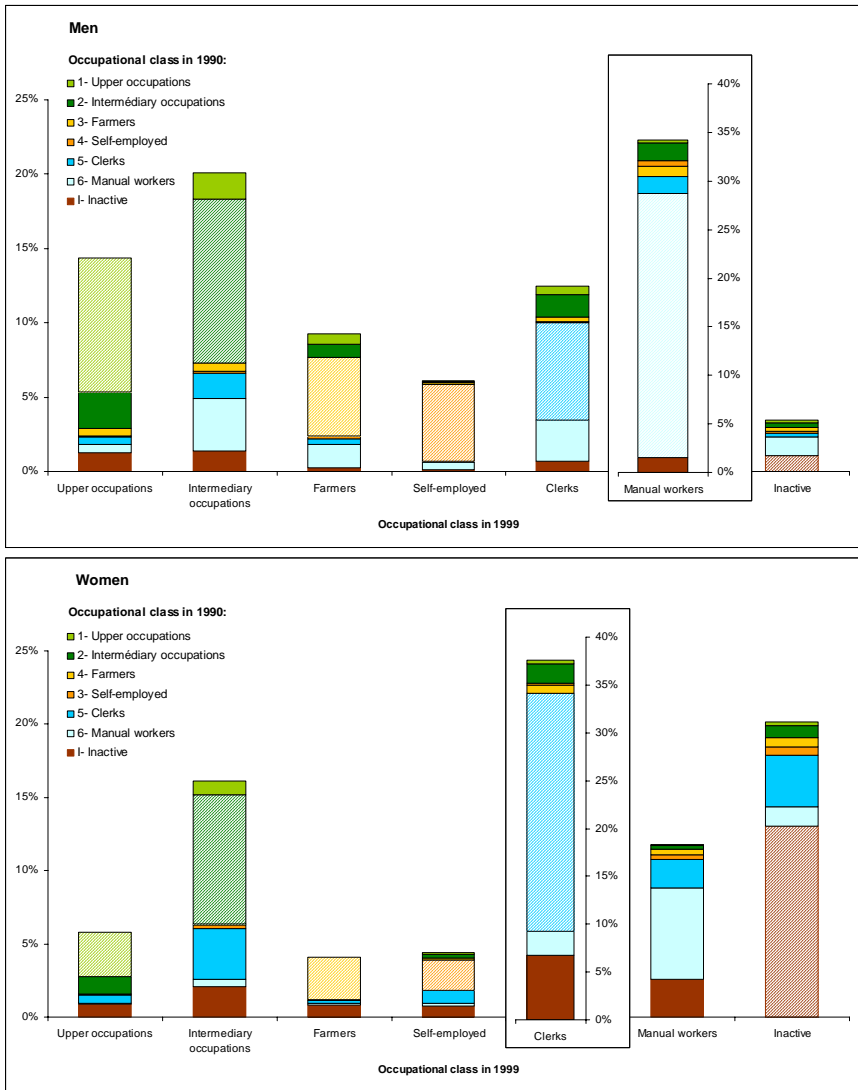
The study shows three main upward types of pathways: administrative pathways (for instance, from clerical workers to managerial occupations); technical pathways (from manual workers to foremen); setting own business (towards self-employed occupations). Due to the high proportion of manual workers in male population (34%), the upward technical moves and own business are frequent; for female, due to the proportion of clerks (38%), administrative moves are numerous. Reverse moves (for instance, from foremen to manual workers) are less frequent but not insignificant. Otherwise, the frequent pathways between clerks and manual workers in both directions is the result of the large number of jobs close to the frontiers of these two classes. For women, inactivity at both dates and the moves between inactivity and clerks occupation class are frequent.
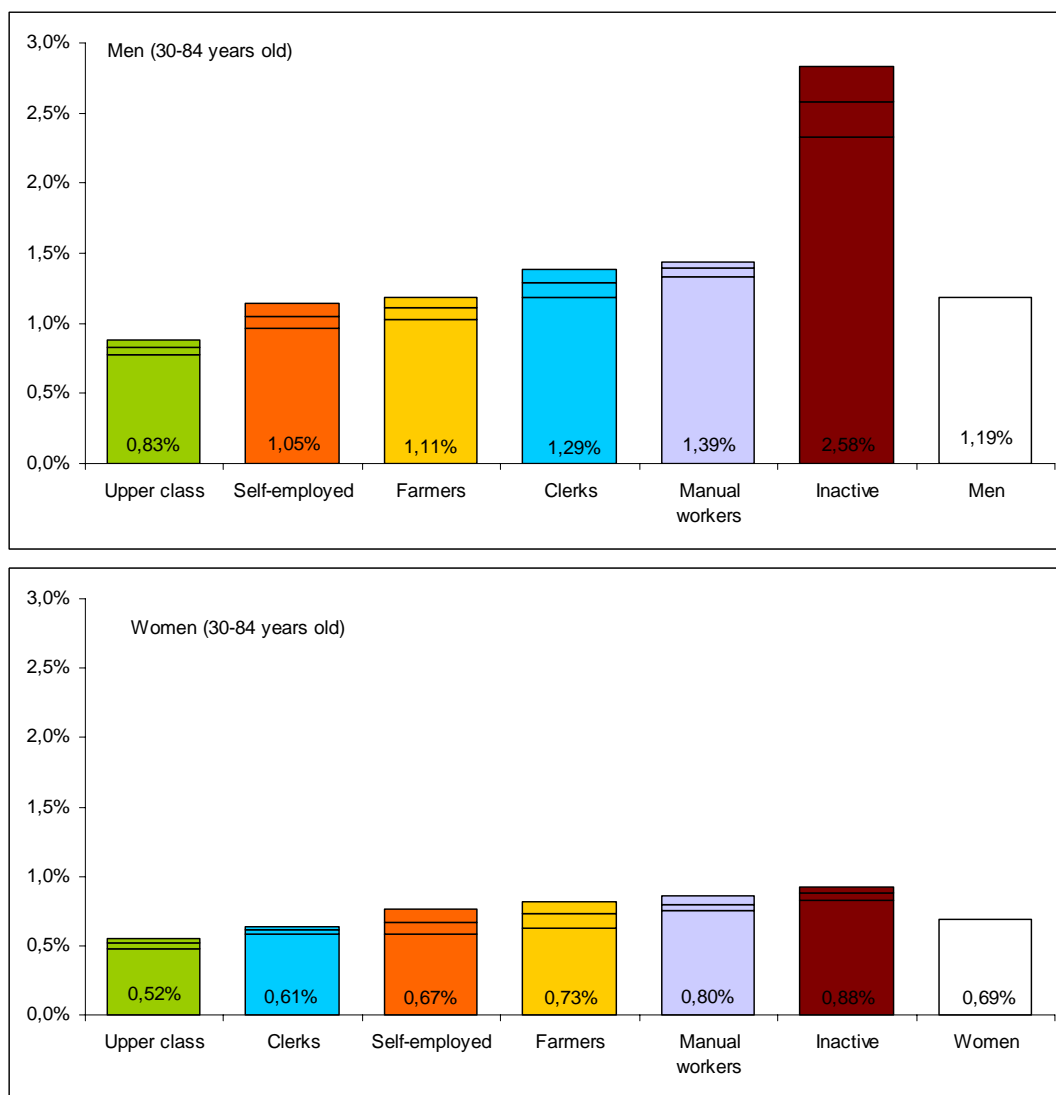
Mortality

Due to the small size of specific groups and small number of deaths, we decided to pool together the upper and intermediary occupations in the so-called *upper class*. In Graph 2, we observe a mortality gradient based on occupational classes for men, from upper class to inactive (AMR=[0.8%-2.6%]) with an average risk in the male population of 1.2% over the 5 years period 1999-2003. For women, mortality is lower than for men with an average risk in the female population of 0.7%; the differentials are small and not always significant from one class to the other (AMR=[0.5%-0.9%]). The occupational classes rank differently in female and male populations; farmers in female population are associated with a relatively high level of mortality despite it has a relatively low mortality level in male population.

Graph 3 and Graph 4 are plotting the SMR for each groups according to the occupational classes in 1999 and in 1990 (tables with figures provided in annex). In these graphs, the X axis shows the occupational classes reported in 1990. For each of them, the SMRs associated with the occupational status in 1999 are plotted on the vertical axis. The SMRs for those who are in the same class in 1990 and 1999, the non-movers, are plotted with circles. Triangles show the SMRs of the so-called downward and upward mobility that were statistically different from risks of the non-movers.

For men, Graph 3 shows that the SMRs for the stable groups drew a clear line between the SMRs associated with downward mobility and the SMRs associated with upward mobility. Upward moves are therefore associated with a reduced risk compared to the average risk in the class left; moves towards the *upper classes* are associated with the lowest risk (SMR=[0.6-0.9]). Downward moves are therefore associated with an increased risks. Mortality risks of the movers are, in most cases, in between the risks of the non-movers in the

class they left and in class they joined, and they are often closer to the average risk in the class joined ("social health gradient constraint"). This pattern means that occupational moves lead to an homogenization of the classes regarding mortality risks. Transfers between manual workers and clerks, in both direction, are associated with one of the highest mortality risks, even higher than the risks in stable groups both in the class of origin and in the class of destination (SMR=1.3). This is due to the blurred frontier between unskilled occupations of these classes, in which workers are often less qualified and more at risk of poor health; these movers might constitute a selected group within both population at origin and at destination (selected on education, skills, health…). The overall higher mortality risks of those who have became inactive (other than the retired population) or were inactive at both dates confirm the "healthy worker effect".
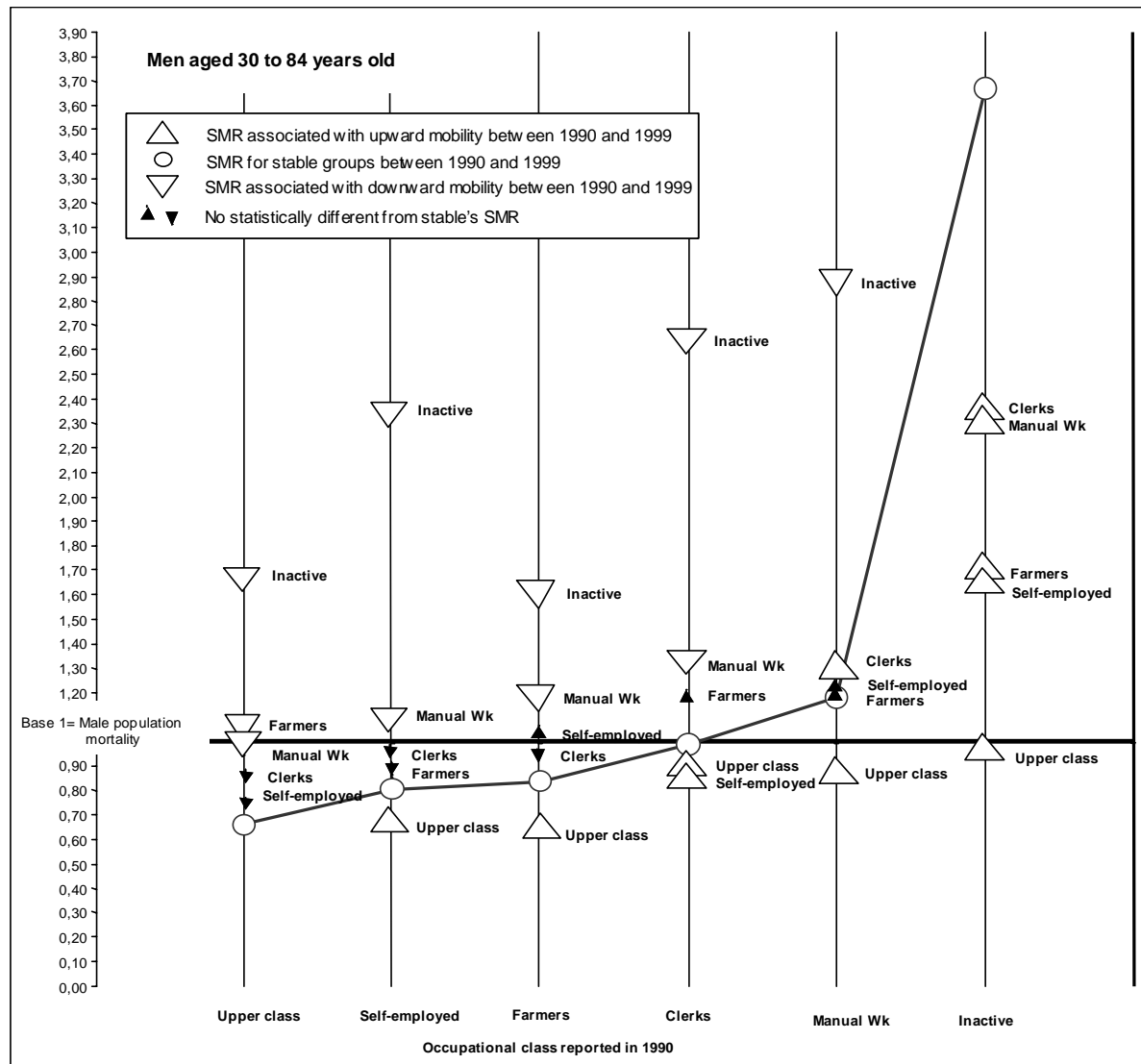
Graph 2: Annual age standardized mortality rate according to occupational class. Men and women aged 30-84 years old in 1999 (for death occurred over the period 1999-2003) . (WITH 95% CONFIDENCE INTERVAL)

For women, Graph 4 shows that the small mortality differences between occupational classes hide disparities. Downwards moves are associated with an increased risk compared to the class left ; moves from upper classes to manual workers are associated with the highest risk (SMR=1.6). In most cases, downward moves are associated to mortality risks higher than the risk of the stable groups both at origin and at destination. Concerning upward moves, the correlation with mortality is not so clear: risks are not so different from the average of the class left and in some cases, they are also higher than the risk of the stable both at origin and at destination. For women, there is no clear « social health gradient constraint » as observed for men; mortality of the movers tend to be higher than mortality of those who remained in their class. As suggested found for men who moved between manual workers and clerks (in both direction), occupational mobility for women might concern groups that are more selected on a criteria linked to mortality (low education and qualification, health problems…) than are occupational classes. The heterogeneity in female occupational classic is an explanation for the reduced differentials in mortality. Finally, Graph 4 shows that moves from inactivity to activity are associated with low mortality risks compared to remaining inactive, except for women entering manual worker class. Becoming inactive is linked to high mortality risks, as it is for men, despite the overall mortality risk of the inactive women is not so different than the average. This result confirms the "healthy worker effect".

When limiting the study to those being in labor force ages in 1990 (30-74 years old in 1999), patterns are almost the same: the mortality gradient is more spread for men and women. The noticeable changes only concerns women. It strengthens some of the patterns suggested with the 30-84 years old group: inactive women who remained inactive have a higher mortality risks, when excluding the oldest part of the sample, and for some of the downwards moves, SMRs became significatively higher than the SMRs of the sable groups at origin while they were not significantly different when including the oldest. But for women, new patterns appeared with the youngest part of the sample: despite female farmers are not well ranked in the mortality gradient, moves towards this occupation is associated with low mortality risks. These changes for women are partly explained by a cohort effect and a possible change in the nature of the occupations within a class: for instance, being a female farmer appeared to be a health damaging occupation in previous generations, while becoming a farmer for a women now might be more a career plan, as it is probably more frequently the case for men.

Graph 3: Male standardized mortality ratios (SMR) over the period 1999-2003 associated with the pathways between the occupational class of 1990 and the occupational class of 1999, in reference to the risk of mortality in the total male population (aged 30 to 84 years)
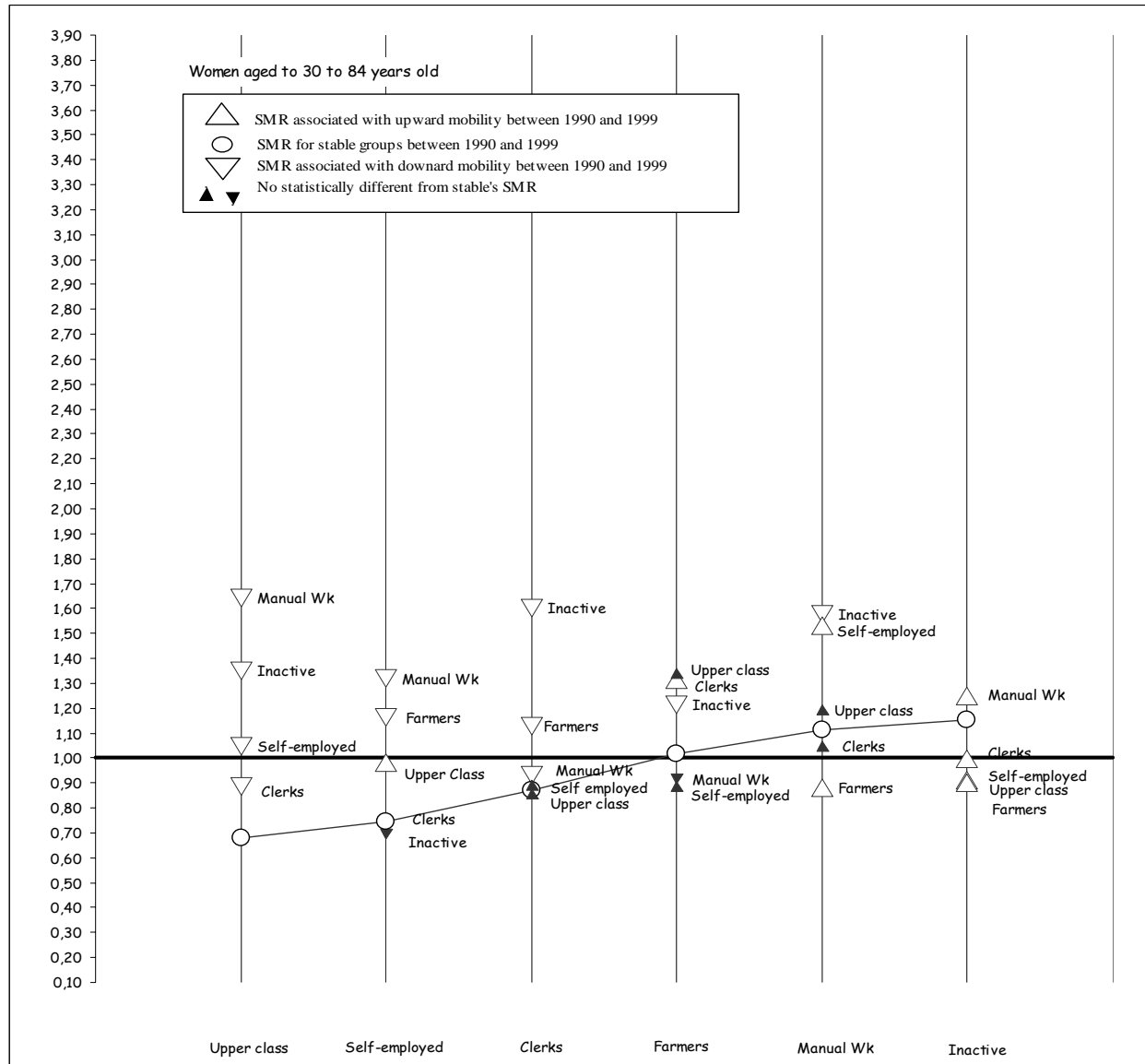
DISCUSSION

The analysis of occupational moves showed that mortality is not only correlated to occupational status but also depends on careers. For men, upward and downward moves are depicting a mortality gradient within occupational classes. Most of the risks for movers are fitting in between the risk of the stable groups at origin and at destination (except for moves between manual workers and clerks). For women, heterogeneity within classes also exists and the link between occupational moves and mortality risks has been reinforced compared to previous study: becoming inactive and downwards moves are associated with higher risk of mortality than the average risk of the class left (the downward movers are also exposed to higher risks than the average risk of the class joined).

These associations between mortality and careers can be due to a selection of movers regarding confounding factors for mortality (educational level, health status, spouse occupation…). They also can be explained by the new context at destination affecting, positively or negatively, health: the new daily environment and practices may directly influence health behavior or access to care. They finally can be the result of mobility being by itself protective or damaging, independently from other health determinants (for instance through the stress for adaptation). These data do not allow to disentangle the contribution of these possible effects. For instance, we don't have information on health status before the occupational move which would be required to elaborate hypothesis on selection effects or health deterioration linked to the new context. Furthermore, the occupational moves in this study are simplistically represented by two 9-year-distance occupational situations, excluding the observation of possible moves between the two censuses as well as knowledge about the date of the change. There are no possibility to document a possible effect of long or short term exposure in the job and social context joined as well as job and social context left.

Still our results help understanding occupational class differences in mortality by searching for heterogeneity within classes. This study proposed to look for possible new patterns linked to intra-class heterogeneity, based on the "life course approach" of the social epidemiology. The "gradient constraint" illustrate a kind of selection effect that makes people joining occupational classes corresponding to some of their demographic characteristics (education, skills, family situation, social support…) and individual resources (health, adaptation and coping abilities…): these characteristics being both linked to the chance of being protected from poor health and to the probability of moving to a more favorable situation. For women, the pattern is not following the "gradient constraint": the downward moves are almost

systematically associated with a much higher mortality risks than what is observed in any stable group. Such a pattern would suggest a damaging effect associated with downward moves, independently to the situation at origin and at destination. But more probably, the explanation could be the important heterogeneity regarding health and mortality determinants in women occupational classes while movers could be more selected on health determinants, similarly to men movers. In conclusion, for women, occupational moves could be a more appropriate mortality predictor than occupational classes.

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Annex: Proportions of men and women in occupational classes and mobility groups (1990 and 1999), related standardized mortality ratios (SMR), over the period 1999-2003, in reference to the risk of mortality in the total male and female populations (aged 30 to 84 years)

Men		Occupational class reported in 1999					
Occupational class reported in 1990	**Upper class**	**Farmers**	**Self-employed**	**Clerks**	**Manual workers**	**Inactive**	**Total for 1990 distribution**
Upper class %	24,3%	1,6%	0,1%	2,1%	2,2%	0,5%	30,7%
SMR	0,66	0,74	1,01	0,85	0,94	1,68	**0,73**
IC	[0,65-,067]	[0,70-0,78]	[0,82-1,24]	[0,91-0,89]	[0,90-0,99]	[1,52-1,86]	[0,72-0,74]
Farmers %	1,0%	5,3%	0,1%	0,3%	1,1%	0,3%	8,1%
SMR	0,68	0,81	0,85	0,86	1,08	2,35	**0,86**
IC	[0,63-0,73]	[0,78-0,83]	[0,70-1,04]	[0,75-0,99]	[1,00-1,16]	[2,03-2,73]	[0,84-0,88]
Self-employed %	0,2%	0,2%	5,1%	0,1%	0,6%	0,1%	6,3%
SMR	0,63	1,03	0,84	0,96	1,20	1,61	**0,89**
IC	[0,52-0,76]	[0,85-1,24]	[0,81-0,87]	[0,76-1,22]	[1,09-1,32]	[1,29-2,00]	[0,86-0,92]
Clerks %	2,3%	0,4%	0,1%	6,5%	1,7%	0,3%	11,2%
SMR	0,87	0,86	1,18	0,99	1,32	2,64	**1,05**
IC	[0,83-0,92]	[0,76-0,96]	[0,89-1,56]	[0,96-1,02]	[1,25-1,40]	[2,28-3,05]	[1,03-1,07]
Manual workers %	4,0%	1,6%	0,5%	2,8%	27,2%	1,2%	37,3%
SMR	0,89	1,22	1,20	1,30	1,18	2,88	**1,21**
IC	[0,85-0,92]	[1,15-1,29]	[1,08-1,33]	[1,24-1,36]	[1,16-1,19]	[2,69-3,07]	[1,20-1,23]
Inactive %	2,7%	0,2%	0,1%	0,7%	1,6%	1,1%	6,4%
SMR	0,99	1,65	1,69	2,36	2,29	3,67	**2,28**
IC	[0,94-1,03]	[1,41-1,92]	[1,38-2,06]	[2,15-2,57]	[2,15-2,43]	[3,41-3,94]	[2,21-2,34]
Total for 1999 distribution %	34,4%	9,3%	6,1%	12,4%	34,2%	3,5%	100,0%
SMR	**0,66**	**0,88**	**0,88**	**1,04**	**1,20**	**2,67**	**1,00**
IC	[0,65-0,66]	[0,86-0,90]	[0,85-0,91]	[1,01-1,06]	(1,18-1,21]	(2,57-2,78]	[0,99-1,01]

Women		Occupational class reported in 1999					
Occupational class reported in 1990	**Upper class**	**Clerks**	**Self-employed**	**Farmers**	**Manual workers**	**Inactive**	**Total for 1990 distribution**
Upper class %	14,0%	2,4%	0,4%		0,3%	1,1%	18,2%
SMR	0,68	0,88	1,04	--	1,64	1,35	**0,80**
IC	[0,67-0,69]	[0,84-0,93]	[0,94-1,17]		[1,45-1,86]	[1,26-1,45]	[0,78-0,81]
Clerks %	4,0%	24,8%	0,8%	0,2%	2,0%	3,5%	35,3%
SMR	0,86	0,87	0,89	1,13	0,93	1,60	**0,95**
IC	[0,83-0,89]	[0,86-0,88]	[0,83-0,96]	[0,96-1,33]	[0,88-0,98]	[1,54-1,66]	[0,94-0,96]
Self-employed %	0,3%	0,9%	2,1%	0,1%	0,3%	0,6%	4,2%
SMR	0,98	0,74	0,74	1,16	1,32	0,70	**0,81**
IC	[0,87-1,11]	[0,69-0,80]	[0,71-0,78]	[0,89-1,51]	[1,15-1,51]	[0,64-0,76]	[0,79-0,84]
Farmers %	0,1%	0,3%	0,1%	2,9%	0,4%	0,6%	4,3%
SMR	1,34	1,32	0,88	1,02	0,92	1,21	**1,05**
IC	[1,05-1,70]	[1,15-1,50]	[0,70-1,12]	[0,98-1,06]	[0,82-1,03]	[1,11-1,33]	(1,02-1,09]
Manual workers %	0,5%	2,6%	0,2%	0,2%	6,2%	1,4%	11,1%
SMR	1,19	1,05	1,53	0,88	1,11	1,58	**1,17**
IC	[1,08-1,32]	[1,00-1,09]	[1,33-1,77]	[0,74-1,06]	[1,08-1,15]	[1,49-1,68]	[1,15-1,19]
Inactive %	3,0%	6,7%	0,7%	0,8%	2,6%	13,0%	26,8%
SMR	0,90	1,00	0,91	0,89	1,25	1,15	**1,10**
IC	[0,86-0,94]	[0,97-1,02]	[0,84-0,99]	[0,82-0,90]	[1,20-1,31]	[1,13-1,17]	[1,08-1,11]
Total for 1999 distribution %	21.9%	37.6%	4.4%	4.1%	11.8%	20.2%	100.0%
SMR	**0,92**	**0,91**	**0,88**	**1,00**	**1,12**	**1,14**	**1,00**
IC	[0,90-0,93]	(0,90-0,92]	[0,85-0,90]	[0,96-1,03]	[1,10-1,14]	[1,12-1,16]	[0,99-1,01]

% : Proportion of the population in the occupational class or mobility group.
SMR: Standardized mortality ratio - IC : 95% confidence interval
--: less than 0,05% of total population