PAA 2007 – Extended Abstract

The Effects of Education and Nativity on Cause-Specific Older Age Mortality in Taiwan

by

Albert I. Hermalin, Mary Beth Ofstedal and Cathy Sun
Population Studies Center, University of Michigan

Introduction

The health and mortality levels of migrants compared to their host populations can take many forms, depending on the socioeconomic characteristics of each group, the reasons for migration and differences in health behaviors, risk factors, health care utilization, and possibly biological and genetic factors. Many major international migration streams in the past have been characterized by disadvantaged groups moving to places of greater opportunity and safety. Insofar as the migrant groups have less education, income, and resources and often poorer living conditions and access to health care, it is not surprising that they have poorer health and higher mortality, given the strong association between socioeconomic status and these outcomes. There have been notable exceptions to this relationship, however, wherein migrants who are socio-economically disadvantaged appear to display lower mortality levels than their host populations. These reversals have received considerable attention, often viewed as "paradoxes" of one type or another; e.g. the Hispanic paradox (Palloni and Morenoff, 2001) and the Mediterranean paradox (Khlat and Darmon, 2003).

Many of these situations are receiving detailed study as a means of further understanding possible artifacts in the analysis of mortality (e.g., selection effects in relation to those who migrate as well as those who return) and, beyond artifacts, in gaining more understanding of how lifestyle, diet, and other cultural traits, as well as psychological dispositions affect mortality. Also of interest is gaining insight into the impact of health on mortality, as in many cases the migrant groups display poorer health despite the apparent mortality advantage. Indeed, Deboosere and Gadeyne (2005, p661) assert that "migrant populations create an exceptional situation. They can be seen as a laboratory experiment in 'real life' where populations have a specific set of characteristics and live in the same environmental conditions as a control population."

This paper initiates an examination into the mortality ramifications of a rather unique migration that took place in Taiwan. Between 1949-51 more than one million people, mostly younger males, arrived from mainland China in the wake of the Communist Civil War victory. The Mainlanders, as they are often called, were distinct from the existing Taiwanese population in a number of ways, although they share a common Chinese cultural heritage. The Mainlanders came largely from different provinces of China than the original Taiwanese settlers, they were better educated on average, and spoke Mandarin rather than Taiwanese. They mainly settled in the northern urban areas of Taiwan and were residentially segregated to some extent insofar as

they occupied the neighborhoods vacated by the Japanese, who ruled the island between 1906 and 1945. A large number of migrants were in the military (approximately 600,000) and many of the others were officials or administrators in the Republic of China government. The education and occupational advantages of the Mainlanders may not have extended to income and wealth, as they were mainly salaried and probably lagged behind the rapid gains in income in the private sector and in the business opportunities that began to expand in Taiwan shortly after their arrival (see Hermalin et al. 1994 for a discussion of Taiwan's social and economic transformation). Despite some hostilities and tensions between the two groups, there was also considerable interaction at many levels and, given the strong sex imbalance among the Mainlanders, a fair amount of intermarriage.

Major Analytic Issues, Data, and Methods

In studying the mortality of Mainlanders and Taiwanese, therefore, we are not examining a disadvantaged group vis à vis a more advantaged host population, but rather comparing two groups with strong cultural similarities along with several cross-cutting differences. We will be analyzing the two groups roughly 40 years after the migration, as the Mainlanders enter into the older ages. During this period there was considerable assimilation as younger military retired and entered the civilian world; and, as noted, Taiwan experienced very rapid economic and socio-demographic development with great strides in education, industrial growth, national income, and a sharp demographic transition with falling fertility and rising life expectancies.

The broad questions on mortality differentials that this analysis is well suited to pursue, and the major tools to be used are as follows:

- How persistent are selection effects and to what degree can differences between the Mainlanders and Taiwanese be accounted for by the educational differentials? To address these questions we have developed nativity and education specific mortality rates by age and cause for 1989-91, for ages 60 and older, from the complete death certificates for this period. We analyze these data in several ways: we present the actual cause specific data by age for each nativity-education group, we model these data and utilize regression analysis to study the relative importance of nativity versus education, and we develop standardized mortality rates to further examine differences by cause and education.
- What is the effect of the Mainlander population moving through the age structure with possibly distinct mortality levels on the overall trends in Taiwanese mortality? To examine this we study time trends in age-specific mortality rates, as well as mortality sex ratios over time, introducing measures of the proportion of Mainlanders in each age group at each time (although we do not have separate mortality rates at each point).
- What are the differences between Mainlanders and Taiwanese in health, risk behaviors, and indicators of health access, and how well do they accord with the mortality differences observed? In many countries there have been health surveys of a cross-section of the population, as well as special surveys of older populations. These surveys can be a valuable adjunct to vital statistics in understanding the causes and dynamics of observed mortality differentials among groups that can be identified in each type of data. (When these surveys are of a panel design and of sufficient size they also permit direct analysis of mortality differentials in considerable depth, as in Zimmer et al. 2005.) We

illustrate this potential by describing some relevant characteristics of Mainlanders and Taiwanese from the 1989 Survey of Health and Living Status of the Elderly and its several follow-up waves.

The major part of the analysis will focus on the newly constructed nativity-education specific causes of death mortality rates, and we present some preliminary findings from these data next.

Preliminary Analysis

The numerators for the detailed mortality rates come from a specially constructed file of all the death certificates for the years 1989 through 1991, in which the certificates from two different Ministries were matched to widen the range of socio-demographic information contained in the records. Among the characteristics captured in these files were nativity and education, and these were used to conduct special analyses of mortality by education (Kramarow and Yang, 1997). We have combined this special file with a complete datafile of the 1990 Taiwanese census to produce denominators by nativity, education, age and sex. From these data, we have constructed unadjusted and age-standardized mortality rates separately for males and females for all causes and major causes of death by education and nativity. The results show marked differences in both unadjusted and adjusted rates by nativity and education for most causes. There are, however, some notable exceptions for several causes (e.g., hypertension, diabetes, cancer). These results are summarized in the tables and figures that follow.

The first two figures present age-specific total (all-cause) death rates by nativity and education for males (Figure 1) and females (Figure 2). For men, the age profile for Mainlanders for each educational group tends to lie below that of the Taiwanese. Indeed, the age specific rates for Mainlanders with less than primary education closely parallel the rates for Taiwanese in the highest educational group, those with more than primary education. A gradient by education is clear among the Mainlanders, but among the Taiwanese, the rates for those with primary school education exceed those with less education for much of the age span. The nativity pattern among women resembles that for men, and the educational gradient is clearer for both Taiwanese and Mainlanders.

Table 1 presents age-standardized mortality rates for nine major causes of death, plus other causes and all causes combined. Differences by nativity are quite pronounced. Taiwanese have higher standardized mortality rates (SMR) than Mainlanders for nearly all causes, and these differences are often substantial. Among males, the SMR for all causes is 1.3 times higher for Taiwanese, and among females it is 1.5 times higher for Taiwanese. There are a few causes of death that are exceptions to this general pattern (e.g., hypertension, cancer and diabetes), for which the differentials are greatly reduced or even reversed. For example, the SMR for hypertension is higher for Mainlander males than Taiwanese males, and the SMR for cancer is higher for Mainlander females than Taiwanese females. The differences in patterns across causes of death can lend some insight into the potential mechanisms underlying nativity differentials in mortality. This will be pursued further in the paper by drawing on survey data to examine nativity differences in health, health behaviors, access to health care, and socioeconomic status.

The differences by education are also pronounced, but somewhat more variable. For Mainlander men and women, mortality tends to follow a consistent and monotonic pattern across the three categories of education. Exceptions include nephritis for men, for which there is essentially no difference by education, and hypertension and bronchitis for women, for which differentials exist, but at different thresholds. For Taiwanese men and to some extent women, the education pattern is less consistent. For several causes (e.g., the first six for males and cancer and diabetes for females), we observe an inverted V-shaped pattern, whereby SMRs are highest in the middle education group (primary graduates). For most causes, the SMRs are lower for those with more than primary education compared to those with less than primary, but for several causes this is not the case. Among males, the SMRs for cancer, diabetes, and nephritis are roughly equal for the lowest and highest educated groups, and among females the SMR for cancer is higher for those with more than primary education compared to those with less compared to primary education.

These results are further illustrated for several causes plus total death rates in Figures 3-5, which present comparisons of standardized mortality rates in graphical form for selected causes of death and total deaths. The bars represent the difference between the SMR for the specific nativity-education group and the total SMR. Bars to the left of the center vertical axis indicate that the group has a mortality advantage relative to the total, and bars to the right indicate that the group has a mortality disadvantage. The charts serve to highlight that Mainlanders (shown in the top set of bars in each chart) tend to be advantaged with respect to cerebrovascular disease (CBV) mortality, heart disease mortality, and total mortality, and that, within each nativity group, education confers an advantage. The charts also underscore the smaller and more variable differentials that are observed for hypertension and diabetes.

The regression analysis carried out for the 1989-91 data (not shown here) tend to confirm these descriptive tables and charts. Independent variables for age, age-square, nativity and educational level were regressed against the total death rates and each cause shown in Table 1. This modeling captured well the age profiles for the groups shown in Figures 1 and 2, as measured by the adjusted R-square. The regression coefficients indicated a significant effect of lower mortality for Mainlander men in 7 of the 10 regressions; for women the Mainlander effect was significant in only 5 of the 10 models. As one measure of magnitude, we estimate that the total mortality rate for Mainlander males at age 74.5 is equivalent to the total mortality rate for Taiwanese males at age 70, at each level of education. By contrast, the education coefficients tended to be much less pronounced and less often significant.

These differentials, their underlying mechanisms, and their implications for trends over time in total and cause-specific mortality in Taiwan will be explored in more detail in the paper. The paper will include results from time series analysis of cause-specific death rates, as well as analysis of survey data to investigate differences between Mainlanders and Taiwanese with respect to health and lifestyle, SES, and access to health care, and the contribution of these factors to explaining the observed mortality differentials.

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Figure 1. Mortality rates for all causes by nativity and education, among males: Taiwan, 1989-1991

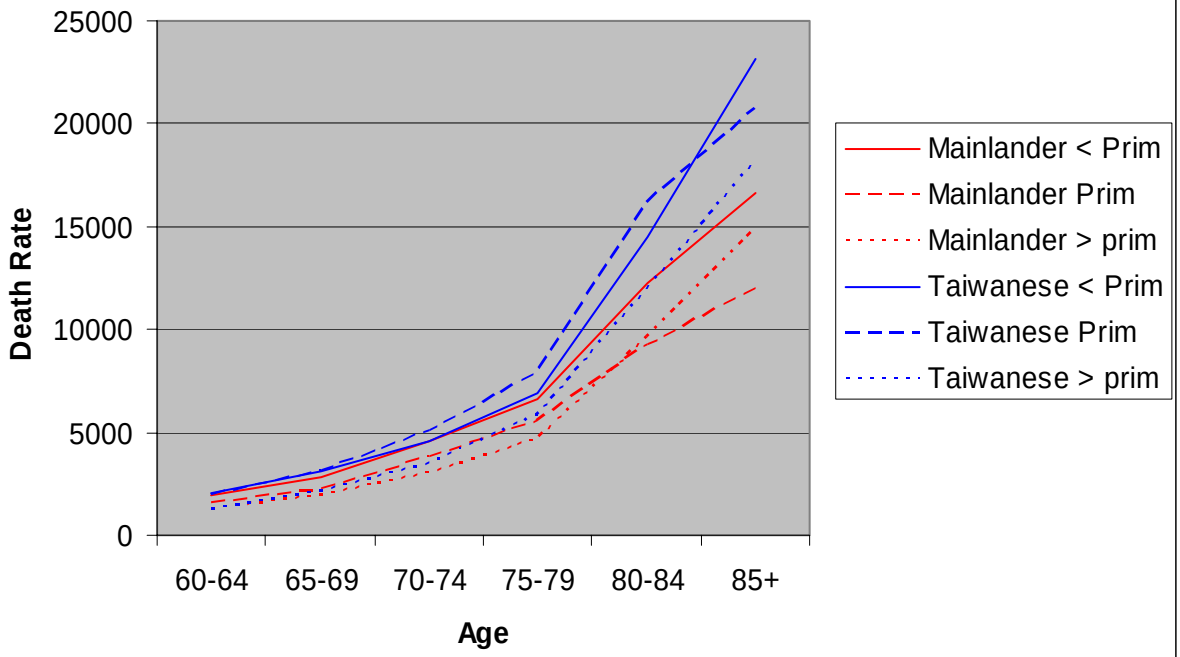

Figure 2. Mortality rates for all causes by nativity and education, among females: Taiwan, 1989-1991

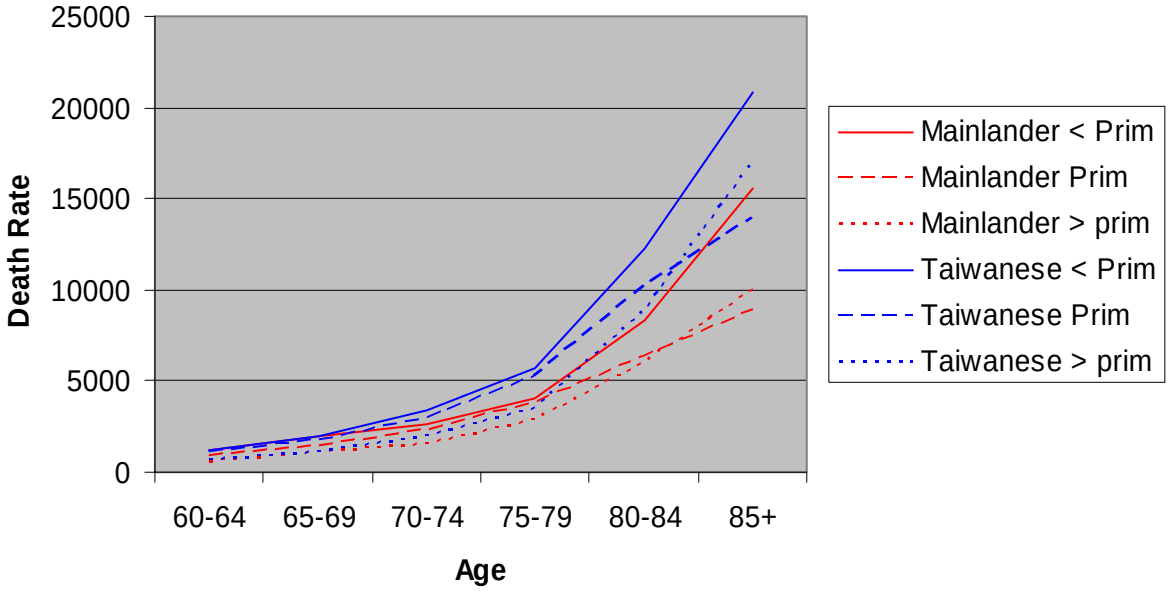

Table 1. Standarized mortality rates by causes, gender, ethnicity and education for age 60+: Taiwan, 1989-1991

		Male								
		Mainlander				Taiwanese				Total
Basic Code	Cause	LT Prim	Prim Grad	MT Prim	Total	LT Prim	Prim Grad	MT Prim	Total	Total
29	Cerebrovascular disease	570	477	380	453	621	701	475	626	565
25,27,28*	Heart diseases	438	347	323	361	503	511	393	498	453
26	Hypertension	173	120	93	124	107	123	86	111	116
8-14	Malignant neoplasms	682	662	657	662	722	844	725	754	713
181	Diabetes	132	102	98	106	122	156	128	133	122
350	Nephritis	65	52	60	59	91	109	93	97	83
347	Chronic liver	111	90	64	82	123	115	69	111	100
323	Bronchitis & emphysema	118	80	65	84	163	142	62	145	125
E47-E53	Accidents	249	190	133	176	253	232	141	227	207
Other	Other	1,169	844	712	871	1,299	1,242	832	1,212	1,100
Total	Total	3,705	2,964	2,585	2,977	4,005	4,176	3,006	3,913	3,584

		Female								
		Mainlander				Taiwanese				Total
Basic Code	Cause	LT Prim	Prim Grad	MT Prim	Total	LT Prim	Prim Grad	MT Prim	Total	Total
29	Cerebrovascular disease	467	348	243	369	669	545	359	641	611
25,27,28*	Heart diseases	352	238	212	289	541	372	344	519	497
26	Hypertension	99	100	51	84	151	109	63	145	139
8-14	Malignant neoplasms	523	476	461	489	422	533	456	436	441
181	Diabetes	202	189	101	159	239	244	135	231	222
350	Nephritis	78	67	36	59	101	100	69	98	94
347	Chronic liver	68	57	35	53	76	71	39	73	70
323	Bronchitis & emphysema	72	41	48	59	91	54	36	87	84
E47-E53	Accidents in total	100	70	44	73	114	96	54	108	104
Other	Other	825	575	459	667	1,084	825	667	1,048	1,012
Total	Total	2,785	2,161	1,691	2,300	3,488	2,949	2,223	3,387	3,275

Figure 3. Differences in standardized mortality rates by nativity and education among males for selected causes: Taiwan, 1989-1991

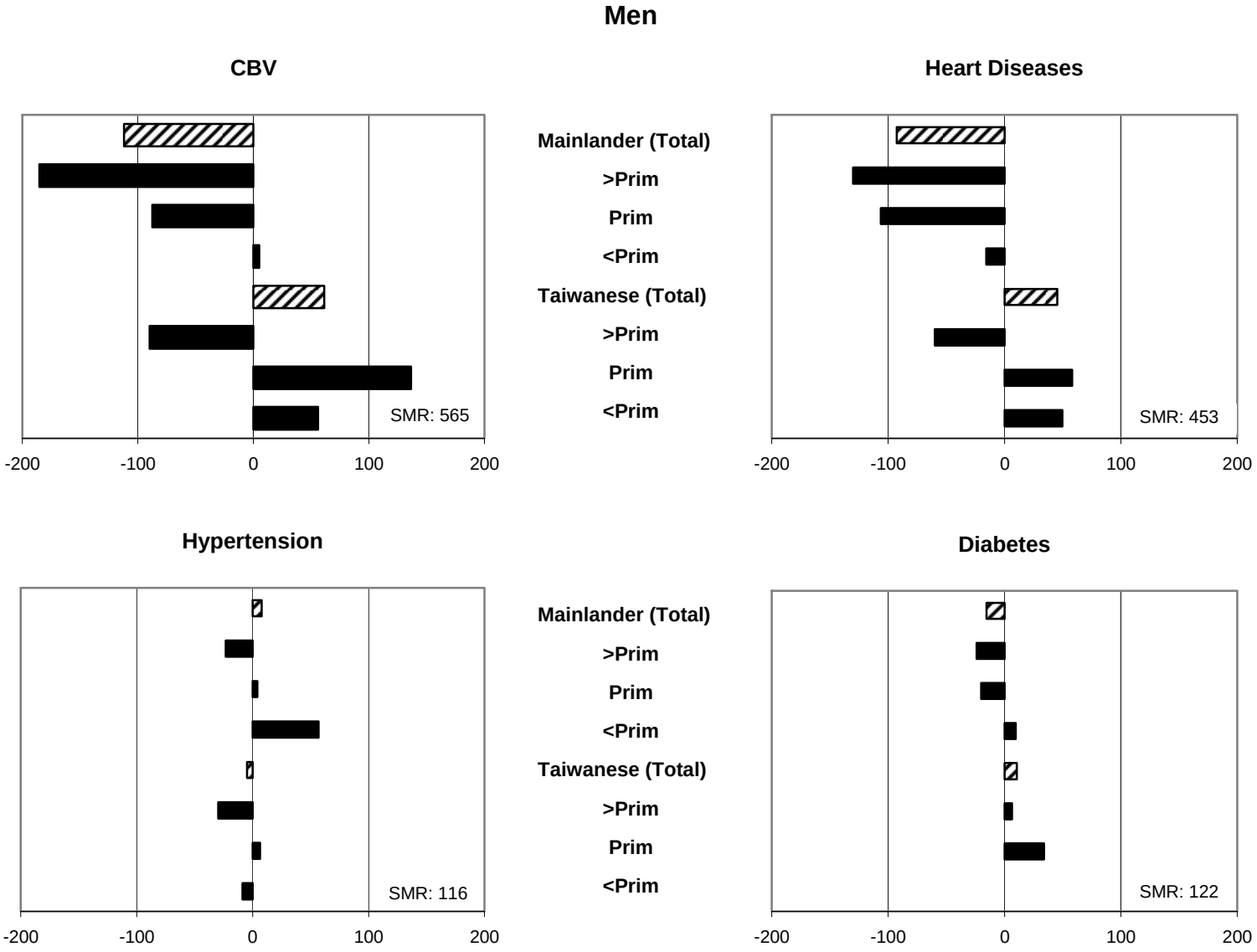

Figure 4. Differences in standardized mortality rates by nativity and education among females for selected causes: Taiwan, 1989-1990

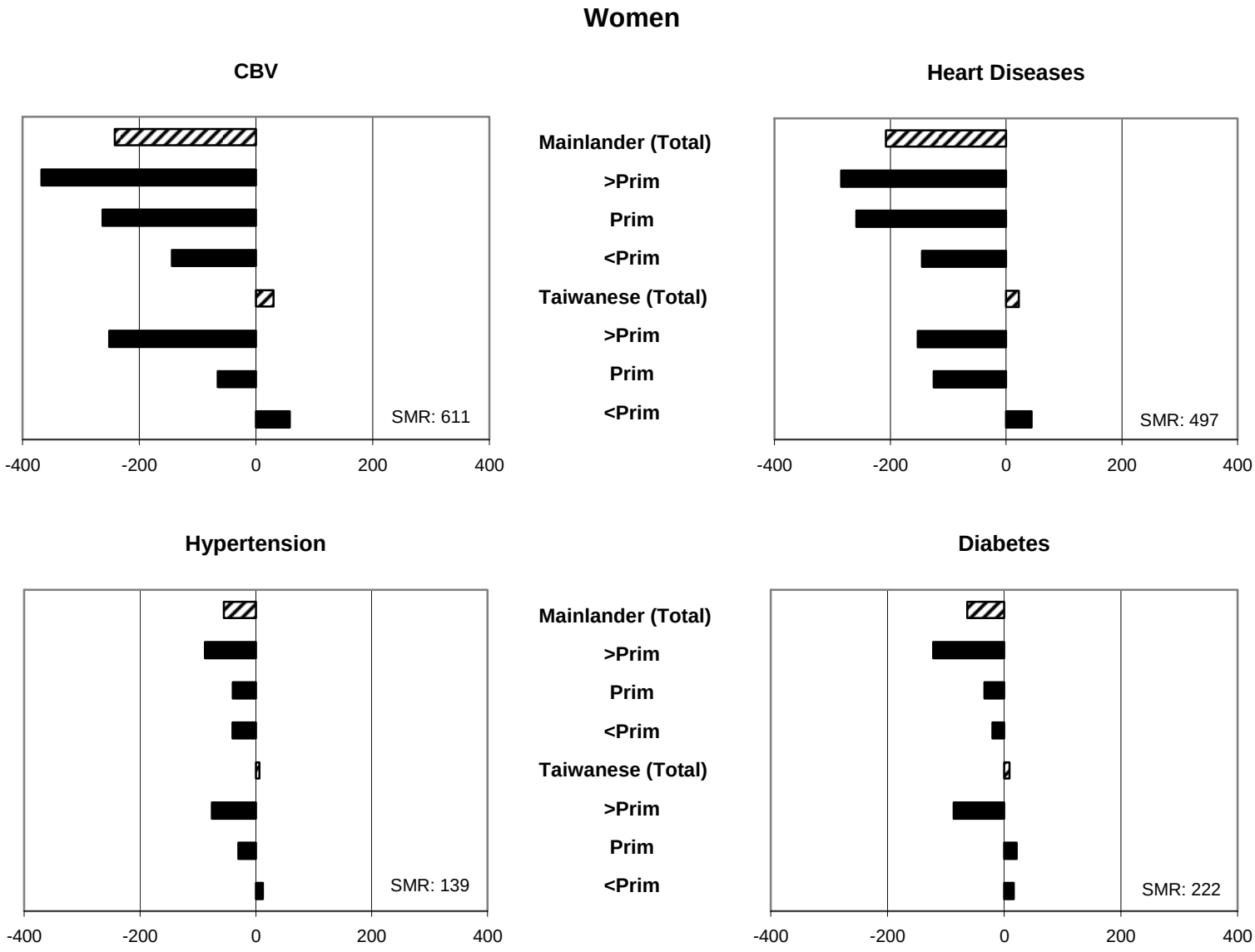

Figure 5. Differences in standardized mortality rates by nativity, education and sex for all causes combined: Taiwan, 1989-1991