EHEMU Technical report 2010_6.1 June 2010

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An exploration of the health–survival paradox

European health expectancy monitoring unit

EHEMU

Observatoire européen des espérances de santé

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EHLEIS project co-funded by DG SANCO (Agreement number 2006109)

The contribution of the gender differences in mortality and in disability to the gender difference in Healthy and Unhealthy Life Years within the European Union, 2006: An exploration of the "health – survival" paradox

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Introduction

Life expectancy in women is higher than in men. This is not an established fact. Only recently, women live longer in all countries of the world (Barford, Dorling, Smith & Shaw, 2006), but on the other hand the gender gap in the duration of life is reducing during the last decades of the twentieth century in most but not all European countries (Van Oyen, Cox, Jagger, Cambois, Robine & EHLEIS team, 2009). Although several biological hypothesis are proposed (Austad, 2006), the dynamics of the gender differences in mortality suggest that its determinants cannot be purely biological, but are depending on modifiable social and lifestyle factors (Barford et al., 2006). In developed countries smoking has been considered as one of the main causes of the gender difference in mortality (Jacobsen, Oksuzyan, Engberg, Jeune, Vaupel & Christensen, 2008; Preston & Wang, 2006; Valkonen & van Poppel, 1997). Even in old age, modifiable health behaviours including smoking abstinence, regular exercise, and weight management remain important determinants of mortality and the gender variation in these factors over time affect the pattern of gender differences in life expectancy (Yates, Djoussé, Kurth, Buring & Gaziano, 2009).

However women's longer lives are not necessarily healthy lives and men tend to report a better self-assessed health and fewer disabilities. This contrast is called the female-male health-survival paradox (Oksuzyan, Juel, Vaupel & Christensen, 2008). Gender difference in morbidity depends on the seriousness and lethality of the disease, the severity measures and the age trajectories of specific diseases. Men suffer from disability and diseases which shorten life, while women's excess tend to be in symptoms and non-lethal conditions (Verbrugge, 1989). Proposed explanations for the health-survival paradox are rooted in biological, social, and psychological interpretations. An extensive review of explanations for the gender differences in health has been published (Oksuzyan et al., 2008). Although selection and information bias through gender differences in participation and reporting cannot be excluded, their contribution to the health survival paradox seems to be small (Oksuzyan, Petersen, Stovring, Bingley, Vaupel & Christensen, 2009).

Research reports on gender differences in health has been challenged as being too oversimplified, ignoring the inconsistency and complexity in patterns of gender differences in health (MacIntyre, Hunt & Sweeting, 1996). To better understand the dynamics of population health and the female-male health-survival paradox, the use of composite health indicators, such as health expectancies, was emphasized (Nusselder, Looman, Van Oyen, Robine & Jagger, 2010). Health expectancies are population health indicators bringing together data on both the quantity (through mortality) and the quality of life (through morbidity) (Robine, 2006). Health expectancies constitute a family of population health indicators, depending on the definition of morbidity used. Health expectancies, predominantly disability-free life expectancies (DFLE), are available for many countries worldwide (Robine, Romieu & Michel, 2003). Within the European Union, it was decided to estimate the DFLE based on a synthetic measure of long-term activity limitations (Van Oyen, Van der Heyden, Perenboom & Jagger, 2006) under the name of Healthy Life Years (HLY). Similar to the life expectancy, the HLY at a given age corresponds to the average life span without activity limitations. The average life span with activity limitations is called the unhealthy life years (YLY).

Current paper aims at investigating the health-survival paradox within the EU without pooling the countries specific data based on a merely administrative division such as the date of integration within the EU (e.g. EU15 or the oldest EU member states; EU10 or the more recent EU member states). To study the health-survival paradox the gender differences in HLY and ULY are partitioned into a proportion of the gender difference which can be attributed to gender differences in mortality (mortality effect) and a proportion which can be attributed to gender difference in activity limitations (disability effect) (Nusselder & Looman, 2004). We explore following questions:

1. In populations with a high life expectancy, is there a reduction of the gender gap in HLY as a combined result of a reduction of the mortality advantage of females have over males and an increase of female disability disadvantage?;
2. In populations with a low life expectancy, is there an increase of the gender gap in ULY as a result of a larger female mortality advantage and a smaller female disability disadvantage?;
3. When indicators of population health are improving (a longer life, a longer life without activity limitations, a shorter life with activity limitations), is there a shift of the concentration of the mortality and disability effect of the gender gap in HLY or in ULY towards older ages (50 years and above)?

Methods

Data

We used the EU member states specific data of the European Health Monitoring Unit Information System (www.Ehemu.Eu). The information includes the age and sex-specific data on the number of death (2006), the population (2006, 2007) and the prevalence of activity limitations information (number of persons with activity limitations and the total number in the sample by age, sex) from the 2006 Statistics of Living and Income Survey (SILC). The SILC is an EU-wide survey, initiated in 2005. The implementation of the SILC survey by the European Member States is based on a common Framework Regulation to enhance the between-countries comparability. The framework defines the survey design, the use of common concepts (household and income) and classifications, the use of harmonized lists of target variables and common requirements (for imputations, weighting, sampling errors calculations). A detailed description of the survey can be found in "http://circa.europa.eu/public/irc/dsis/eusilc.library". The SILC survey population consists out of nationally representative probabilistic samples from the community dwelling population, excluding the institutionalized population. The 2006 SILC survey covers a total of 375 243 participants 16 years and above.

Activity limitations

The SILC contains the Minimum European Health Module (MEHM), devised by the Euro-REVES group (Robine & Jagger, 2003), which includes a disability measure, the global activity limitation indicator (GALI). The GALI instrument ("For at least the last 6 months, have you been limited because of a health problem in activities people usually do?") aims to capture long-term limitation (>6 months) in usual activities, caused by ill-health with three severity levels: none, limited but not severely and severely limited (Van Oyen et al., 2006) and provides the health status information to calculate the HLY. For the Unhealthy Life Years (ULY) we define disability to be any activity limitation. The validity and the reliability of the GALI has been documented (Cox, Van Oyen, Cambois, Jagger, Le Roy, Robine et al. 2009; Jagger, Gillies, Cambois, Van, Nusselder & Robine, 2010; Van Oyen et al., 2006). To ensure a maximum harmonization of the MEHM questions in the SILC at the point of the data collections, all Member States received definitions of the concepts included in the GALI and translation guidelines for the translation of the item to the underlying concepts. Checks were made on whether there were any cultural issues that were likely to impair understanding or reporting (Robine & Jagger, 2003). Despite this process, the comparability is still not fully achieved. In particularly in Denmark and Germany the GALI question used was not comparable. However, both countries were not excluded because the focus of the paper is on gender differences which diminished the problem, the estimates of the gender differences in both Denmark and Germany were not extreme, excluding both countries did not alter the inference.

Methods

The HLY at age 15 was calculated using the Sullivan method, which integrate age-specific disability prevalence into the life table (Jagger, Cox, Le Roy, Clavel, Robine, Romieu et al. 2007; Sullivan, 1971). As the variance due to mortality is negligible compared to the variance due to morbidity, the mortality part of the variance was ignored when estimating the variance of the health expectancies (Mathers, 1991). The ULY are the difference between the LE and the HLY.

To estimate the contribution made by differences in mortality and by differences in the prevalence of activity limitations to the gender differences in HLY and ULY, a method of decomposition was used (Nusselder, Looman, Mackenbach, Huisman, Van Oyen, Deboosere et al. 2005; Nusselder & Looman, 2004). The method is an extension of the decomposition techniques (Arriaga, 1984) that are used in mortality research to assess the contribution that age groups or specific diseases make to the differences in LE. The gender difference in LE, HLY and ULY are split into different parts: 1) the proportion due to the inequality in age specific mortality rates and 2) the proportion due to the difference in the age specific prevalence of activity limitations. The first component is the “mortality effect”: the difference in person-years lived with or without activity limitations that is due to a differential mortality. The second component, the “disability effect”, is the difference in person-years lived with or without activity limitations because of differences in the prevalence of activity limitations. Whereas the gender inequalities in LE reflect differences in mortality rates only, the gender differences in HLY or ULY are a result of differences in mortality combined with differences in the prevalence of activity limitations. The mortality and disability component of the gender differences in HLY and ULY were further decomposed by age of origin (15-49 years versus 50 years and above) to estimate the relative contribution of age groups to the gender differences. Calculations were done using R-macro[1]. To estimate the variances and 95% CI around the decompositions indicators (the mortality and disability effects), a bootstrapping procedure with 1000 resamples was used (Efron & Tibshirani, 1993). For mortality it was assumed that the number of age specific deaths followed a Poisson distribution, while for the number of persons with activity limitations resampling was done within the sample size of the age specific survey participants following a binomial distribution. The 2.5 and 97.5 percentile of the bootstrap distribution defined the 95% CI boundaries.

To investigate the relationships between the mortality advantage or the disability disadvantage that female experience over men and the duration and/or gender gap in the duration of life, healthy or unhealthy life at age 15, random-effects meta-regression models were fitted (Sutton & Abrams, 2001). Similarly, the relationship of the relative contribution of older age (50 years and above) to the decomposition indicators by kind of effect (mortality effect and disability effect) was evaluated. Within the meta-regression analysis the uncertainty around the country specific mortality or disability contribution to the gender difference in HLY or ULY is accounted for. In a first set of models (model 1) the duration or the gender difference in the duration of life in different health states was entered univariately. In a second set of models (model 2), the member state specific level of the duration (among women) and the gender difference were entered simultaneously. The analyses were repeated 4 times to investigate the mortality effect in HLY and in ULY and the disability effect in HLY and in ULY. The values of the coefficients of the meta-regression analysis on the disability effect of the HLY or the ULY are the same but with a different sign, so only the first will be discussed in detail. Some of the univariate associations are presented with a line graph of the fitted values, together with the estimates from each member state represented by circles. The circle sizes depend on the precision of each estimate (the inverse of its within-study variance), which is the weight given to each country in the fixed-effects model.

[1] A copy of the R program and user manual are available from W. Nusselder (w.nusselder@erasmusmc.nl)

Results

Table 1 and Table 2 provide the information for the year 2006 on the different health expectancy indicators, the gender differences and the decomposition by kind of effect for each of the 25 EU countries. The data are summarized by boxplots (Figure 1). The female LE always exceeds the male LE, but the LE varies substantially across countries. E.g. at age 15, the median LE for women is 67.23 years, with an interquartile range (IQR) of 2.74 years (65.08 - 67.82) and range 7.76 years (62.06 – 69.65). Among males these figures related to the LE are respectively 61.96 years; 5.14 years (57.64 – 62.78) and 13.05 years (51.01 – 64.06) with the value of Estonia (51.06 years) as low outlier. Among females, the median HLY at age 15 years is 48.33 years with IQR of 7.42 years (42.97 – 50.12) and range of 15.87 years (38.63 – 54.50); the median ULY at age 15 years is 19.55 years with IQR of 5.62 years (16.85 - 22.47) and range of 16.06 years (12.63 – 28.69). Among men at the same age, the median HLY is 46.78 years (IQR: 8.35 years (42.09 – 50.44), range: 17.80 years (35.69 – 53.49)) and median ULY is 14.04 years (IQR: 3.36 years (12.29 – 15.65), range: 13.03 years (8.03 – 21.06)). Both females and males in Finland are living an extreme high number of years with activity limitations (respectively 28.69 and 21.06 years).

The median gender difference (females minus males) in LE was 5.55 years with an IQR of 3.19 years (4.70 - 7.89) and range of 8.18 years (3.47 – 11.65). The median gender difference in HLY is 0.77 years (IQR: 2.43 years (-0.32 – 2.11), range: 6.22 years (-1.98 – 4.42). In 7 countries (Cyprus, Denmark, Germany, Italy, the Netherlands, Portugal and Spain) men at age 15 can expect to live more years without activity limitations than women; in 3 countries (Cyprus, the Netherlands and Portugal), the HLY is statistically significant higher in men. In all countries, women live more years with activity limitations than men; the median gender difference in ULY is 5.43 years with IQR of 2.85 years (4.01 – 6.86) and range of 5.79 years (3.10 – 8.89).

Decomposition by kind of effect of the gender gap in HLY splits the gender difference up into a part that is due to differences in mortality and a part that is due to differences the prevalence of activity limitations. A positive value of the mortality effect indicates a the mortality advantage that women have over men is causing women to life more years without activity limitations and increases the gender difference in HLY. A negative value of the disability effect of the HLY suggest that the higher prevalence of activity limitations in women or the disability disadvantage of women over men is reducing the HLY in women and decreases the gender difference in HLY (Table 2). In all countries, the mortality advantage of women over men, contributes to more HLY in women: the median mortality effect of the gender difference in HLY is 2.78 years (IQR: 1.04 years (2.33 – 3.37); range 3.59 years (1.68 – 5.27)). The high value (5.27 years) of the mortality effect in Lithuania is an outlier.
In all but two countries (Austria and Estonia), the higher prevalence of activity limitations in women reduces the gender difference in HLY. As mentioned above, in 7 countries, the disability disadvantage of women is larger compared to the mortality advantage and therefore the gender difference in HLY becomes negative: women have a shorter life without activity limitations compared to men.

Figure 2 shows the results of the univariate meta-regression analysis of the decomposition components by kind of effect of the gender gap in HLY in function of LE. The results of the meta-regression of the HLY gender difference and LE are not shown as they can be derived from the tables 3 and 4 by adding up the coefficients of the decomposition components. When Le of either females or males is larger, the gender gap of the HLY is reduced as both of its effect components are decreasing: (1) the mortality advantage of women is reducing and (2) the disability disadvantage of women however becomes more important as shown by the fact that the disability effect becomes more negative. The associations are only statistically significant for the mortality component of the gender difference in HLY (Table 3a). The gender difference in HLY is larger when the gender gap in LE is wider. More specifically, the female mortality advantage on the gender difference in HLY increases while the female disability disadvantage decreases. The disability effect becomes more positive and does no longer offset the lower mortality in women. The association is again only significant with respect to the mortality effect of the gender difference in HLY and remains significant after adjustment for the LE of women.

When the health of populations improves as measured by an increase of LE, an increase of HLY or a decrease of ULY, there is a shift of the age groups contributing to the mortality effect of the gender difference in HLY towards the older ages (50 years and above) (Table 4 a). When the gender difference in either the LE, the HLY or the ULY is smaller, there is an increasing part of the mortality effect of the gender difference in HLY that can be attributed to difference in mortality in older ages. These associations of the relative contribution of older age groups to the mortality effect of the HLY remain significant after adjustment for the duration of life or the duration of life without or with activity limitations. None of the associations of the relative contribution of older age to the disability effect of the gender difference in HLY were statistically significant. However the sign of the coefficient pointed into the expected direction. E.g. when the HLY is higher or when the ULY is lower, the disability disadvantage of women is relatively more important at older ages than at younger ages.

Table 2 also gives the decomposition indicators of the gender gap in ULY. A positive value of the mortality effect of ULY indicates that the mortality advantage of women over men results in longer life with activity limitations. A positive value of the disability effect in case of the gender difference in ULY should be interpreted that the longer life of women with activity limitations is a result of the higher prevalence of activity limitations in women. The value of the disability effect is the same for the gender gap in HLY and ULY, but the sign is reversed. The presentation of the results is thus limited to the mortality effect of ULY. In all countries but Austria and Estonia, women are living more years with activity limitations because of the additive ULY mortality and disability effect. The mortality effect is positive in all countries. The median ULY mortality effect is 3.37 years (IQR: 2.53 years (2.13 - 4.66); range 5.90 years (1.20 – 7.10). In all but two countries (Austria and Estonia), women live also more years with activity limitations because they have a higher prevalence of activity limitations.

Figure 3 shows the results of the univariate meta-regression analysis of the decomposition components of the gender gap in ULY in function of LE. In countries with a high Le in either females or males, the mortality advantage of women decreases but the disability disadvantage of women increases. Both have an opposite effect on gender difference in ULY. The association is only statistically significant for the mortality component of the gender difference in HLY (Table 3b). When the gender gap in LE is wider the gender gap in ULY increases mainly because of the larger increase of the female mortality advantage compared to the size of the reduction of the female disability disadvantage due to the gender difference in the prevalence of the activity limitations. The association is only significant with respect to the mortality effect of the gender difference in ULY and remained remains significant after adjustment for the LE of women.

Similar as described above, when the health of populations improves, there is a shift of the age groups contributing to the mortality effect of the gender difference in ULY towards the older ages (50 years and above) (Table 4 b). When the gender difference in either the LE, the HLY or the ULY is smaller, there is an increasing part of the mortality effect of the gender difference in ULY that can be attributed to difference in mortality at older ages. These associations of the relative contribution of older age groups to the mortality effect of the ULY gender difference remain significant after adjustment for the duration of life or the duration of life without or with activity limitations.

Discussion

In this paper we tried to disentangle the health-survival paradox by using composite indicators, the HLY and ULY which contain information on both components of the paradox: the mortality and the prevalence of (ill)-health. For the gender differences in HLY and in ULY we evaluated which part is due to gender difference in mortality or due to gender differences in (ill)-health. The results confirm the presence of such a gender difference, but at the same time, the heterogeneity of the indicators and the associations of the decomposition components suggest that the health-survival paradox is not an established fact. The health-survival paradox is function of the level of population health indicators and their gender difference. In this paper we observe that in populations with a high LE, the gender difference in year lived without activity limitations become smaller or even negative. It is important to acknowledge that this may mask important evolutions in the gender differences in mortality and activity limitations as it is a result of two opposite forces: a reduction in the gender difference in mortality and an increase in the gender differences in the prevalence of activity limitations. The changes in the gender difference in mortality are somewhat larger than the changes in the gender difference in activity limitations. So while the survival part of the paradox, the female mortality advantage, becomes smaller, the gender differences in health, the female disability disadvantage, increases. This observation is consistent with reports on trends in health expectancy indicators over time where more often evidence for compression is reported among males while there is evidence for expansion among women (Robine, Jagger, Van Oyen, Cambois, Romieu, Clavel et al. 2005; Van Oyen, Cox, Deboosere & Lorant, 2008). It also goes against the general accepted wisdom that declining mortality goes with an increase in the duration and the proportion of ill-health, which is at least not the case among males. However the differences in evolution by gender in populations with a high LE can be a result of the fact women have already reach extreme older ages and changes in health are much more concentrated at the frontier of human life span. Simulation models have shown that in order to obtain compression the effect of reducing the incidence is larger than increasing recovering rates and that the improvement in the incidence and recovery rates have to be more substantial for a same change in mortality at older ages due to the higher concentration of ill health (Nusselder, 1998). In populations with a low life expectancy, we observed that the gender gap in ULY is large both because the gender difference in mortality is larger although the gender difference in the prevalence of activity limitations becomes less important. In populations with less favorable population health indicators such as low LE, low HLY and high ULY, the hardship among males start already at young ages (15 to 49 years) both with a higher mortality compared to women and a prevalence of activity limitations which is closer to prevalence among females. This confirms the double burden on men living in less healthy populations as next to their shorter life, they have a shorter healthy life and a longer unhealthy life with an unfavorable health situation and increased mortality starting at young ages (Nusselder et al., 2010).

Multiple causes have been considered to explain the mechanisms which drive the health-survival paradox between the genders. The impact of methodological issues such as gender differences in participation to survey or in reporting of health problems have been minimized (Oksuzyan et al., 2009). Among the biological explanations most attentions have been given to hormonal, autoimmune and genetic difference (Oksuzyan et al., 2008). However, the wide range within Europe of the gender differences in LE, HLY or ULY; the changing importance of either the mortality component, the disability component or the age groups contributing to the gender difference is at the same time a statement that the health-survival paradox is not fake artifact, but also a strong argument that what determines the health-survival paradox is dependent on modifiable societal, social and behavioral factors. Both the size and the gender difference in HLY are associated with country specific macro level indicators (Jagger, Gillies, Moscone, Cambois, Van Oyen, Nusselder et al. 2008; Van Oyen, Cox, Jagger, Cambois, Nusselder, Gilles et al. 2010). More specific, the gender gap in years with activity limitations decreases as the gross domestic product, the expenditure on elderly care and the life long learning among men increased while it increased with an increasing inequality in the income distribution. Social position is an important determinant of inequality in health expectancy indictors (Bossuyt, Gadeyne, Deboosere & Van Oyen, 2004; Cambois, Robine & Hayard, 2001; Crimmins & Saito, 2001; Davis, Graham & Pearce, 1999; Perenboom, van Herten, Boshuizen & van den Bos, 2005). Women and especially older women have a lower social position as a result of a lower education or a lower social class occupation and this may affect the gender difference in health and functional disability (Arber & Cooper, 1999). Several lifestyle factors, which have a different uptake in men compared to women, not only affects the LE, but are also associated with the expected years of life without disability (Juel, Sorensen & Bronnum-Hansen, 2008). Some of the life style factors may influence especially the mortality and reduces both the year lived with and without limitations; while other factors such as obesity mainly expand the year lived with disability (Reuser, Bonneux & Willekens, 2008). Men have an excess in disability and diseases which shorten life, while the disease pattern in women creates an excess in non-lethal conditions (Verbrugge, 1989). Contributing causes of morbidity to the mortality effect of gender difference in the disability free life expectancy (DFLE) in the Netherlands were heart diseases, cancer, COPD. Causes contributing to gender difference in disability effect of the gender difference in DFLE are heart disease, arthritis, back complaints, diabetes and COPD (Nusselder & Looman, 2004).

The study has several strengths. The country data were not pooled and the substantial heterogeneity among the EU member states is used (Jagger et al., 2008). In a meta-regression the uncertainty of each van de estimates was accounted for. The gender difference in HLY and ULY were subsequently divided into a part that can be explained by a differential age-specific mortality selection and a part that is due to a different age-specific prevalence of activity limitations (Jagger et al., 2008).

Limitations of the study are in the first place related to cross-sectional design and the Sullivan method which estimates of the health expectancy indicators are not period indicators which may introduce bias in case of absence of a steady state (Barendregt, Bonneux & Van der Maas, 1994; Mathers & Robine, 1997). Further the decomposition components does not assess the underlying processes of the incidence and recovering of activity limitations (Nusselder & Looman, 2004). A second limitation results from the fact that the SILC survey is limited to the community dwelling population and no information is available on the health status of the institutionalized population (Sullivan, 1971). Not only the proportion of the population within institutions differs between the EU countries, but also the type of care-related institutions is heterogeneous. Ignoring the differences in health status between the people in the general population and in institutions probably leads to an overestimation of the expected years without activity limitations and an underestimation of the years with activity limitations. It is unknown if this error occurred similarly in both genders in which case it would not affect the gender differences. Even so, the over- or underestimation may be larger in countries with a higher proportion of the population in institutions. A last limitation is related to the remaining problems in the harmonization of the GALI instrument as mentioned in the methods section.

Conclusion

In this paper we observed a large inequality in health and the gender difference in health between member states within Europe. In countries at the lower level of health as indicated by a low LE, a low HLY and a large ULY, men are in the worst position. Not only do they have a higher mortality differences compared to females in their country, they also face a high prevalence of activity limitations. Contrary to men in populations with a high health profile, the ill-health of these men starts already early in life.

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TABLES and FIGURES

Table 1.
Healthy (HLY*), Unhealthy Life years (ULY*), Life Expectancy (LE) and the % of remaining life in good health (%HLY) at age 15 in the European Member States, 2006

	MALES				FEMALES			
Countrya	HLY	ULY	LE	%HLY/LE	HLY	ULY	LE	%HLY/LE
Austria	44.23	18.24	62.48	70.8	46.48	21.51	67.99	68.36
	(43.52;44.84)	(17.63;18.96)	(62.35;62.61)	(69.66;71.76)	(45.81;47.20)	(20.79;22.20)	(67.88;68.11)	(67.36;69.43)
Belgium	48.55	13.40	61.96	78.37	48.67	18.84	67.50	72.10
	(47.90;49.29)	(12.65;14.07)	(61.84;62.06)	(77.29;79.58)	(47.83;49.44)	(18.05;19.64)	(67.40;67.60)	(70.91;73.27)
Cyprus	49.95	14.04	63.99	78.05	48.59	18.87	67.47	72.03
	(49.13;50.82)	(13.18;14.85)	(63.58;64.37)	(76.82;79.37)	(47.80;49.45)	(18.01;19.73)	(67.10;67.84)	(70.81;73.24)
Czech Republic	43.71	15.09	58.8	74.34	45.68	19.41	65.10	70.18
	(43.09;44.28)	(14.53;15.72)	(58.70;58.91)	(73.27;75.30)	(45.06;46.27)	(18.80;20.05)	(65.00;65.19)	(69.20;71.10)
Denmark	53.40	8.03	61.43	86.93	52.95	13.03	65.98	80.25
	(52.60;54.13)	(7.29;8.80)	(61.28;61.57)	(85.67;88.12)	(52.02;53.92)	(12.05;14.00)	(65.85;66.12)	(78.81;81.72)
Estonia	35.69	17.28	52.96	67.38	39.87	24.00	63.86	62.42
	(35.06;36.27)	(16.69;17.88)	(52.65;53.29)	(66.26;68.45)	(39.26;40.51)	(23.33;24.61)	(63.60;64.12)	(61.49;63.43)
Finland	39.21	21.06	60.27	65.06	39.52	28.69	68.21	57.94
	(38.36;40.03)	(20.24;21.92)	(60.14;60.42)	(63.64;66.42)	(38.55;40.45)	(27.79;29.63)	(68.08;68.37)	(56.53;59.29)
France	48.55	14.12	62.67	77.47	49.79	19.82	69.61	71.52
	(48.03;49.02)	(13.64;14.63)	(62.62;62.71)	(76.65;78.23)	(49.24;50.38)	(19.23;20.38)	(69.56;69.66)	(70.72;72.38)
Germany	44.18	18.28	62.45	70.74	43.94	23.70	67.64	64.96
	(43.66;44.66)	(17.78;18.80)	(62.41;62.50)	(69.90;71.52)	(43.44;44.52)	(23.13;24.21)	(67.61;67.68)	(64.20;65.80)
Greece	51.76	10.69	62.45	82.88	53.43	13.80	67.23	79.48
	(51.21;52.30)	(10.15;11.23)	(62.35;62.56)	(82.02;83.74)	(52.82;54.06)	(13.17;14.39)	(67.14;67.32)	(78.60;80.40)
Hungary	40.11	14.67	54.77	73.22	42.71	20.49	63.20	67.58
	(39.62;40.59)	(14.19;15.15)	(54.67;54.88)	(72.34;74.09)	(42.23;43.19)	(20.01;20.98)	(63.10;63.31)	(66.82;68.33)
Ireland	48.97	13.81	62.78	78.00	50.45	16.96	67.41	74.84
	(48.34;49.60)	(13.19;14.45)	(62.61;62.95)	(76.98;79.00)	(49.77;51.13)	(16.24;17.66)	(67.22;67.59)	(73.82;75.88)
Italy	50.18	13.59	63.77	78.69	49.74	19.55	69.29	71.78
	(49.85;50.49)	(13.27;13.91)	(63.72;63.81)	(78.17;79.19)	(49.38;50.07)	(19.25;19.91)	(69.25;69.33)	(71.26;72.24)
Latvia	36.71	14.53	51.25	71.64	38.63	23.42	62.06	62.26
	(36.08;37.41)	(13.86;15.19)	(51.00;51.48)	(70.42;72.93)	(37.92;39.36)	(22.71;24.13)	(61.85;62.26)	(61.16;63.41)
Lithuania	38.48	12.54	51.01	75.42	42.15	20.51	62.66	67.26
	(37.88;39.08)	(11.93;13.12)	(50.82;51.22)	(74.29;76.59)	(41.53;42.80)	(19.83;21.13)	(62.49;62.84)	(66.27;68.33)
Luxembourg	46.78	15.14	61.92	75.55	47.55	19.41	66.95	71.01
	(45.83;47.70)	(14.26;16.17)	(61.39;62.47)	(74.04;76.95)	(46.43;48.63)	(18.34;20.53)	(66.46;67.47)	(69.37;72.60)
Malta	53.49	8.81	62.30	85.87	54.5	12.63	67.13	81.18
	(52.69;54.29)	(8.12;9.53)	(61.81;62.86)	(84.74;86.96)	(53.70;55.29)	(11.85;13.43)	(66.67;67.62)	(80.08;82.32)
Netherlands	50.90	12.19	63.09	80.68	48.91	18.41	67.32	72.66
	(50.06;51.69)	(11.40;13.02)	(63.01;63.17)	(79.37;81.93)	(48.03;49.73)	(17.58;19.29)	(67.25;67.40)	(71.34;73.89)
Poland	44.09	12.39	56.48	78.06	48.33	16.74	65.07	74.28
	(43.74;44.43)	(12.06;12.74)	(56.41;56.54)	(77.45;78.64)	(47.97;48.73)	(16.34;17.11)	(65.01;65.12)	(73.71;74.89)
Portugal	45.21	15.71	60.92	74.21	43.24	24.26	67.49	64.06
	(44.59;45.86)	(15.04;16.31)	(60.81;61.02)	(73.25;75.30)	(42.49;43.99)	(23.48;24.99)	(67.40;67.60)	(62.96;65.19)
Slovakia	40.49	15.58	56.08	72.21	40.48	23.43	63.91	63.34
	(39.90;41.07)	(15.03;16.20)	(55.92;56.23)	(71.13;73.22)	(39.84;41.08)	(22.82;24.06)	(63.78;64.06)	(62.34;64.27)
Slovenia	43.68	15.95	59.63	73.25	47.35	19.77	67.11	70.55
	(42.88;44.47)	(15.18;16.77)	(59.39;59.88)	(71.94;74.53)	(46.49;48.19)	(18.91;20.61)	(66.89;67.35)	(69.28;71.79)
Spain	49.38	13.67	63.05	78.32	48.98	20.67	69.65	70.33
	(48.97;49.79)	(13.26;14.07)	(62.99;63.10)	(77.68;78.98)	(48.46;49.50)	(20.15;21.17)	(69.59;69.70)	(69.60;71.08)
Sweden	52.58	11.48	64.06	82.08	52.93	15.30	68.23	77.57
;	(51.73;53.44)	(10.61;12.33)	(63.95;64.17)	(80.75;83.45)	(51.97;53.90)	(14.35;16.27)	(68.13;68.34)	(76.17;78.97)
United Kindom	50.71	12.07	62.78	80.77	50.80	16.27	67.07	75.74
	(50.20;51.19)	(11.61;12.58)	(62.73;62.83)	(79.98;81.52)	(50.19;51.38)	(15.70;16.87)	(67.03;67.12)	(74.85;76.60)

Table 2.
Decomposition by kind of effect of the gender difference (Females-Males) in Healthy Life Years (HLY), Unhealthy Life Years (ULY) and total Life Expectancy (LE) at age 15 in the European Member States, 2006

	HLY			ULY			LE		
Country	Difference	Mortality effect	Disability effect	Difference	Mortality effect	Disability effect	Difference	Mortality effect	Disability effect
Austria	2.25	2.13	0.11	3.27	3.38	-0.11	5.52	5.52	0
	(1.31;3.24)	(2.00;2.27)	(-0.87;1.11)	(2.26;4.17)	(3.23;3.53)	(-1.11;0.87)	(5.34;5.68)	(5.34;5.68)	
Belgium	0.11	2.76	-2.65	5.43	2.79	2.65	5.55	5.55	0
	(-0.98;1.11)	(2.58;2.95)	(-3.78;-1.62)	(4.40;6.56)	(2.61;2.97)	(1.62;3.78)	(5.40;5.69)	(5.40;5.69)	
Cyprus	-1.36	1.68	-3.03	4.83	1.80	3.03	3.47	3.47	0
	(-2.51;-0.24)	(1.40;1.97)	(-4.21;-1.91)	(3.69;5.99)	(1.49;2.13)	(1.91;4.21)	(2.93;4.02)	(2.93;4.02)	
Czech Republic	1.97	2.81	-0.84	4.32	3.48	0.84	6.29	6.29	0
	(1.12;2.86)	(2.68;2.94)	(-1.68;0.06)	(3.43;5.16)	(3.35;3.62)	(-0.06;1.68)	(6.15;6.42)	(6.15;6.42)	
Denmark	-0.45	3.35	-3.8	5.00	1.20	3.80	4.55	4.55	0
	(-1.70;0.80)	(3.12;3.57)	(-5.00;-2.54)	(3.72;6.20)	(1.04;1.38)	(2.54;5.00)	(4.36;4.74)	(4.36;4.74)	
Estonia	4.18	3.8	0.37	6.72	7.10	-0.37	10.90	10.90	0
	(3.38;5.04)	(3.57;4.07)	(-0.48;1.27)	(5.81;7.57)	(6.80;7.44)	(-1.27;0.48)	(10.50;11.32)	(10.50;11.32)	
Finland	0.31	2.78	-2.47	7.63	5.16	2.47	7.94	7.94	0
	(-0.91;1.55)	(2.55;3.06)	(-3.72;-1.24)	(6.38;8.88)	(4.88;5.43)	(1.24;3.72)	(7.74;8.16)	(7.74;8.16)	
France	1.24	2.97	-1.73	5.70	3.98	1.73	6.95	6.95	0
	(0.50;2.04)	(2.83;3.11)	(-2.49;-0.94)	(4.92;6.45)	(3.83;4.12)	(0.94;2.49)	(6.87;7.01)	(6.87;7.01)	
Germany	-0.24	2.08	-2.32	5.43	3.11	2.32	5.19	5.19	0
	(-0.91;0.53)	(1.99;2.18)	(-3.01;-1.52)	(4.66;6.11)	(3.01;3.20)	(1.52;3.01)	(5.14;5.24)	(5.14;5.24)	
Greece	1.67	2.91	-1.24	3.1	1.86	1.24	4.77	4.77	0
	(0.85;2.48)	(2.80;3.02)	(-2.07;-0.44)	(2.29;3.92)	(1.77;1.96)	(0.44;2.07)	(4.63;4.92)	(4.63;4.92)	
Hungary	2.60	3.39	-0.79	5.82	5.03	0.79	8.43	8.43	0
	(1.90;3.26)	(3.26;3.53)	(-1.50;-0.11)	(5.16;6.52)	(4.88;5.19)	(0.11;1.50)	(8.27;8.58)	(8.27;8.58)	
Ireland	1.48	2.33	-0.84	3.14	2.30	0.84	4.63	4.63	0
	(0.54;2.48)	(2.17;2.50)	(-1.77;0.16)	(2.11;4.08)	(2.14;2.47)	(-0.16;1.77)	(4.38;4.90)	(4.38;4.90)	
Italy	-0.44	2.27	-2.71	5.96	3.25	2.71	5.53	5.53	0
	(-0.92;0.07)	(2.20;2.34)	(-3.19;-2.21)	(5.47;6.44)	(3.18;3.32)	(2.21;3.19)	(5.46;5.58)	(5.46;5.58)	
Latvia	1.92	4.27	-2.35	8.89	6.54	2.35	10.81	10.81	0
	(0.92;2.90)	(4.03;4.49)	(-3.37;-1.38)	(7.92;9.84)	(6.28;6.80)	(1.38;3.37)	(10.51;11.11)	(10.51;11.11)	
Lithuania	3.67	5.27	-1.60	7.98	6.38	1.6	11.65	11.65	0
	(2.81;4.56)	(5.05;5.50)	(-2.42;-0.72)	(7.13;8.83)	(6.14;6.60)	(0.72;2.42)	(11.37;11.92)	(11.37;11.92)	
Luxembourg	0.77	2.33	-1.56	4.27	2.71	1.56	5.04	5.04	0
	(-0.70;2.13)	(1.90;2.77)	(-2.97;-0.23)	(2.80;5.61)	(2.26;3.16)	(0.23;2.97)	(4.33;5.76)	(4.33;5.76)	
Malta	1.01	2.62	-1.61	3.83	2.22	1.61	4.84	4.84	0
	(-0.02;2.16)	(2.19;3.08)	(-2.60;-0.54)	(2.81;4.84)	(1.84;2.58)	(0.54;2.60)	(4.14;5.58)	(4.14;5.58)	
Netherlands	-1.98	2.18	-4.17	6.22	2.05	4.17	4.23	4.23	0
	(-3.12;-0.79)	(2.00;2.37)	(-5.33;-2.99)	(5.03;7.40)	(1.87;2.22)	(2.99;5.33)	(4.12;4.34)	(4.12;4.34)	
Poland	4.24	4.31	-0.06	4.34	4.28	0.06	8.59	8.59	0
	(3.78;4.78)	(4.19;4.43)	(-0.55;0.47)	(3.79;4.82)	(4.16;4.39)	(-0.47;0.55)	(8.51;8.66)	(8.51;8.66)	
Portugal	-1.97	2.52	-4.49	8.55	4.05	4.49	6.57	6.57	0
	(-2.94;-1.02)	(2.38;2.65)	(-5.47;-3.58)	(7.61;9.52)	(3.90;4.21)	(3.58;5.47)	(6.44;6.73)	(6.44;6.73)	
Slovakia	-0.01	2.65	-2.66	7.85	5.19	2.66	7.84	7.84	0
	(-0.82;0.85)	(2.47;2.83)	(-3.48;-1.76)	(6.99;8.65)	(4.99;5.40)	(1.76;3.48)	(7.64;8.04)	(7.64;8.04)	
Slovenia	3.67	3.83	-0.16	3.81	3.65	0.16	7.48	7.48	0
	(2.52;4.85)	(3.54;4.12)	(-1.32;1.08)	(2.65;4.97)	(3.39;3.92)	(-1.08;1.32)	(7.14;7.84)	(7.14;7.84)	
Spain	-0.40	3.22	-3.63	7.00	3.37	3.63	6.59	6.59	0
	(-1.08;0.20)	(3.12;3.33)	(-4.28;-3.02)	(6.40;7.67)	(3.26;3.48)	(3.02;4.28)	(6.52;6.67)	(6.52;6.67)	
Sweden	0.35	2.83	-2.48	3.82	1.34	2.48	4.17	4.17	0
	(-0.89;1.64)	(2.65;3.03)	(-3.76;-1.21)	(2.56;5.07)	(1.17;1.50)	(1.21;3.76)	(4.02;4.33)	(4.02;4.33)	
United Kindom	0.09	2.47	-2.38	4.20	1.82	2.38	4.29	4.29	0
	(-0.66;0.81)	(2.39;2.56)	(-3.12;-1.66)	(3.49;4.95)	(1.74;1.90)	(1.66;3.12)	(4.23;4.36)	(4.23;4.36)	

Table 3
Association of decomposition indicators by kind of effect of the gender differences in Healthy Life Years (HLY) and Unhealthy Life Years (ULY) with the Life Expectancy (LE), HLY and ULY at age 15 years, EU, 2006

	a. Gender difference in HLY							
	Mortality effect				Disability effect			
	Model 1		Model 2		Model 1		Model 2	
Le Women	-0.25	**	-0.05		-0.20		-0.08	
Le Men	-0.16	**			-0.12			
Gender difference LE	0.30	**	0.27	**	0.21		0.16	
HLY Women	-0.06		-0.03		-0.03		0.03	
HLY Men	-0.08	**			-0.10			
Gender difference HLY	0.33	**	0.31	**	0.65	**	0.67	**
ULY Women	0.01		-0.08		-0.01		0.19	*
ULY Men	-0.04				0.10			
Gender difference ULY	0.16		0.28	*	-0.35	**	-0.63	**

	b. Gender difference in ULY							
	Mortality effect				Disability effect			
	Model 1		Model 2		Model 1		Model 2	
Le Women	-0.49	**	0.05		0.20		0.08	
Le Men	-0.35	**			0.12			
Gender difference LE	0.70	**	0.73	**	-0.21		-0.16	
HLY Women	-0.31	**	-0.28	**	0.03		-0.03	
HLY Men	-0.29	**			0.10	*		
Gender difference HLY	0.49	**	0.32	**	-0.65	**	-0.67	**
ULY Women	0.31	**	0.19		-0.01		0.19	*
ULY Men	0.29	**			0.10			
Gender difference ULY	0.65	**	0.36	*	-0.35	**	-0.63	**

*: significant at p=0.05, **: significant at p=0.01
Model 1: Univariate meta-regression; Model 2: Multivariate meta-regression

Table 4

Association of relative contribution (%) of older age (50 years and above) to the decomposition indicators by kind of effect of the gender differences in Healthy Life Years (HLY) and Unhealthy Life Years (ULY) with the Life Expectancy (LE), HLY and ULY at age 15 years, EU, 2006

	a. Gender difference in HLY			
	Mortality effect		Disability effect	
	Model 1	Model 2	Model 1	Model 2
Le Women	2.96 **	0.99	-1.87	-4.20
Le Men	1.86 **		-0.38	
Gender difference LE	-3.30 **	-2.67 **	-0.44	-3.15
HLY Women	1.32 **	1.15 **	3.97	5.65
HLY Men	1.28 **		1.34	
Gender difference HLY	-2.58 **	-1.87 **	14.74	18.25
ULY Women	-1.04 **	-0.29	-6.39	-2.49
ULY Men	-0.78		-5.24	
Gender difference ULY	-2.82 **	-2.39	-16.11	-12.34
HLY Women		1.12		1.60
ULY Women		0.98		-2.74
Gender difference HLY	-3.19[§] **	-2.36 **	12.28	14.66
Gender difference ULY	-3.42[§] **	-2.57 **	-13.83	-6.12

	b. Gender difference in ULY			
	Mortality effect		Disability effect	
	Model 1	Model 2	Model 1	Model 2
Le Women	2.03 **	1.08 **	-1.87	-4.20
Le Men	1.18 **		-0.38	
Gender difference LE	-1.98 **	-1.28 **	-0.44	-3.15
HLY Women	0.73 **	0.61 **	3.97	5.65
HLY Men	0.74 **		1.34	
Gender difference HLY	-1.70 **	-1.32 **	14.74	18.25
ULY Women	-0.45 **	0.06	-6.39	-2.49
ULY Men	-0.23		-5.24	
Gender difference ULY	-1.53 **	-1.62 *	-16.11	-12.34
HLY Women		1.01 *		1.60
ULY Women		1.12 **		-2.75
Gender difference HLY	-2.04[§] **	-1.34 **	12.28	14.66
Gender difference ULY	-1.91[§] **	-1.50 **	-13.83	-6.12

*: significant at p=0.05, **: significant at p=0.01
Model 1: Univariate meta-regression; Model 2 and §: Multivariate meta-regression

Figure 1. Distribution of Life Expectancy (LE), Healthy and Unhealthy Live Years (HLY, ULY), the gender differences (dif_) and the decomposition indicators by kind of effect (mortality (mef_)and disability (def) effect) at age 15 years, EU, 2006

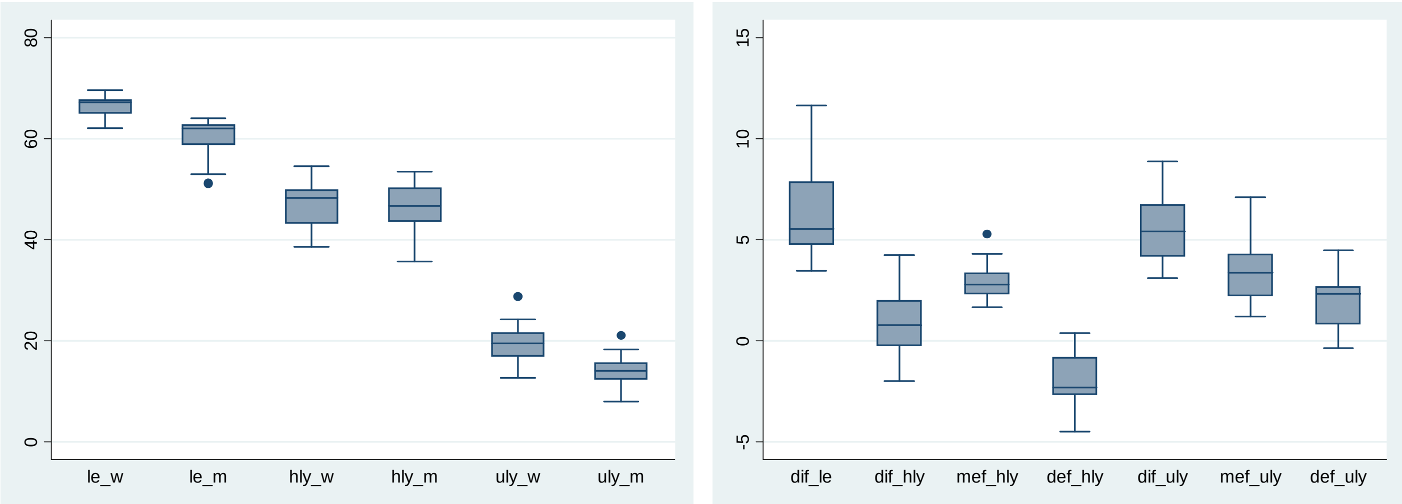
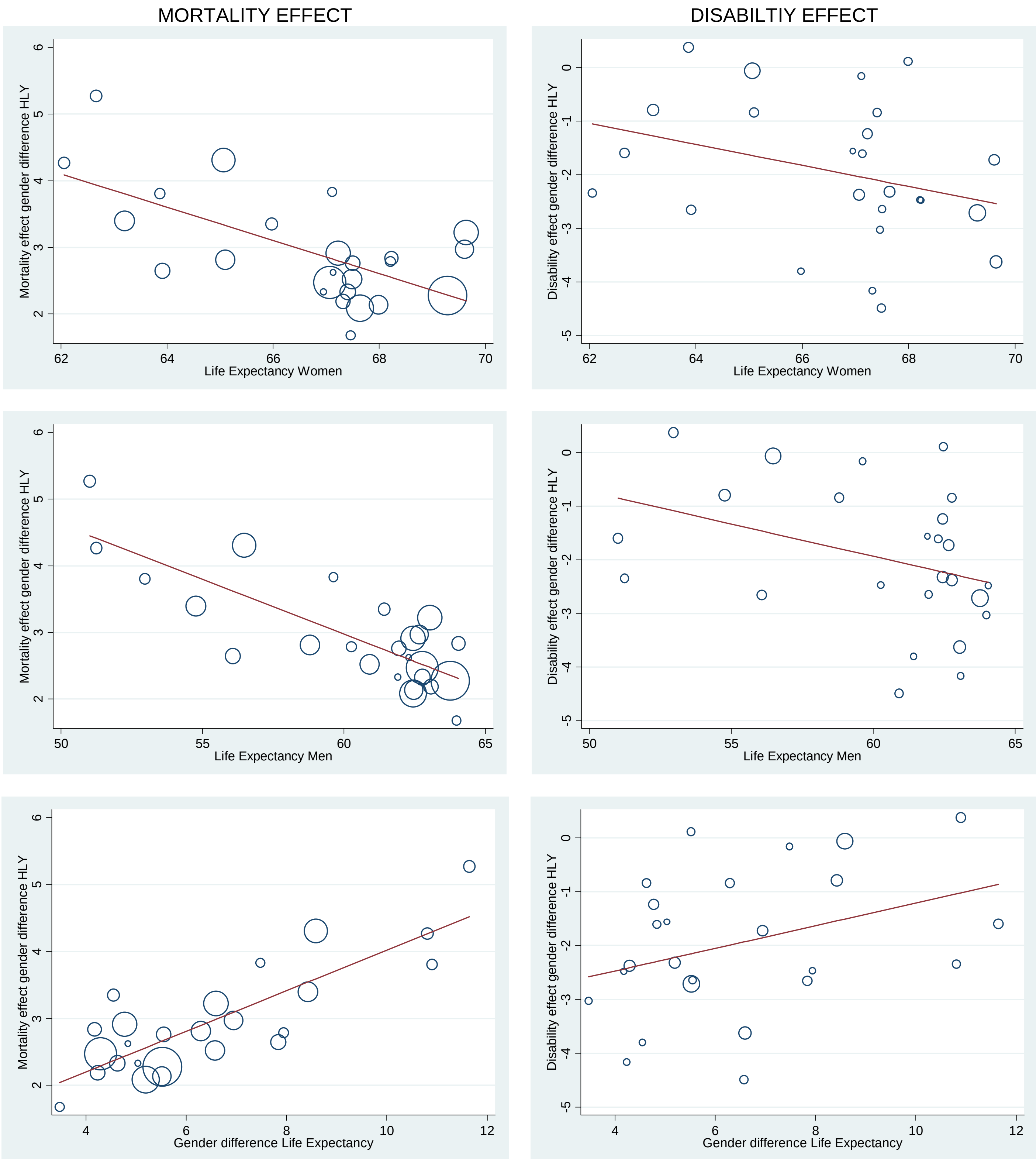
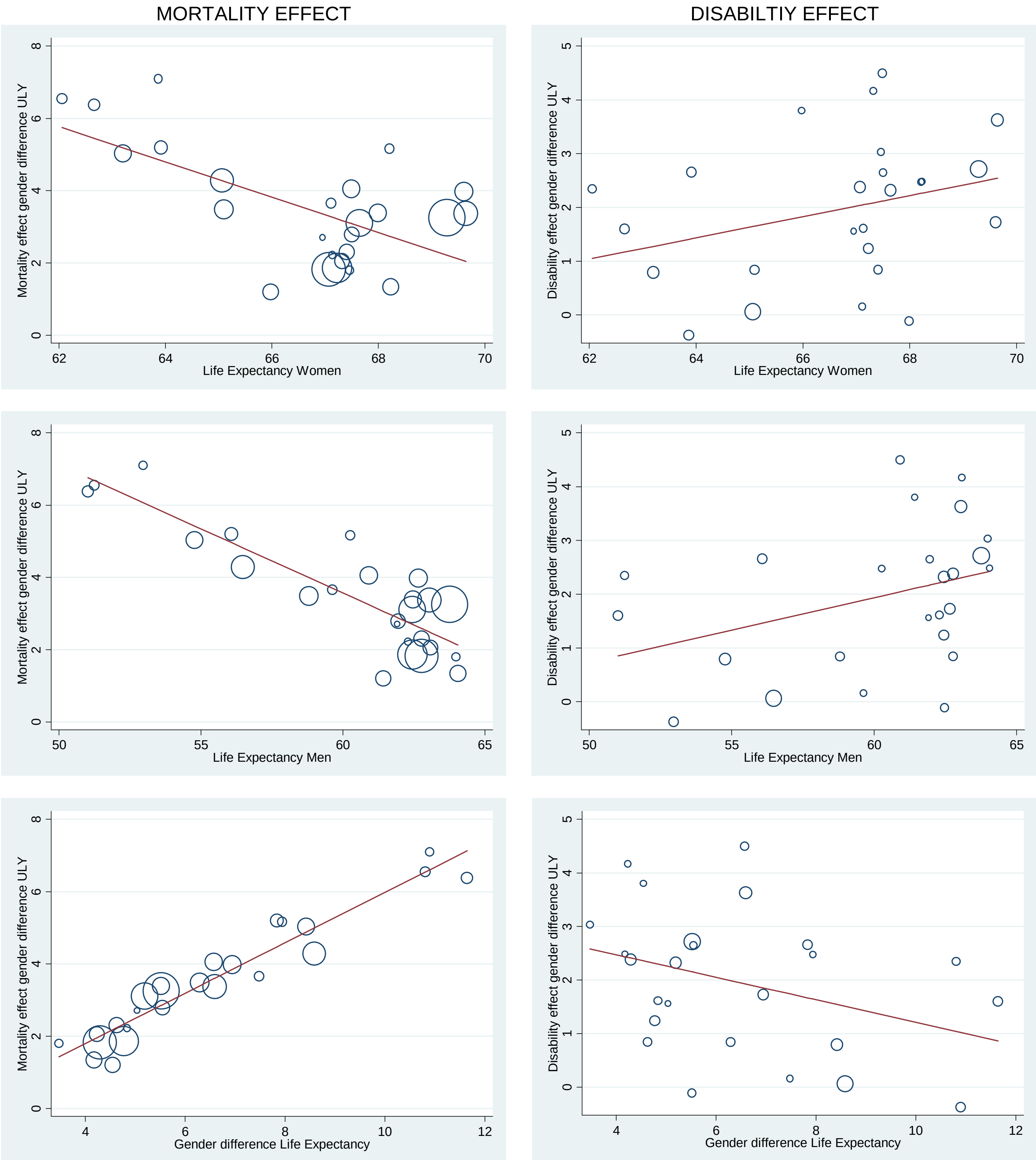


Figure 2. Association of decomposition indicators by kind of effect of the gender differences in Healthy Life Years (HLY) and Life Expectancy at age 15 years, EU, 2006



Meta-regression (univariate) line graph of fitted values. Circles represent the estimate (mortality or disability effect) from each country, with circle size depending on the inverse of the within-country variance

Figure 3. Association of decomposition indicators by kind of effect of the gender differences in Unhealthy Life Years (ULY) and Life Expectancy at age 15 years, EU, 2006



Meta-regression (univariate) line graph of fitted values. Circles represent the estimate (mortality or disability effect) from each country, with circle size depending on the inverse of the within-country variance