MS ritgerð

Fjármálahagfræði

Income-related inequality in Body Mass Index:
The effects of the 2008 economic collapse in Iceland

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Leiðbeinandi Tinna Laufey Ásgeirsdóttir

Hagfræðideild

Júní 2013

HÁSKÓLI ÍSLANDS

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Lokaverkefni til MS -gráðu í hagfræði

Leiðbeinandi: Tinna Laufey Ásgeirsdóttir

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Félagsvísindasvið Háskóla Íslands

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Formáli

Eftirfarandi ritgerð er 30 ECTS eininga meistaraverkefni í Fjármálahagfræði við Háskóla Íslands. Umfjöllunarefnið er tekjutengd líkamsþyngd á Íslandi einu ári fyrir og einu ári eftir efnahagshrunið sem varð hér á landi árið 2008. Til grundvallar liggja niðurstöður úr spurningakönnun Lýðheilsustöðvar, Heilsa og líðan Íslendinga, sem framkvæmd var árin 2007 og 2009. Upplýsingagildi rannsóknarinnar er mikið þar sem skoðuð eru margvíð þverskurðargögn sem felur í sér að sömu einstaklingum er fylgt eftir milli ára.

Ég vil þakka Lýðheilsustöð fyrir að hafa framkvæmt spurningakönnunina og Stefáni Hrafni Jónssyni hjá Lýðheilsustöð kærlega fyrir afnot af gögnunum. Einnig vil ég þakka öllum þeim sem komu að gerð þessarar spurningakönnunar. Án góðra gagna er erfitt að framkvæma athyglisverðar rannsóknir. Ritgerðin er skrifuð á ensku til þess að hafa möguleikann á því að senda hana til birtingar í erlendu tímariti.

Leiðbeinandi minn er Tinna Laufey Ásgeirsdóttir, doktor í hagfræði og lektor við Hagfræðideild Háskóla Íslands. Ég vil þakka henni kærlega fyrir góða leiðsögn og gagnlegar ábendingar við gerð þessara verkefnis.

Einnig vil ég þakka fjölskyldu minni fyrir veittan stuðning og þolinmæði í minn garð meðan á þessu stóra verkefni stóð. Ég vil líka þakka öllum þeim sem komu á einn eða annan hátt að þessu verkefni með mér.

Abstract

Background and aims: How mortality and morbidity measures are related to business cycles has gotten increased attention with the great economic recession. Similarly income-related health inequality has been studied in many countries and in recent years more researches have measured income-related health inequality with concentration index and concentration curve. However the relationship between macroeconomic conditions and income-related health distribution has received limited attention. What happens when an economy collapses? Recent results have indicated that physical health can actually improve in recession.

Data and methods: The data used in this thesis is longitudinal and originated from a health and lifestyle survey carried out by The Public Health Institute in 2007 and again in 2009. The goal of this survey was to gather information about health, wellbeing, quality of life and diseases of people in Iceland using a stratified random sampling method. To evaluate income-related health inequality concentration indexes were computed and concentration curves graphed. The variables used to measure living standards were individual income and equivalent household income, both before taxes. The variable used to measure health status was Body Mass Index.

Results: Income-related health inequality is not to be detected in Iceland in 2007 or 2009 when considering equivalent household income. The concentration curves almost coincide with the line of equality. The concentration indexes are almost the same between the years and very close to zero indicating no difference between the years. When considering individual income, there is also little or no income-related health inequality to be detected in 2007 or in 2009 when looking at the whole sample. Actually the concentration curve in 2009 goes a little bit closer to the line of equality meaning less income-related inequality one year after the economic collapse and the concentration index swifts from being positive to negative. The only evidence of income-related inequality is seen for women in 2009 when considering individual income. The concentration index is negative favouring the higher income groups.

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1 Introduction

In 1989 Sobal and Stunkard published a seminal review of the literature on the relationship between socio-economic status (SES) and obesity. They found 144 published studies on the socio-economic status obesity relation in men, women and children in the developed and developing world. Their findings included higher likelihood of obesity among women in lower socio-economic strata in developed societies. The relation for men and children in developed societies was inconsistent. However, for men, women and children in developing societies there was a higher likelihood of obesity among persons in higher socio-economic strata. Sobal and Stunkard´s work has greatly influenced subsequent research on the socio-economic patterning of weight (McLaren, 2007).

Income-related health inequality has been studied in many countries using concentration index and concentration curve. However the relationship between macroeconomic conditions and income-related health distribution has received limited attention. Recent results have indicated that physical health can improve in recession but it may not hold for psychological health (Ruhm, 2000). Inequality in health has lately been greatly discussed and is of interest in itself for public health policy makers. Body weight is an important health determinant and may therefore have consequences for general health in the long run. Because of the increasing prevalence of obesity in many countries, coupled with growing interest in social inequalities in health, continued monitoring of the socio-economic patterning of weight is important.

The main object of this study is to evaluate the relationship between income and Body Mass Index (BMI) of adult Icelanders before and after the economic crisis in 2008. To reach this object, concentration indexes will be calculated for body weight and concentration curves will be found and graphed. The main results will be the indexes themselves. The research questions can be stated as follows:

1. **Is there a negative relationship between income and Body Mass Index in Iceland in 2007?**
2. **Is there a change in this relationship one year after the economic collapse in Iceland in 2008?**

This thesis will proceed as follows. In the next chapter the literature on income-related health inequality is reviewed as well as impacts of economic collapse on health in general. Chapter three presents the data and the methodology used to answer the research questions. In chapter four the results are stated for both individual income and equivalent household income. Conclusion is in the fifth and final chapter.

2 Literature review

It is important to clarify the definition of Body Mass Index and income-related health inequality. Body Mass Index is a measure of heaviness and it is calculated by dividing weight in kilograms by the square of height in meters. The Body Mass Index is thus a continuous measure, but the following categorization is frequently used: underweight (<18.5), normal weight (18.5–24.9), overweight (25.0–29.9), and obese (>30.0) (Himes, 1999). Income-related health inequalities are potentially avoidable differences in health between groups of people who are more or less advantaged socially (Braveman, 2006).

Various measures are available to quantify the extent of income inequality within a given community or society. Of these, the Gini coefficient is most frequently used. If income in a population is distributed completely equally, the Gini value is 0. If one person has all the income, the Gini value is 1.0 (Subramanian & Kawachi, 2003). According to the lifestyle surveys conducted by Statistics Iceland the Gini index has gradually risen from 24.1 in 2004 to 29.6 in 2009. In 2007 the Gini index was 28.0 („Risk of poverty and income distribution 2004-2009“, 2010). However, it is sometimes argued that one of the disadvantages of the Gini coefficient is that it is not additive across groups. For example the total Gini of a society is not equal to the sum of the Ginis for its sub-groups.

Statistics Iceland publishes and reports once a year earnings in the private sector. Income is defined and categorized into three groups, regular salaries, total regular salaries and total salaries. Regular salaries include only salaries for contract work hours. Total regular salaries include salaries and additional overtime. Total salaries include total regular salaries in addition to bonuses that are not paid every month excluding driving benefits and other paid benefits such as call options. Total regular salaries for full-time employees were just above 360,000 ISK (mean) and about 325,000 ISK (median) in the year 2007 („Earnings in the private sector 2007,“ 2008). In the year 2009 total regular salaries for full-time employees were just below 400,000 ISK (mean) and about 350,000 ISK (median) („Earnings in the private sector 2009,“ 2010). Since the median is lower than the mean in both years the distribution is skewed to the right.

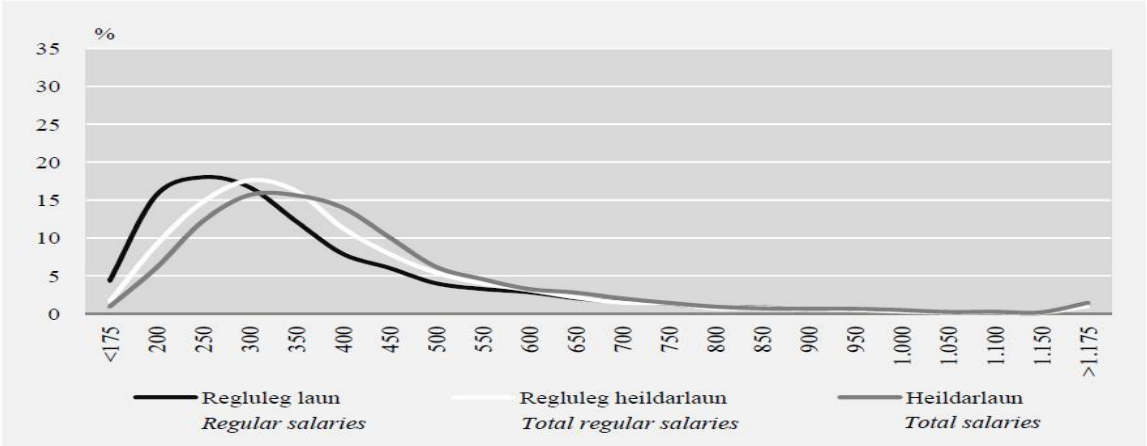


Figure 1 Distribution of earnings for full-time employees in 2009.

Figure from: („Earnings in the private sector 2009," 2010)

In figure 1 the distribution of regular salaries, total regular salaries and total salaries for full-time employees in 2009 is shown. About 63% of the employees have regular salaries between 175,000 – 375,000 ISK per month, 58% of the employees have total regular salaries in the same range and 50% of the employees have total salaries in the same range. The quartile share ratio is the ratio of weighted wages of those individuals in the top quartile and the bottom quartile. For full-time employees the ratio for total salaries was 3.2 in 2007 and 2.8 in 2009 („Earnings in the private sector 2009," 2010), indicating less difference between wages in the top and bottom quartile for 2009.

Obesity is increasing rapidly throughout the developed world and in some countries rates have doubled in just a few years. Overweight and obesity have been found to be major risk factors for chronic diseases, including cardiovascular disease, diabetes, musculoskeletal disorders and some forms of cancer. The health outcomes that are commonly investigated are very general endpoints such as life expectancy, mortality and self-rated health. Weight status may function as an intermediary link between income inequality and more general health measures because obesity is an important health determinant and may therefore have consequences for general health in the long run. Genetics can partly explain the prevalence of overweight but it is highly unlikely that the genetic evolution can explain the rapid increase in obesity that has been seen in the recent decades. Both medical and psychosocial factors also contribute with reasonable and complementary explanations. Technological progress and economic and social aspects also contribute to an extent and should not be ignored.

Cheaper access to junk food, more sedentary life-styles and cheaper production which results in lower food prices are all good examples (Ljungvall & Gerdtham, 2009).

In a study conducted by The Public Health Institute of Iceland where body weight of adult Icelanders was evaluated over the years of 1990-2007 it was shown that the Body Mass Index of Icelanders has increased over the last two decades and more people now have higher BMI than before. In the year 1990 the number of obese men was 7.2% but had increased to 18.9% in 2007. With women the rate went from being 9.25% in 1990 to 21.3% in 2007. However a more recent study showed that the Body Mass Index of Icelanders has been steady since 2007, so at least it has not been increasing.

Income-related health inequality has been studied in many countries. The existing economic literature on the socio-economic determinants of body weight usually conclude a negative gradient between income and body weight, higher income is related to lower body weight. One study regarding body weight was conducted in USA in 2007 (Zhang and Wang, 2007). The study examined the changes in socio-economic status inequality of overweight among US adolescents in the past three decades, using data from 1971-2002. The research showed that patterns of socio-economic status disparity of overweight among US adolescents varied across ethnic and gender groups, and have changed over time. It also stated a negative relationship between Body Mass Index and income. Another study was conducted in Sweden (Ljungvall & Gerdtham, 2009) with data over a 17-year period to analyze income-related inequalities in obesity. Among females, inequalities in obesity favored the rich, but the estimated inequality declined over time. Income and marital status were the main driving forces behind body weight inequality, and income explained the majority of declined obesity inequality over time. Similar trends were found for males, although less pronounced. Similar results are found in the economic literatures of Wamala et al. in 1997 and Nayga in 1999.

In economic contractions unemployment usually rises, wages decline and stress often increases. Low income-level, unemployment and social isolation may increase the likelihood of weight changes. Studies on the relationship between unemployment and body weight show a positive relationship between BMI and unemployment at the individual level, while aggregate unemployment is negatively related to a populations BMI. The relationship between unemployment and changes in body weight in Iceland

following the economic collapse in 2008 was estimated in 2012 and the results were that both men and women gain less weight in the event of a job loss (Jónsdóttir, 2012). But how is the distribution of body weight between individuals in Iceland with regard to income and is there a change in this distribution between the years 2007 and 2009? It is interesting to see if the same results apply to Iceland as for many other countries where this has been examined, that there is a negative relationship between Body Mass Index and income. Although the magnitude of such a relationship is very difficult to predict, as well as the role of ambient economic conditions.

3 Data and methodology

The data used in this thesis is longitudinal and originated from a health and lifestyle survey carried out by The Public Health Institute in 2007 and again in 2009. The goal of this survey was to gather information about health, wellbeing, quality of life and diseases of people in Iceland. A stratified random sampling method was used to gather this information. Most of those who answered the survey in 2007 agreed to participate in a secondary survey in 4-6 years but because of the economic collapse in Iceland in 2008 the secondary survey was done earlier than planned. The main goal of the secondary survey was to measure the changes in people´s life, social status and health one year before and one year after the economic collapse in October 2008. The participants in the survey are defined as individuals with residence in Iceland and have enough Icelandic knowledge to answer the questionnaire. Elderly individuals and those from rural areas were oversampled. In 2007, the gross sample consisted of 9.928 Icelandic citizens who were 18-79 years old and had residence in Iceland. The net sample consisted of 9.807 individuals since 121 were excluded. The response rate was 60.3% or 5.909 individuals. The response rate in 2009 was 41.7% or 4.092 individuals of the original sample. 69.3% of the individuals who answered the survey in 2007 did so again in 2009.

The methodology used in this thesis is based on the concentration index and corresponding concentration curve. The concentration index and concentration curve provide a means of quantifying the degree of income-related inequality in a specific health variable. The concentration curve graphs on the x-axis the cumulative percentage of the sample, ranked by living standards (income), beginning with the poorest and on the y-axis the cumulative percentage of the health variable (BMI) corresponding to each cumulative percentage of the distribution of the living standard variable.

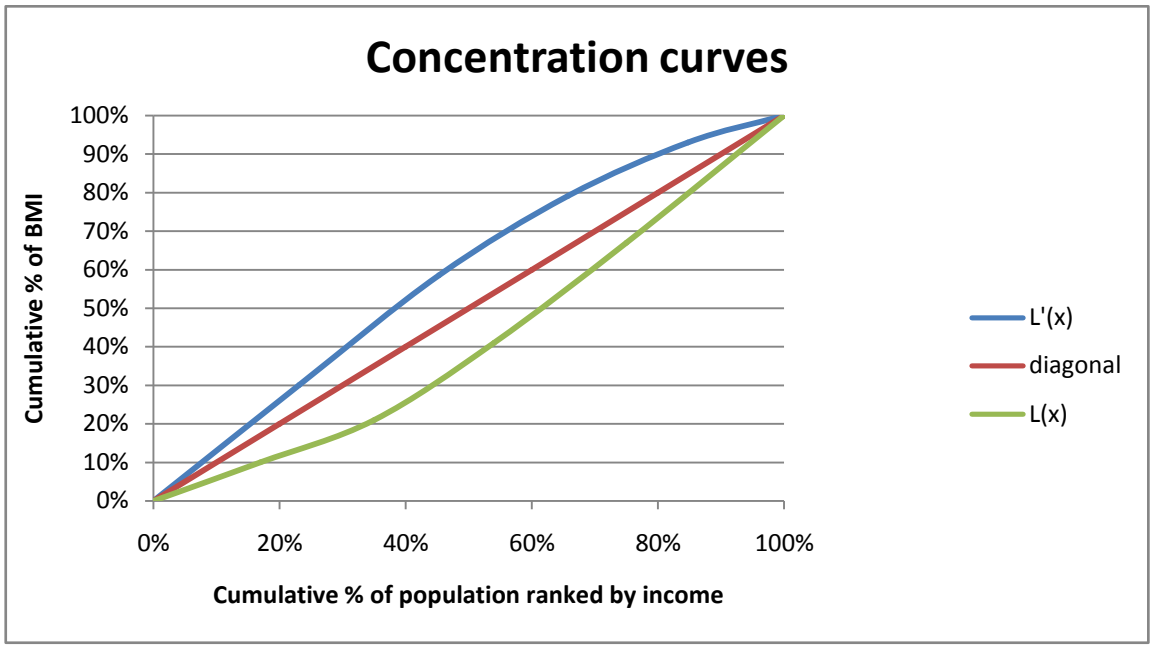


Figure 2 Concentration curves

As seen in figure 2, the concentration curve lies above the diagonal if the Body Mass Index is more concentrated among the less advantaged people. If the concentration curve lies below the diagonal the Body Mass Index is more concentrated among the more advantaged people. The closer the concentration curve lies to the diagonal, the more equal the distribution of Body Mass Index is across the socio-economic status. A concentration curve dominates another when it lies above the other one and they do not cross each other. The concentration index is defined as twice the area between the concentration curve and the diagonal, ranging from -1 to 1. The value of the concentration index measures the severity of socio-economic inequality so the larger the absolute value of the index the greater the disparity. The concentration index is negative (positive) if the Body Mass Index is more concentrated among the lower (higher) income groups. The concentration index is zero when the concentration curve coincides with the diagonal. Then there is no income-related inequality in Body Mass Index.

Both STATA/IC 11.2 for Windows and Microsoft Excel 2010 were used.

3.1 The data

The results are based on individuals, from the two questionnaires, who provided enough information needed to calculate individual income, equivalent household income and Body Mass Index. The range in age was 18-79 years in the 2007 sample, 51 mean and a standard deviation of 16. The range in age in 2009 was 20 – 81 years, 53 mean and a standard deviation of 16. The results are based on 3553 individuals in 2007 and 2009 when considering individual income and 3413 individuals when considering equivalent household income. The proportion between the genders were 47,65% men and 52,35% women when considering individual income and 48,29% men and 51,71% women when considering household income. Self-reported height and weight in the questionnaire were used to calculate the Body Mass Index for each individual. When working with individual income and equivalent household income only people who marked that they were currently working were considered. The goal of this thesis is to only look at individuals who were on the labour market in both years.

Income, expenditure and consumption are examples of direct approaches to measure living standard and availability of data is often what determines which of those approaches are used (O´Donnell, et al., 2008). To measure living standard in this thesis questions on individual income per month (ten point scale from „less than 75 thousand ISK“ to „700 thousand or more“) and household income per month (fourteen point scale from „less than 75 thousand ISK“ to „more than 1.5 million ISK“) were used. Questions about age, gender, marital status and family size were also used. To better represent the spending money available when considering household income the OECD-modified scale was used. This scale which was first proposed by Haagenars et al. (1994) assigns a value 1 to the household head, 0.5 to each additional adult member and 0.3 to each child. Individuals 17 years and younger were defined as children in this thesis although the OECD-modified scale defines children as individuals younger than 15 years old. That is because of the available information in the questionnaire. Using this method gives a better indicator of the individuals financial means because economies of scale in household have been taken into account. Equation 1 was used to compute equivalent household income.

$$Equivalent\ household\ income = \frac{Household\ income}{1\alpha + 0{,}5\beta + 0{,}3\gamma}$$ **Equation 1**

The question about household income was reported in 14 groups and the midpoint in each group was used as a proxy for household income in equation 1. If the individual marked that he/she lived alone, the question about individual income was used as a proxy. The same method was used for individual income, the midpoint in each individual income group was used as a proxy. After calculating the equivalent household income with equation 1 the results were used to calculate the concentration indexes and concentration curves. The question about individual income was reported in 10 groups and these groups were used without any alterations when calculating the concentration indexes and concentration curves for individual income. The individual income groups and the frequency in each group in 2007 and 2009 are shown in figures 3 and 4. The proportion of Body Mass Index in each individual group is shown in appendix 1.

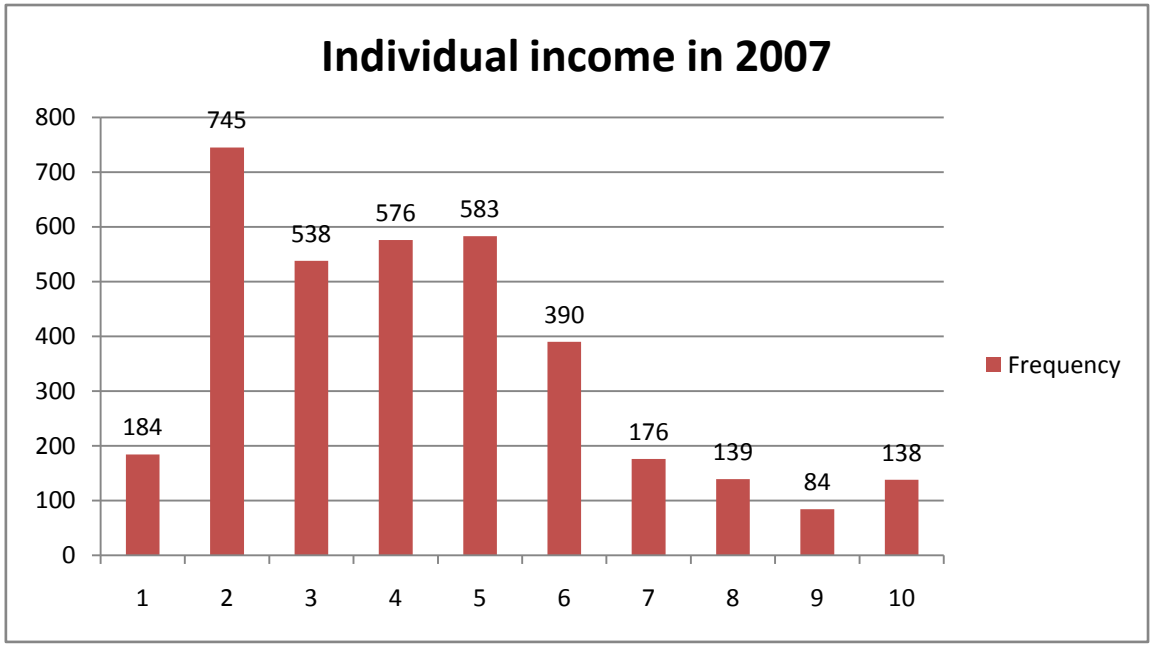


Figure 3 Frequency in each individual income group in 2007

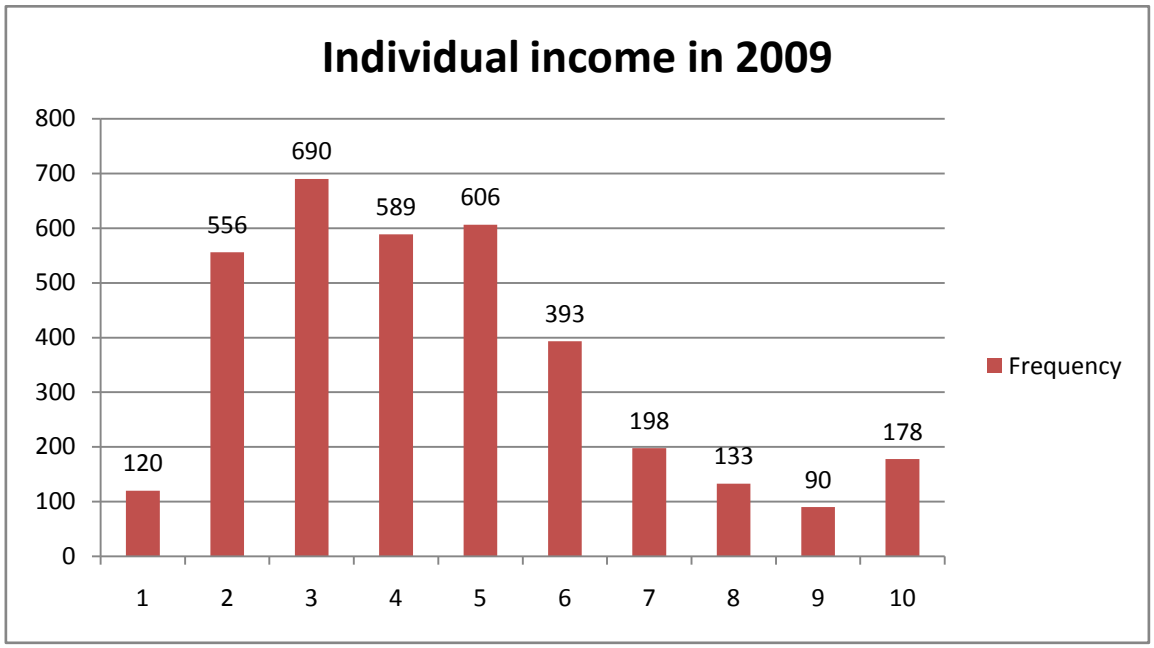


Figure 4 Frequency in each individual income group in 2009

As seen in figures 3 and 4 the number of individuals in the lowest income group is lower in 2009 than in 2007. There are also more individuals in the highest income group in 2009 than in 2007. The most frequent income group in 2007 is the second income group („75,000 – 141,000“) but in 2009 it is the third income group („142,000 – 200,000“). Summary statistics are shown in table 1.

Table 1 Summary statistics

Individual income	obs	Mean	Std.Dev
2007	3553	4,31382	2,24129
2009	3553	4,52744	2,23554

Equivalent household income	obs	Mean	Std.Dev
2007	3413	335470,3	246854,5
2009	3413	359760,9	244036,5

Body weight	obs	Mean	Std.Dev
2007	3553	81,76893	16,48557
2009	3553	82,09457	16,26517

Body weight	obs	Mean	Std.Dev
2007	3413	81,8963	16,5922
2009	3413	82,3711	16,4121

Height	obs	Mean	Std.Dev
2007	3553	173,0369	9,013756
2009	3553	172,9513	9,086958

Height	obs	Mean	Std.Dev
2007	3413	173,197	9,01829
2009	3413	173,331	9,07783

Body mass index	obs	Mean	Std.Dev
2007	3553	27,24965	4,926988
2009	3553	27,38446	4,845148

Body mass index	obs	Mean	Std.Dev
2007	3413	27,2376	4,93754
2009	3413	27,3502	4,84429

Gender	Freq	Percent.
Male	1693	47,65%
Female	1860	52,35%
	3553	100%

Gender	Freq	Percent.
Male	1648	48,29%
Female	1765	51,71%
	3413	100%

3.2 The methodology

As stated before both STATA and Excel were used for calculations and statistical work in this thesis. The concentration indexes and the concentration curves were computed in Excel. When graphing the concentration curves, the cumulative percentage of Body Mass Index was on the y-axis and the cumulative percentage of the sample ranked by individual income or equivalent household income on the x-axis. The proportion of Body Mass Index for each individual income group was found and then the cumulative proportion was used as a y coordinate to draw the curve when working with individual income. The proportion of Body Mass Index for equivalent household income was also found and the cumulative proportion was used as a y coordinate to draw the curve when working with household income.

Linear regression analysis was used to estimate if it had any influence on the relationship between Body Mass Index and income if men or women were married or

single. 95% confidence interval was used in these regressions. Linear regression analysis is used to produce an equation that will predict a dependent variable using one or more independent variables. The equation has the form:

$$Y = bX + A \qquad \text{Equation 2}$$

where *Y* is the dependent variable, Body Mass Index. X is the independent variable, income and b is the coefficient that describe the size of the effect the independent variable is having on the dependent variable. A is the value Y is predicted to have when all the independent variables are equal to zero.

4 Results

As stated before when the concentration curve lies above the diagonal the inequality favors the higher income groups. The closer the concentration curve lies to the diagonal, the more equal the distribution of Body Mass Index is across the socio-economic status. The smaller the concentration index the less income-related inequality there is. The results are based on individual income and equivalent household income as measures for socio-economic status. Concentration curves and concentration indexes for both the years 2007 and 2009 were computed and also for men and women separately. Results and explanations from linear regression analysis are available in appendix 2.

4.1 Body Mass Index and individual income

The concentration curve for Body Mass Index in 2007 lies so close to the line of equality that a difference is hard to detect graphically. The concentration index (CI) is therefore almost zero or 0.001204 (see figure 5).

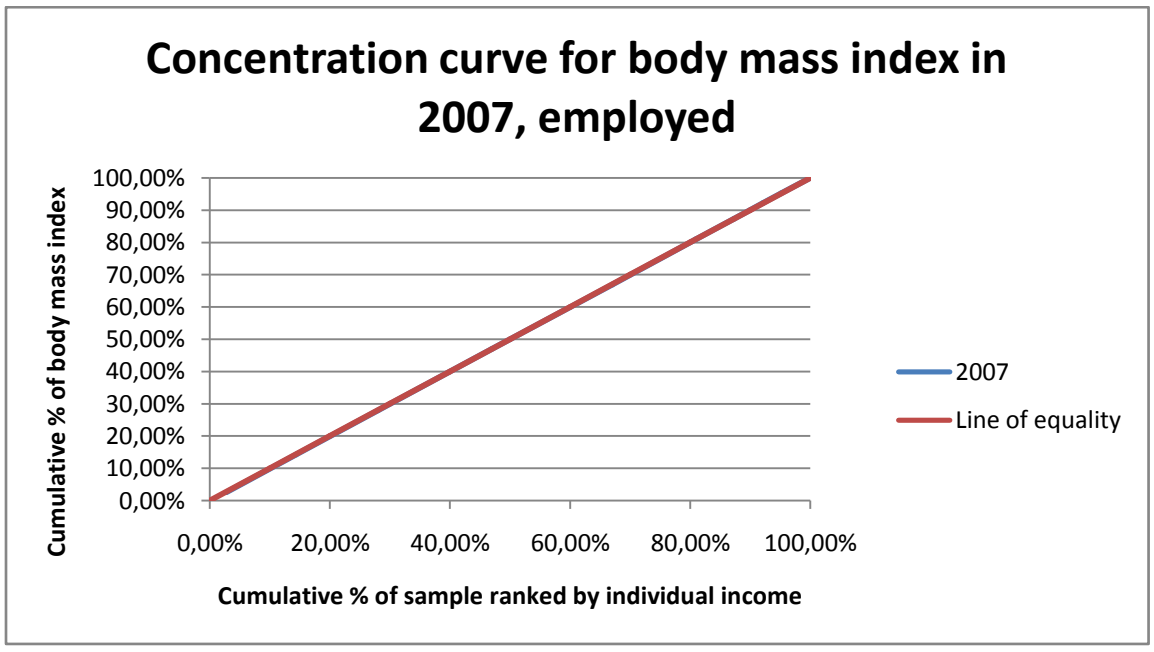


Figure 5 Concentration curve for body mass index in 2007, employed

When looking at the concentration curve for Body Mass Index in 2009, one year after the economic collapse in Iceland, the same result appears. The concentration curve lies

so close to the line of equality that a difference is hard to detect graphically. The concentration curve actually lies closer to the line of equality one year after the economic collapse in Iceland than it did one year prior. This indicates less income-related inequality than in 2007. The concentration index is almost zero or -0.000061 (see figure 6).

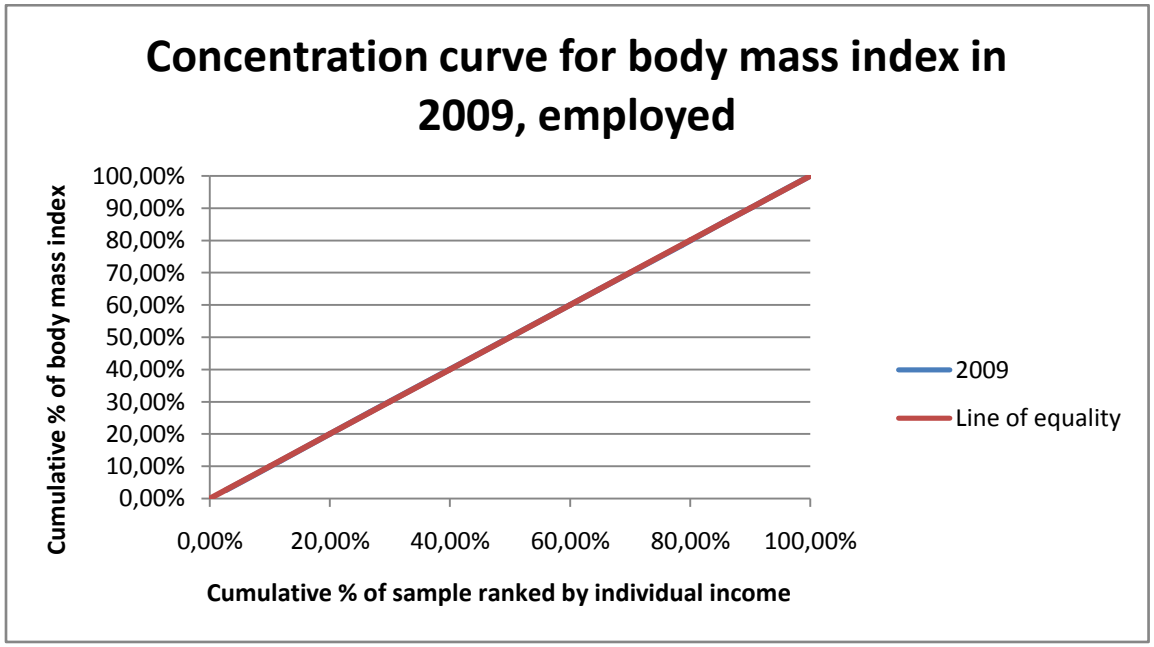


Figure 6 Concentration curve for body mass index in 2009, employed

When concentration curves for men and women are calculated separately in 2007 there is also little difference to be detected. The concentration curves lie so close to the diagonal that they almost match. The concentration index for men is 0.004981 and for women -0.005578 (see figure 7).

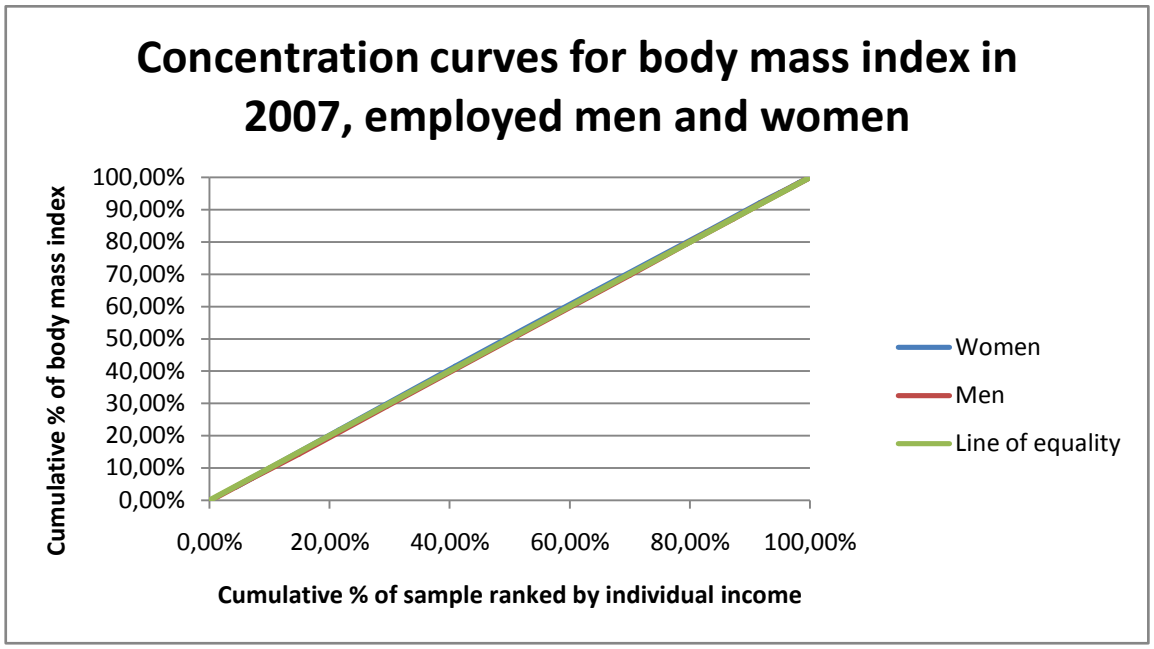


Figure 7 Concentration curves for body mass index in 2007, employed men and women

When concentration curves are calculated separately for men and women in 2009 there is also hard to detect difference graphically for men, the concentration curve almost matches the line of equality. The concentration index for men in 2009 is 0.007387. For women there is a small difference, the concentration curve lies a little bit over the line of equality favoring the higher income groups. The concentration index is -0.010266. As stated before if the concentration index is negative the Body Mass Index is more concentrated among the lower income groups (see figure 8).

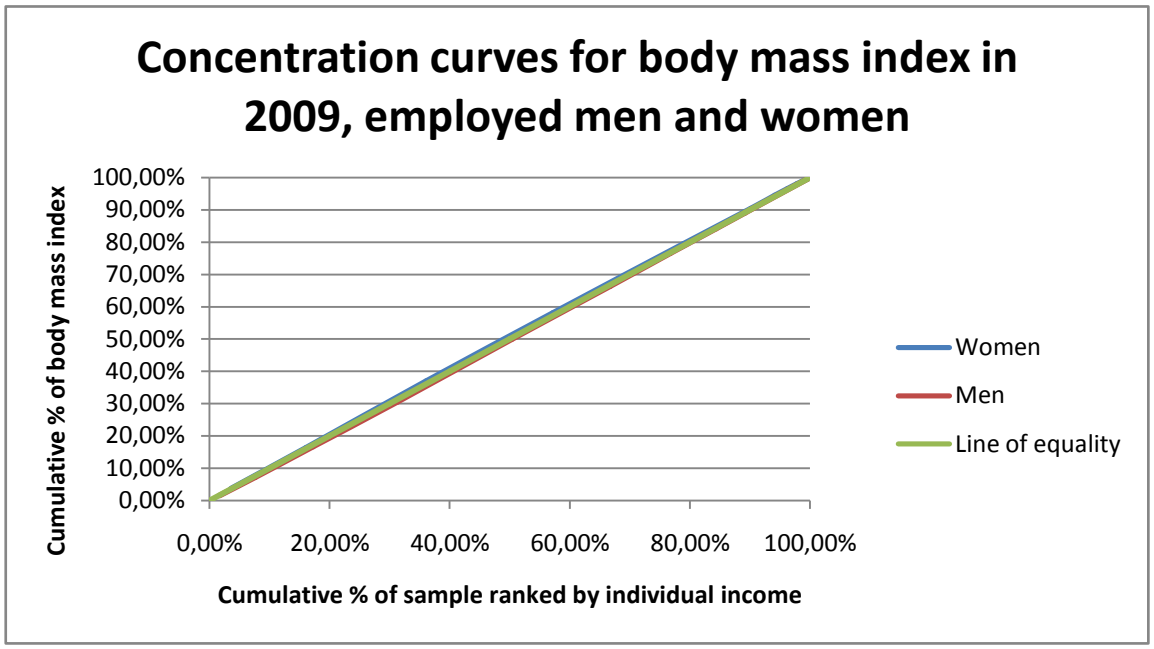


Figure 8 Concentration curves for body mass index in 2009, employed men and women

Figure 9 shows the deviation from the line of equality for women in 2009 more clearly.

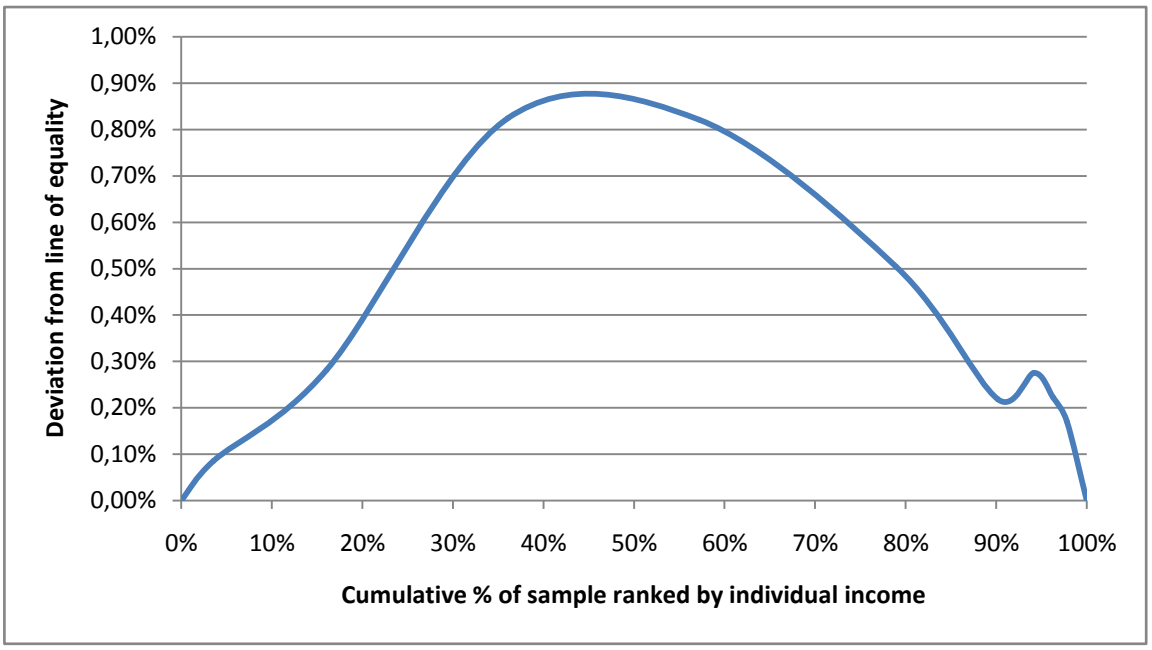


Figure 9 Deviation from the line of equality for women in 2009

These results may be a little bit surprising. Usually an income-related inequality appears stating that people in lower income groups have slightly higher Body Mass Indexes than people in higher income groups. The CI´s are usually higher and the concentration curves show more differences from the line of equality. These results from both 2007 and 2009 in Iceland do not show this, except for women in 2009. But when looking at the average Body Mass Indexes in 2007 and 2009 for the ten individual income groups it can be seen that the Body Mass Indexes for the individuals in the sample do not follow the same pattern (see table 2 and table 3).

Table 2 Average BMI and individual income groups, 2007

2007		2007 women		2007 men	
Income groups	Average BMI	Income groups	Average BMI	Income groups	Average BMI
1	25,038	1	25,804	1	23,313
2	27,781	2	27,319	2	26,720
3	27,455	3	27,537	3	26,554
4	27,241	4	27,115	4	27,386
5	27,060	5	26,508	5	27,405
6	27,313	6	27,178	6	27,385
7	27,153	7	25,395	7	27,715
8	27,482	8	26,345	8	27,364
9	27,452	9	27,143	9	27,594
10	26,949	10	25,208	10	27,118

Table 3 Average BMI and individual income groups, 2009

2009		2009 women		2009 men	
Income groups	Average BMI	Income groups	Average BMI	Income groups	Average BMI
1	26,608	1	27,830	1	25,136
2	27,653	2	27,606	2	26,303
3	27,759	3	27,917	3	26,704
4	27,134	4	27,176	4	27,110
5	27,300	5	26,784	5	27,878
6	27,112	6	26,486	6	27,392
7	27,667	7	27,566	7	27,785
8	27,218	8	26,500	8	27,418
9	27,589	9	26,250	9	27,984
10	27,039	10	25,069	10	27,543

As seen in table 2 and table 3, in 2007 the lowest average Body Mass Index is in the lowest income group and the highest. The same applies when looking at women separately but when looking at men in 2007 the lowest average Body Mass Index is in the lowest income group but rises as the income groups are higher. In 2009 the lowest average Body Mass Index is in the lowest income group but when looking at women separately the average Body Mass Index goes down as the income groups get higher and the lowest average Body Mass Index is actually in the highest income group. For men in 2009 the lowest average Body Mass Index is in the lowest income group and goes up as the income groups are higher.

4.2 Body Mass Index and equivalent household income

The concentration curve for Body Mass Index in 2007 when working with equivalent household income is shown in figure 10.

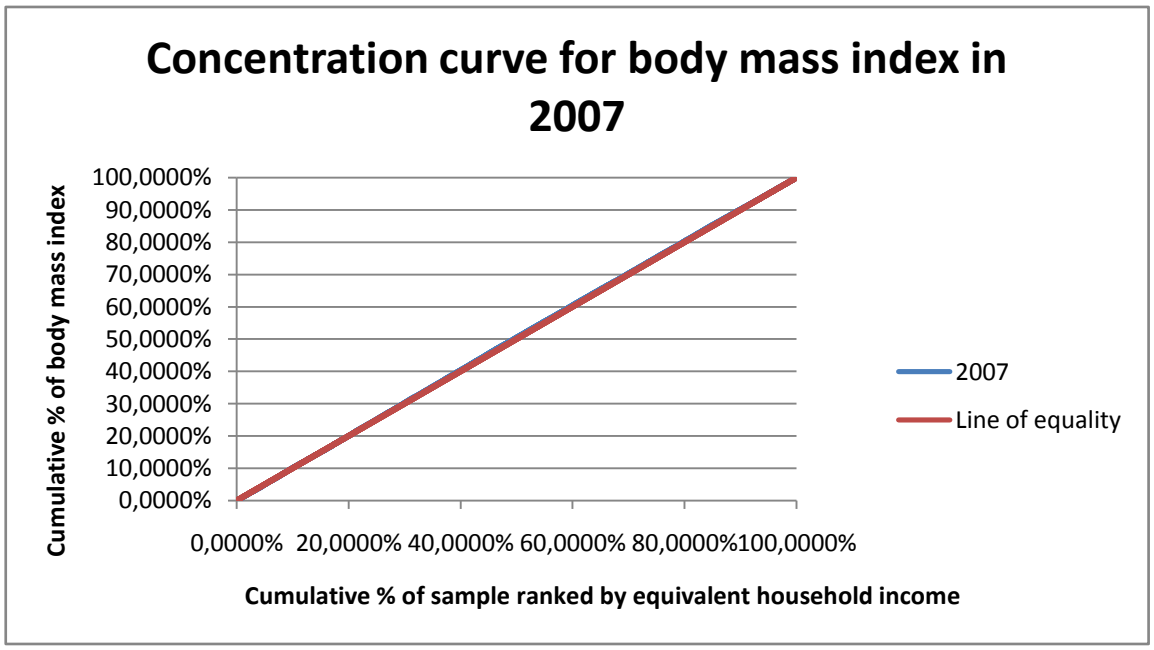


Figure 10 Concentration curve for body mass index in 2007, equivalent household income

The concentration curve lies so close to the line of equality that again a difference is hard to detect graphically. The concentration index is close to zero or -0.004377. In 2009 the same result appears and the concentration index is almost the same as in 2007 or -0.004717 (see figure 11).

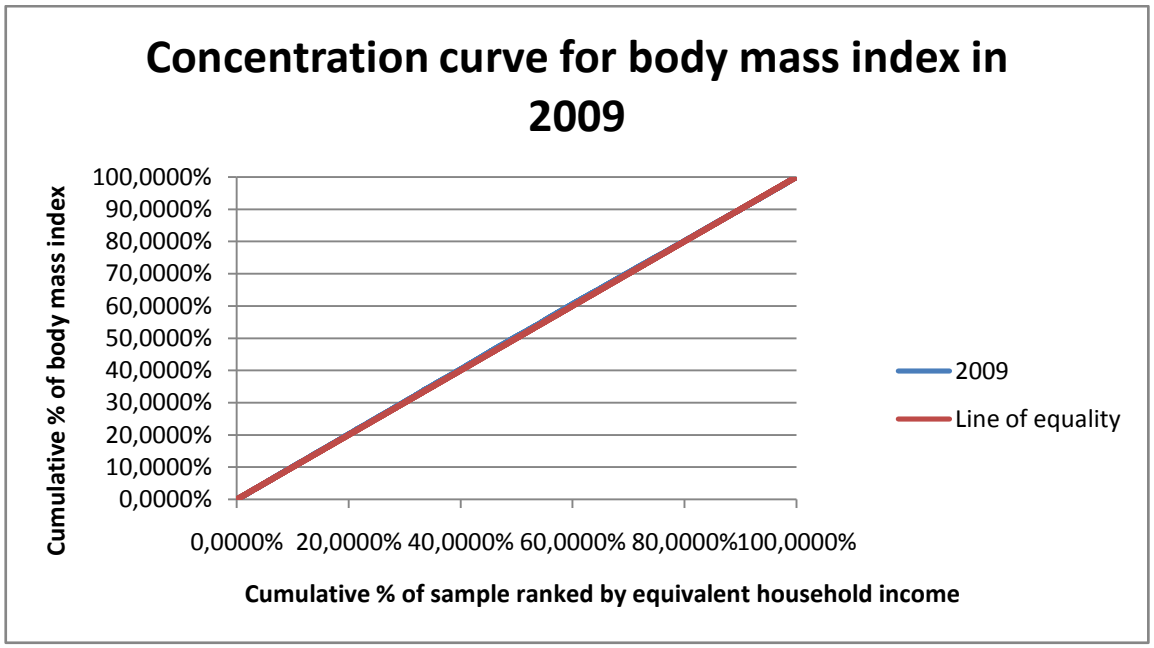


Figure 11 Concentration curve for body mass index in 2009, equivalent household income

If the concentration curves for men and women are calculated separately in 2007 the concentration indexes are 0.000077 for men and -0.008900 for women. The concentration curves can be seen in figures 12 and 13.

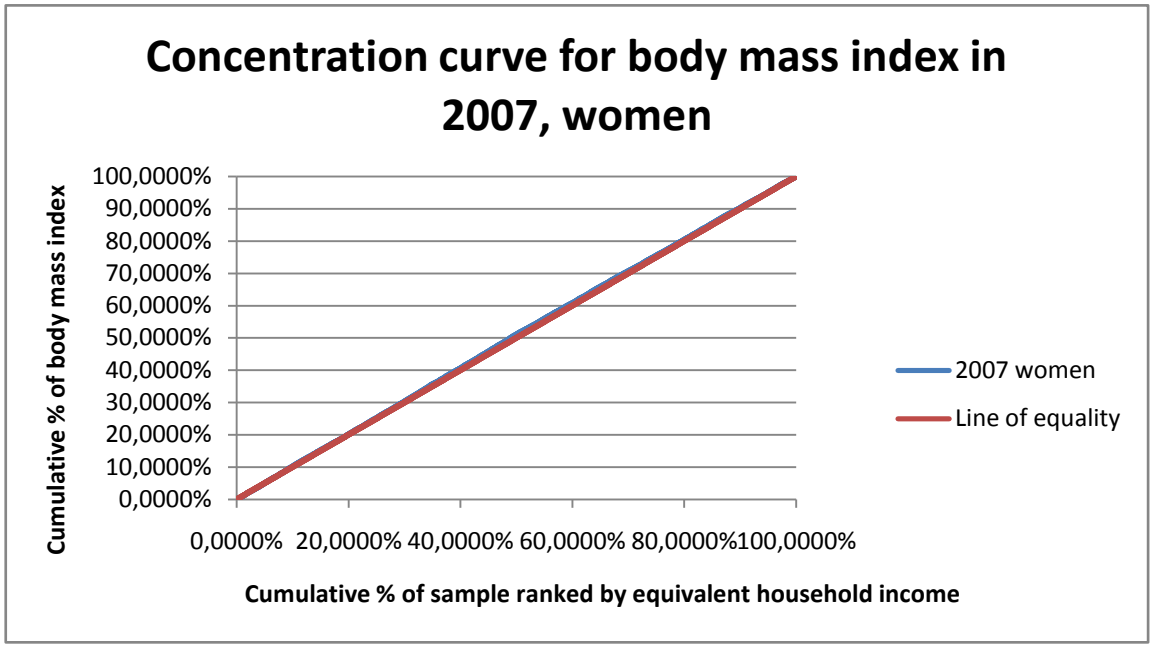


Figure 12 Concentration curve for body mass index in 2007, equivalent household income, women

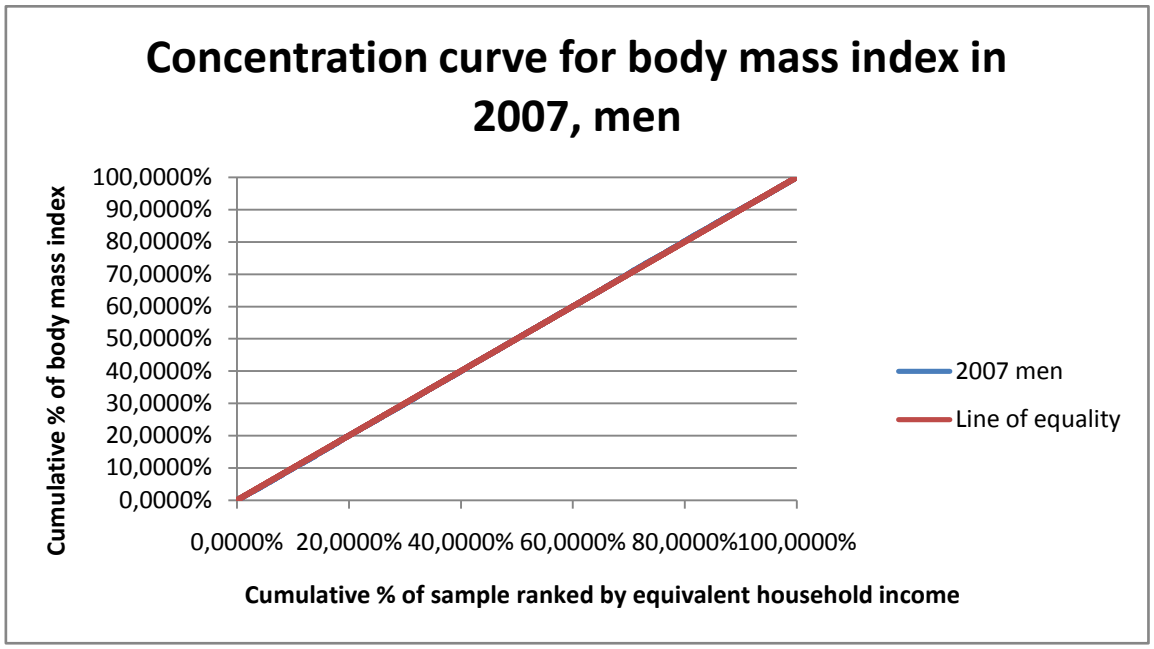


Figure 13 Concentration curve for body mass index in 2007, equivalent household income, men

There is no difference to be detected graphically when looking at the concentration curves for men and women. Both curves almost match the line of equality. The concentration curves for men and women when calculated separately in 2009 are shown in figures 14 and 15.

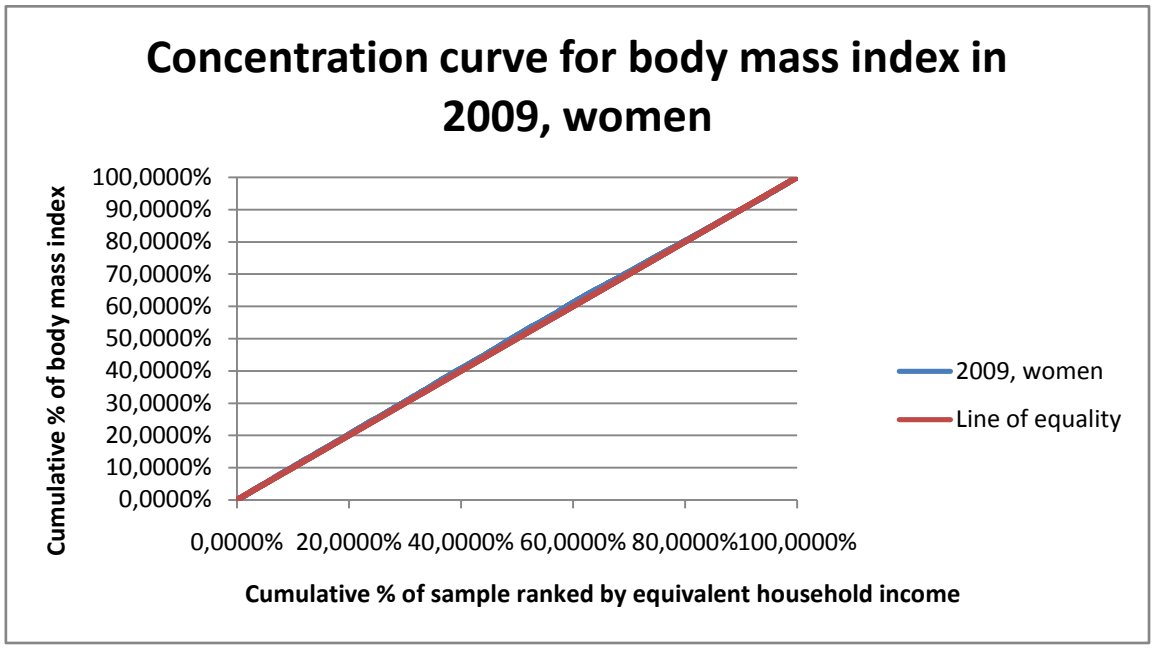


Figure 14 Concentration curve for body mass index in 2009, equivalent household income, women

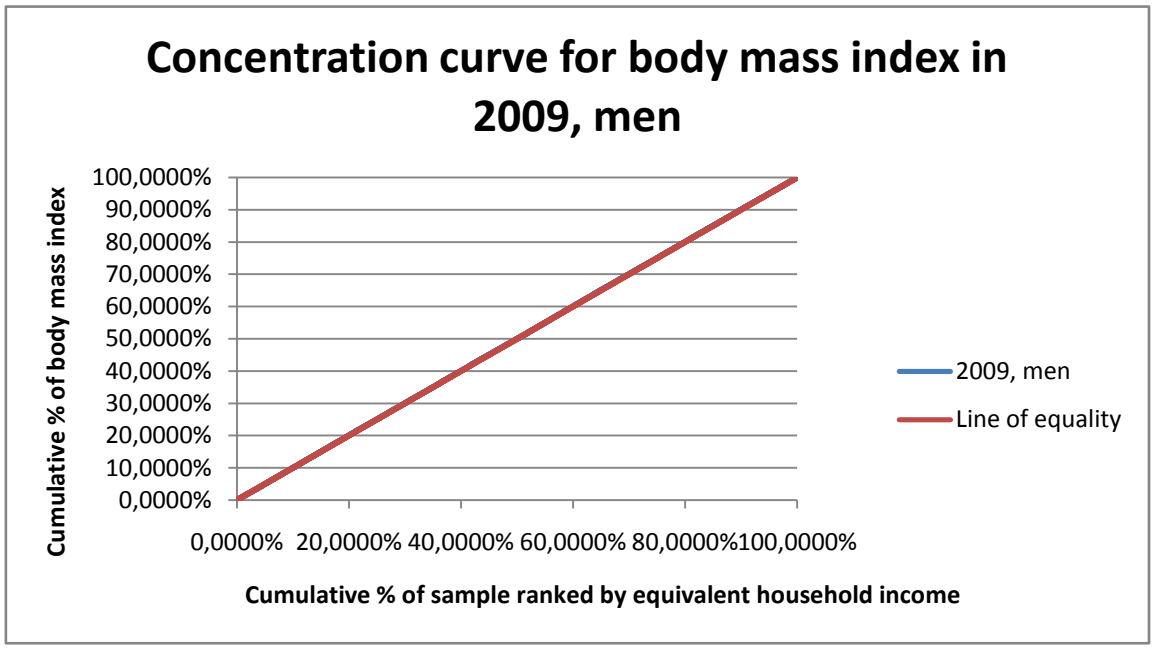


Figure 15 Concentration curve for body mass index in 2009, equivalent household income, men

As in 2007 there is no difference to be detected graphically. The concentration indexes are close to zero or -0.000211 for men and -0.009501 for women.

4.3 Summary

Table 4 Summary of the concentration indexes

Individual income

	2007	2009
Concentration index	0,001204	-0,000061

2007 women	2009 women
-0,005578	-0,010266

2007 men	2009 men
0,004981	0,007387

Household income

	2007	2009
Concentration index	-0,004377	-0,004717

2007 women	2009 women
-0,008900	-0,009501

2007 men	2009 men
0,000077	-0,000211

The overall concentration indexes are shown in table 4. For individual income in all cases the concentration indexes are really close to zero except for women in 2009. As stated before, the smaller the concentration index the less income-related inequality there is. From 2007 to 2009 the concentration curve moves a little bit closer to the line of equality, meaning less income-related inequality and is more concentrated among the lower income groups in 2009 than in 2007. Both indexes are though close to zero meaning very little or no income-related inequality both years. For women in 2007 and 2009 the concentration indexes are negative both years but for men in 2007 and 2009 the concentration indexes are positive both years. This means that the Body Mass Index is a little bit more concentrated among the lower income groups for women but more concentrated among the higher income groups for men. But the concentration indexes

for men in 2007 and 2009 are so low that little or no income-related inequality can be detected. There is also little or no income-related inequality in Body Mass Index for women in 2007 but in 2009 there is. In 2009 the concentration index is -0,010266 meaning there is a small income-related inequality and the Body Mass Index is more concentrated among the lower income groups. That means women in 2009 with lower individual income actually have higher body weight than women with higher individual income. For household income in all cases the concentration indexes are really close to zero. There is almost no difference in the concentration indexes between the years 2007 and 2009, both are negative and really close to zero meaning very little or no income-related inequality to be detected both years. When looking at women seperately in 2007 and 2009 there is also very little difference between the years and the concentration indexes are close to zero. For men in 2007 and 2009 the concentration indexes are close to zero meaning very little or no income-related inequality to be detected. The only difference is that in 2009 the concentration index is negative instead of positive.

5 Conclusion

The only sign of income-related inequality in Body Mass Index in Iceland in 2007 and 2009 is for women in 2009 when considering individual income. Otherwise a very little or no income-related inequality in Body Mass Index is to be detected a year before and a year after the economic collapse. In Sobal and Stunkard´s seminal review published in 1989, as mentioned earlier in this thesis, similar results as in Iceland in 2009 appeared. Their findings were that women in lower socio-economic strata were more likely to have higher Body Mass Indexes than women in higher socioeconomic strata. The relation for men was inconsistent. Also as meantioned earlier, their work has greatly influenced subsequent research on the socioeconomic patterning of weight.

The research questions in chapter one were the following:

1. **Is there a negative relationship between income and Body Mass Index in Iceland in 2007?**
2. **Is there a change in this relationship one year after the economic collapse in Iceland in 2008?**

To answer the research questions the concentration curves and concentration indexes are evaluated. There is little or no sign of negative relationship between income and Body Mass Index in 2007 when both looking at individual income and equivalent household income. However there is a notable change in this relationship after the economic collapse in 2008 for women when considering individual income. In 2009 a small sign of a negative relationship between income and body weight can be detected for women. Otherwise there is no notable change in this relationship before and after the economic collapse in 2008.

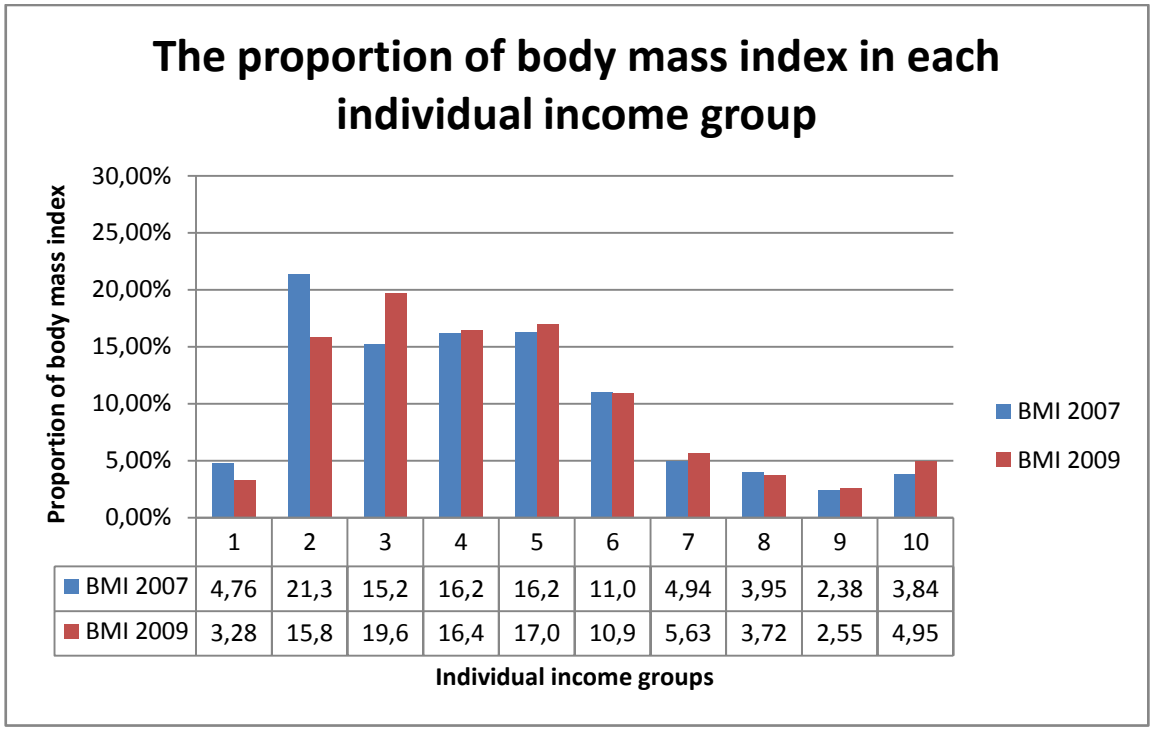
The strength of this thesis is panel data on individual-level information gathered with a stratified random sampling method. The individuals are followed up on between the years. There are though limitations also. The individual income and the equivalent household income used as a measures of socio-economic status are based on income before taxes and therefore not repressentative for the spending money available. And as with other analysis based on survey data the data is self-reported.

This thesis gives a good idea on how body weight is distributed among Icelanders. At the end of 2012 a third survey was sent out by The Public Health Institute in Iceland to the same individuals as participated in the surveys in 2007 and 2009. So further analyses on body weight and income are possible and it could be interesting to see if there is more or less income-related inequality in body weight today than it was one year prior and one year after the economic collapse.

While writing this thesis a new meta-analysis on the relationship between weight and mortality risk was published in The Journal of the American Medical Association (Campos, 2013). The analysis involved nearly three million subjects from more than a dozen countries. This analysis stated that all adults categorized as overweight and most of those categorized as obese had a lower mortality risk than so-called normal weight individuals. So maybe it is not so bad after all to have a slightly higher Body Mass Index?

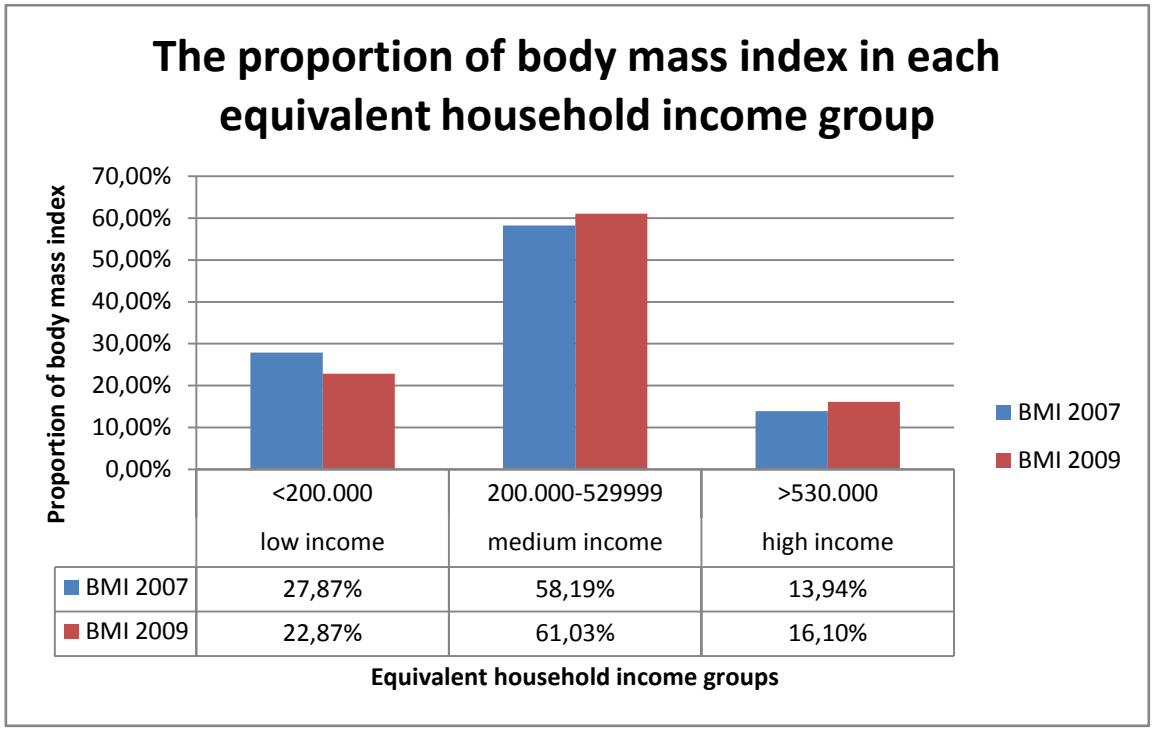
Appendix 1:

The proportion of Body Mass Index in each individual income group



	1	2	3	4	5	6	7	8	9	10
BMI 2007	4,76	21,3	15,2	16,2	16,2	11,0	4,94	3,95	2,38	3,84
BMI 2009	3,28	15,8	19,6	16,4	17,0	10,9	5,63	3,72	2,55	4,95

The proportion of Body Mass Index in each equivalent household income group if equivalent household income is divided into three different groups: low income, medium income and high income



	<200.000 low income	200.000-529999 medium income	>530.000 high income
BMI 2007	27,87%	58,19%	13,94%
BMI 2009	22,87%	61,03%	16,10%

Appendix 2:

Linear regressions for men and women seperately, individual income

Results from linear regression analysis show for women in 2007 that if they are married they are more likely to have higher Body Mass Index if their income gets lower. If they are single they are more likely to have higher Body Mass Index if their income gets higher.

Women married

number of obs.	1052
R-squared	0,0042

bmi07	**Coef.**	**SE**	**p-value**	**95% Conf. Interval**	
tekjur07	-0,17619	0,0833008	0,035	-0,33964	-0,01273
Cons	28,00891	0,3494928	0	27,32313	28,69469

Women single

number of obs.	183
R-squared	0,0225

bmi07	**Coef.**	**SE**	**p-value**	**95% Conf. Interval**	
tekjur07	0,4950196	0,2424548	0,043	0,016618	0,973421
Cons	25,69414	0,9170436	0	23,88467	27,50361

Results from linear regression analysis show for women in 2009 that if they are married they are more likely to have higher Body Mass Index if their income gets lower. If they are single there is no statistically significant relationship between Body Mass Index and income.

Women married

number of obs.	1044
R-squared	0,0176

bmi07	**Coef.**	**SE**	**p-value**	**95% Conf. Interval**	
tekjur07	-0,3944899	0,0912334	0	-0,5735121	-0,2154677
Cons	29,05227	0,3946586	0	28,27786	29,82669

Women single

number of obs.	159
R-squared	0,0136

bmi07	**Coef.**	**SE**	**p-value**	**95% Conf. Interval**	
tekjur07	0,3597756	0,2442529	0,143	-0,1226701	0,8422213
Cons	26,71883	1,0202221	0	24,7037	28,73396

Results from linear regression analysis show for men in 2007 that if they are married there is no statistically significant relationship between Body Mass Index and income. If they are single they are more likely to have higher Body Mass Index if their income gets higher.

Men married

number of obs.	1139
R-squared	0

bmi07	**Coef.**	**SE**	**p-value**	**95% Conf. Interval**	
tekjur07	-0,0016983	0,0549597	0,975	-0,1095322	0,1061356
Cons	27,66149	0,3230925	0	27,02756	28,29541

Men single

number of obs.	151
R-squared	0,0315

bmi07	**Coef.**	**SE**	**p-value**	**95% Conf. Interval**	
tekjur07	0,3685172	0,167426	0,029	0,0376812	0,6993532
Cons	24,94037	0,7429026	0	23,47238	26,40835

Results from linear regression analysis show for men in 2009 that if they are married there is no statistically significant relationship between Body Mass Index and income. Although, when looking at a 10% significant level there is a small relationship. Then men are more likely to have higher Body Mass Index if their income gets higher. If they are single they are more likely to have higher Body Mass Index if their income gets higher.

Men married

number of obs.	1146
R-squared	0,0028

bmi07	**Coef.**	**SE**	**p-value**	**95% Conf. Interval**	
tekjur07	0,0837488	0,0465717	0,072	-0,0076267	0,1751242
Cons	27,15971	0,2811787	0	26,60803	27,71139

Men single

number of obs.	131
R-squared	0,0392

bmi07	**Coef.**	**SE**	**p-value**	**95% Conf. Interval**	
tekjur07	0,4507186	0,1964315	0,023	0,062074	0,8393631
Cons	25,07058	0,8280699	0	23,43223	26,70894

Linear regressions for men and women seperately, equivalent household income

Results from linear regression analysis show for women in 2007 that if they are married there is no statistically significant relationship between Body Mass Index and income. Although, when looking at a 10% significant level there is a small relationship. Then women are more likely to have higher Body Mass Index if their income gets lower. If they are single there is also no statistically significant relationship between Body Mass Index and income.

Women married

number of obs.	988
R-squared	0,0035

bmi07	**Coef.**	**SE**	**p-value**	**95% Conf. Interval**	
tekjur07	-0,00000123	6,62E-07	0,064	-0,00000253	7,02E-08
Cons	27,71803	0,2917094	0	27,14559	28,29047

Women single

number of obs.	170
R-squared	0,003

bmi07	**Coef.**	**SE**	**p-value**	**95% Conf. Interval**	
tekjur07	-0,0000023	0,00000323	0,478	-0,00000869	0,00000408
Cons	28,05033	0,9250964	0	26,22402	29,87664

Results from linear regression analysis show for women in 2009 that if they are married there is no statistically significant relationship between Body Mass Index and income. If they are single there is also no statistically significant relationship between Body Mass Index and income.

Women married

number of obs.	991
R-squared	0,0023

bmi07	**Coef.**	**SE**	**p-value**	**95% Conf. Interval**	
tekjur07	-0,00000105	0,0000007	0,135	-0,00000242	3,26E-07
Cons	27,88853	0,3126066	0	27,27508	28,50198

Women single

number of obs.	84
R-squared	0,003

bmi07	**Coef.**	**SE**	**p-value**	**95% Conf. Interval**	
tekjur07	-0,00000173	0,0000035	0,622	-0,00000871	0,00000524
Cons	27,78189	1,130177	0	25,53361	30,03018

Results from linear regression analysis show for men in 2007 that if they are married there is no statistically significant relationship between Body Mass Index and income. If they are single there is also no statistically significant relationship between Body Mass Index and income.

Men married

number of obs.	1107
R-squared	0,0005

bmi07	**Coef.**	**SE**	**p-value**	**95% Conf. Interval**	
tekjur07	-3,37E-07	4,52E-07	0,456	0,00000122	0,00000055
Cons	27,8005	0,2153959	0	27,37787	28,22313

Men single

number of obs.	143
R-squared	0,0046

bmi07	**Coef.**	**SE**	**p-value**	**95% Conf. Interval**	
tekjur07	0,00000175	0,00000216	0,419	-0,00000252	0,00000601
Cons	25,86243	0,7091436	0	24,4605	27,26435

Results from linear regression analysis show for men in 2009 that if they are married there is no statistically significant relationship between Body Mass Index and income. If they are single there is also no statistically significant relationship between Body Mass Index and income.

Men married

number of obs.	1109
R-squared	0,0001

bmi07	**Coef.**	**SE**	**p-value**	**95% Conf. Interval**	
tekjur07	-1,14E-07	4,34E-07	0,792	-9,67E-07	0,00000601
Cons	27,69618	0,2030703	0	27,29773	28,09462

Men single

number of obs.	57
R-squared	0,0135

bmi07	**Coef.**	**SE**	**p-value**	**95% Conf. Interval**	
tekjur07	3,36E-06	3,88E-06	0,390	-4,41E-06	0,0000111
Cons	25,20385	1,184386	0	22,83029	27,57741

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