HEALTH AND INCOME: THE CASE OF ICELAND*

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ABSTRACT

Health-care costs are rising in Iceland, as in the rest of the Western World. Furthermore, the Icelandic government takes financial responsibility for the medical-care demands of its citizens, to the point where non-governmental funding of such consumption has been negligible for several decades. This centralization of the medical system is motivated by equalitarian views and makes the case of Iceland both important and interesting. It is largely unknown whether income-related inequalities in health have been effectively restrained. Is the effect of income largely alleviated, or does it remain a significant influence in the production of good health? The effect of household income in the production of health is considered in the current study, using data that came available as a product of a postal-survey, conducted in 2002, by Gallup-Iceland. With one of the most expensive centralized medical systems in the world, the scale of the matter has reached a point where comparative Icelandic studies are essential. The results show that income influences an Icelander's health under the current political and social structure. Results reveal a statistically significant relationship between health and income in Iceland that is smaller than that reported for other countries. Furthermore, unexpected adverse effects of income on health are revealed at high-income levels.

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1. INTRODUCTION

An individual's health is known to be affected by economic and social factors. Among those, a positive relationship between income and health has been found in many previous studies, both within and between countries.[1]

It is common in Iceland and other countries to be concerned with how social arrangements meet each individual's "right" to a certain level of sustenance. This view of entitlement has different appeal regarding different goods, but health seems to be one of the primary goods in question.[2] It is not simply the idea to decrease variation in health, but rather, to decrease variation in health by socio-economic status. It is widely accepted that one of the principal objectives of government expenditure on health care is to improve health, irrespective of the patient's financial means.[3]

Countries go to different lengths to attain health equality, irrespective of financial means.[4] It is evident that governments in most European countries, including Iceland, are very committed to providing good access to health care for all citizens. This is less obvious in their US counterparts (OECD 1992, Wagstaff and Van Doorslaer 2000). One way that this goal is pursued in Europe is through centralized medical systems. In Iceland, mitigation of the health-income relationship has been the focus of large-scale

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[1] Empirical estimations can, for example, be found in Drever and Whitehead (1997), Mackenbach (2002), Mackenbach, Cavelaars, Kunst and Groenhof (2000), Marmot (1999), and Townsend and Davidson (1982). A theoretical model predicting this relationship can be found in Grossman (1972).

[2] Health is commonly referred to as a good in this literature. Although more accurately referred to as a desideratum, the wording will be kept consistent with tradition in this paper.

[3] See, for example, Wagstaff et al. (1991) for a discussion of the goals to generate income-related health equality.

[4] Health equality, irrespective of income/finances refers to a lack of systematic differences in health by financial status or income. Complete income-related health equality does not, however, mean that everyone shares the same level of health, only that systematic differences in health by income do not exist.

government expenditures. The Icelandic law on health care starts by stating that “all citizens should have available to them the greatest quality health care services that they can possibly be provided with at any given time, to protect their psychological, physical and social health” (Vefutgafa Althingistidinda 2006a).

Although the shift to non-communicable diseases related to own behavior and the environment has brought greater importance to the role of the individual’s lifestyle in the production of their health, it has not led to any drastic policy changes in Iceland regarding publicly provided health care. It remains the expressed goal of the Icelandic government “to ensure all citizens easy access to good health care services” (Rikisstjorn Islands 2003).

The Icelandic health-care system can generally be described as centralized and comprehensive.[5] The government runs a comparatively expensive health care system and costs are on a steep upward trend. The rise in health care expenditure per capita in the past 30 years has been higher in Iceland than in most other countries of the Organization for Economic Co-operation and Development (OECD). Total expenditures on health care, as a percentage of Gross Domestic Product (GDP), in Iceland have more than doubled since 1970. Table 1 shows total, private, and public health expenditures, as a percentage of GDP, as reported by Statistics Iceland (1991-2000).

When measured as the sum of public and private spending per capita, Iceland had the fourth highest total health-care expenditures among the OECD countries in the year 2000. The three countries spending more on health care per capita were the

[5]Dental care is only subsidized for children, the elderly, and when due to birth defects, diseases or accidents. Consequently, dental care comprises the largest portion of private expenditures on health as described in Vilhjalmsson and Sigurdardottir (2003). For a detailed overview of the Icelandic medical system, see Halldorsson (2003).

United States, Switzerland, and Germany. However, the government paid almost all of the expenditures in Iceland, and the country was second only to Germany in terms of public expenditures on health care (Halldorsson 2003).

Table 1
Health Expenditures in Iceland

Year	Total health-care expenditures as % of GDP	Public health-care expenditures as % of GDP	Private health-care expenditures as % of GDP
1970	4.03	3.20	0.83
1975	5.83	5.08	0.75
1980	6.19	5.46	0.73
1985	7.25	6.31	0.94
1990	7.81	6.77	1.05
1995	8.25	6.92	1.32
2000	9.32	7.80	1.52

Because of their scarcity, studies conducted in the context of Iceland are of particular value to Icelandic policy makers, who are otherwise left to rely on intuition and results from people, places, and times that may be very different from the current Icelandic reality. A great deal of scarce resources go to centralized health production in Iceland. It is therefore important to ask if their allocation seems to alleviate the income-related health inequalities as intended.[6] Furthermore, Iceland can serve as an important example for policymakers of other countries as health outcomes in the Icelandic population have traditionally been extremely favorable.

[6] One may or may not subscribe to the political views in which those policies are rooted. Some argue that each individual has to be responsible for his/her own health, and that good health is a normal part of societies reward system. After all, there are many things, besides health, that those of lower financial status have less access to. However, others feel that increasing responsibility for health production is problematic, since poverty itself is widely accepted as one of the most significant risk factors for illness and premature death in countries where individuals bear greater responsibility, such as the United States (Syme, 1996).

This study examines systematic variations in health depending on family income. The relationship between income and health is examined in two steps. First, aggregate measures of income-related health inequalities are derived for Iceland, and compared to those available for other countries.[7] Subsequently, traditional regression techniques are used to estimate a health-production function, with the focus on the coefficient for income.[8] This is done using data collected by IMG-Gallup, an opinion-poll and market-research company in Iceland. The data was collected in 2002.

Of particular interest is the fact that in the survey used, subjects report family income, rather than their individual income. Family income is relevant, as families are the main consumption units in Iceland, as elsewhere. Thus, family income is a more accurate measure of an individual's access to money, than is the individual's own income. This is especially important in the case of women, as their financial means still tend to be heavily dependent on their spouses' income. Even in Western Europe, where the female workforce-participation rate is high, women's income status may still be largely determined by their spouses' income. This might be the reason for a lesser association found in the case of females, relative to males, in previous international studies (Moss 2000, Stronks et al. 1995, Arber and Lahelma 1993).

The Icelandic government has tried to reduce the causal effect of income on health. In determining the success of those policies, it is important for the researcher to

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[7] The specific measures are the concentration coefficient and the associated concentration curve. Those measures are related to the commonly used Lorenz curve and the Gini coefficient. However, they allow the examination of inequalities in one good (health), to be based on variations in another good (income). Those measures are discussed in more detail in Section 4.1.

[8] In it strictest theoretical setting, income does not enter the health-production function. However, its inclusion is common and a theorietical justification is available via substitution of demand for factors of production into the health-production function. Thus one can also view the resulting regression equation as a hybrid between a production and demand functions.

correct for possible biases due to the endogenous nature of the relationship or individual heterogeneity. Results from those estimations show that income is a determinant of health in Iceland, although its effect may not be as dramatic as elsewhere, or favor higher-income individuals in all cases.

To summarize, the paper will proceed as follows: Section 2 discusses the state of the literature and the relevant cultural and political structure in Iceland. Section 3 describes the dataset. Section 4 focuses on methods and results. This section comprises two parts. First aggregate measures are attained and held up against those of other countries for which results are available. Then the relationship between health and income, in the context of Iceland, is examined further with traditional regression techniques. The paper concludes with a discussion of the results and policy implications.

2. BACKGROUND AND LITERATURE REVIEW

As the analysis of the data is twofold, the reviewed literature is separated into two sections, consistent with the analysis. First, literature regarding aggregate measures of income-related inequalities will be discussed. Thereafter, studies that consider cross-sectional data, using traditional regression techniques, will be reviewed. This section concludes with a sub-section on the determinants of health and health variations, and the status of those determinants in Iceland.

2.1 Aggregate Measures of Income-Related Health Equality

Unlike the economics literature on income inequality, studies regarding inequalities in health are rarely concerned with pure inequality.[9] However, examples of this work do exist. Illsley and Le Grand (1987), as well as Le Grand (1987, 1989), measure health inequality using the Gini coefficient, and, at times, the Atkinson's index. Non-economists, who feel that the socio-economic aspect of this question is important, have criticized their approach, as it does not take into account whether persons in ill health are rich or poor (Wagstaff and Van Doorslaer 2000). Furthermore, the three studies mentioned above are based on inequalities in age at death and the data at hand do not include mortality. Thus, those studies do not lend themselves to comparison with the results obtained in this study.

The more common assessments involve income-related health inequalities and estimations of the concentration index. Examples of this work include Propper and Upward (1992), who examine health inequalities by income using British data from the 1970s and 1980s. They employ equivalent household income and four different measures of health. Of the health variables used, the self-assessed health (SAH) showed the greatest income-related inequality in health. The other measures of health were: presence or absence of non-limiting chronic illness, the presence or absence of limiting chronic illness, and a dichotomization of SAH. The greater level of health inequality observed when using SAH should be kept in mind when reading the results of the current analysis as it is the health variable used.

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[9] Pure inequality refers to general variations in a variable (in this case health), unrelated to variations in any other variable.

Van Doorslaer et al. (1997) examined income-related inequalities in health for nine countries. As was done in the study by Propper and Upward, individuals were ranked by equivalent household income, and health was measured by the traditional SAH variable. The study found pro-rich inequalities in health in all nine countries. The results showed the two Scandinavian countries within their cross-country analysis (Sweden and Finland) to possess relatively low income-related health inequality. The greatest income-related inequality was found in the United States and thereafter the United Kingdom. Other countries had less income-related inequality in health, although the difference between them was not statistically significant. Besides Sweden and Finland, those countries were East and West Germany, The Netherlands, Switzerland and Spain.[10] The results from the current analysis are compared to those of Van Doorslaer et al. (1997).

The results of Van Doorslaer et al. are consistent with conventional wisdom, which suggests that the Scandinavian countries display relatively low income-related inequalities in health. However, in the same year, Mackenback et al. (1997) report prominent inequality in the Scandinavian countries that exceeds that of some other Western-European countries. This finding is contradictory to widely held beliefs and triggered discussions among researchers and authorities on relative health equality across countries. The conclusion was that there is limited evidence from the Nordic countries to counter the surprising results reported in Mackenbach et al. (1997). The length of their paper does not allow for detailed discussions of methods. As such, this paper does not lend itself well to validation with different data.

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[10] The German data allowed for stratification by the former division of that country. Due to the relatively short period since the countries' reunification, the authors decided to do so.

2.2 Cross-Sectional Analysis of Income-Related Health Equality

The notion that individuals are motivated to invest in themselves is widely accepted in economics under the rubric of human-capital theory.[11] The treatment of health as an example of this got its impetus when Grossman (1972) proposed an inter-temporal optimization model to describe the process of accumulation of health capital. Grossman gave special attention to medical care in the production of health as one of several factors that may be used to improve the health status of an individual. The model has been most widely used to explain the demand for medical care, as a derived demand for an input to the production of health. Although this is not central to the current analysis, the construct of a health-production function with various inputs is used in this study.

The health-production function captures the relationship between health status and the various factors that may be used to produce good health. Health can, for example, be restored or produced with medical care. However, medical care is hardly the only input available to those interested in producing health. Many other factors are involved, such as the individual's environment and lifestyle. In many cases, income can facilitate health production. Although income is not generally included in a production function, its inclusion is theoretically justified as it may enter the function through substitution of demand functions for factors of production. In the strictest theoretical sense, the function used is thus a hybrid of a production function and a demand function. For simplicity, it will be referred to as a production function hereafter.

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[11] The use of the term dates back to Mincer (1958), although Becker (1964) became a standard reference for many years.

The correlation between income and health is unlikely to be a one-way relationship. Other reasons for the association need to be considered and accounted for. Investment in health-capital yields returns, as health is likely to influence a person's ability to work, both in regards to hours worked and productivity during those hours. Economists seem to have placed greater emphasis on the effect that health has on income than have researchers from other disciplines. In short, economists view health both as an output of health production and as an input, where potential gains in productivity are among the individual's incentives to invest in their health.

The impact of health on finances cannot be ignored, and will be considered within the analysis. Furthermore, if not accounted for, the effect of income on health could be inflated due to unobservable individual heterogeneity, such as differences in inter-temporal discounting and genetic factors.

While the correlation between finances and health is well documented, the causal direction of this relationship is not agreed upon, and debate continues both within and across disciplines. In a recent paper, this debate was even described as researchers "brandishing pokers" at each other.[12] Not surprisingly, researchers continue to contribute individual studies using different data and methods, as the real story behind this relationship is vital in determining the policy measures appropriate for improving general health or narrowing health inequalities in society. The final answer to this question is unlikely to be provided with a single study, but as the literature grows, some theories are less favored, while others become more convincing. Such mixed results, from such an extensive literature, indicate that there are true effects running in

[12] Chase (2002), quoting Sir Michael Marmot, a professor of epidemiology and public health.

both directions, which have different weights in different populations and under different political circumstances.

The statistical analysis is often similar in studies outside the field of economics, although the vocabulary and theoretical background may be different. What economists call a health-production function is estimated, although the importance of deprivation is more common, and the idea of health production for investment purposes is less prominent. It follows that the hypothesis of a causal pathway from income to health is often assumed or strongly suggested within other fields. For example, epidemiologists have demonstrated that residents in poor neighborhoods in the United States have a 40% higher mortality rate than their counterparts in rich neighborhoods. Significant differences in mortality remained even when smoking, diet, exercise, and other traditional risk factors were controlled for, but without controlling for endogeneity, they were interpreted as causal effects (Haan et al. 1987). Several researchers have addressed this problem with different measures.

The relationship between income and health has, for example, been studied with longitudinal data, which is a superior feature of a dataset when determining causality. Wolfson et al. (1993) analyzed nearly 550,000 administrative records from the Canada Pension Plan in a longitudinal analysis of male mortality after age 65. The results show that higher earnings in late middle age (45 to 64) were associated with significantly lower mortality at older ages (65 to 74). Duleep (1986) examined the relationship between income and mortality using data on 35-to-65-year-old males drawn from the 1973 Current Population Survey (CPS). She found that income displayed diminishing marginal returns in its reduction of mortality, with particularly pronounced gains from income for the very poor. Menchik (1993) also concluded persistent poverty to be a powerful predictor of mortality risk in his analysis of the National Longitudinal Survey (NLS) of Mature Men, where a cohort of American men aged 55 or older were followed over the period 1966 to 1983. Adams et al. (2003) examined the Asset and Health Dynamics of the Oldest Old (AHEAD) panel data, in a search for a causal relationship between income and health. They found that when the incidence of new health problems were conditioned on initial health status, the statistically significant positive association between socio-economic status and health disappeared. This led the authors to conclude that there was no causal link from wealth to the sudden onset of health conditions. However, a negative association between wealth and the incidence of gradually worsening health conditions, as well as mental problems, did remain. Benzeval et al. (2000) found recent poverty to be a strong predictor of SAH. They did not control for unobservable heterogeneity, although their use of longitudinal data (the British Household Panel Study) is helpful in eliminating the reverse causality.

Other researchers have used instrumental-variable techniques in their efforts to disentangle this causal relationship. Among research addressing the issue of causality using instrumental variables is Ettner (1996). She used several individual-level datasets, all of which were based on the non-institutionalized civilian US population.[13] The income variable was instrumented in the health-production function using the state unemployment rate, the respondent's work experience, parental education, and the spouse's education and experience. The hypothesis of income entering the model

[13] Specifically, the data used comes from the 1987 National Survey of Families and Households (NSFH), the 1986 and 1987 panels of the Survey of Income and Program Participation (SIPP), and the Alcohol Supplement of the 1988 National Health Interview Survey (NHIS). Those samples were merged with Bureau of Labor Statistics data on state unemployment rates.

exogenously was rejected, although income remained a statistically significant predictor of health in most two-stage estimations. In fact, the coefficient increased with instrumentation.

Gardner and Oswald (2004) found large reductions in mortality risk by income for men, but within their sample (The British Household Panel Survey), the correlation between income and mortality amongst women was largely absent. Although this gender difference has been reported before (Grove 1973), it is especially interesting in this case, since Gardner and Oswald used family income, and the null female results have been attributed to the extent to which male socio-economic status influences the female's income and status.

Meer et al. (2003) used four waves of data from the University of Michigan Panel Study of Income Dynamics (PSID) to analyze the impact of wealth upon an individual's health status. They instrument wealth with information on the value of inheritance received over the last five years. The instrumental-variables estimation renders the coefficient of wealth insignificantly different from zero. Even when the point estimate is increased by twice its standard error, the quantitative effect is small. They conclude that the wealth-health connection is not driven by short run changes in wealth.

As mentioned before, Mackenback et al. (1997) reported evidence of Scandinavian income-related inequalities in health that were greater than assumed by conventional wisdom. Subsequently, studies emerged confirming inequality in some of those countries. Although Iceland was not considered in the aforementioned cross-country studies, it shares many of the egalitarian policies of the other Nordic countries and is comparable on many other dimensions.

Krokstad and Westin (2002), used traditional regression techniques in examination of cross-sectional data from a single municipality in Norway. They reported some inequalities, but did not control for the endogenous nature of this relationship in their study. Lindahl (2005) examined the relationship with data from Sweden. Two-stage estimations were conducted, where exogenous variation in income resulting from lottery prizes served as instruments. He concluded that income has a causal effect on health and found limited changes in coefficients with instrumentation.

In summary, it is reasonable to conclude that there are influences between income and health that run in both directions. In such a setting, identifying causal relationships is difficult and it is perhaps not surprising that the evidence remains mixed in this area. The extent of the relationship running in either direction may differ based on the different social groups inspected, as well as the policy under which the examined group lives.

The literature is quite consistent in its finding of a positive relationship between health and income, which extends across all income groups. However, two studies found some adverse effects of income on health. Results from Backlund et al. (1996), as well as Ecob and Smith (1999), suggest flattening, or even a reversal, of the income and morbidity relationship at the high end of the income spectrum. Neither study addressed the endogenous aspects of this relationship. Backlund et al. used American data, while Ecob and Smith used data from England, Wales, and Scotland. Although those studies are mentioned, the overwhelming majority of studies in this literature report a monotonic relationship between health and income.[14]

It is not possible to report any previous evidence on this relationship in Iceland, as no studies exist. However, the next section describes relevant Icelandic policies and characteristics, and elaborates on their expected effect on health and health variations according to the literature on the determinants of health and health equity.

2.3. Determinants of Health and Health Variations

The study of the determinants of health and health variations is currently attracting multidisciplinary interest. Individual lifestyles, genetic factors, psychosocial factors, and material factors as well as other determinants have been proposed and confirmed to some extent.[15] These determinants and their manifestations within Iceland will now be discussed. Special emphasis will be given to medical services, due to the country's strong centralized health care system. Furthermore, the role of income will be addressed, as it is central to the analysis that follows.

The Icelandic health care system can be described as universal and comprehensive. It is largely financed with taxes, although the patient pays some minor fees at the time of service. It should be noted that these payments do not take into

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[14] It should be mentioned that this may partly be because of the methods used, which don't always include income in polynomial form (See, for example, Ettner 1996)

[15] Individual lifestyles have, for example, been addressed by Kenkel (1995). Baird (1994) is an example of work on genetic factors determining health. Wilkinson (1996) addresses psychosocial factors and Princhett and Summers (1996), as well as Fiscella and Franks (1997), address the effect of material factors on health. For comprehensive, multi-authored books that give a good overview of the determinants of health, readers are referred to *Why Are Some People Healthy and Others Not?*, edited by R.G. Evans, M.L. Barer and T.R. Marmor, or to *Social Determinants of Health*,edited by M. Marmot and R.G. Wilkinson.

account the patient's earnings.[16] Although not representing the full opportunity cost, the relative monetary cost for low-income families is thus higher than for those with greater means. However, this cost is comparatively limited. If we examine Icelandic health expenditures for the year in which the data used were collected, we find that out of the OECD countries, Iceland spent the second largest portion of GDP on centralized health care, second only to Germany. Furthermore, only four OECD countries spent a smaller percentage of GDP on private medical services (Human Development Report 2004). Only in the United Kingdom, Norway, Sweden, and Luxembourg was less spent on private medical care. Due to the provided public medical services, private health insurance hardly exists in Iceland, and neither do employer-provided ones, although neither one is prohibited by law. This is not surprising as the incentive for such insurances is negligible when the Health Services Act and the Act on the Rights of Patients state that every citizen has the right to the best health services available at all times, for the restoration and protection of their mental, physical, and social health. Furthermore, the law details that discrimination based on a list of factors, including financial status, is prohibited (Halldorsson 2003).

However, the relative equality in health care delivery and financing is not the same as income-related equality in health. For one thing, there may be income related differences in the use of the health-care system. Furthermore, medical care is not the only input in the production of health. Given all these conditions, one could nonetheless expect the relationship between income and health to be reduced to some extent.

[16] Although not directly related to earnings, it should be mentioned that some groups, such as the disabled or retired pay a lower fee.

There are, however, still opportunities for differences based on finances, even in societies such as Iceland, where a strong social-welfare system should keep people out of desperate poverty and where medical services are largely provided through governmental funding. For example, financial means can help people invest in their health, through elements such as fitness centers, nutritional counseling, and better living conditions. Thus, the efforts of the Icelandic government may or may not have dramatic effects regarding variations in health.

In fact, universal access to health care has not been found to break the link between social status and health in cross-country comparisons (Van Doorslaer et al. 1997). Health care may reduce income-related health inequalities to some extent, but our health is not only affected by the ease with which we can pay the doctor, although that surely matters. The fact that socio-economic disparities in health outcomes are often relatively large in countries with universal health-care coverage suggests that health-insurance reforms may only remedy income-related inequalities to a limited extent.

Van Doorslaer, et al. (1997) also explored the statistical association between health inequality and two national measures of health spending, as well as the level and distribution of income for the nine countries in their study. Neither total health-care expenditure per capita nor the percentage of total expenditure borne by the government appears to have a statistical association with health inequality. This suggests that neither higher spending nor the level of centralization is associated with lower income-related inequalities in health. The same was true of GDP per capita. However, the Gini coefficient of income inequality proved to be positively and significantly associated with health inequality. This is consistent with findings from other studies, which generally find that inequality in the distribution of income is associated with poorer health, independent of the effect of household income.

Wealthier countries generally have higher average life expectancy. However, this only holds if what one could consider poor countries and rich ones are included in the analysis. Among developed countries, not income, but income distribution correlates with variation in life expectancy or SAH. Wealthy countries with more equal income distributions, such as Sweden and Japan, have higher life expectancies than the United States, despite their lower per capita GDPs. In fact, despite being rich in terms of GDP, the United States performs rather poorly on major health indicators. The examples are numerous and many studies have provided support for this relative-income hypothesis in the form of associations (Evans et al. 1994, Kawachi and Kennedy 2002, Kennedy et al. 2005).

However, the literature does not provide evidence of a causal effect and the reasons for this association are not clear, although the existence of a relationship between the two has long been recognized. Multiple studies, including Lynch et al. (2001), Kawachi and Kennedy (2002), Kennedy, Kawachi, Glass, and Prothrow-Stith (1998), Rodgers (1979), and Le Grand (1987), have found greater income inequality to be associated with poorer health. However, studies that find the impact of income inequality to be very small or even undetectable should be noted. Those include Gravelle (1998), Gravelle, Wildman, and Sutton (2002), as well as Deaton and Paxson (2001).

The full story has yet to be told, but this research suggests an importance of national demographics in addition to individual indicators. The level of income equality appears of particular importance. Thus, the state of income inequality within Iceland will now be discussed.

General income inequality is shown in Figure 3.1, as reported by Jonsson et al. (2001). The countries chosen are Iceland and those countries whose current results are compared later in this chapter. The year 1995 is chosen as it is the last year before sizable changes in income distribution commenced in Iceland. Until then, the Gini coefficient in Iceland had consistently remained among the lowest in the world. This is deemed important, as health results from the accumulation of factors through a person's life. Then again, it is also important to note significant changes in the income distribution since then, where the Gini coefficient has increased by approximately .01 every year, leaving it around .28 in the year of the current survey. That is still relatively low within the OECD context, although it leaves Iceland with greater income inequality than the other Nordic countries (Gylfason 2005).

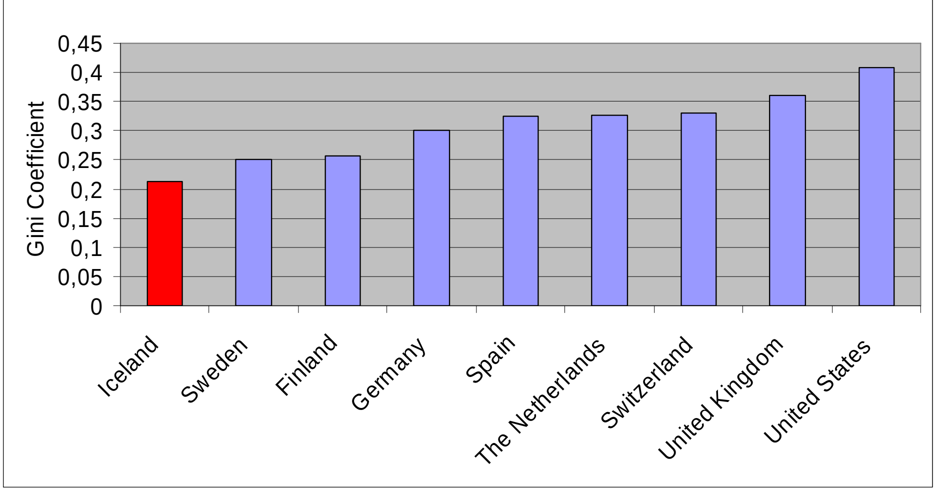

Figure 3.1 - Gini Coefficients of Income Inequality (1995)

There are also factors beyond the political and social settings that are likely to influence income-related differences in health. Genetics have played a major role in the discussion of determinants of health and health variations. Although less important for policy implications and behavioral fields such as economics, it should be noted that the Icelandic populace is genetically very homogeneous. This could be expected to reduce variations in health that relate to income in Iceland when compared to other countries. For example, the medical literature examining genetic variations in health and the incidence of diseases in the United States has found fairly dramatic differences between races.[17] This may influence the income-health gradient, as the distribution of income varies significantly across races. Furthermore, the relatively young age of the Icelandic populace is expected to attenuate the health-income gradient even further as health inequality is known to increase with age (Deaton and Paxson 2003).

In short, the amount of spending on medical care, however measured, does not appear to have a great impact on income-related variations in health. Nevertheless, if we go by conventional wisdom and assume this to be of great importance, then it should follow that income-related inequalities in health are relatively small in Iceland. What has more consistently been found to influence systematic variations in health by income among industrialized countries are variations in income itself. Although income inequality is increasing in Iceland, it has never been of great magnitude. Due to the equalitarian efforts in Iceland, and other country characteristics, ex-ante expectations

[17] See, for example, Helgadottir et al. (2005) for variations in cardiovascular disease by ethnicity.

favor relatively low income-related inequalities in health. [18] How Iceland fits into this global picture will be examined in the next section.

3. THE DATA

The data utilized in the current study come from a health and lifestyle survey collected by Gallup-Iceland in January of 2002. In Iceland, Gallup is run as an integral part of the IMG Group, a research and consulting company in Iceland. The company specializes in information gathering, such as opinion polls and market research, as well as in data analysis.

A random sample of 2000 Icelanders between the ages of 20 and 80, received questionnaires on nutritional habits, drinking and smoking, exercise, illnesses, accidents, stress, quality of life, use of drugs, dental care, and other lifestyle factors, as well as demographics and work-related issues. This sample comprises approximately 1.4 percent of the adult population.

3.1 Response Rate, Representation, Strengths, and Weaknesses

The net-response rate, after a telephone follow-up, was 54%. This equates to 1062 returned questionnaires.[19] Such a low response rate might be a cause for

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[18] Regarding the reverse causal relationship, it may be noted that Icelandic regulations make it rather difficult to lay off an employee on the grounds of bad health. Still, there are a number of people with such severe health conditions or disabilities that they are unable to participate in the workforce. These individuals receive economic benefits in the form of income replacements. Other disadvantaged groups, such as the unemployed, also get such compensations, besides the almost-free medical care. Although those compensations are generous when compared to those of many other countries, they do not compare to average income levels in Iceland and the reverse causal effect may thus be reduced to some extent.

[19] Discrepancies can occur due to the time lag between changes in people's lives and those changes being reported in the census. The net response rate refers to responses after sample deductions

concern. However, the sample proved to be representative of the Icelandic population, with matching averages showing only slight discrepancies between population and census data (Statistics Iceland 2005). For example, gender representation was off by 1%; the labor force participation in Iceland was 86.5%, while in the sample it was 86.9%; hours worked in a week for the working population were 43.8, compared to 44.23 for the sample.[20] Although the inconsistencies found were not significant enough to warrant serious concerns, the most pronounced ones should be mentioned.

The greatest inconsistency between the sample and population data pertains to age representation, as subjects in their twenties were less likely to turn in their questionnaires than other age groups were. Furthermore, those above the age of 65 were slightly more likely to do so than average. Although the discrepancies are not large, they are reported in Table 3.1, as they show greater divergence from population data than do other variables in this particular survey.

based on deaths or emigration. The gross response rate, however, is based on all subjects who were originally sent questionnaires and would accordingly be 53%.

[20] 44.23 refers to total hours worked in main, as well as extra, jobs for the working population. The sample mean for hours worked in a main job is 41.67.

TABLE 2.1
Representation by Age

Age group	% in census	% in sample
20-24	11.4	7.7
25-29	11.2	10.8
30-34	10.4	10.9
35-39	11.3	11.4
40-44	11.1	10.2
45-49	10.1	11.2
50-54	8.7	8.9
55-59	7.0	8.2
60-64	5.1	5.1
65-69	4.9	5.2
70-74	4.7	6.7
75-80	4.2	4.9

Furthermore, the subjects were asked about their own weekly hours worked and about those of their spouses. Comparing means from those questions shows a difference of 7 hours and 14 minutes, with individuals reporting a greater number of hours for themselves. This is not surprising in light of the fact that own-hours worked are only reported if the individual's main employment identification is being an employer or an employee. Individuals who report being students, disabled, retired, unemployed, or homemakers do not answer this question, although they may be working part time. However, married individuals were expected to answer the question on market hours worked by their spouses, regardless of the spouse's employment status.[21] In summary, subjects who failed to return the survey do not appear systematically different from

[21] Throughout the paper, no distinction is made between marriage and co-habitation. This is consistent with the low emphasis placed on marriage in Iceland, relative to the United States.

subjects who successfully completed the study, with regard to available population statistics.[22]

The strength of the data lies in the amount of health and lifestyle information obtained for each individual. The number of variables available increases the options for use of statistical techniques such as instrumental variables estimations and experimentation with different control variables. Furthermore, the data are relatively new and have not been previously examined in a multivariate context.

Nevertheless, the actual data available generally differ from the ideal, and this study is no exception. One limitation regards the sample size. The power of the sample in this regard, and the subsequent likelihood of type-one and type-two errors, needs to be considered when interpreting results. Besides that, some analyses would have benefited from the availability of longitudinal data, which are not obtainable for Iceland. The next section discusses each variable used and preparation of the data for further statistical analysis.

3.2 Description of Variables Used

Health: The survey contains several measures of health. The one chosen for the empirical analysis is a traditional five-level self-assessed health variable (SAH), ranging from "very good" to "very poor." This choice was motivated in part because the variables use is supported by a literature that shows it to predict mortality and morbidity, even when a variety of other health and behavioral measures are controlled for (Kaplan and

[22] Two observations were dropped from the sample altogether due to major inconsistencies between questions, inconsistencies that take more than a great imagination to believe. Furthermore, missing values resulted in case-wide deletion, unless otherwise specified.

Camacho 1983, Okun et al. 1984, Connelly et al. 1989, Idler and Angel 1990, Wannamethee and Shaper 1991, Idler and Kasl 1991 & 1995, McCallum et al. 1994, Idler and Benyamini 1997, Gerdtham et al. 1999, Burstrom and Fredlund 2005). Furthermore, the fact that this measurement is frequently used opens the possibility for interesting comparisons to countries with different characteristics, such as more or less government funding of the health-care system. What made this variable even more attractive was the fact that as the first variable in the survey, it did not suffer the missing observations that the other health variables did.

In all instances, the numeric values of the SAH variable are reorganized such that a higher number indicates better health. This is done to assist interpretation of empirical results.

When health is used as a dependent variable in regression analysis, it is dichotomized. This approach can lead to different results depending on where the cut-off point is set, but it is motivated by the use of statistical techniques that are not supported within multinomial frameworks.[23]

When the variable is used for aggregate measures of income inequality, it is used under the assumption of a continuous latent variable with a log-normal distribution. This is done to keep consistency with international results to which the current ones are compared. Summary statistics of the health variables used can be found in Table 3.2.1.

TABLE 2.2.1
Summary Statistics of Health

	Males (N=512)		Females (N=543)	
Variable	Mean	S.D.	Mean	S.D.
1 if health is rather/very good	0.854	0.354	0.838	0.369
Simulated health	4.263	0.789	4.199	0.745

[23] The statistical methods referred to are two-stage estimations with instrumental variables.

Income: Monthly family income, as asked about in the survey, refers to total household income before taxes, such as salaries and government benefits. Icelandic benefits come in multiple forms, such as child benefits, housing benefits, and interest relief, and generally depend on the individual's labor-market income.

In the survey, income is reported in four brackets (in Icelandic Kronur); lower than ISK250,000; ISK250,000-399,000; ISK400,000-549,000; ISK550,000 or more.[24] In the text, the lowest income bracket is referred to as income being less than ISK250,000. This is consistent with the wording of the question in the questionnaire. However, it should be noted that Iceland's welfare system is such that individuals rarely have to subsist on total family income, including benefits, that is below ISK100,000. Thus, the size of the bracket is not as wide as it appears at first glance. However, the range of the highest income bracket is inconsistent with that of the others, as it could, and probably does, contain individuals that have income above ISK700,000.

The formulation of the income question in the survey needs to be considered in the estimations conducted. The distribution of income cannot be assumed uniform across each bracket, and statistics describing the distribution of family income in Iceland were needed in order to assign family income measures. This information was not available in any type of published form. However, official data from tax records were obtained through the Ministry of Finance in Iceland. Unfortunately, those data were not obtainable for 2002. However, they were available for 2003 and a year's difference is not expected to harm the analysis.[25]

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[24] Approximate exchange rate at the time of the survey: ISK100 = USD1

[25] The data were obtained via e-mail: Gudmundsson (2005) who deserves thanks for his help. A difference was observed between the data obtained from tax records and the responses reported in the

The distribution of family income in the population showed some differences from the traditional log-normal or truncated normal distributions known in the United States. Those distinctions regard the lowest income bracket, which contains over 30% of the sample. Thus, they need to be considered.

The population data show frequencies at the lowest income levels is higher than frequencies at levels moderately above the lowest levels. What causes this is not clear and explanations are not to be found in Icelandic studies. One possible explanation regards the effective “floor” placed under Icelandic incomes by the Icelandic welfare system. The individuals affected are not distributed as the rest of the sample, but crowded at the lower levels, where the government benefits place them. Whatever the reason, it affects a large portion of the sample and renders simulation as a log-normal distribution inappropriate.

As traditional functional forms are not appropriate, the income frequency distribution was obtained using non-parametric techniques, more specifically with locally weighted means of frequencies (Lowess smoothing). The bandwidth chosen was 0.2, or 20% of the sample.[26] This frequency distribution is graphed in Figure 3.2.1 and shows the distinct difference from a log-normal distribution along the lowest income levels.

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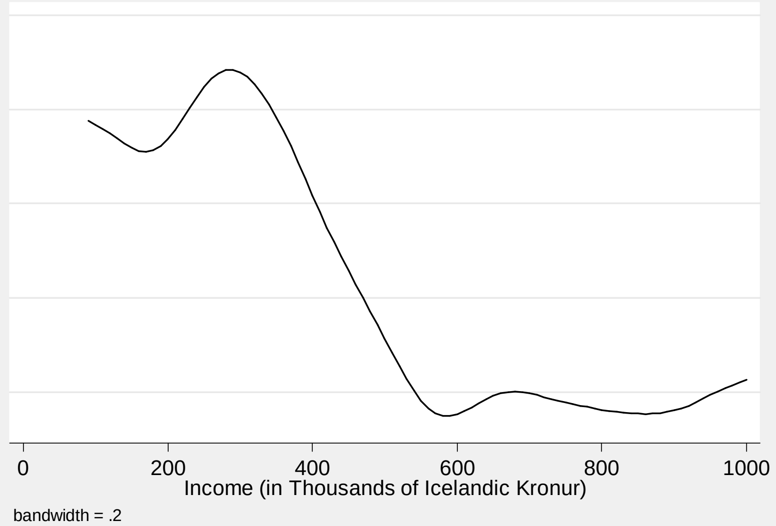
sample. Individuals appear to have reported higher income in the sample than tax records indicate to be the case. The proportion of Icelandic families with income below ISK250,000 is almost five percentage points lower in the current sample. This bracket contains around 30% of the survey sample, but 34.6% according to tax records. The size of the second bracket was fairly consistent, or 31% in the sample, but 32% according to tax records. The two highest income brackets contained a greater portion of individuals in the sample by just over two and three percent. Whether this suggests a selection- or reporting bias in responses is unknown, as individuals have strong incentives not to report all their income to tax-authorities due to high tax rates and income-related government benefits.

[26] It is possible to estimate each point using a regression of the data surrounding each point or the mean, dependent on the nearby data. For this analysis, the locally weighted means are used. The greater the bandwidth, the more radical the smoothing will be. Using 20% of the sample is a considerably smaller portion than STATA, the statistical program used for this analysis, uses by default. Generally, a smaller bandwidth gives a jagged curve that more closely resemble the raw data. A smaller bandwidth is

Figure 2.2.1 - Mean Locally Weighted Income Distribution



Subsequently income values were simulated within each of the four income brackets in relation to frequencies in the population.[27] In effect, each respondent is assigned an income score corresponding to his or her reported income bracket.

Finally, an equivalence scale was used to adjust for family size.[28] Results from Burkhauser et al. (1996) show that overall inequality and poverty levels are not very sensitive to the equivalence scale used. However, which precise specification of equivalence scales to use involves judgment and will continue to be debated. This revolves around the nature and extent of economies of scale in families or households

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therefore more detailed. As this level did not result in great noise, it was chosen over higher bandwidths, which produce locally less accurate, but generally smoother curves. For further discussions, see Hamilton (2004).

[27] One can think of this as a tightly grained histogram of frequencies. In assigning income values, those frequencies are used as probabilities of each individual having a certain income.

[28] One dimension of the capacity to pay for health expenditure is family or household income, but an essential step in comparing like with like is to adjust family income for family size. The application of an equivalence scale provides an indication of the overall access to resources, some of which could potentially be spent on health services. The rationale behind the use of equivalence scales is based on economies of scale in the household. Although a greater number of household members does require more resources, a six-person family does not need six times the resources that one person needs to reach the same welfare. That is, an additional family member does not cause a proportionate increase in expenditure on, say, heating or housing.

(Guobao et al. 1996). The choice is even more controversial in cross-national research, since it must account for country-specific differences in addition to differences across households (Burkhauser et al. 1996). No information is available that compares the appropriateness of each measure in the context of Iceland. Thus, there is a considerable range of methods that can be used to derive equivalence scales, and a large number of scales are used in the OECD countries. To correct the income measure according to this underlying assumption about economies of scale, a method of dividing household income by number of household members raised to the power of 0.36 has been used in other studies and is followed here (Brown 1994, Mackenbach et al. 1997).[29]

In fact, it should be noted that the questionnaire does not include the number of household members. What it does include is whether the individual is married or co-habiting with a spouse, as well as the number of children that the individual has. Whether the individual lives with his/her children is not specified. However, parents not living with their children are legally obligated to pay child-support for their children until the age of 18. In Iceland, as elsewhere, parents are also known to assist their grown children financially after they leave the household. Thus, the importance of this factor is not clear and may be debated. Other studies, to which this one is compared, do not report in any detail the variables on which family structure or household size is based. Summary statistics of the income variables used can be found in Table 3.2.2.in

[29] The current results are compared to those of Van Doorslaer et al. (1997), a study which uses different equivalence scales for each country in the study. Since there is not cross-country consistency within that study, the use of a widely accepted and used scale is deemed appropriate.

TABLE 2.2.2
Summary Statistics of Monthly Family Income

	Males (N=512)		Females (N=543)	
Variable	Mean	S.D.	Mean	S.D.
1 if < ISK 250,000,-	0,263	0,428	0,339	0,455
1 if ISK 250,000-399,000	0,332	0,459	0,296	0,437
1 if ISK 400,000-549,000	0,208	0,395	0,216	0,395
1 if ISK > ISK 550,000,-	0,196	0,388	0,150	0,341
Simulated family income in thousands of ISK	390,391	211,600	359,890	210,973
Simulated and equivalized income in thousands of ISK	243,623	144,049	220,978	132,102

Employment: Employment status was based on a question that asked if the individual is an employee, employer, student, homemaker, pensioned, unemployed or disabled. Summary statistics on employment can be found in Table 3.2.3.

TABLE 2.2.3
Summary Statistics of Employment

	Males (N=512)		Females (N=543)	
Variable	Mean	S.D.	Mean	S.D.
1 if employee	0,63	0,48	0,62	0,48
1 if employer	0,17	0,38	0,07	0,25
1 if student	0,03	0,17	0,07	0,25
1 if working for home	0,01	0,10	0,08	0,26
1 if pensioned	0,11	0,31	0,12	0,32
1 if unemployed	0,02	0,15	0,01	0,10
1 if disabled	0,03	0,17	0,04	0,19

Lifestyle variables: While it is technologically feasible to ascertain the fat composition of an individual directly, such procedures are extremely costly and are rarely used in large samples. Indirect measures of fat composition, which are based on weight and height, are employed instead. The primary measure of this type is the Body Mass Index (BMI), which calculates the ratio of weight in kilograms to height in meters squared.[30] In this study, the data allow for the use of this standard measurement. Optimal BMI levels for adult males and females are generally believed to lie between 20 and 25. BMI below 20 is considered thin, BMI 25-30 is overweight and BMI above 30 is obese. These

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[30] $BMI = \frac{Kg}{m^2}$

distinctions are based on the medical literature, which shows increasing rates of disease and deaths as BMI rises above 25.[31] However, this measure has its shortcomings, as under-reporting of weight in obese individuals and over-reporting of height may underestimate BMI.

A further limitation of BMI is that it does not distinguish between fat and other tissue. Very muscular individuals can thus measure as being overweight, even though their bodies have very little actual fat. Although variation in female muscle mass is generally too small to affect the results, male results could potentially be affected. For this reason, all estimations were repeated with a separate measure for weight. This alternative variable is based on five categories of people's self-evaluated weight status; very overweight, rather overweight, neither over- nor underweight, rather underweight, and very underweight. Results of the analysis were robust to such changes.

Alcoholism is generally defined as suffering from either alcohol abuse or alcohol dependence.[32] The data do not allow for diagnosis of alcoholism according to traditional standards. However, they contain questions relating to both abuse and dependence.

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[31] A recent article in the Journal of American Medical Association challenged those standard cut-off points and suggests optimal BMI levels above 25 (Flegal et al. 2005). It is too early to say whether this study will have an effect on the traditional cut-off points employed. Thus, the traditional cut-off point of 30 for obesity is employed in the current analysis.

[32] Alcoholism is the popular term for two disorders: alcohol abuse and alcohol dependence. The word "alcoholism" is widely used, especially by certain groups, such as Alcoholics Anonymous, and diagnostic questionnaires used by therapists are often used to define alcoholism. However, it should be noted that the American Psychiatric Association dropped "alcoholism" as one diagnostic category, in favor of two distinct categories previously combined within it. With the publication of the third edition of The Diagnostic and Statistical Manual of Mental Disorders in 1980 (DSM-III) two separate syndromes, those of alcohol dependence and alcohol abuse, have replaced the use of alcoholism in their definition of alcohol problems. The same holds for the American medical community, which now separates the before-used category of alcoholism into alcohol dependence disorder and alcohol abuse disorder. The World Health Organization also dropped the diagnostic category "alcoholism" in 1979, replacing it with the diagnostic categories "alcohol dependence" and "harmful use" (Babor, 1992, American Psychiatric Association 1994, WHO 1992).

The individuals are asked about their propensity to drink more than they intended (abuse). An individual is regarded as suffering probable abuse if he/she drinks more than intended sometimes, often, or always. Another variable indicates the individual's difficulty in reducing alcohol consumption (dependence). It is asked if the individual has tried to decrease their alcohol consumption in the last 12 months, and if those attempts were successful.

Furthermore, a binary variable stands for whether or not the individual had drunk or tasted alcohol in the past 12 months. Only those who had tasted alcohol in the past 12 months answer the questions discussed above. In the analysis that follows, those who have not had alcoholic beverages in the past year are assumed not to have made any unsuccessful attempts to reduce drinking nor to frequently drink more than they intend to.

A binary variable of daily smoking has a mean of 0.20 in the case of males as well as females. Summary statistics regarding BMI as well as drinking behavior can be found in Table 3.2.4.

TABLE 2.2.4
Summary Statistics of Lifestyle Variables

	Males (N=512)		Females (N=543)	
Variable	Mean	S.D.	Mean	S.D.
Body Mass Index (weight adj. for height)	26,76	4,44	25,72	5,09
5 level tendency to over drink 1=always, 5=never	4,303	0,980	4,536	0,807
1 if has not tried to reduce consumption (past year)	0,887	0,314	0,923	0,261
1 if tried without success to reduce drinking	0,022	0,145	0,014	0,113
1 if tried successfully to reduce drinking	0,091	0,286	0,063	0,239

Spouses Hours Worked: Spouses' hours worked are reported for respondents who are married or co-habiting with a partner. The mean hours worked for the spouses of men and women in the sample are 24.47 (S.D. = 18.80) and 31.32 (S.D. = 23.80) respectively. In some analysis, this variable is used as a predictor of family income. In such cases, missing values for this variable of single respondents are replaced with zeros, as no spouse is contributing any hours worked to the family income pool.

Experience at Current Job: The survey asks for how long the individual has held his present job. This question is only asked if the individual is working. If the individual is not working, he or she is assumed to have held "the present job" for zero years. This is justified as this variable is only used to predict family income. Seniority does not contribute to the income of those not working. The variable is used in its ordinal form. This should not be problematic as it is only used as an instrumental variable, and its effect is not of specific interest in this analysis beyond its purpose as such. When used in this form, it passes traditional tests for instrumental variables. Summary statistics on the responses of this variable can be found in Table 3.2.5.

TABLE 2.2.5
Summary Statistics for Years in Current Job

	Males (N=415)		Females (N=396)	
Variable	Mean	S.D.	Mean	S.D.
1 if less than 1 year	0,094	0,292	0,187	0,390
1 if 1-3 years	0,222	0,416	0,278	0,448
1 if 4-6 years	0,173	0,379	0,157	0,364
1 if 7-10 years	0,096	0,295	0,063	0,244
1 if over 10 years	0,414	0,493	0,316	0,465

Hours Worked on Household Chores: Hours worked on household chores are reported in continuous form and used as such. The mean of weekly hours spent on household chores are 8.647 (S.D. = 7.642) and 17.662 (S.D. = 12.027), for men and women respectively.

Stress and Satisfaction with Life: Twenty-three questions comprise three scales that relate to the individuals' stress level and their satisfaction with their own life in general. Although numeric values of those variables are difficult to interpret for the untrained reader, that should not be of serious consequence as they are only used as control variables in a limited amount of analysis, and no attempts are made at interpreting the values of the associated coefficients. A general description of all three variables follows.

The Satisfaction with Life Scale (SWLS) is designed to measure global cognitive judgments of the direction and events of people's lives. The scale indirectly gets at the question: Is my life going well according to the standards that I choose to use? It is thus important to note that each person's score relates to his or her own expectations. The transfer from the five dimensional questionnaires to a single dimension satisfaction with life is done through a simple summation. The assumption that each item has the same significance may not be correct, but it is the traditional way of using the scale.

The Perceived Stress Scale (PSS) is a widely used psychological instrument for measuring the perception of stress. Items were designed to disclose how unpredictable, uncontrollable, and overloaded respondents find their lives to be. The scale also includes questions about current levels of stress. The questions ask about feelings and thoughts during the last month.

The original scale, which was made from 10 questions, is not available within the current data. However, a shorter 4-item extraction is at hand in the survey utilized here. The PSS scores are obtained by reversing responses to the two negatively stated questions (e.g. 1≥5, 2≥4, 3≥3, 4≥2, 5≥1), and then summing across all four answers. This simple summation of the four dimensions could be problematic since we do not know if all the dimensions are comparable. However, this is the traditional way of using this scale.

The General Health Questionnaire (GHQ) is a screening instrument, to detect psychiatric disorders in non-psychiatric clinical settings, such as primary care or general practice. Different versions have been developed, but results from GHQ-12 (based on 12 questions) are employed in the survey at hand.

As those scales are summations of numerous questions, observations with some missing values accumulate quite quickly. It is argued here that case wide deletion due to missing values for some questions in unnecessarily conservative and would result in the loss of valuable information contained in available answers. Thus, it is argued here that replacement of missing values with sample means is worth the sacrifice of potentially reduced standard errors for those variables.

Demographics and Education: Gender, age, number of children and marital-status-dummy variables are used. Educational dummies indicate if the individual has finished the degree each question refers to. Summary statistics on those demographic variables can be found in Table 3.2.6.

TABLE 2.2.6
Summary Statistics for Demographics

	Males (N=512)		Females (N=543)	
Variable	Mean	S.D.	Mean	S.D.
Age	46,665	15,945	45,080	16,053
1 if married/living together	0,786	0,407	0,722	0,447
1 if never married or co-habiting	0,120	0,324	0,082	0,273
1 if divorced/separated	0,062	0,238	0,107	0,309
1 if widow/widower	0,032	0,174	0,089	0,284
Number of children	2,379	1,510	2,458	1,490
1 if finished elementary school	0,240	0,419	0,332	0,461
1 if finished high school	0,086	0,274	0,162	0,362
1 if finished vocational school or training	0,208	0,399	0,247	0,421
1 if finished masters or journeyman's cert.	0,274	0,442	0,048	0,199
1 if finished undergraduate degree	0,126	0,326	0,163	0,362
1 if finished a graduate degree	0,066	0,245	0,047	0,205

4. METHODS AND RESULTS

The analysis of the data is separated into two sub-sections. The concentration index, an aggregate measure of income-related inequality in health, is the focus of sub-section 4.1. Although the concentration index does not give detailed information about the health-income relationship, it is helpful in cross-country comparisons. Subsequently, the relationship between health and income is examined further with cross-sectional analysis and estimations of a health production function.

4.1 The Concentration Index

A wide variety of summary measures for the magnitude of inequalities in health exists. The Gini coefficient, and its close relative, the concentration index, are most widely used within the field of economics. The concentration index and the corresponding concentration curve will be used in this thesis, as they allow for comparisons between Iceland and other countries.

The concentration curve is based on the Lorenz curve, a cumulative frequency curve, which compares the distribution of a specific variable with the uniform distribution that represents equality. The concentration curve is a plot of the cumulative proportion of health (or ill health) against the cumulative proportion of the population ranked by income or other socio-economic factors. As such, it allows for examination of variations in one variable relative to variations in another variable.

In the current analysis, the income dimension is included by ranking of the observations by household equivalent income on the horizontal axis, with the least advantaged furthest to the left. The cumulative proportion of the health variable is then represented on the vertical axis. The concentration curve can be compared with a diagonal line representing a uniform distribution, or perfect equality. The greater the deviation of the concentration curve from this line, the greater the inequality.

The numeric representation that goes with the concentration curve is called the concentration index or the concentration coefficient and corresponds to twice the area between the concentration curve and the diagonal line. The concentration index provides a measure of socio-economic inequality in health. It ranges from -1 to 1, with 0 representing perfect equality and -1 and 1 representing total inequality, and can be represented by the following formula:[33]

$$C_{H,I} = 1 - 2\int_{0}^{1} L(s)ds \,,$$

where *L(s)* is the cumulative distribution of health, as a function of cumulative income, *s*,[34] and can be computed straightforwardly using individual-level data using the following formula:

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[33] The literature is not consistent regarding which number represents inequality favoring the less advantaged and which number favors the more advantaged. This inconsistency happens as there is not consistency on whether health or ill health is measured on the vertical axis. Originally, -1 meant that income-related inequalities in health favored the higher income levels and 1 favored the lower income levels. However, those signs appear when the vertical axis is represented by the inverse of SAH, or ill health. This is for example the case by Van Doorslaer et al. (1997), and results in a concentration curve that lies above the diagonal line of equality, despite the fact that the inequality favors the high-income groups. This is the opposite of the traditional Lorenz curve, which generally lies below the line of equality. It is also inconsistent with studies that measure health in different ways, such as with lifespan (age at death), which results in a concentration curve that lies below the diagonal (Illsley and Le Grand 1987, Le Grand 1987 & 1989).

A trend is now emerging that suggests that health should be used on the vertical axis rather than ill health, as the use of “a bad” on the vertical axis has caused some misunderstandings. In this analysis, health is used on the vertical axis, resulting in a concentration curve that is more familiar in view and interpretation. This is consistent with a discussion at the Nordic Health Economics Study Group (NHESG) in 2004, where researchers working on similar projects agreed that the previous method led to unnecessary confusion. The current method has been followed by others, such as Gravelle (2001).

Absolute values are used for the concentration index when comparing results from studies that use the opposite method. This should not be problematic as the sign only shows whom the inequality favors. So far, it has never been the case in any country in which it has been studied that the concentration of health favors individuals ranking low in socio-economic status. If such a result were to arise, it would still be quite clear during calculations of the index and drawing of the concentration curve.

[34] The use of the letters *L* and *s* is consistent throughout the literature and is kept here.

$$C_{H,I} = \left| \frac{2}{n\mu} \sum_{i=1}^{n} x_i R_i - 1 \right|,$$

where x_i (i=1, … ,n) is the health score of individual i, μ is the mean level of health and R_i is the relative rank of individual i.

The concentration index has a number of advantages as a measure of income inequalities in health. Most important, it reflects the experience of the entire population and not just those of two extreme socio-economic groups, as measures frequently used by non-economists do. The concentration index would thus change if the sizes of various groups changed, even if their mean health did not.

One limitation of the concentration index is the fact that if everyone's health were to double, the value of the index would not change. Such a difference would be captured in the absolute concentration index, which multiplies the traditional concentration index by the mean of the health variable used (Wagstaff and Van Doorslaer 2000). That number would obviously increase if everyone's health was enhanced. The reason that this measure is not chosen for use in this analysis is its limited use in the current literature, which hinders its use in cross-country comparisons.[35]

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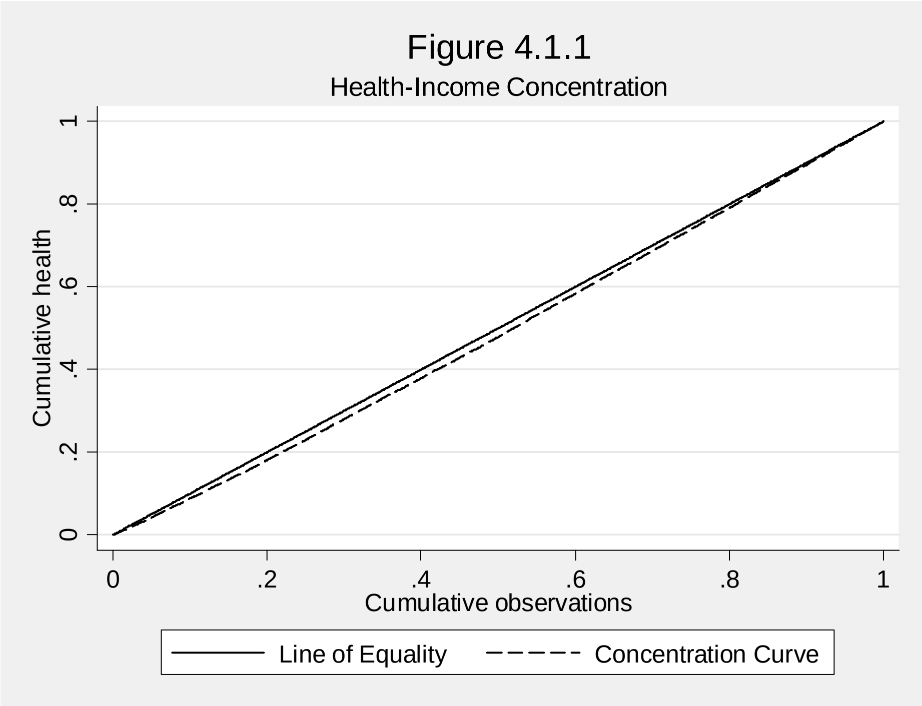
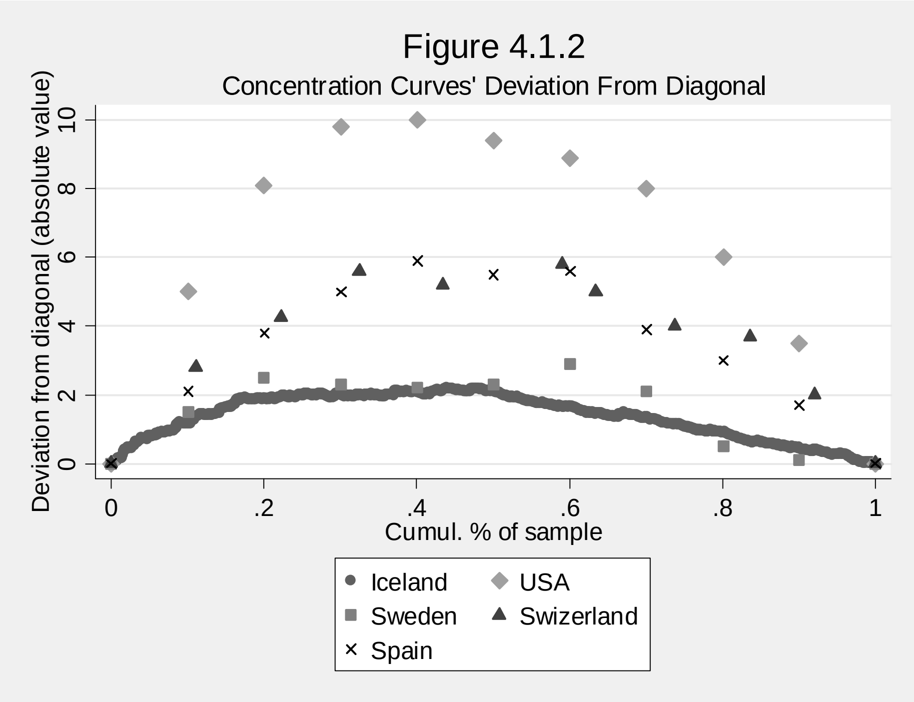
[35] Unfortunately, Van Doorslaer et al. (1997) do not report means of health in each country, which would have allowed for calculations of the absolute concentration index for the countries analyzed in their study.



Graphical representation of the health-income concentration can be found in Figure 4.1.1, which shows that the concentration curve for Iceland lies very close to the line of perfect equality. Results can be seen more easily in Figure 4.1.2, which shows the distance between the line of equality and the concentration curve.

For comparison, results from Van Doorslaer et al. (1997) on four other industrialized countries are shown, alongside the results calculated from the Icelandic data. Comparison with the international results suggests that, although existent, health inequality is relatively limited in Iceland when compared to other countries. The difference between the line of equality and the Icelandic concentration curve is maximized below 2.5%. For comparison, Van Doorslaer et al. (1997) estimate the difference in the United States to exceed 10% at its greatest point, as can be seen in Figure 4.1.2.[36]



A different and some would say more detailed comparison can be reached by examining the concentration index itself. It is calculated for this sample to be 0.0274 (95% Confidence Interval: 0.0056—0.0492).[37]

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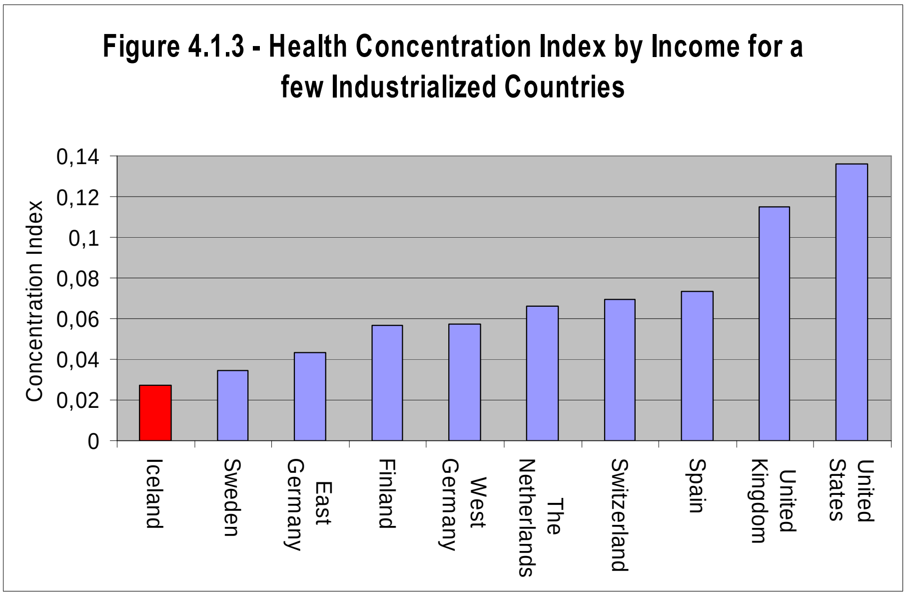
[36] Van Doorslaer et al. (1997) do not report information in the same detail on each country analyzed. Only information reported on the United States, Sweden, Spain, and Switzerland are detailed enough to graph in this manner, alongside the Icelandic results. However, the concentration index was also available for Germany, The United Kingdom, Finland, and The Netherlands. This difference in the extent of information explains the difference in the list of countries to which the Icelandic results are compared.

[37] The confidence interval was calculated as suggested by Kakwani et al. (1997). Other, less involved measures of the standard errors have been used. However, Kakwani et al. have shown that they can be unreliable due to the serial correlation induced by the ranking variable.



Of the nine countries examined in Van Doorslaer et al. (1997), no concentration index ranked lower than that of Iceland. The results for Iceland are shown alongside the results from Van Doorslaer et al. (1997) in Figure 4.1.3.[38] A general comparison shows Iceland to have limited income inequality in health compared to the other countries.[39]

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[38] The numeric estimates represented in the histogram above are: Iceland (0.0274), Sweden (0.0347), East Germany (0.0436), Finland (0.0566), West Germany (0.0571), The Netherlands (0.066), Switzerland (0.0696), Spain (0,0732), United Kingdom (0.1148), United States (0,136).

[39] It is well known that both health and income are associated with exogenous demographic factors, such as age and gender. The failure to consider these presupposes that all socio-economic inequalities in health are avoidable. This is unrealistic, since there are biological influences on health that are to a large degree unalterable. It is clearly unreasonable, for example, to suppose that a person of 85 could be made as healthy as a 20-year old. The diagonal is thus an unsuitable benchmark against which to compare $L(s)$ and might lead to an overestimation of the extent of socio-economic inequalities in health. (See, for example, Kakwani et al. 1997). One way to correct for differences in demographic factors such as age and gender is to employ the direct method of standardization. This method requires that persons be grouped into socio-economic groups (SEGs) and involves applying the age-sex-specific average rates of health of each SEG to the age and gender structure of the population. This is the method used in Van Doorslaer et al. (1997) and was applied to the data at hand, using gender groups and both six and twelve age groups. However, the standard errors were very large, and certainly much larger than the concentration index itself. This is likely due to the significantly smaller number of observations in the Icelandic data, relative to the ones used by Van Doorslaer et al. (1997). The estimation of a statistic from grouped data generally gives larger standard errors as the effective sample size is reduced to the number of categories, rather than n. This is referred to as the standardized concentration index, and is generally smaller than the unstandardized index, implying that some of the inequality is unavoidable and due simply to the age structure of the sample. Due to this, one can even interpret the lower value of a concentration index as an upper bound in international comparisons.

In summary, the results here show a statistically significant relationship between health and income in Iceland that is smaller than that of the other countries for which comparable results are available. However, the causal nature of the relationship is not defined by the previous analysis and the impact of health on financial attainment cannot be ignored. Simple associations of income and health variations are insufficient evidence for policy purposes. For example, the policy prescription is different if the association of income and health arises solely because health limitations reduce labor-market productivity. Of considerable importance would be to know if reductions in income harm health. This relationship will be explored further in the following analysis, using traditional regression techniques.

4.2 Regression Analysis

In the previous section, a statistically significant gradient between health and income was established in the context of Iceland and held up against international results. This relationship will now be examined further by means of traditional regression techniques, with focus on the coefficient of income, α, in the following health-production equation;

$$H_i = \beta X_i + \alpha I_i + \varepsilon_i ,$$

where H_i is an indicator of self-reported health for individual i, X is a vector of other control variables, β is a vector of parameters, I is a vector of equivalent family income for individual i in polynomial form, and ε is the individual specific error term. H takes the value of 1 if the individual is in “very good” or “rather good” health, and zero otherwise. Although some information is lost with the dichotomization of health, it is judged appropriate in this analysis, as the instrumental-variable estimations introduced later in this chapter do not lend themselves well to multinomial frameworks. The model will thus be estimated using probit regression techniques.

The individual's characteristics contained in *X* include age and age-squared, measures of family structure through marital status and number of children, as well as lifestyle factors such a smoking habits, alcohol misuse, and BMI. Education is also controlled for, as it is traditionally thought of as a class divider. A direct measure of the individual's years of education is not available in the study. Thus, six educational indicators are included in the regression, each indicating completion of a specific educational level. Indicators for employment status were also included, as has been the case in previous studies (Ettner 1996).

Income is used in its simulated form, and adjusted for family size, as described in Chapter 2. However, marital status and the individual's number of children are also kept in the regression, as they might affect an individual's health through other routes than simply income effects. Such effects are thus prevented from biasing the coefficient of income, which is meant to represent financial situation, rather than family structure.[40]

As reasons for stratification by gender are not clear, the possibility of systematic differences between males and females was examined. If the effect of income is different between men and women, separate regressions by gender should be considered. To test for such differential effects, the model was estimated with the inclusion of a gender dummy, and an interaction term between gender and income. The

[40] It should be noted that the adjustments of income for family size are such that multicollinearity is not present between equivalent income and family vairables, as examined by the Variance Inflation Factor (VIF). The VIF will be described in further detail below.

coefficients of both terms were statistically significant. Therefore, the sample was stratified by gender.

Multicollinearity between BMI and its squared term, age and its squared term, as well as income and its squared term was evident as calculated by the variance inflation factor (VIF).[41] Chatterjee, Hade, and Price (2000) suggest that if the VIF is above 10, multicollinearity is present. In the case at hand, VIF for variables entered in polynomial form were all greater than 10. In fact, they ranged between 14 and 55, as is common with such model specifications. In the case of age and BMI, this was resolved by centering the variables on zero before they were used in squared form. This reduced the dependence between terms so the VIFs became well within the suggested limits of 10.[42] Although multicollinearity may affect the standard errors, theoretical considerations led to the use of income in its squared form without centering.

The White (1980) test for heteroscedasticity did not reject homogeneous standard errors. However, it should be noted that the *p*-value of the *Chi*-squared test statistic was below 0.2 for both men and women.

The estimations described above, in which exogeneity of income is assumed, are done for comparison purposes, although they might be biased. To tackle the problem of endogeneity, instrumental-variables estimations are used and compared to regression results where income is treated as exogenous. This method will yield consistent

[41] The Variance Inflation Factor (VIF) measures the impact of collinearity among the *X*es in a regression model on the precision of estimation. It expresses the degree to which collinearity among the predictors degrades the precision of an estimate. The VIF calculation is based on regressions of each "regressor" on the other regressors. Then $1-R^2$ from each regression was calculated to see what fraction of the first regressor's variance is independent of the other *X* variables. For example, around 90% of employment status's variance tended to be independent of the other variables. For further information on the VIF see Velleman and Welsch (1981).

[42] Centering reduces collinearity as a variable containing positive and negative numbers is much less correlated with its own squared values then one who's values are all of the same sign.

estimates of the effect of income on health, as long as the identifying instruments are valid. This, however, results in inefficient estimates. Durbin-Wu-Hausman tests are used, as well as Wald tests of exogeneity to compare the two methods mentioned above and determine if efficient results suffer a bias. If they do not, then estimations using a single stage are preferred.[43]

An additional reason for the use of instrumental variables is the potential attenuation bias due to measurement error in the income variable. The approach taken here corrects for this bias as well, subject to the validity of the instruments. It is not possible, a priori, to predict the overall direction of the bias, as endogeneity bias would be expected to inflate the coefficient, but measurement error would deflate it.

In an effort to obtain consistent estimates, the spouse's market hours worked and the individual's experience with the current employer, are used as instruments. Both of those factors would influence the expected family income, but are not seemingly related to health in a direct way. This is what is theoretically required of an instrument, although further statistical tests are also needed.

The main qualifications of good instruments are that they should be: (a) correlated with the potentially endogenous right-hand-side variable; and (b) orthogonal to the error process. The former requirement is tested by significance tests of the

[43] The Durbin-Wu-Hausman test is equivalent to the standard Hausman test, except that the two covariance matrices used in the test are based on the variance from the efficient estimator. This option provides a proper estimate of the contrast variance for tests of exogeneity in instrumental variables regression. For further detail on the Durbin-Wu-Hausman test see Baum et al. (2003). The test is supported within the linear-probability framework, and thus estimations were repeated for this purpose with linear probability estimations. It is calculated here as a robustness check for the Wald test of exogenity, which is supported within the probit framework and tests if the correlation parameter between the error terms in the structural equation and the reduced-form equation is equal to zero (Wooldridge 2002). The results from those two types of tests were consistent in estimation throughout the thesis.

instruments in the first stage equation. The second requirement was tested with the Sargan (1958) test.[44] The results from those tests are as follows.

Spouse's hours worked and responder's own experience were statistically significant in the first-stage regressions in all cases, both regarding significance of the coefficients separately and when joint significance was measured. Bound, et al. (1993) further suggest that *F*-statistics of the hypothesis of joint significance above ten are indicators of good instruments. The *F*-statistics were marginally below or above this level. Specifically, they are slightly below ten in the case of males and only slightly above ten for females. It should thus be kept in mind that the instruments are not particularly strong, although usable. Readers interested in the full estimation results from the first stage equations are referred to Appendix B.

[44] The Sargan test is a test of overidentifying restrictions. The joint null hypothesis is that the instruments are uncorrelated with the error term, and that the excluded instruments are correctly excluded from the estimated equation. Under the null, the test statistic is distributed as *Chi*-squared in the number of overidentifying restrictions. A rejection casts doubt on the validity of the instruments. The Sargan test is supported in a two-stage linear-probability framework. The model was estimated using those techniques for the purposes of the Sargan test.

TABLE 4.2.1 - Male Estimations - Marginal Effects at Mean

Dependent variable is binomial health indicator variable	Probit dy/dx	Probit S.E.		Two-Stage Probit dy/dx	Two-Stage Probit S.E.	
income (in 100,000s of Icelandic Kronur)	0,036	0,017	**	0,030	0,015	**
income squared	-0,011	0,006	**	-0,010	0,005	*
age	-0,00337	0,00148	**	-0,00309	0,00132	**
age squared	0,00007	0,00007		0,00008	0,00006	
1 if never married or lived with anyone	-0,0006	0,047		-0,0009	0,044	
1 if divorced/separated	0,076	0,031	**	0,069	0,026	***
1if widow/widower	0,040	0,045		0,030	0,041	
children	0,002	0,011		0,001	0,009	
1 if finished high school	0,201	0,104	*	0,180	0,094	*
1 if finished vocational school or training	0,007	0,035		0,004	0,031	
1 if finished masters or journeyman's cert.	0,025	0,035		0,023	0,031	
1 if finished undergraduate degree	-0,007	0,045		-0,008	0,041	
1 if finished a graduate degree	0,094	0,080		0,098	0,084	
1 if smokes	-0,051	0,020	*	0,072	0,059	
5 level tendency to overdrink 1=always, 5=never	0,028	0,016	*	0,021	0,013	
1 if tried without success to reduce drinking	-0,020	0,080		-0,024	0,073	
1 if tried successfully to reduce drinking	-0,026	0,048		-0,024	0,042	
BMI (weight adj. for height)	-0,0037	0,0041		-0,0032	0,0038	
BMI squared	0,00008	0,00019		0,00007	0,00017	
1 if employer	-0,028	0,035		-0,031	0,031	
1 if student	0,314	1,019		0,276	0,736	
1if homemaker	-0,151	0,122	*	-0,127	0,100	
1 if pensioned	-0,041	0,059		-0,037	0,050	
1 if unemployed	-0,172	0,083	**	-0,159	0,069	**
1 if disabled	-0,187	0,079	**	-0,161	0,066	**
p-value of Wald test of exogeneity				0,2505		
p-value of Sargan test				0,1981		
Pseudo R-square	0,2182					
Number of observations	490			490		
Instruments	none			Spouse's market hours and tenure at current job		
First stage estimations	none			See Appendix B, Table B1		

Benchmark for education is finishing elementary school, benchmark for marital status is being married or living with someone, benchmark for smoking is daily smoking, benchmark for others opinion on drinking is if others find it problematic, benchmark for quitting is not having tried to quit in the last year and benchmark for employment status is being and employee.
*** significant at 1% level, ** significant at 5% level, * significant at 10% level

The second qualification was tested with the Sargan test, which supported the use of the instruments selected. Those results are reported along with the full regression results for the male sample in Table 4.2.1, and for the female sample in Table 4.2.2.

Single-stage probit estimations for sub-samples by gender show income and health to be related in a statistically significant way, although the effect is not great in magnitude. Casual comparisons between the general probit model and the two-stage probit estimation indicate limited differences between the two estimations. This is confirmed by the Wald tests of exogeneity, reported along with the results in Tables 4.2.1 and 4.2.2. The test fails to reject the null hypothesis of income being exogenous. This suggests that differences between the estimations under the assumption of exogenous income and those correcting for endogeneity are not systematic. The one-stage estimations would thus be of greater interest as they are efficient. For this reason, the single-stage estimations will be the focus of the following discussion, although the two-stage estimations are also reported for comparison and completeness' sake.

Figure 4.2.1

Predicted Health After Probit Estimation - Males

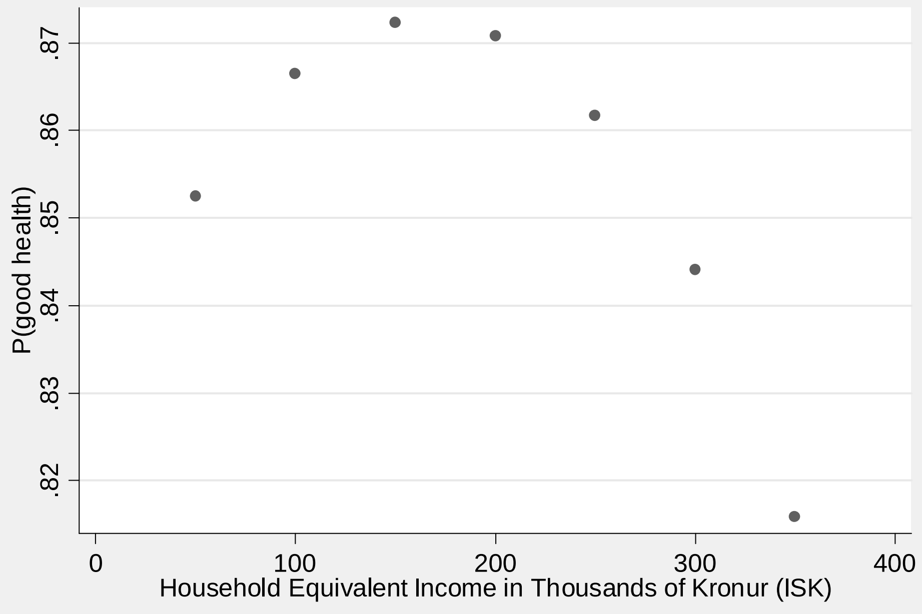


TABLE 4.2.2 - Female Estimations - Marginal Effects at Mean

Dependent variable is binomial health indicator	Probit			Two-Stage Probit		
variable	dy/dx	S.E.		dy/dx	S.E.	
income (in 100,000s of Icelandic Kronur)	0,047	0,016	***	0,039	0,014	***
income squared	-0,014	0,007	**	-0,013	0,006	**
age	-0,0034	0,0013	***	-0,0030	0,0012	**
age squared	-0,00009	0,00007		-0,00006	0,00006	
1 if never married or lived with anyone	0,081	0,026	***	0,073	0,024	***
1 if divorced/separated	0,059	0,025	**	0,050	0,022	**
1if widow/widower	0,075	0,023	***	0,060	0,021	***
children	0,013	0,010		0,009	0,008	
1 if finished high school	0,294	0,084	***	0,252	0,074	***
1 if finished vocational school or training	0,033	0,030		0,029	0,025	
1 if finished masters or journeyman's cert.	-0,006	0,062		-0,011	0,053	
1 if finished undergraduate degree	0,038	0,040		0,030	0,035	
1 if finished a graduate degree	0,014	0,071		0,039	0,073	
1 if smokes, but less than daily	-0,085	0,062		-0,078	0,054	
5 level tendency to overdrink 1=always, 5=never	-0,018	0,018		-0,018	0,016	
1 if tried without success to reduce drinking	-0,152	0,116		-0,133	0,097	
1 if tried successfully to reduce drinking	-0,064	0,052		-0,066	0,045	
BMI (weight adj. for height)	-0,0047	0,0033		-0,0036	0,0029	
BMI squared	0,00054	0,00038		0,00045	0,00034	
1 if employer	0,066	0,059		0,061	0,054	
1 if student	-0,068	0,086		-0,057	0,078	
1if homemaker	-0,045	0,046		-0,042	0,038	
1 if pensioned	0,003	0,054		0,007	0,044	
1 if unemployed	0,164	0,371		0,152	0,357	
1 if disabled	-0,221	0,069	***	-0,179	0,061	***
p-value of Wald test of exogeneity				0,4973		
p-value of Sargan test				0,1584		
Pseudo R-square	0,3834					
Number of observations	515			515		
Instruments	none			Spouse's market hours and tenure at current job		
First stage estimations	none			See Appendix B, Table B2		

Benchmark for education is finishing elementary school, benchmark for marital status is being married or living with someone, benchmark for smoking is daily smoking, benchmark for others opinion on drinking is if others find it problematic, benchmark for quitting is not having tried to quit in the last year and benchmark for employment status is being an employee.
*** significant at 1% level, ** significant at 5% level, * significant at 10% level

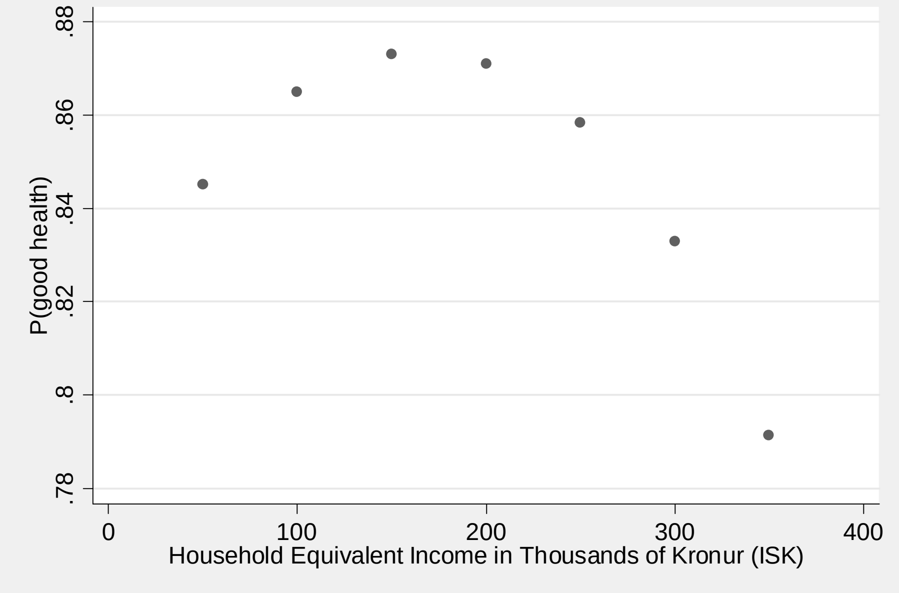
If we turn our attention first to the male results, reported in Table 4.2.1, we can see that income is nonlinearly related to men's health. Due to the polynomial effect of income, the marginal effects can be difficult to read. Therefore, this relationship is represented graphically in Figure 4.2.1 as well.

Results show a relationship between health and income that is not monotonic. Income is positively related to male health at lower income levels, but negatively related to health at higher income levels. As can be seen in Figure 4.2.1, the variation is not of great magnitude and variations in the likelihood of being in good health remains within the point-eighties for the majority of the Icelandic income range.

Due to the unexpected result of income being related to some adverse health outcomes, the sample was split by income level, and both samples estimated, excluding income in its squared form. Significance was lost in those estimations as might be expected, due to limited observations. However, the sign of the coefficient of income was positive for the lower-income levels and negative for the higher income levels, as suggested by the main results discussed here.

Female results, reported in Table 4.2.2 and Figure 4.2.2, show a similar reversal in the relationship between income and health. In fact, the results for men and women appear to be remarkably similar, although statistical tests reported earlier suggested stratification by gender. The relationship between income and female health is apparent in terms of statistical significance, and the results are of similar magnitude to those for males. In order to examine the surprising reversal of the health-income relationship further, estimation was undertaken for lower- and higher-income groups as before. The results were similar to those found in the case of males, confirming the negative relationship at higher income levels, although without significance.

Figure 4.2.2
Predicted Health After Probit Estimation - Females



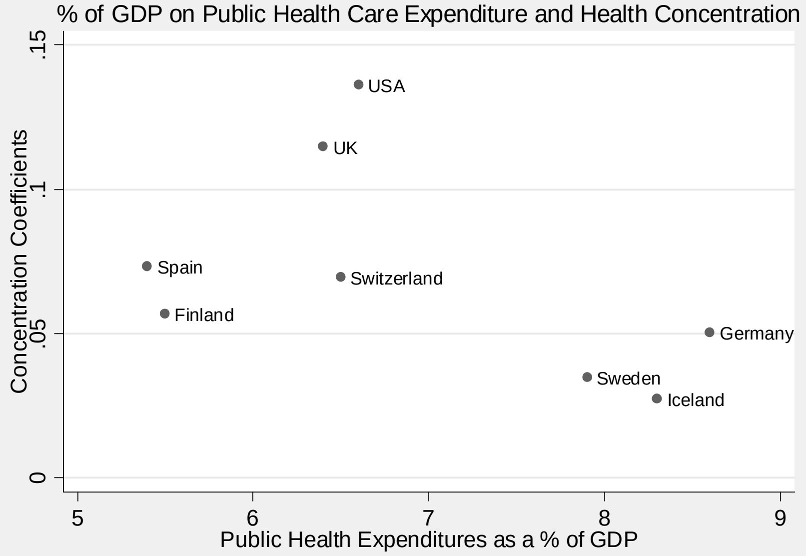
Ecob and Smith (1999), who found reversals of the health-income relationship for the highest-income groups in England, Wales, and Scotland, hypothesized that stress may be a factor in this relationship, as it is likely that those with limited means may suffer greater stress, as well as those with high income and thus possibly great job-related stress. The survey at hand has three widely used measures of stress and satisfaction with life, as described in Chapter 2. Multiple estimations were carried out with those variables and their interaction with income. The results were robust to those changes in control variables, indicating that stress is not the principal reason driving this relationship.

5. DISCUSSION AND CONCLUDING REMARKS

Although health inequalities exist in Iceland, the current analysis suggests that the goal of income-related health equality has been attained to a greater extent than in many other countries. By international standards, Icelandic health inequality by family income does not appear to rank high when compared to studies such as Ettner (1996) or Van Doorslaer (1997). It has to be noted though that the relationship between income and health is strong in terms of statistical significance, although it is not severe in terms of magnitude when compared to other countries in the Western world.

Figure 5.1

% of GDP on Public Health Care Expenditure and Health Concentration

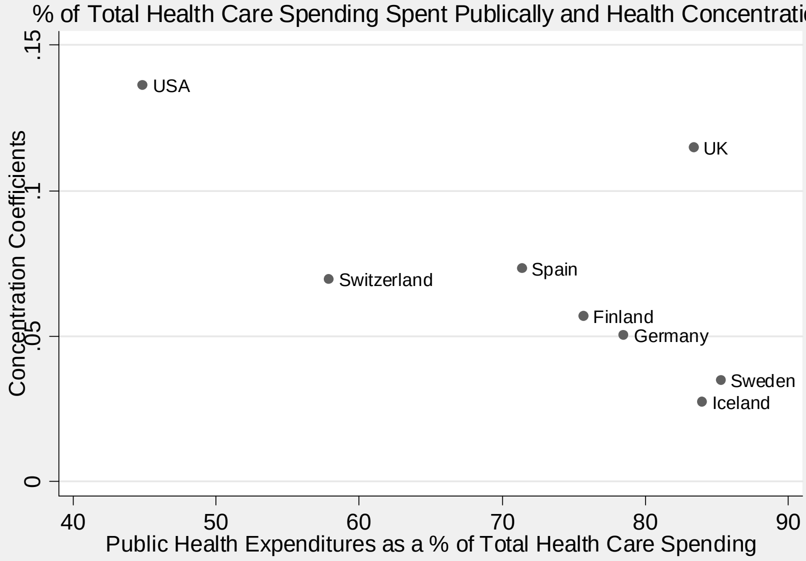


The Icelandic concentration coefficient is fairly consistent with a priori expectations regarding the determinants of health, and as such reinforces previous reports of such determinants. When looking at measures of expenditures on health care, and their relationship to the concentration of health, inconsistencies are observed. Figure 5.1 shows the relationship between public health expenditures as a percentage of GDP, and the concentration index; Figure 5.2 shows public expenditure on health care as a percentage of total expenditure and the concentration index; and Figure 5.3

shows total per-capita expenditures on health and the concentration index.[45] The ranking of the health expenditure measures is quite different from that of income-related inequalities in health, with one exception. The portion of total expenditures on health spent by public agencies appears to move systematically with the concentration of health (correlation coefficient of -0.6420), as depicted in Figure 5.2.

Figure 5.2

% of Total Health Care Spending Spent Publically and Health Concentration



Although the effect of the public portion of health-care expenditures is significant at the 10% level in a simple linear regression, significance is lost with the inclusion of the Gini coefficient. The Gini coefficient, however, is highly significant under the inclusion or exclusion of any, or all, of the other aggregate health-spending measures. Thus, the most apparent relationship between health concentration and other aggregate measures in the relevant countries is found in the comparison between health and

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[45] The values for the concentration coefficients of the other countries are used as reported by Van Doorslaer et al. (1997). Unfortunately, the OECD does not report detailed values of the health expenditures used here for the Netherlands. The country was thus not included in those graphs. The average of the health concentration coefficients for East and West Germany (0.0436 and 0.0571 respectively) was used so as to keep consistency with official OECD data on health-care expenditures.

income equality, as can be seen in Figure 5.4. Ranked cross-country comparisons of income-related health concentration seem to be more consistent with the ranking of income inequality than with the amplitude of government medical benefits, which, for example, are relatively high in the United Kingdom, a country with relatively high income-related inequalities in health (Van Doorslaer et al. 1997).

Figure 5.3

Total Health Care Spending Per Capita and Health Concentration

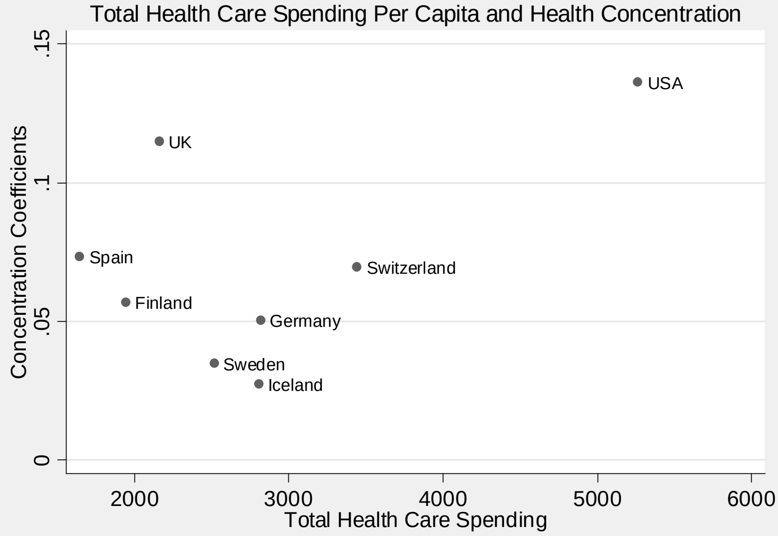
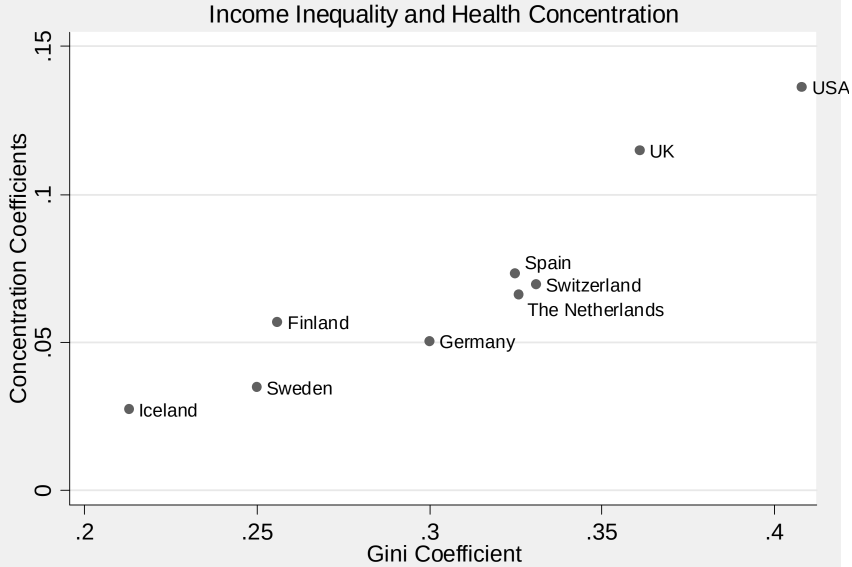


Figure 5.4

Income Inequality and Health Concentration



In just about every society, the more affluent and better-educated members of a society tend to live longer and healthier lives. It has been suggested that the correlations between income and health do not only regard absolute income, and that relative income matters even more. We now know that countries with a greater degree of socio-economic inequality show greater inequality in health status. More specifically, middle-income groups in relatively unequal societies are in worse health than comparable, or even poorer, groups in societies that are more equal. However, the exact processes are far from being understood, and whether inequality is associated with generally poorer health remains debated. In the context, however, of currently available information, the results from Iceland, are not surprising, and confirm previous findings in other countries of the relationships discussed above.

Similarly, regression analyses show a relationship between health and income that is statistically significant, although not extreme in terms of magnitude, as seen in Figures 5.4 and 5.5. What is somewhat puzzling is the sign reversal of the health-income relationship at higher income levels, perhaps indicating some adverse effects of high income. The reason for this reversal is unclear, but one hypothesis involves the cost of time, which in Iceland is expected to form the majority of the opportunity cost of health production. Unfortunately, the data at hand are not rich enough to confirm or reject this hypothesis convincingly.

This is the first study on the topic using Icelandic data and, despite efforts at comprehensiveness, the current picture of income-related inequalities in health is still fragmentary. It is argued here that this analysis gives valuable guiding clues on the magnitude and direction of the two-way relationship between health and income in

Iceland. It would be beneficial to extend this knowledge with studies on specific policy measures and their marginal effects on the health distribution. The data for such an analysis is currently not available. In an international context, meta-analysis of the literature of causal direction would be an interesting contribution.

6. POLICY IMPLICATIONS

Research specific to Iceland on the topic studied in this paper is in its infancy. Hopefully, the results presented here will be useful for Icelandic policymakers at a time when the costs of the centralized health-care system are rising dramatically.

Policy matters need to be based on many factors. Although this chapter discusses some relevant policies, it should not be construed as a plea for intervention. Some of the options discussed have wide-ranging effects, which have not been a part of this analysis, in addition to considerations regarding the appropriateness of interventions in general.

A broader-spectrum political debate on equalizing access to health-promoting goods begs the question: Why health? Answers to this question run deeper than this analysis can address. What we can tell from this analysis is how Iceland is doing in its pursuit to reduce income-related inequalities in health.

The results on the relationship between health and income are somewhat as expected, given the characteristics of the society studied. Health inequality is certainly detectable, but its relatively limited magnitude is consistent with conventional wisdom. What is less expected is that when traditional background and lifestyle factors have been controlled for, the effect is non-monotonic and health appears to decrease with income at higher levels.

Risky lifestyle choices in Iceland, as in the industrialized world in general, have attracted the attention of policy makers. There is a large difference between what is currently acknowledged as healthy lifestyles and what most individuals practice. This difference seems difficult to reconcile, and has been projected by Iceland’s health minister Jon Kristjansson to be the source of leading health issues facing Icelanders in the next decades (Kristjansson 2002).

It is true that crude summary statistics reveal that those of lower income are in worse health than those of greater means. However, the present results suggest that policymakers wishing to explain and remedy this have to look to other reasons than financial deprivation in their search for mitigating factors.

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Appendix A

FIRST-STAGE ESTIMATIONS FOR HEALTH AND INCOME

This appendix contains first-stage estimations relating to two-stage models described in Section 0.

TABLE A1 - Male Estimations - First Stage

Dependent variable is:	Income			Income Squared		
variable	dy/dx	S.E.		dy/dx	S.E.	
spouse's market hours worked	0,013	0,005	**	0,026	0,008	***
experience at current job	0,008	0,004	**	0,026	0,011	**
age	-0,001	0,006		-0,001	0,018	
age squared	-0,00023	0,00033		-0,00028	0,00100	
1 if never married or lived with anyone	0,702	0,254	***	2,861	0,773	***
1 if divorced/separated	-0,029	0,299		1,111	0,909	
1if widow/widower	-0,240	0,412		-0,204	1,253	
children	-0,258	0,052	***	-0,633	0,157	***
1 if finished high school	0,261	0,253		0,646	0,768	
1 if finished vocational school or training	-0,084	0,188		0,429	0,572	
1 if finished masters or journeyman's cert.	0,145	0,181		0,380	0,551	
1 if finished undergraduate degree	0,675	0,217	***	1,072	0,661	
1 if finished a graduate degree	1,303	0,272	***	2,331	0,827	***
1 if smokes	-0,186	0,162		-0,345	0,494	
5 level tendency to overdrink 1=always, 5=never	-0,156	0,071	**	-0,400	0,216	*
1 if tried without success to reduce drinking	0,178	0,445		0,226	1,353	
1 if tried successfully to reduce drinking	0,295	0,219		1,769	0,665	***
BMI (weight adj. for height)	-0,003	0,020		0,002	0,061	
BMI squared	0,000	0,001		-0,002	0,003	
1 if employer	-0,017	0,168		0,771	0,511	
1 if student	-0,776	0,469	*	-2,143	1,424	
1if homemaker	-0,768	0,769		-0,600	2,337	
1 if pensioned	-0,834	0,369		0,257	1,121	
1 if unemployed	-1,674	0,472	***	-3,454	1,436	**
1 if disabled	-1,474	0,482	***	-1,747	1,465	
R-square	0,2762			0,1797		
Partial R-square	0,0282			0,0261		
F-test of instruments joint significance	8,03			8,97		
Number of observations	490			490		

Benchmark for education is finishing elementary school, benchmark for marital status is being married or living with someone, benchmark for smoking is daily smoking, benchmark for others opinion on drinking is if others find it problematic, benchmark for quitting is not having tried to quit in the last year and benchmark for employment status is being an employee.
*** significant at 1% level, ** significant at 5% level, * significant at 10% level

TABLE A2 - Female Estimations - First Stage

Dependent variable is:	Income			Income Squared		
variable	dy/dx	S.E.		dy/dx	S.E.	
spouse's market hours worked	0,013	0,004	**	0,013	0,003	***
experience at current job	0,004	0,001	***	0,001	0,000	***
age	0,007	0,006		0,024	0,014	*
age squared	-0,00001	0,00035		0,00117	0,00088	
1 if never married or lived with anyone	0,624	0,277	**	2,666	0,701	***
1 if divorced/separated	-0,430	0,249	*	1,501	0,630	**
1if widow/widower	-0,272	0,275		1,145	0,696	
children	-0,181	0,046	***	-0,116	0,115	
1 if finished high school	0,208	0,188		0,009	0,474	
1 if finished vocational school or training	-0,006	0,150		-0,026	0,378	
1 if finished masters or journeyman's cert.	0,440	0,281		0,865	0,711	
1 if finished undergraduate degree	0,636	0,167	***	0,713	0,421	*
1 if finished a graduate degree	1,493	0,270	***	2,359	0,682	***
1 if smokes	-0,384	0,137	***	-0,559	0,347	
5 level tendency to overdrink 1=always, 5=never	-0,034	0,077		0,160	0,194	
1 if tried without success to reduce drinking	0,911	0,487	*	2,575	1,231	*
1 if tried successfully to reduce drinking	-0,452	0,234	*	-0,502	0,593	
BMI (weight adj. for height)	-0,045	0,014	***	-0,096	0,034	***
BMI squared	0,00043	0,00068		0,00246	0,00173	
1 if employer	0,138	0,217		0,034	0,548	
1 if student	-0,342	0,330		0,000	0,833	
1if homemaker	0,154	0,269		0,014	0,680	
1 if pensioned	-0,641	0,365		-0,938	0,921	
1 if unemployed	1,014	0,621		0,312	1,570	
1 if disabled	-0,554	0,380		-0,442	0,961	
R-square	0,3472			0,1666		
Partial R-square	0,0403			0,0312		
F-test of instruments joint significance	13,31			11,02		
Number of observations	515			515		

Benchmark for education is finishing elementary school, benchmark for marital status is being married or living with someone, benchmark for smoking is daily smoking, benchmark for others opinion on drinking is if others find it problematic, benchmark for quitting is not having tried to quit in the last year and benchmark for employment status is being an employee.

*** significant at 1% level, ** significant at 5% level, * significant at 10% level