Master's Thesis

Income Inequality and Distributional Effects of Publicly Provided Services

An Empirical Analysis for Switzerland

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Abstract

Recently published results on the distribution of income show that inequality has increased over the last 30 years in many developed countries. The rise in inequality is worrisome not only for reasons of social equity. It can also be argued that inequality has a certain price in terms of a loss of social welfare. However there are some conceptional difficulties which have to be faced when analysing inequality. One important issue arises from the fact that empirical work on inequality is usually based on the concept of disposable income and therefore accounts for distributional effects of taxes and cash transfers but ignores the value of publicly provided services. For some publicly provided services beneficiary households are identifiable and these services can be regarded as in-kind transfers. In-kind transfers affect the economic well-being and the relative economic position of the beneficiary households and therefore should be considered in empirical work on inequality.

For Switzerland educational and health care services are identified as major in-kind transfers and should consequently be included in the concept of income when analysing inequality. The actual inclusion of the value of these services in a concept of extended income lies beyond the limits of this paper. It is however empirically analysed if beneficiaries of these in-kind transfers differ in income from households not consuming the respective services. This information allows to draw certain conclusions on how inequality is affected by these transfers. The empirical results show that public expenditure on education and health care tend to reduce inequality.

Moreover it is investigated if the size and composition of in-kind transfers vary internationally. For the 27 OECD countries observed, considerable variation in the size and composition of in-kind transfers is found. These results imply that studies on inequality that rely on disposable income yield in a biased and inaccurate comparison of inequality across countries. For countries with high in-kind transfers the relative position of the country in terms of equality tends to be underestimated whereas for countries with low in-kind transfers it tends to be overestimated. Switzerland reports the second lowest in-kind transfers (in % of disposable income) among the 27 OECD countries observed which is a result of very low public expenditure on health care services compared to the other countries. Hence Switzerland is assumed to rank considerably more unequal in a cross-country analysis on inequality when in-kind transfers are included in the concept of income than studies on inequality across countries which rely on disposable income suggest.

Contents

1 Introduction

Inequality of income and wealth is currently discussed extensively and has attracted the interest of many economists. This interest is presumably largely driven by results as the ones published by Alvaredo and Piketty (2010) suggesting that inequality of income has considerably increased over the last 30 years in many developed countries.

Inequality cannot only be regarded as problematic for reasons of social equity. There are also economic reasons why a reduction of inequality may be desirable. One reason arises from the assumption of diminishing marginal utilities of income and is explained in section 2.1. Recently published results by Ostry et al. (2014) on the link between inequality and growth deliver another rationale. Ostry et al. (2014) find empirical evidence that lower inequality is (positively) correlated with growth. In other words inequality might have a negative effect on growth. Hence there are arguments legitimizing the classification of inequality as a problem relevant not only socially but also economically. The results on the evolution of inequality over time reinforce the importance of research on inequality.

When studying inequality, the first question that has to be addressed is on what economic concept the the analysis of inequality should be based. Feasible concepts include income, wealth, consumption and many other proxies for economic well-being. There are in fact arguments for income, wealth and consumption. Wealth and consumption have the property of being less influenced by short time shock and thus being more stable over time. A major disadvantage is though, that there are issues related to the availability of reliable data on wealth or consumption. For income on the other hand, the availability of reliable data is a major advantage. Consequently, most academic work on inequality is based on the concept of income. [Glaeser (2005), p.3]

In accordance with this practice, the analysis of inequality is also based on the concept of income in this paper. It is important to state though that in order to be able to analyse and interpret inequality in a meaningful sense, the concept of income has to be defined in a way that it reliably represents the economic well-being of the individuals in a society [Cowell (2011), p.4]. Most studies on inequality, however, rely on cash income only and thus ignore important components of income [Aaberge et al. (2010)]. From this it follows that important aspects that affect economic well-being are omitted and the omission of these aspects yields an incomplete and

potentially biased picture of inequality [Garfinkel et al. (2006)]. Income therefore has to be defined in a way that it includes not only cash income but also non-cash components that affect economic well-being [Cowell (2011), p.4ff.]. Aaberge et al. (2010) identify publicly provided services as important components of economic well-being and recommend that the value of these services is included in the concept of income for the purpose of analysing inequality.

The aim of this paper is to discuss conceptual issues related to the analysis of inequality under consideration of publicly provided services and to infer the effect caused by the inclusion of the value of these services on income inequality in Switzerland. For this purpose the following questions are of major interest:

1. Which publicly provided services should be included?
2. How large is the the value of these services?
3. Who benefits from these services?
4. How is income inequality affected by these services?

The conceptual issues and question 1 are addressed in section 2. Questions 2 to 4 are empirically analysed for Switzerland by relying on government expenditure data by function from the OECD and on the Swiss Household Panel SHP data. The answers to these questions are then provided in section 3. Moreover, it is examined if public expenditure on specific services vary across countries. This analysis is based on OECD data on government expenditure by function for 27 OECD countries. The results of the cross-country analysis are presented and discussed in section 4.

2 Inequality and Publicly Provided Services

This section provides a theoretical foundation for the subsequent analyses of inequality and the distributional effects of publicly provided services. As a starting point, the implications of inequality on social welfare are discussed. This discussion is followed by an introduction to the basic methods of measuring inequality, which are later applied in the empirical analysis in section 3. Furthermore, methodologies and difficulties related to the conception of income and the valuation and allocation of publicly provided services are presented. Lastly, a theoretical classification of public expenditure with respect to the impact on the distribution of income and inequality is provided.

2.1 The Impact of Inequaltiy on Social Welfare

The fact that income is unequally distributed is commonly known and there are of course many reasons why inequality can be undesirable. On the other hand there are some reasons that justify income inequality to some extent. A discussion of all aspects of inequality lies beyond the scope of this paper but nevertheless an idea of how inequality can be interpreted from a micro-economic perspective is provided. The following analytical framework specified by Rosen and Gayer (2010) [p.261ff.] delivers some valuable insights and provides a basis from which to study the effects of inequality on social welfare.

In the framework by Rosen and Gayer (2010) social welfare is defined as a measure of the economic well-being of all individuals within a society. Stated differently, social welfare W is a function of the utilities U_i for all individuals $i = \{1, ..., n\}$. [Rosen and Gayer (2010), p.261]

$$W = F(U_1, U_2, ..., U_i, ..., U_n) \tag{1}$$

Rosen and Gayer (2010) make the following assumptions:

1. The maximum of the social welfare function W is the most desirable outcome.
2. The utilities U_i enter the social welfare function W additively.
3. The individual utility functions depend solely on the individual's income.

4. The utility functions are identical across all individuals.

5. The utility functions are (strictly) increasing and (strictly) concave in income.

6. The total amount of income is fixed.

By relying on these assumptions, the social welfare function (1) can now be expressed more precisely as

$$W = \sum_{i=1}^{N} U(y_i) \tag{2}$$

where $U(y_i)$ represents the (identical) utility function for all individuals i. The specific utility for individual i is a function of the individuals income y_i where the individual utility is (strictly) increasing in income but with a marginal utility that is (strictly) diminishing. [Rosen and Gayer (2010), p.261ff.]

From equation (2) and by considering the assumptions on the utility functions it can easily be seen how a given total amount of income has to be optimally distributed among all individuals i in order to maximise the social welfare function W. Since diminishing marginal utilities are assumed, the social welfare function is increased by shifting income from a rich individual (with a low marginal utility) to a poor individual (with a high marginal utility). Hence the social welfare function is maximised by shifting income from the rich to the poor until a point is reached where all individuals receive the same income and encounter the same marginal utility. In other words, the optimal distribution of income in terms of maximising the social welfare function is a distribution where all individuals receive exactly the same amount of income. [Rosen and Gayer (2010), p.262ff.]

Even though this theoretical approach to the optimal distribution of income is based on somewhat reasonable assumptions, these assumption are also restrictive and ignore many aspects of economic behaviour and well-being. Nevertheless this approach provides a framework to argue that income inequality is not optimal from a social welfare perspective. Kakwani and Son (2005) analyse inequality in a similar framework and provide an interesting interpretation of inequality. They indicate that income inequality causes a loss of social welfare [p.41]. So, from a social welfare perspective, inequality can be regarded as inefficiency and it can be argued that

a reduction of inequality increases social welfare for a given amount of aggregate income.[2]

Dalton (1946) also provides arguments for a more equal distribution of income and states that by the principle of maximum social advantage "a reduction in inequality is desirable, in order that income may be distributed, at any given time, more in accordance with individual and family needs at that time, and with capacity to make good use of income" [p.11f.]. In other words, Dalton explains that all received incomes should be in accordance with the need for income and points to the circumstance that not all income can be assumed to provide the same marginal utility. The theoretical framework that explains the impact of different marginal utilities across individuals on social welfare has already been provided. The issues concerning the difference in needs for income are addressed in section 2.3.

2.2 Methods of Measuring Inequality

Since inequality seems to have a certain price in terms of the loss in social welfare, the ability to measure and assess of inequality is highly relevant. The introduction and discussion of all methods of measuring inequality lies beyond the scope of this thesis but a number of important methods are presented in this section. To be more precise, the methods that are going to be applied in the empirical analysis of Switzerland in section 3 and in the cross-country analysis in section 4 are introduced. Since most of these methods are well known they are only explained briefly.[3]

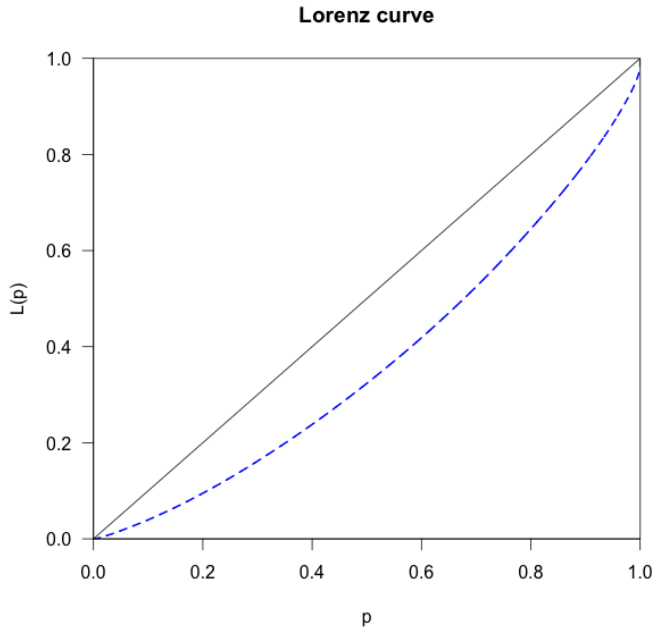
The Lorenz Curve

The Lorenz curve is a graphical illustration of the distribution of income across individuals in a specific population. The curve corresponds to a function that specifies the relationship between the proportion of people with income at or below a specific

[2]It is important to stress that this is only true if the total amount of aggregate income is fixed and is not affected by a reduction of inequality. It seems however reasonable to assume that aggregate income is affected by government redistribution because high income individuals have less incentive to gain income if a large proportion of their income is redistributed to low income individuals. If leisure is expected to also increase utility, high income individuals start to substitute (work) income for leisure because additional income no longer sufficiently increases utility anymore which, in this case, results in lower aggregate income. [Rosen and Gayer (2010),p.263f.]

[3]The unfamiliar or interested reader can find more information in Cowell (2011) and in many other (even more general) economic textbooks.

Figure 2.1: Example of a Lorenz Curve



level and the proportion of total aggregate income those people receive. The cumulative proportion of the people at or below a specific level of income is denoted by p and is plotted on the horizontal axis. The cumulative proportion of incomes that the respective proportion of individuals p receive is denoted by $L(p)$ and is plotted on the vertical axis. In more general terms, the function $L(p)$ exhibits the total proportion of aggregate income received by the pth share of individuals when all individuals are ranked according to income in ascending order. [Kakwani and Son (2005), p.34ff.]

Figure 2.1 exhibits an example of a Lorenz curve. In the figure the main characterstics of the Lorenz curve can be easily seen. The curve is typically drawn in a unit square where p and $L(p) \in [0, 1]$. Moreover, $L(0) = 0$ and $L(1) = 1$ holds for any distribution of income. It can also be seen that $L(p)$ is monotonically increasing and convex. As a result of that, $L(p) < p$, $\forall\ p \in (0,1)$ unless income is equally distributed. If income is distributed equally $L(p) = p$, $\forall\ p \in [0, 1]$. This case is represented by the *egalitarian line* which is a linear function with slope 1 plotted as the thin black line in figure 2.1. The Lorenz curve reveals deviations of income distribution from perfect equality. The closer the Lorenz curve is to the egalitarian

line the more equally income is distributed. Hence the Lorenz curve is an instrument that can be used to identify and describe inequality and will also be applied in the empirical analysis in section 3. [Kakwani and Son (2005), p.34ff.]

The Gini Coefficient

The Gini coefficient is a single measure of inequality that can be derived directly from the Lorenz curve. This is also one of the main reasons why the Gini coefficient is the most popular single measurement of inequality. Kakwani and Son (2005) describe the Gini coefficient as a measure of the extent " (...) to which the Lorenz curve departs from the egalitarian line" where the Gini coefficient "is defined as twice the area between the Lorenz curve and the egalitarian line" [p.36]. Since the area between the egalitarian line and the Lorenz curve is limited to 0 (in which case income is distributed completely equality) on one end and to 0.5 (in which case the richest individual receives all income an all other individuals receive nothing) on the other end, the Gini coefficient (which is twice this area) always lies between 0 and 1. [Cowell (2011), p.26f.; Kakwani and Son (2005), p.36f.]

Cowell (2011) [p.155] provides the following formula to calculate the Gini coefficient for a given distribution of income Y

$$G = \frac{1}{2n^2\bar{y}} \sum_{i=1}^{N} \sum_{j=1}^{N} \mid y_i - y_j \mid \tag{3}$$

where n represents the number of individuals in the population and y_i and y_j denote the incomes of individual i and j and $\bar{y}$ is the mean income. Equation (3) illustrates that the Gini coefficient accounts for all differences in income between all individuals i and j and puts it in relation to the aggregate income of the population $n\bar{y}$. It is easy to see that a more unequal distribution of income increases the expression $\sum_{i=1}^{N} \sum_{j=1}^{N} \mid y_i - y_j \mid$ which results in a higher G for a given aggregate income $n\bar{y}$. In other words, the more unequal the distribution of income the higher the Gini coefficient G. [Cowell (2011), p.155ff.]

Quantiles, Shares and the Relative Share of Quantiles

Descriptive statistics have proven to be a useful instrument to describe particular distributions. These measures include mean, median, standard deviation, skewness and kurtosis but are not limited by them. When it comes to the analysis of income inequality, quantiles are considered to be especially useful because they provide additional information on the distribution of income by reporting the income level of specific proportions of individuals.

Quantiles are constructed by ranking all individuals according to their income in ascending order and then dividing them into a number of subsets. These subsets are referred to as *quantiles*. The number of quantiles can be chosen freely. Most common is the division into 4 quantiles (also called quartiles), into 5 quantiles (also called quintiles) or into 10 quantiles (also called deciles). Formally the maximum income level of a specific quantile is expressed as Q_p where $p \in (0,1)$ is a specific proportion of the individuals ranked according to their income and Q_p yields the highest income of all individuals up to the respective quantile. Stated differently, all individuals i in the specific proportion p have an income y_i that is lower or equal to Q_p. So for instance if $Q_{0.2} = 1000$ we can state that the 20% of the individuals with the lowest incomes all have an income that is smaller or equal to 1000. On the other hand, this also implies that the other 80% of the individuals all have an income that lies above 1000. In case information on more quantiles is provided this allows to make even more such statements. If for instance there is the information that $Q_{0.8} = 8000$, this implies that the 20% of the poorest all have an income below or equal to 1000 whereas the 20% of the richest all have an income above or equal to 8000. [Cowell (2011), p.31ff.]

Quantiles can also be compared across multiple distributions of income. Cowell (2011) calls this method *quantile ranking*. If, for instance, all quantiles in income distribution A are above the ones from income distribution B, quantile ranking suggests that all quantiles of distribution A are better off compared to income distribution B. [Cowell (2011), p.33]

Shares are somewhat familiar to quantiles but they are not expressed in an absolute measure of income but instead they express the share of cumulated income up to the corresponding quantile relative to the total income of the whole population. The share actually expresses what can be read from the Lorenz curve, which is the

proportion of income (y-axis) for a given proportion of population (x-axis) after all individuals in the population have been ranked according to income. [Cowell (2011), p.34ff.]

Verbist et al. (2012) study the effects of publicly provided services on inequality and use a special method based on quantiles. This method is also applied in the analysis on the distributional effects of government expenditure on publicly provided services in Switzerland in section 3.3 and is later referred to as *the relative share of quantiles*. Since this method may not be commonly known, it is briefly explained here. The method of the relative share of quantiles is based on a two steps approach. In the first step the whole population is subdivided into a number of quantiles where m denotes the number of quantiles. Then the information of the respective quantile is added to each observation. This means that each observation carries the information of the quantile it has been assigned to. In the second step a subset of the whole population is defined. The definition of this subset is based on other characteristics than income (e.g. according to age). Then the relative share of each (originally defined) quantile in the specific subset is observed. For the whole population the relative share is (approximately)[4] $\frac{1}{m}$. For the subset on the other hand, the relative share of quantiles might differ from the relative shares reported for the whole population. A relative share above $\frac{1}{m}$ for the first quantile q_1 indicates that there are (relatively) more low income individuals represented in this subset. Accordingly a relative share below $\frac{1}{m}$ in q_1 suggests that there are relatively more people with an income above the $Q_{1/m}$ income in the subset. So, if for instance for the subsets of households benefiting from a specific public service the relative share of the first quintile is 30%, this indicates that there are relatively more households with an income at or below the $Q_{0.2}$ income level (in other words of the poorest 20%) represented in the subset. It can therefore be concluded that beneficiaries of the specific service are more likely to be among the poorest 20% than this would be the case for the whole population. Hence, the respective public services are more extensively directed to the poorest households.

[4]If there are multiple observations with exactly the same income, the ranking according to income is not unique. Consequently there might be several observations with an income exactly equal to the threshold income level between the quantiles. Since there is no criteria for further subdivision for these observations, the whole group has to be assigned to one quantile, which in this case, results in quantiles that are only approximately but not exactly equal in terms of the number of observations in each quantile.

2.3 The Conception of Income

The need for a concept of income that represents the economic well-being of individuals has already been introduced in section 1. The features a concept of income has to capture in order to adequately represent economic well being are discussed in this section. These features arise from the fact that individuals share income within households and from redistributional activities undertaken by the government.

Unit of Analysis and Adjustment for Size

When analysing inequality by the concept of income, two aspects that are related to the way in which income is used, are highly relevant and have to be considered. Individuals spend large parts of their lives living in socioeconomic groups and share accommodation with the members of their group. These groups include families and many other social and economic arrangements among individuals and are commonly referred to as households, where a household is defined as a group of individuals living together. The only criteria that defines the household is the arrangement to share the accommodation. Hence, no blood or legal relation among the individuals is needed. The second aspect to consider is that income is typically shared among individuals within a household. Parents provide infrastructure and goods for their children by spending their income but adults also share income in many other ways. [Ruggeri (2005), p.7ff.]

There are two methodical issues raised by the fact that individuals tend to share accommodation and income: The first issue relates to economies of scale in consumption resulting from common housekeeping. The need for housing space, electricity, and many other goods consumed by households increases with any additional member of the household but not in a proportional way due to the effects of *economies of scale*. In other words, if the number of individuals in a household is doubled, the total need of the household is higher but less than twice the amount it used to be. The other issue concerns the sharing of income among individuals in the same household. Typically there are individuals that have no personal income and can rely on the income gained by other individuals in the household. This situation applies for children or young adults in education that are supported by their parents as well as in households where specific individuals choose not work or are not able to work and gain an income from work on their own. In addition to that,

in situations where individuals' incomes differ across adults in a specific household, income is often shared in a way that economic well-being across individuals is more equal. [Ruggeri (2005), p.7ff.]

Considering these issues the need for a concept of income that captures economies of scales as well as the income sharing across individuals within a household seems to be an obvious requirement. This is approached in two steps. First of all, the income of all individuals within a household is aggregated. This implies that household income rather than income on an individual level is used to assess income inequality. In a second step, household income has to be adjusted for the size of the household in a way that the effects from economies of scales are accounted for. This is usually done by so called *equivalence scales*. These scales are constructed by adding up fractions for each household member that represent the marginal cost (expressed as a fraction of the cost for the first adult) added by this particular member. The size of the fraction added for each particular member depends on the composition of the respective household and on the age of the particular individual. Once the constructed equivalence scale factors have been added up for each household and have been assigned to each household, total household income is divided by the corresponding equivalence scale factor. The result is an equalised income for each household that captures the differences in the needs for income of the respective household. [Ruggeri (2005), p.9ff.]

Many equivalence scales have been developed and empirically applied but there is no consensus in economic literature on which scale to use [Ruggeri (2005), p.9]. One scale that is often used is the so called modified OECD scale which is a modification of the previous OECD scale and was designed by the Statistical Office of the European Union (eurostat). This scale assigns a factor of 1 to the first adult member, a fraction of 0.5 to each additional adult household member and a fraction of 0.3 to each child in the household [OECD (2005), p.1]. So for a household with two adults and two children the corresponding equivalence scale factor is 2.1 (= 1 + 0.5 + 0.3 + 0.3). Household income adjusted by the modified OECD scale is also used in the empirical part of this paper (section 3) and is later referred to as *equalised income*.

There is however one particular difficulty concerning the equivalence scales when including the benefits from publicly provided services in the concept of income. As argued by Radner (1997), equivalence scales that only account for different needs and economies of scale of cash-income may not be applicable when the analysis

of inequality is based on a concept of income that includes cash as well as non-cash components like the value of publicly provided services. This is due to the fact that beneficiaries of publicly provided services also have particular needs for these services (e.g. the need of families with children for education) that are not captured by equivalence scales constructed by only focussing on cash components [Aaberge et al. (2010)]. There is a number of theoretical works on equivalence scales adjusted for extended income[5] but there is no consensus on what equivalence scale to use and in most empirical work on inequality (also for empirical work that relies on a concept of income that includes the value of publicly provided services) the standard cash income equivalence scales are still applied [Verbist et al. (2012), p.23]. In accordance with this practice, there is also a standard equivalence scale applied in the empirical section of this paper. It is important to stress though, that the choice of the equivalence scale has to be carefully reconsidered for future research on inequality in Switzerland.

Disposable and Extended Income

Total income is defined as the sum of all income components from employment such as salaries, wages or income from self-employment as well as income from invested capital such as interest and dividend payments.[6] Aaberge et al. (2010) refer to this level of income as *market income*. Even though market income includes various components of income, it does not yet qualify as a proxy for economic well being because it ignores the effects of government activities. These activities include the collection of revenue through taxation as well as transfer payments to individuals, which both directly affect the households total amount of income available for consumption. Since taxation and transfer payments affect households to different extents, the relative economic position of the households is also influenced by these government activities. This means that, *disposable income* which accounts for taxation as well as for public transfer payment represents the economic well being of households more accurately than market income and can therefore be assumed to be a more adequate concept of income for the purpose of measuring inequality. [Aaberge et al. (2010); Ruggeri (2005)]

[5] See for instance Aaberge et al. (2010), Aaberge et al. (2013), Radner (1997) and Verbist et al. (2012).

[6] Definition from OECD Glossary of Statistical Terms. (http://stats.oecd.org/glossary/detail.asp?ID=1313)

Aaberge et al. (2010) refer to disposable income as *cash income* and state that most studies on income inequality are based on cash income. They criticise this practice however, because disposable income does not account for the value of public services and therefore ignores important components of income. They state that "as the tax burden levied on households represent a deduction from their disposable income, it is important to account for the services which governments provide to households through these taxes" and add that the omission of these services may result in inaccurate description of inequality [p.549]. Instead they recommend that studies on inequality should be based on *extended income* which is defined as the sum of disposable income and the value of publicly provided goods or services received by individuals and households.

2.4 Publicly Provided Goods and Services

A *public good* (or service) is defined by the characteristics of being *non rival* and *non excludable* in consumption. Non rival means that the marginal cost of another individual consuming the good is zero once the good is provided. Non excludable relates to the lack of opportunity to exclude anyone from consuming the good either because exclusion is impossible or because it is very expensive. In contrast private goods feature the properties of being rival and excludable. Even though these characteristics can be assumed to influence weather a good is provided by the private sector or the public sector, it is wrong to assume that all private goods are provided by the private sector and all public goods are provided by the public sector. In fact, there are many private goods that are provided by the public sector. Publicly provided private goods include medical services, education, cultural activities and many other services. Hence, publicly provided goods and services include all goods or services, both private and public, that are provided by the government. [Rosen and Gayer (2010), p.54ff.]

2.5 Benefits of Publicly Provided Services

Section 2.3 has already stated that disposable and extended income is substantially influenced by government activities and since individuals are affected differently, the distribution of income and income inequality is also affected. The distributional effects of government activities through taxation as well as though public expen-

diture are discussed in more detail in this section. These effects are referred to as *tax incidence* and *expenditure incidence* where tax incidence describes the change in distribution of income induced by taxation and expenditure incidence specifies the impact of public expenditure on the distribution of income. [Ruggeri (2005); Rosen and Gayer (2010), p.268ff.]

The incidence of direct taxation can be accounted for relatively easily by relying on after tax income.[7] Consequently, studies on inequality that are based on disposable income account for the incidence of direct taxation. The incidence of expenditure on the other hand is only partly accounted for when relying on disposable income. This is because of the fact that only direct cash transfer payments are included in the concept of disposable income but public expenditures are not limited by these payments. They also include expenditure for health care, education, national defence and many other services and goods. As a result, the incidence of expenditure is only fully accounted for when relying on a concept of extended income that includes the benefits of all publicly provided services. There are however some conceptual difficulties related to the inclusion of these benefits. [Ruggeri (2005)]

The first issue concerns the valuation of the benefits of publicly provided services. Ruggeri (2005) states that according to economic theory, the value of the benefit a good or service provides to a specific individual is equal to its willingness to pay and adds that since the willingness to pay is not known for publicly provided goods and services, it is not possible to determine the exact value that these goods and services provide to a specific individual consuming it. Due to the lack of reliable information on how much individuals value publicly provided goods and services it is common to assume the value of these goods or services is equal to the cost of providing them. Ruggeri (2005) also points out that "it is important to stress, therefore, that what is being allocated in expenditure incidence studies are the expenditures actually incurred by government in making cash transfers and in providing public goods and services" [p.16]. In other words costs and not benefits are being allocated. [Ruggeri (2005), p.16]

Another difficulty in public expenditure incidence arises from the fact that ben-

[7]The incidence of indirect taxation (e.g. value added tax) is considerably more difficult to account for. Since this paper focuses on the discussion on expenditure incidence rather than tax incidence, the issues related to the incidence of indirect taxation are not covered here. The interested reader can find information about the inclusion of indirect taxes and empirical findings about the effect of indirect taxation on inequality in Garfinkel et al. (2006).

eficiaries of publicly provided goods cannot always be identified. Many publicly provided services feature characteristics of public goods and public expenditure on the provision of these services marks a large share of total government expenditure. Since public goods are non rival and non excludable, it is not possible to distinguish between the people who consume these goods and the ones who do not and the total number of units consumed is unknown. Consequently, there is no information on who consumes public goods to what extent and how much the respective individuals value the benefits that these public good services provide. This information is a prerequisite to inferring the effect that public expenditure on the provision of these services has on distribution of income and therefore inequality. [Rosen and Gayer (2010), p.269ff.]

Other public expenditure include direct cash transfers to individuals or certain groups of individuals but also public expenditures on private goods that are consumed only by some individuals or specific groups of individuals. The latter is referred to as *in-kind transfers*. In contrast to public goods only a selection of individuals can benefit from in-kind transfers. These in-kind transfers include expenditures that are clearly directed towards low income households (e.g. food stamps) but also expenditures that are directed to households with high and low incomes (e.g. education). [Rosen and Gayer (2010), p.269ff.]

2.6 Classification of Government Expenditure

Ruggeri (2005) suggests classifying public expenditure for the purpose of expenditure incidence based on the difficulties of making the allocation from cost to governments to benefits to individuals. In the first step he divides public expenditure into *specific expenditure* and *general expenditure*. Specific expenditures are characterised by the feature that beneficiaries may be identified by certain criteria (for example by age or income level). General expenditure on the other hand include all programs for which beneficiaries (groups or individuals) cannot be identified by specific criteria because these programs provide benefits to the all individuals.[8] [Ruggeri (2005), p.17ff.]

[8]The classification of public expenditure applied in this paper is a simplified version of the classification of government expenditures in Ruggeri (2005). The fact that there are also transfer payments to business, in other words subsidies, is ignored because the effects of subsidies on inequality are indirect and almost impossible to assess [Ruggeri (2005)]. Interest on debt is included in the general expenditure whereas Ruggeri (2005) classifies it separately.

Specific expenditures include transfer payments to individuals and in-kind transfers. The benefits of public expenditure on transfer payments can easily be determined. This is due to the fact that these transfer are provided in cash and therefore there is (almost) a one-to-one relationship between the money spent by the government and the money received by the individuals. The beneficiaries of transfer payments can most often be identified because these transfers are usually targeted to well specified groups (e.g. to individuals at or above the age of 65 or to families with children). For in-kind transfers beneficiaries are also identifiable. The value of in-kind transfers however is more difficult to asses than for cash transfers because in-kind transfers are provided in the form of free goods and services. As previously explained, since these goods are free (or at a price lower than the market price) beneficiaries do not reveal (or at least do not fully reveal) their willingness to pay for these goods and services and hence the value can only be approximated by the cost of providing them. The two largest in-kind transfers are usually education and health care. [Ruggeri (2005), p.17ff.]

Expenditure on general public services, national defence, public order and safety, environmental protection and all other goods and services where specific beneficiaries cannot be identified are classified as general expenditures. Most of these expenditures are on public goods. Hence the identification of specific beneficiaries is impossible by definition and as a result of that, general expenditure can only be allocated by the use of somewhat arbitrary assumptions [Ruggeri (2005), p.22f.].

Even though there are empirical studies that allocate general expenditures to individuals and hence try to account for the distributional impacts of general expenditures, the distributional impacts of general expenditures are not considered in this paper and in many other empirical studies on this subject. Instead, the focus is on the analysis of the effects of in-kind transfer on inequality.[9]

[9]Ruggeri (2005) mentions empirical studies that are allocating general expenditure and explains the applied methods [p.23f.]. The reason for not accounting for the distributional effect of general expenditures in this paper is that the allocation of these expenditures is considered to be arbitrary and that the results can be assumed to be highly affected by the choice of the allocation rule. In addition to that, all empirical studies that are referred to in this paper also do not allocate general public expenditure.

2.7 Allocation of Benefits from Publicly Provided Services

In addition to the issues of the valuation of in-kind transfers, there is also an issue concerning the allocation of in-kind transfers. Verbist et al. (2012) state that there are two approaches to allocate the value in-kind transfers provide to beneficiaries: the *actual consumption approach* and the *insurance value approach*. In the actual consumption approach beneficiaries are identified by the characteristics based on actual consumption of these services. In the insurance value approach on the other hand, an insurance value that represents the (hypothetical) price for an insurance that provides coverage to a specific person is allocated to this person. The insurance value varies across individuals and depends on certain characteristics of the individual like age, gender or socio-economic position. [Verbist et al. (2012), p.13f.]

Verbist et al. (2012) consider the actual consumption approach to be more appropriate for most in-kind transfers under the condition that the beneficiaries can be identified. When it comes to the allocation of public expenditure of health care though, they consider the insurance value approach to be more adequate. They argue that individuals relying on health care services also have additional needs. The allocation of public expenditure on health care to individuals by the actual consumption approach would imply that public expenditure on health care increases the economic well being of individuals who rely more on health care services. This is misleading because a sick person who is relying more extensively on health care services cannot be regarded as being better off compared to a healthy person not relying on health care services only because the sick person is consuming more health care services. [Verbist et al. (2012), p.14]

2.8 Distributional Effects of Publicly Provided Services

The distributional effects of public expenditures vary across categories of expenditures and depend on the income level of the beneficiaries. To be more precise, one can assume that public expenditures that are directed exclusively to low income households reduce inequality to a higher degree than public expenditures that are directed to both low and high income households. Dalton (1946) studies the effects of public expenditure on the distribution of income and states that "a particular grant (...) may be regressive, proportionate or progressive" and explains that "a grant is regressive if, the smaller the recipient's income, the smaller the proportion-

ate addition made by the grant; progressive if , the smaller the recipient's income, the larger the proportionate addition; proportional if, whatever size of the recipient's income, the proportionate addition is the same" [p.229]. From this definition it follows that a total addition which is more extensively directed to low income groups and, as a result of that, represents a higher proportionate addition for low income groups than for high income groups, is progressive because in this case a larger share of the total additions is directed to low income groups. An addition that is (in absolute terms) equal for all income groups is proportionate because an equal share of the total addition is directed to each income group. An addition that is (in absolute terms) larger for high income groups is regressive because the proportionate addition is higher for high income groups.

The characterisation of grants provided by Dalton (1946) can also be applied for the purpose of specifying the distributional effect of expenditure on publicly provided services that are classified as in-kind transfers. It is obvious that progressive in-kind transfers tend to reduce inequality and that the higher the progression the higher the reduction in inequality can be assumed. But it is important to stress that also proportionate or even weakly regressive in-kind transfers might reduce inequality.[10] This is because the concept of income is extended when accounting for in-kind transfers and hence the base from which income inequality is measured is changed. As a result of that, for a fixed per capita in-kind transfer the inequality in absolute terms is unchanged but since income is extended, inequality in relative terms is reduced. Because the Gini coefficient describes relative inequality, it can be stated that proportionate in-kind transfers reduce inequality (measured in terms of the Gini). Even slightly regressive in-kind transfers can reduce inequality. This is true under the condition that inequality in the respective transfers is smaller than the existing inequality in disposable income. In this case, absolute inequality is increased by the transfer but the relative inequality is reduced due to the equalising effect that arises from extending income. A highly regressive in-kind transfer on the other hand tends to increase inequality.

[10] Dalton (1946) [p.230] explains that proportionate or even weakly regressive grant systems tend to reduce inequality but reason for this effect and the conditions under which this is true are not further discussed.

3 Empirical Analysis for Switzerland

The subsequent empirical analysis is based on data from the *Swiss Household Panel* (SHP) provided by the Swiss Centre of Expertise in the Social Sciences (FORS). The SHP is a panel study on a random sample of households in Switzerland. The data has been collected on an annual basis starting in 1999 and is organised in 14 waves. Data on the household as well as on the individual level is presented for a particular year in each wave. For the empirical analysis the latest available data sets on the household and on the individual level from wave 14 (year 2012) have been used. Since data on the consumption of cultural activities is not collected on an annual basis, the data from wave 10 (year 2008), which is the most recent data that includes the respective information, has been used to analyse the questions related to cultural activities in section 3.3.3. The data sets for the year 2012 contain information on 4593 households and on 10970 individuals and include more than 200 variables on the household level and more than 400 variables on the individual level. In 2008 4456 households and 10889 individuals were observed. [Voorpostel et al. (2013)]

The information on government expenditures and disposable income is based on data provided by the OECD.[11]

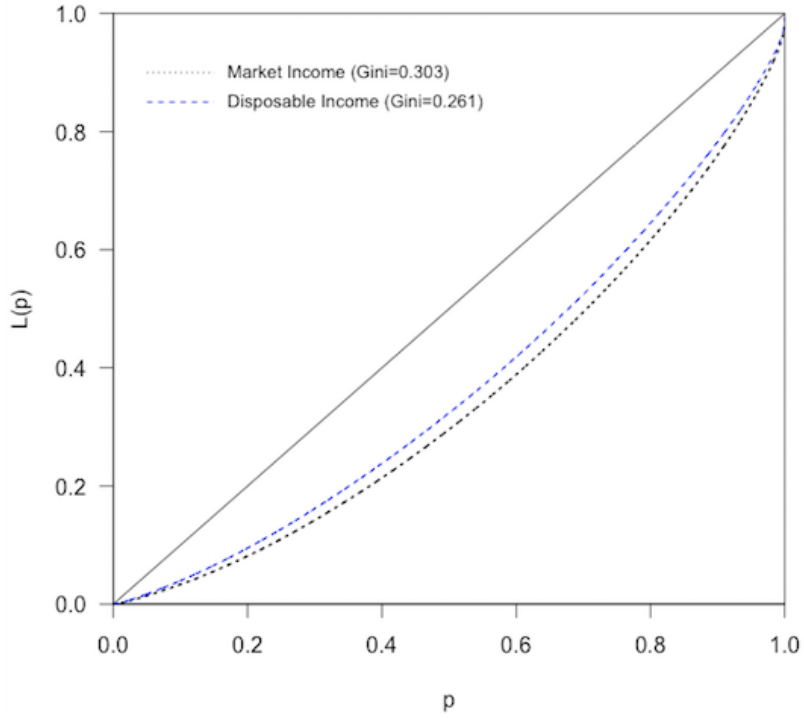
3.1 Income Inequality in Switzerland

The analysis on the inequality of incomes and the distributional effect of publicly provided services in Switzerland is based on the concept of equalised household income according to the modified OECD scale. The reason for relying on equalised rather than total household income is that equalised income captures the different needs of households with consideration for the effects of economies of scale arising from common housekeeping.[12] The interpretation of the distribution of equalised income is therefore considered to be more meaningful.

[11] The data is available in the OECD's iLibrary databases and is accessible via http://stats.oecd.org.

[12] The rational for relying on equalised rather than on total household income has already been provided in section 2.3.

Figure 3.1: Lorenz Curve and Gini for Market and Disposable Income in Switzerland



Source: Swiss Household Panel SHP

The analysis of income inequality in the SHP data acts as a starting point for the empirical analysis of the distributional effects of publicly provided services. Figure 3.1 exhibits the distribution of equalised household income in Switzerland by relying on SHP data for the year 2012 and shows the lorenz curves for market and disposable income. As already stated in section 2.3, market income is defined as the total household income before taxes and cash transfers. Disposable income is defined as market income after taxes and cash transfers. Figure 3.1 shows that market income is distributed more unequally than disposable income in the SHP data. The higher inequality of market income can also be seen by the higher Gini coefficient. For market income a Gini of 0.303 is reported whereas for disposable income the Gini adds up to 0.261. Considering these results it is possible to conclude that tax and cash transfer payments reduce income inequality in Switzerland. The next step, however, is to infer if the same is true when accounting for the value of publicly provided services. To be more precise, it is analysed if and to what extent government expenditure on publicly provided services in Switzerland tend to reduce inequality.

3.2 Public Expenditure Qualifying for In-Kind Transfers

In this section public expenditures in Switzerland are examined in the context of expenditure incidence. For this purpose public expenditure data classified according to the OECD *Classification of the Functions of Government* (COFOG) is used. The breakdown of the expenditure by government function with respect to the incidence of public expenditure follows the simplified expenditure incidence classification of Ruggeri (2005) described in section 2.6.

Table 3.1: Government Expenditure by Function (COFOG) for Switzerland

Function	Classification	Exp. p.a.	[%] Share of Exp.
010: General Public Services	Public Good	18'441	9.1
020: Defence	Public Good	5'672	2.8
030: Public Order and Safety	Public Good	10'410	5.2
040: Economic Affairs	Public Good	27'379	13.6
050: Environment Protection	Public Good	4'246	2.1
060: Housing and Community Amenities	Public Good	1'272	0.6
070: Health	In-Kind Transfer	13'052	6.5
080: Recreation, Culture and Religion	In-Kind Transfer	5'255	2.6
090: Education	In-Kind Transfer	36'336	18.0
100: Social Protection	Cash Transfer	79'599	39.5
T: Total Function		201'663	100.0

Note: Absolute expenditure for the year 2012 is in millions and national currency.
Source: OECD data on government expenditure by function (COFOG)

Table 3.1 shows public expenditure for Switzerland in the year 2012. The largest item is the expenditure on the function of social protection which includes services and transfers provided for sickness and disability, old age, family and children, unemployment and other groups. Public expenditure on social protection can be regarded as specific (rather than general) expenditure because beneficiaries are identifiable. According to the official definition by the United Nations Statistics Division public expenditure on social protection not only includes the provision of social protection in the form of cash benefits but also in the form of benefits in-kind.[13] Because the large majority of public expenditure on social protection in Switzerland is assumed to be provided in the form of cash-transfers, it seems reasonable to classify all public expenditure on social protection as cash transfers for the purpose of sim-

[13]The detailed structure and explanatory notes are provided by the United Nations Statistics Division and is accessible via http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=4.

plicity.[14] Since cash transfers are included in the concept of disposable income they are already accounted for in empirical studies on inequality that rely on disposable income. For studies that aim to capture all in-kind transfers however, further and more detailed research on the individual components of public expenditure on social protection in Switzerland is needed.[15]

For public expenditure on general public services, defence, public order and safety, economic affairs, environment protection and housing and community amenities specific beneficiaries cannot be reliably identified. This is mainly true because most of the services feature characteristics of public goods. The function general public services for instance includes expenditures on the executive and legislative organs of the government. The benefits which the services generated by these entities provide to the citizens, can clearly be characterised as being non rival in consumption and specific citizens cannot be excluded from consumption of these services. Hence these services feature the characteristics of public goods and the identification of specific beneficiaries is not possible by definition. The same is true for most other components of the functions 010 to 060, thus these expenditures are classified as expenditures on the provision of public goods.

Education and health care are private goods because they are rival in consumption and also excludable. In addition to that, beneficiaries of education and health care services are identifiable and these services can be assumed to provide benefits to the individuals receiving them. Thus public expenditure on the provision of education and health care services can be classified as in-kind transfers.

Public expenditure on recreation, culture and religion (RCR) include expenditure for the provision of sporting, recreational, religious and cultural services that can be assumed to be (to some extent) rival and excludable. Beneficiaries may also be identified for these services. On the other hand public expenditure related to the protection of cultural heritage and publishing and broadcasting services which qualify as public goods are also listed under RCR expenditure. Since most RCR

[14] According to the most recent detailed figures on government expenditure by function for the year 2011 from the BFS expenditure for the old aged and disabled (AHV and IV) and for the unemployed account for more than 80% of expenditure on social protection and can be assumed to be provided to the a large extent in the form of cash transfers.

[15] Table 3.1 shows the level 1 COFOG. There is also a classification on a level 2 which provides a more detailed breakdown of the various components of the level 1 functions. Level 2 information however is not yet available for Switzerland at the OECD. After inquiring at the BFS it was stated that work to provide the data on level 2 is in progress and the data is expected to be available in the first half of 2015.

expenditure are related to sporting, recreational and cultural services, public expenditures on RCR are also classified as in-kind transfers in this paper for the purpose of simplicity.[16]

The aggregate result of the classification of government expenditures by function is exhibited in table 3.2. Cash transfers are the largest class of public expenditure accounting for almost 40% of total government expenditure in Switzerland. A large share of this expenditure can be assumed to be captured in empirical work on inequality that relies on disposable income. Public expenditure on the provision of public goods account for a third of total government expenditure. As it has already been stated, because of the general character of these expenditures, their inclusion in the analysis of public expenditure incidence can only be based on somewhat arbitrary assumptions. It therefore seems reasonable not to extend the concept of income by including government expenditure for the provision of public goods for the purpose of analysing inequality of income.[17] In-kind transfers account for 27% of government expenditure in Switzerland. Public expenditure on services classified as in-kind transfers are directed to specific beneficiaries and hence should be accounted for when assessing inequality of income. This can be achieved by extending the concept of income by the value these services provide. However, since (as it has already been described in section 2.5) this information is not available the value can only be approximated by the cost of providing these services.

Table 3.2: Classification of Government Expenditure for Switzerland

		[%]
Classification	Expenditure p.a.	Share of Expenditure
Cash Transfer	79'599	39.5
In-Kind Transfer	54'643	27.1
Public Good	67'421	33.4
T: Total Function	201'663	100.0

Note: Aggregation of the public expenditures by classes reported in table 3.1
Source: OECD data on government expenditure by function (COFOG)

In order to assess the relevance of these in-kind transfers in terms of the effect on inequality, an approach used by Verbist et al. (2012) is applied. Verbist et al. (2012)

[16] According to BFS figures on public expenditures by function three quarter of expenditure on RCR are related to sporting, recreational and cultural services in Switzerland in the year 2011.

[17] See section 2.6

express public expenditures on the provision of in-kind transfers as a share of (aggregate) disposable income. Table 3.3 shows the results for public expenditures on health care, RCR and educational services for the year 2012 in Switzerland.[18] The reported figures reveal that in-kind transfers in Switzerland correspond to a considerable percentage of disposable income. Education is the largest in-kind transfer in Switzerland with public expenditures amounting to 6.3% of disposable income. Public expenditure on heathcare relate to 2.3% of disposable income and expenditures on RCR relate to 0.9%. Hence it seems reasonable to state that in-kind transfers can be regarded as relevant components of economic well being and should therefore be included in the concept of income when studying inequality in Switzerland.

Table 3.3: In-Kind Transfers as Share of Disposable Income in Switzerland

	[%]
In-Kind Transfers	Share of Disposable Income
070: Health Care	2.3
080: Recreation, Culture and Religion	0.9
090: Education	6.3
T: Total In-Kind Transfers	9.5

Source: Author's calculation based on OECD data on government expenditure by function (COFOG) and disposable income (year 2012/2011)

3.3 Distributional Effects of In-Kind Transfers

As it has already been explained in section 2.8, transfers which are progressive tend to reduce inequality to a higher degree than transfers that are proportionate or regressive. From this it follows that the classification of in-kind transfers according to their distributional effects is relevant for the purpose of studying the effect of these transfers on inequality. Stated differently, the classification allows to draw certain conclusions on how public expenditure on the provision of the services identified as in-kind transfers affect the distribution of (extended) income and therefore also affect inequality.

The approach is to analyse the relation between income and consumption of the

[18] Disposable income is based on data for the year 2011 because data for the year 2012 was not available. Since (aggregate) disposable income usually does not vary extensively between two years and since the main purpose of the figures is only to get an idea of the size of in-kind transfer this inconsistency is considered to be acceptable.

respective services. To be more precise, it is examined if the identified beneficiaries of specific in-kind transfers differ in income characteristics from individuals not receiving these transfers. This information allows to characterise the respective in-kind transfer according to their distributional effects. In other words, in-kind transfers can be classified as being progressive, proportionate or regressive.

The relationships between income and the consumption of education, health care and RCR services will be attempted to be empirically analysed using the SHP data where applicable. The empirical analysis relies on net household income equalised according to the modified OECD scale (see section 2.3). This income level is referred to as *equalised income*.

3.3.1 Education

As seen in section 3.2 education is the largest in-kind transfer in Switzerland. An inclusion of public expenditure on education in the concept of income increases average disposable income by 6.3% and can be assumed to affect not only the economic well-being of the individuals and households consuming these services but also to have an impact on the distribution of (extended) income and therefore also affect inequality. If education tends to be consumed more extensively by low income households, pubic expenditure on education can be classified as being progressive. These expenditure make low income households on average better off in absolute as well as in relative terms compared to high income households and therefore tend to reduce inequality.

When it comes to the analysis of the relation between income and consumption of publicly provided education the different levels of education have to be considered separately. Education is therefore subdivided into primary and lower secondary (compulsory), upper secondary and tertiary education following the UNESCO *International Standard Classification of Education* (ISCED). [19]

[19] Information on the classification of Swiss education programs can be found in BFS (2012a). The subdivision of education with respect to the different levels of education for the purpose of expenditure incidence is suggested by Ruggeri (2005). In accordance with this suggestion, most empirical work encountered during research on the topic also analyses distributional effects of education under separate consideration of the different levels of education (see for instance Verbist et al. (2012)).

In Switzerland primary and lower secondary education is compulsory for all children. The age at entry of primary education is between 5 and 7 years and compulsory education endures for 9 years. Since participation in primary and lower secondary education is compulsory it cannot be assumed that income has any causal effect on consumption of compulsory education. Nevertheless it is reasonable to assume that beneficiaries of compulsory education (i.e. families with children at the ages in which compulsory education has to be attended) differ in income characteristics from groups who do not benefit from expenditure on compulsory education. If this is true and income is correlated with the consumption of compulsory education, it is possible to infer (to some extent) the distributional characteristics of this kind of expenditure.

For secondary and tertiary education on the other hand, we cannot assume that income has no effect on consumption of education. It might be possible that individuals from high income families consume non-compulsory education more extensively than the ones from low income families or vice versa. For this reason the distributional characteristics of non-compulsory education might differ from those implied by compulsory education.[20]

Compulsory Education

Primary and lower secondary education is the largest item of education expenditure and accounts for 43% of public expenditure on education in Switzerland.[21] The empirical analysis of the relation between income and consumption of compulsory education is based on the SHP data. For 647 households (out of 4065[22] households in the *SHP2012* data set) at least one member attending compulsory education could be identified.[23] These household are therefore beneficiaries of public expenditure on primary and lower secondary education. Table 3.4 exhibits descriptive statics on

[20] Even if the effect of income on consumption of non-compulsory education is not causal but arises from omitted factors (e.g. ability of the children, education of parents, etc.) that are correlated with income and consumption of education, we still have to assume that the correlation between income and consumption of education differs between compulsory and non-compulsory education.

[21] Authors's calculation based on 2011 data on expenditure by function provided by the Bundesamt für Statistik BFS. The results are provided in table B.1 in appendix B.

[22] The SHP2012 data contains information on a total of 4593 households but information on equalised income is only available for 4065 household. The households with no information on equalised income have been excluded.

[23] The procedure of the empirical analysis is described in appendix A.

equalised income and reports significantly[24] lower equalised income for households consuming compulsory education. The mean equalised income for households with at least one member in compulsory education is more than TCHF 12 below the average income of households not consuming compulsory education. The outlier robust median income differs by almost TCHF 10 confirming the tendency to lower income for households consuming compulsory education. In addition to that, equalised income is lower for households consuming compulsory education over all quintiles.

Table 3.4: Income Characteristics of Households Consuming Compulsory Education

	N	$\bar{Y}$	Y_{med}	SD	$Q_{0.2}$	$Q_{0.4}$	$Q_{0.6}$	$Q_{0.8}$
HH consuming CEDU	647	57.1	51.4	34.0	36.7	46.7	55.7	71.1
HH not consuming CEDU	3418	69.7	61.2	102.6	39.2	54.0	69.2	89.3
Total HH	4065	67.7	59.1	95.2	38.4	52.2	66.7	87.3

Note: The table reports descriptive statistics on equalised income for the subset of households (HH) with at least one member in compulsory education (CEDU), the subset of households with no member in CEDU and for the total population of all households in the SHP. N denotes the number of observations. Descriptive statistics on equalised income include mean ($\bar{Y}$), median (Y_{med}), standard deviation (SD) and the threshold levels of equalised income for each quintile. All figures are reported in thousand Swiss francs (TCHF).
Source: Swiss Household Panel SHP

To analyse the distributional effects of the transfer in more detail, the method of the relative share of quintiles is applied.[25] The results are exhibited in table 3.5 and also suggest, that public expenditure on compulsory education is more extensively directed towards lower income households. More than 23% of all households consuming compulsory education are from the first quintile and hence report an equalised income at or below the total population threshold income level for the first quintile $Q_{0.2}$ of TCHF 38.4. For households not consuming compulsory education, the share of household in the first quintile is at 18.9% and hence lower than for households consuming compulsory education. Looking at the of top 20% households, in other words the fifth quintile, the relative share of quintiles for the specific groups is opposed to the situation in the first quintile. Only 10.4% of households consuming compulsory education are classified as households in the top quintile whereas for households not consuming compulsory education 21.9% are in the top quintile. These results

[24]Significance well above the 1% significance level is found. The statistical inference is reported in figure A.1 in appendix A.

[25]This method has been used by Verbist et al. (2012) and is explained in section 2.2.

imply that a household consuming compulsory education is more likely to be in quintile one or two (53.4% of all households consuming compulsory education) than in quintile four or five (24.5%). Households not consuming compulsory education on the other hand are slightly more likely to be in quintiles four or five (43.1%) than in quantiles one or two (37.4%). It can therefore be concluded that households consuming compulsory education tend to be at the lower end of the distribution of equalised income whereas households not consuming compulsory education are more equally distributed over all quintiles with a slight tendency to be at the upper end of the distribution of equalised income. From this it follows that public expenditure on compulsory education in Switzerland is more extensively directed to low income groups. As a result of that, a larger share of the total additions to (extended) income from public expenditure on compulsory education is directed to low income groups. Therefore public expenditure on compulsory education can be classified as being progressive and therefore reduce inequality in absolute as well as in relative terms.

Table 3.5: The Relative Share of Quintiles [%] for HH consuming CEDU

	Q1	Q2	Q3	Q4	Q5
HH consuming CEDU	23.1	30.3	22.1	14.1	10.4
HH not consuming CEDU	18.9	18.5	19.5	21.2	21.9
Total	19.6	20.4	19.6	20.0	20.0

Source: Swiss Household Panel SHP

Upper Secondary Education

Upper secondary education accounts for 17.3% of public expenditure on education in Switzerland which is considerably less than for compulsory and tertiary education. In the SHP data there are 427 households with at least one member in upper secondary education. Descriptive statistics on the beneficiaries of upper secondary education and on households not consuming upper secondary education are reported in table 3.6.

The beneficiary households for upper secondary education also show a significantly[26] lower mean equalised income (TCHF -9) and a lower median income (TCHF -4.6).

[26]Significance well above the 1% significance level is found. The statistical inference is reported in figure A.2 in appendix A.

Table 3.6: Income Characteristics of HH Consuming Upper Secondary Education

	N	$\bar{Y}$	Y_{med}	SD	$Q_{0.2}$	$Q_{0.4}$	$Q_{0.6}$	$Q_{0.8}$
HH consuming SEDU	427	59.6	55.2	28.3	39.2	49.9	62.2	74.6
HH not consuming SECU	3638	68.6	59.8	100.0	38.4	52.5	66.9	88.2
Total HH	4065	67.7	59.1	95.2	38.4	52.2	66.7	87.3

Note: Equalised income according to the modified OECD scale in thousand swiss francs.
Source: Swiss Household Panel SHP

But compared to households consuming compulsory education they report a slightly higher median income at TCHF 55.2 (TCHF + 3.8). Income levels of the quintiles also tend to be lower for households consuming the respective educational services except for $Q_{0.2}$.

The relative share of quintiles for the two groups (see table 3.7) show a slight tendency for households consuming educational services to be at the lower end of the distribution of equalised income. 43.6% of all households consuming upper secondary education are in quintiles one or two whereas only 33.2% are in quintiles four and five. Households not consuming upper secondary education are more equally distributed over all quintiles with a slight tendency to be at the upper end of the distribution. The results for upper secondary education also suggest that public expenditure on the respective educational services are progressive and hence tend to reduce inequality in absolute as well as in relative terms. However they seem to be less progressive than for compulsory education.

Table 3.7: The Relative Share of Quintiles for HH Consuming SEDU

	Q1	Q2	Q3	Q4	Q5
HH consuming SEDU	18.3	25.3	23.2	24.1	9.1
HH not consuming SECU	19.7	19.8	19.6	19.5	21.3
Total HH	19.6	20.4	19.6	20.0	20.0

Source: Swiss Household Panel SHP

Tertiary Education

Public expenditures on tertiary education account for 32.5% of educational expenditure. This is less than for compulsory education but is directed to fewer individ-

uals benefiting from these expenditures and can therefore be assumed to be higher in terms of per capita expenditure on beneficiaries.[27] In the *SHP2012* data 353 households with at least on member currently participating in tertiary education have been identified. Descriptive statistics on equalised income for these households are presented in table 3.8. In contrast to households consuming primary and secondary education the average equalised income does not significantly[28] differ from households not consuming tertiary education. The median income of households consuming tertiary education is at TCHF 60.9 and therefore even slightly above the median income of households not consuming tertiary education and considerably above the median income of households benefiting from compulsory (TCHF +9.5) and upper secondary education (TCHF +5.7).

Table 3.8: Income Characteristics of Households Consuming Tertiary Education

	N	$\bar{Y}$	Y_{med}	SD	$Q_{0.2}$	$Q_{0.4}$	$Q_{0.6}$	$Q_{0.8}$
HH consuming TEDU	353	66.3	60.9	29.9	42.3	56.0	67.6	88.3
HH not consuming TECU	3712	67.8	58.8	99.1	38.3	52.0	66.6	87.1
Total HH	4065	67.7	59.1	95.2	38.4	52.2	66.7	87.3

Note: Equalised income according to the modified OECD scale in thousand Swiss francs.
Source: Swiss Household Panel SHP

Table 3.9 exhibits the relative share of quintiles for the two groups of households. Unlike in the case of compulsory education and upper secondary education, the households consuming tertiary education slightly tend to be at the upper end of the distribution of equalised income. 41% of all households benefiting from public expenditure on tertiary education are in the fourth or fifth quintile whereas 34.3% are reported to be in quintiles one or two of the income distribution.

Since the results do not suggest that income differs significantly across subsets, the distributional characteristic of public expenditure on tertiary education cannot be defined as clearly as in the case of compulsory and upper secondary education. Nevertheless it seems reasonable to state that public provision of tertiary education is expected to reduce inequality. This can be explained by the fact that in-kind transfers that are directed to low and high income households to equal size rep-

[27] OECD (2013) reports annual expenditure per student (year 2010, in equivalent USD converted using PPPs for GDP) of 11'513 on primary education, 14'216 on lower secondary education, 15'595 on upper secondary education and 23'457 on tertiary education for Switzerland [p.174].

[28] The results are not significant to any common significance level and are reported in figure A.3 in appendix A.

Table 3.9: The Relative Share of Quintiles for HH Consuming TEDU

	Q1	Q2	Q3	Q4	Q5
HH consuming TEDU	14.2	20.1	24.6	19.5	21.5
HH not consuming TECU	20.1	20.4	19.5	20.1	19.9
Total HH	19.6	20.4	19.6	20.0	20.0

Source: Swiss Household Panel SHP

resent a higher addition to disposable income for low income households than for high income households. The same can be true even for in-kind transfers that are slightly higher for high income households. Hence in-kind transfers tend to reduce inequality unless they are clearly directed to high income households which cannot be empirically confirmed for the case of tertiary education in Switzerland.

The fact that equalised income for households consuming education is lower can partly be explained by the definition of equalised income. From the definition of equalised income (which is total household income divided by an equivalence factor that increases by number of people in the same household) it follows that equalised income tends to be smaller for larger households compared to smaller households with the same total household income. Since households consuming education, hence households with children, tend to be larger than household not consuming education, equalised income tends to be a smaller fraction of total household income for households consuming education. However, as already argued in section 2.3, the concept of equalised household income captures the different needs of households. Therefore equalised income is considered to be a more adequate concept for the purpose of this analysis.

Another aspect, that is important in terms of the interpretation of the results in this section, arises from issues related to the collection of the data on the household level. The issue is particularly important with regard to the interpretation of the distributional characteristic of tertiary education. As it is explained in Ruggeri (2005) [p.21] students participating in tertiary (or also in upper secondary) education might not live in the household they grew up in anymore but instead in a newly formed or different household. Consequently, for individuals still living in the household they were raised in, their family's income is observed whereas for individuals living alone or in a different household only their own income or the

income of all members of the new household is observed. Since students usually do not work or work only part time, individual student households may be more likely to be low income households. This issue should be taken into consideration when interpreting the distributional effects of public expenditure on education. Many individual student households might be classified as very low income households even if they are supported by their (rich) parents. It therefore follows that public expenditure on tertiary education may seem very progressive. In this case however it can be misleading to classify these expenditures as pro-poor for two reasons. The first reason is that financial support of the parents might not be captured by the data. The second reason arises from a fundamental drawback when analysing inequality by the concept of annual income. Education comes at a certain cost in terms of a loss in ability to earn money now but provides benefits for the future periods in terms of the ability to earn a higher salary. This means that beneficiaries of tertiary education might only temporarily be members of low income households and will be more likely to become a member of a high income households in the future. [Ruggeri (2005), p.21f.]

Moreover, it is of interest, if the distributional effects of education found for Switzerland are also observed for other countries. Verbist et al. (2012) study the effect of in-kind transfers on inequality and analyse the distributional effects of compulsory, upper secondary and tertiary education for 27 OECD countries. They find that the income characteristics of beneficiaries of compulsory and upper secondary education vary to some extent across countries but the relative share of quintiles are distributed rather equally with a tendency for higher relative share of quintiles in the first and second quintiles for most countries [p.40f.]. For tertiary education on the other hand, they observe considerable variation across countries. In Mexico, Estonia and Slovenia tertiary education expenditure seems to be highly directed to high income households whereas in the Nordic countries and Germany most households benefiting from tertiary education seem to be from the lowest quintile [p.43]. It can therefore be concluded that the distributional effect of compulsory and upper secondary education observed in Switzerland are well in line with other OECD countries. For tertiary education, beneficiary households seem to be distributed rather equally across all quintiles in Switzerland suggesting that public expenditure on tertiary education is less progressive in Switzerland than in the Nordic countries and Germany but more progressive than in many other countries observed. It should be stressed though, that the issue arising form differences in the composition of house-

holds for beneficiaries of tertiary education (introduced in this section) has to be considered when interpreting cross country variation on the distributional effects of tertiary education as well.

3.3.2 Health Care

Public expenditure on health care corresponds to 2.3% of aggregate disposable income in Switzerland (year 2012). It is therefore the second largest in-kind transfer. Beneficiaries of health care services however are more difficult to identify. This arises from the fact that the SHP does for this purpose not provide useful information on the consumption of health care services. In addition to that, there are conceptional issues related to the identification of beneficiaries based on the actual consumption approach. One issue identified is that the distinction between the healthy (who only rely on few health care services) and the sick (who heavily rely on health care) is less clear cut than in the case of education. Another issue is that health care services are very heterogenous and thus so are the costs. It is for this reasons that a classification of the distributional effects of public expenditure on health care services in Switzerland by the actual consumption approach is regarded as not feasible and can not be covered in this paper.

In addition to that, an allocation of health care services based on the actual consumption approach is, as it has already been stated in section 2.7, questionable and Verbist et al. (2012) recommend to apply the insurance value approach to allocate benefits from publicly provided health care services. The determination of an insurance value for specific groups in Switzerland lies beyond the limits of this thesis and therefore a clear answer on the distributional effects of public expenditure on health care in Switzerland cannot be provided. Despite the fact that an attempt to empirically estimate the distributional effects has not been performed, it does not seem reasonable to assume that these expenditure are (highly) regressive and increase inequality. This would imply that the rich benefit much more from publicly funded health care services than the poor.

Another approach that allows to infer the distributional effect of public expenditure on health care to some extent is to analyse expenditure on health care and income by age groups. It can be argued that if annual per capita expenses on health care tend to increase with age and if people above the age of 65 tend to receive lower incomes because they (in most cases) get a (lower) pension as compared to work

income, public expenditure on health care is progressive. Data from the BFS (2011) confirms considerably higher health expenses per capita for the population above the age of 65.[29] The SHP data reveals significantly lower income for households with at least one person above the age of 65.[30] This approach suggests that it therefore seems reasonable to assume that public expenditure on health care services tends to reduce inequality.

3.3.3 Recreation, Culture and Religion

Public expenditure on recreation, culture and religion (RCR) correspond to 0.9% of aggregate disposable income. Consequently, extended income (including in-kind transfers) is considerably less influenced by these expenditures compared to education (6.3% of disposable income) or health care (2.3% of disposable income). In addition to that, expenditures on recreation, culture and religion are quite heterogeneous and range from the provision of sport facilities to the financial support of cultural programs (theatre, opera, museums etc). It therefore has to be assumed that beneficiaries of these expenditures are also heterogeneous and as a result of that they have to be identified for each kind of expenditure separately.

The SHP provides little information on the consumption of cultural activities. To be more precise, data on the frequency of visiting the opera, the theatre and exhibitions is collected only. This data is used to analyse whether individuals who consume more cultural services differ in income characteristics from individuals who consume less of these services or do not consume these services at all. The results are exhibited in table 3.10 and hint at a clear correlation between the frequency of visiting the respective cultural services and income. Individuals who visit these services at least once a week report the highest average income. The average income decreases with the frequency of the visits and is reported to be lowest for individuals who never

[29] Average annual per capita health care expenses of 13 TCHF for people above the age of 65 are reported by the BFS (year 2011). These expenses are further increasing by age up to a level of more than TCHF 100 for people at the age of 96 or above. For people under the age of 65 on the other hand, expenses are below TCHF 11 and decrease further by age to below TCHF 2 for children between the ages of 6 and 10 years. The data is published at http://www.bfs.admin.ch/bfs/portal/de/index/themen/14/05/blank/key/05.html

[30] The mean net equalised income *I12EQON* is considerably lower for households with at least one member above 65. For this subset a mean equalised income of TCHF 57 is reported. The mean net equalised income for households with no member above 65 is TCHF 72. The two sample t-test reports high significance with a t value of well above |6|. Procedure and results are exhibited in appendix A.

demand these services. The median income and all quintile income levels show the same pattern.

Table 3.10: Income Characteristics - Subsets of Individuals Grouped by the Frequency of Visiting Opera, Theatre and Exhibitions

Frequency	N	$\bar{Y}$	Y_{med}	SD	$Q_{0.2}$	$Q_{0.4}$	$Q_{0.6}$	$Q_{0.8}$
at least once a week	106	75.7	68.0	47.7	40.0	57.7	72.8	100.5
at least once a month	1385	73.5	62.8	55.7	41.9	56.3	71.2	96.5
less than once a month	2886	64.0	57.6	41.2	38.8	52.0	65.0	84.7
never	1956	51.2	46.9	27.8	31.2	41.3	52.6	67.6
Total HH	6333	62.3	55.8	42.4	36.0	48.8	62.4	82.2

Note: Equalised income in thousand Swiss francs.
Source: Swiss Household Panel SHP

The relative share of quintiles for the specific groups (see table 3.11) confirm the described relation between income and consumption of the respective cultural services. Almost 36% of all individuals visiting theatre, opera and exhibitions at least once a week are from the fifth quintile whereas only around 10% of all individuals never consuming these services are in the top quintile of the income distribution. Individuals who never consume cultural services are more likely to be from the lowest quintile (29%). These results suggest that pubic expenditure on cultural services like theatre, opera and exhibitions have to be classified as being rather regressive and presumably do not reduce inequality of income (or even increase inequality). But since public expenditure on recreation, culture and religion are directed to a broad range of different services, beneficiaries are assumed to differ largely across these services. The SHP however only provides information on the consumption of very specific cultural services and for that reason no general characterisation of expenditure on RCR is possible. Due to the difficulties in characterisation of these expenditures and the relatively small percentage of these expenditures on disposable income, it seems reasonable to not consider these expenditures in terms of expenditure incidence for Switzerland and focus on the two major component education and health care.[31]

[31]For the cross counter analysis of in-kind transfer in the next section though, public expenditure on RCR is not ignored because this expenditure might be higher and hence more important in other countries.

Table 3.11: The Relative Share of Quintiles for Subsets of Individuals Classified by the Frequency of Visiting Opera, Theatre and Exhibitions

Frequency (Opera, Theatre, Exhibitions)	Q1	Q2	Q3	Q4	Q5
at least once a week	17.0	11.3	16.0	19.8	35.9
at least once a month	14.3	16.0	18.6	21.5	29.6
less than once a month	16.6	19.0	20.9	21.7	21.8
never	29.1	24.9	19.7	16.6	9.7
Total HH	20.0	20.0	20.0	20.0	20.0

Source: Swiss Household Panel SHP

3.4 Findings

The empirical results provided in this section show that education and heath care services can be regarded as major in-kind transfers that correspond to a considerable share of (aggregate) disposable income. Compulsory and upper secondary education beneficiaries report significantly lower equalised income and it can be concluded that public expenditure on the respective services are progressive and tend to reduce inequality in absolute and in relative terms. For tertiary education no significant difference in average equalised income between households with at least one member in tertiary education and households with no member in tertiary education is found. Nevertheless it can be argued that public expenditure on tertiary education tends to reduce inequality because these expenditures are not clearly directed to high income households in Switzerland.

The distributional effects of expenditure on tertiary education have to be interpreted carefully though because they may seem pro-poor even if they are in fact pro-rich. The rational for this statement is that individual student households may receive financial supported from parents which is not accounted for in the reported household income and because these households may be only temporarily poor but are likely to gain above average income in the future. [Ruggeri (2005)]

For public expenditures on health care the identification of beneficiaries based on the actual consumption is not feasible by using the SHP data. There is empirical evidence however that indicates that annual health care expenses per capita are higher for old people and income of households with at least one member above the age of 65 is lower. Hence public expenditure on health care seems to be progressive and tends to reduce inequality. The actual consumption approach is however considered

to be less appropriate for health care services because it ignores the higher need of people relying on health care services and Verbist et al. (2012) recommend the insurance value approach to allocate benefits from publicly provided health care.

RCR services are heterogenous and the identification of beneficiaries by the SHP is only possible for very specific services. As a result of that, and since public expenditure on RCR are rather low compared to education and health care, it is recommended to ignore RCR expenditure for the purpose of expenditure incidence in Switzerland and to focus on the major components which are education and health care.

4 Cross-Country Analysis of Public Expenditure, In-Kind Transfers and Inequality

The aim of this section is to study the variation of public expenditure for a number of OECD countries and to discuss the results in the context of differences in inequality across countries. The analysis is performed in three steps. In the first step the cross-country variation in the size and composition of government expenditure by function is analysed. The next step is a more detailed analysis on in-kind transfers in the respective countries. Lastly, it is examined if a relation between inequality and in-kind transfers can be identified. The analyses in this section are based on data on government expenditure by function (COFOG), disposable income and inequality in terms of the Gini coefficient provided by the OECD.[32]

4.1 Public Expenditure and In-Kind Transfers

Public expenditure by function considerably vary across counties. Table 4.1 exhibits government expenditure by function (COFOG) as share of (aggregate) disposable income for 27 OECD countries. Total public expenditure range from almost 59% of disposable income in Denmark to 29% in the Republic of Korea. Switzerland is located at the bottom of the table with total public expenditure of 36.2% of disposable income. An important aspects however has to be addressed when analysing the

[32]The data is available in the OECD's iLibrary databases and is accessible via http://stats.oecd.org.

cross-country variation of public expenditure by function as percentage of disposable income. Public expenditure expressed as a percentage of disposable income is influenced by the total amount of expenditure within the specific country but also by the aggregate disposable income of the respective country. This aspect considerably affects the results in table 4.1 and is also a reason why the country ranking does not seem to deliver a very clear cut pattern. The Nordic countries for instance, which are known to be social welfare states, can not directly be seen as a cluster of countries which reports very high public expenditure. Only Denmark and Finland are at the top of the table whereas Sweden ranks at position 9 and Norway ranks at position 20 out of the 27 countries. These differences in the ranking are not entirely based on lower public expenditures but are also a result largely driven by differences in aggregate disposable income. In fact, when analysing public expenditure in absolute terms and on an per capita basis, all Nordic countries rank (as expected) at the top of the table.[33] Switzerland is ranked at position 13 when considering government expenditure per capita which is very different compared to the ranking based on the share of disposable income which is position 26. The reason why public expenditure are expressed as share of disposable income rather than in absolute terms per capita in this paper, is that this measure is considered to be more meaningful with regard to the impact of specific public expenditure on extended income and inequality.

Countries do not only differ in the total public expenditure but also in the composition of public expenditure by functions. Social protection is the largest item of expenditure for all countries except for the USA and the Republic of Korea and corresponds to up to 25% of disposable income in Denmark. For the USA public expenditure for health care slightly exceeds expenditure for social protection and marks with 8.6% of disposable income the highest function for the US. The Republic of Korea on the other hand directs most of its public expenditure to the function of economic affairs.

A more detailed analysis of all government expenditures by function lies beyond the scope of this paper because (as it has already been argued in section 2.5) only specific public expenditure are recomended to be included in the concept of income when studying inequality. For this reason, only public expenditure on health care, education and RCR, which have been identified as in-kind transfers, are further discussed.

[33]Government expenditure per capita and in in $ PPP are exhibited in table B.2 in appendix B.

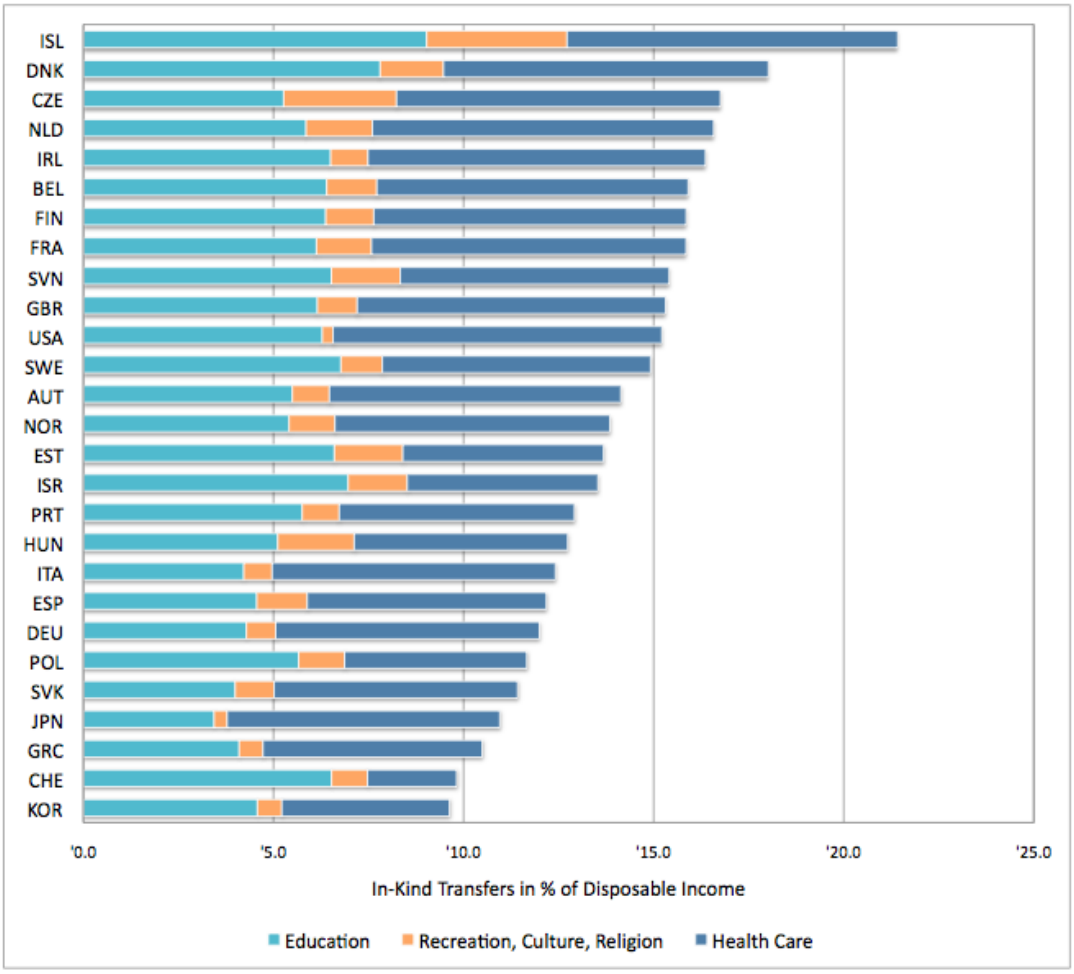
Table 4.1: Government Expenditure (COFOG) in Percent of Disposable Income

	010: GPS	020: DEF	030: POS	040: EA	050: EP	060: HCA	070: HC	080: RCR	090: EDU	100: SP	T: Total
DNK	8.9	1.5	1.1	3.6	0.4	0.4	8.5	1.7	7.8	25.0	58.9
FIN	7.5	1.6	1.5	4.9	0.3	0.5	8.2	1.3	6.4	24.9	56.9
FRA	5.9	1.9	1.8	3.7	1.1	1.9	8.3	1.4	6.1	24.4	56.6
BEL	8.2	1.0	1.9	7.1	0.7	0.4	8.2	1.3	6.4	20.6	55.8
GRC	13.8	2.4	1.8	3.2	0.6	0.2	5.8	0.6	4.1	21.1	53.6
ISL	10.3	0.0	1.7	5.6	0.7	1.3	8.7	3.7	9.0	12.6	53.5
IRL	7.3	0.5	2.1	4.4	1.0	1.0	8.9	1.0	6.5	20.4	53.1
HUN	9.6	0.9	2.1	6.6	0.8	1.0	5.6	2.0	5.1	18.2	51.9
SWE	7.2	1.4	1.4	4.4	0.3	0.7	7.1	1.1	6.8	21.3	51.6
ITA	9.2	1.4	2.0	3.4	0.9	0.7	7.5	0.7	4.2	21.3	51.4
NLD	5.5	1.3	2.1	5.4	1.7	0.6	9.0	1.7	5.9	17.7	50.8
AUT	6.5	0.7	1.5	5.3	0.5	0.6	7.7	1.0	5.5	20.8	50.0
GBR	5.9	2.4	2.4	2.8	0.9	0.8	8.1	1.0	6.2	18.3	48.9
SVN	5.9	1.1	1.8	4.0	0.7	0.8	7.1	1.8	6.5	19.2	48.9
ESP	6.2	1.0	2.1	7.8	0.8	0.4	6.3	1.3	4.6	18.1	48.7
CZE	5.5	1.0	2.0	6.1	1.5	0.8	8.5	3.0	5.3	15.0	48.5
PRT	9.3	1.2	1.9	2.8	0.5	0.6	6.2	1.0	5.8	19.1	48.2
DEU	6.0	1.0	1.5	3.4	0.6	0.5	6.9	0.8	4.3	19.1	44.2
POL	6.2	1.2	1.8	4.8	0.6	0.9	4.8	1.2	5.7	16.7	43.8
NOR	3.9	1.4	0.9	4.2	0.7	0.7	7.2	1.2	5.4	17.2	42.9
ISR	5.9	6.1	1.6	2.5	0.6	0.5	5.0	1.6	7.0	11.0	41.6
JPN	4.4	0.9	1.3	4.2	1.1	0.7	7.2	0.3	3.4	17.5	40.9
EST	3.7	1.9	2.1	4.7	0.9	0.7	5.3	1.8	6.6	13.0	40.7
USA	5.8	4.2	2.2	3.6	0.0	0.7	8.6	0.3	6.3	8.1	39.7
SVK	6.2	1.1	2.5	3.7	1.0	0.8	6.4	1.0	4.0	12.6	39.2
CHE	3.3	1.0	1.9	4.9	0.8	0.2	2.3	0.9	6.5	14.3	36.2
KOR	4.4	2.5	1.2	5.8	0.7	0.9	4.4	0.6	4.6	3.8	29.0

Note: Government expenditure by function (COFOG) expressed in percent of aggregate disposable income is reported for 27 OECD countries. The functions are General Public Services (GPS), Defence (DEF), Public Order and Safety (POS), Economic Affairs (EA), Environmental Protection (EP), Housing and Community Amenities (HCA), Health Care (HC), Recreation, Culture and Religion (RCR), Education (EDU) and Social Protection (SP). The countries are listed in decreasing order by total government expenditure in percent of disposable income. Government expenditure in percent of disposable income are also reported in Verbist et al. (2012).

Source: Author's calculation based on OECD data for government expenditure by function (COFOG) and disposable income for the the year 2012. The calculation for Austria and the Republic of Korea and disposable income for Switzerland are based on data for the year 2011 due to data availability issues.

Figure 4.1: In-Kind Transfers in Percent of Disposable Income



Source: Authors calculation based on OECD data for government expenditure by function (COFOG) and disposable income of 27 OECD countries for the the year 2012. The calculation for Austria and the Republic of Korea and disposable income for Switzerland are based on data for the year 2011 due to data availability issues. The figure is a modification of the graphical illustrations of in-kind transfers as share of disposable income for OECD countries in Verbist et al. (2012).

Figure 4.1 displays government expenditures classified as in-kind transfers and reveals that public expenditure on education, RCR and health care vary considerably across countries. The country with the highest in-kind transfers (as share of disposable income) is Iceland where these expenditures correspond to more than 20% of aggregate disposable income. This is a result of the highest expenditure (in percent

of disposable income) for education and RCR as well as high expenditure on health care services.[34] Denmark, Czech Republic, Netherlands and Ireland also rank at the top, reporting in-kind transfer of well-above 15% of disposable income and are followed by Belgium, Finland and France. As in the analysis of all government expenditure across countries, the Republic of Korea and Switzerland mark the bottom of the figure with government expenditure for in-kind transfers of less than 10% of disposable income. Whereas the Republic of Korea has relatively low expenditure on all in-kind transfers, Switzerland reports rather high expenditure on education, moderate expenditure on RCR and by far the lowest public expenditure on health care in terms of the percentage of disposable income. Public expenditure for health care correspond to only 2.3% of disposable income in Switzerland. Other european countries report considerably higher shares of public expenditure on health care which are between 5.3 and 9.0% of disposable income.

The low public expenditure for health care in Switzerland is however not a result of lower total expenses for health care services. In fact, as stated in BFS (2011) [p.10], according to OECD data of 2008, Switzerland spends after the USA and France more of its resources on health care than any other OECD country. This implies that the low public health care expenditure can not be explained with low total health care expenses in Switzerland. Hence, there have to be other factors explaining the low public expenditure on health care. One factor identified is related to the financing source of health care services. As stated in BFS (2012b) [p.3], the share of publicly financed health care expenditure (measured as share of total expenditure on health care services) is lower for Switzerland than for most other OECD countries observed and is the lowest among the european countries observed.[35] Another factor identified is related to direct payments of households for health care. In OECD/WHO (2011) [p.70] annual direct payments of households for health care services of USD 1600 per capita are reported for Switzerland which is extensively more than in any other

[34]Iceland is with a population roughly 300 thousand inhabitants by far the smallest country observed. This fact might also affect expenditure on in-kind transfer services. For the provision of health care, educational and RCR infrastructure it seems reasonable to assume a high share of fixed cost. Consequently, this yields in a situation of diminishing marginal cost in the provision of the actual services. If the share of fixed cost is higher in a small country, this results (ceteris paribus) in higher average cost on the provision of the services for the small country. From this it follows that the fact that cost to government rather than benefits to individuals are considered to approximate the value of in-kind transfer can be assumed to be a relevant issue when comparing a relatively small country to a larger one. Hence Iceland might only report high cost on the provision of these services even if the value of these services are not considerably higher than in other countries observed.

[35]More detailed information is available in BFS (2012b).

OECD country.[36] The country with the second largest direct payments are the USA with annual household spending of slightly below USD 1000 per capita followed by Norway with annual spendings slightly above USD 800 per capita. The OECD average is below USD 600.

4.2 In-Kind Transfers and Inequality of Income

As stated by Aaberge et al. (2013) [p.9]" (...) differences in the size and composition of the public sector introduce a profound comparability problem between countries when public in-kind transfers are not accounted for in the analysis of income distribution." As already described in this chapter, public expenditure and in-kind transfers vary considerably across the countries observed. In this context the relation between income inequality and the provision of in-kind transfers is of interest. Once this relation is known, it is possible to infer if the countries observed differ to a higher or to a lower degree in terms of inequality when including in-kind transfers in the concept of income.

Figure 4.2 plots inequality of disposable income (in terms of the Gini coefficient) and in-kind transfers as percentage of disposable income for the 27 OECD countries observed.[37] The plot of the countries reveals no clear relation between inequality and the provision of in-kind transfers. In other words, the size of in-kind transfers varies across relatively equal countries as well as across more unequal countries. Hence, it is not reasonable to state that differences in inequality across countries are increased or reduced in general when including benefits from in-kind transfers. It seems however reasonable to assume that inequality within each country is reduced when accounting for in-kind transfers and that the reduction of within country inequality is higher for countries with large in-kind transfers (in percent of disposable income).[38] This implies that countries with high in-kind transfer would in fact rank as more equal than studies on inequality that rely on disposable income suggest. On the other

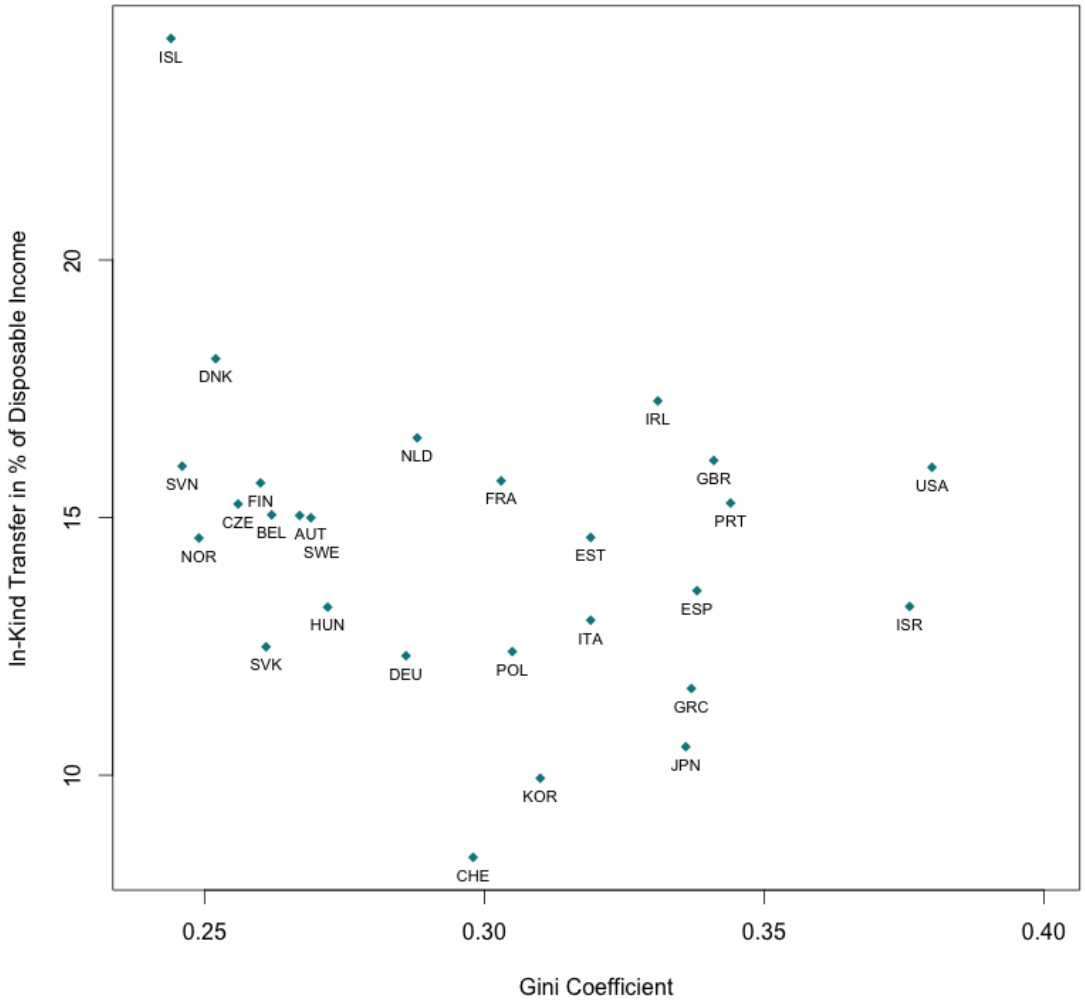
[36] Based on OECD data for the year 2009 and in USD PPP. The data and additional information is published in OECD/WHO (2011).

[37] The latest available data on the Gini coefficient at the OECD was data from the year 2010 (for Switzerland 2009). For this reason, the analysis on the relation between inequality and in-kind transfer has to be performed by relying on data for the years 2010/2009.

[38] Aaberge et al. (2013) study the effects of four publicly financed services (education, health care, long term care and early childhood education and care) on inequality for 23 european countries and find that by extending the concept of income by the value these services provide, inequality (in terms of the Gini) is reduced in all countries observed.

hand, countries with low in-kind transfers are expected to rank as more unequal when including benefits of in-kind transfers.

Figure 4.2: The Relation between Income Inequality and In-Kind Transfers



Source: OECD data on Gini coefficient (at disposable income, post taxes and transfers) and in-kind transfers in percent of disposable income (year 2010) for 27 OECD countries. For Switzerland data for the year 2009 is reported because data for the year 2010 was not available.

4.3 Findings

Total government expenditure and government expenditure on functions that can be classified as in-kind transfers are considerably lower in Switzerland than in most other OECD countries observed. The low amount of in-kind transfers in Switzerland arises from very low public expenditure on health care services. The lower public expenditure on health care cannot be explained by lower total health care expenses but is a result of a low public share in financing health care services as well as of higher direct payments of households for health care services.

Even though inequality in Switzerland is assumed to be reduced by in-kind transfers, the reduction of inequality is expected to be lower than in most other countries observed due to the lower in-kind transfers. This implies that Switzerland is expected to rank as more unequal, compared to the other OECD countries observed, when the value of in-kind transfer is include in the concept of income, than studies on inequality which rely on disposable income suggest.

5 Conclusion

The results and discussion in this paper can only be regarded as a first step towards an empirical study for Switzerland that accounts for benefits of publicly provided services. The paper provides information on the major difficulties that have to be faced in order to be able to thoroughly capture and describe inequality. From this information it follows, that equalised household income rather that income on the individual level can be regarded as a more adequate concept when studying inequality. Moreover, the concept of income has to be defined in a way that it reliably describes economic well being.

In the empirical analysis of this paper, education and health care services have been identified as major of in-kind transfers in Switzerland. These transfers are directed to specific beneficiaries and affect their economic well being as well as their relative economic position. Therefore, these in-kind transfers have to be included in the concept of income when studying inequality.

Beneficiaries of education services could be identified based on the actual consumption approach and by using a microeconomic dataset that provides information on

income, educational status and on the composition of the household. It has been shown, that the inclusion of benefits of education services is assumed to reduce inequality. The actual allocation of educational expenditure has not been performed but an allocation based on the actual consumption approach seems to be reasonable and OECD data on expenditure per student for different levels of education is available for Switzerland and many other OECD countries.

For the allocation of benefits from public expenditure on health care, the insurance value approach is regarded to be more adequate. The conception and determination of an insurance value for the purpose of allocating public expenditure on households lies beyond the limits of this work though and is therefore not covered in this paper.

Many cross-country analyses of inequality are based on disposable income and omit benefits of publicly provided services. Since large difference in the composition and size of public expenditure on the provision of public services across countries have been found, these analyses may be incomplete and hence only inaccurately describing difference in inequality across countries. There is a number of empirical work on inequality of extended income available. However, no work including data for Switzerland has been found during research on the topic. The results in this paper suggest that Switzerland seems to be relatively equal in terms of income inequality compared to other countries when relying on disposable income, but reports considerably lower in-kind transfer as a share of disposable income. From this it follows that Switzerland might rank considerably more unequal compared to other countries observed if inequality is based on the concept of extended income. This result, however, can just be regard as an approximation. For a more accurate cross-country analysis of inequality including Switzerland, empirical work that actually allocates the value of in-kind transfers is needed. It is important to point out though, that cross-country comparison of inequality based on extended income can only be assumed to be valid if the same concepts and methodologies are applied. For this reason, an empirical study for Switzerland has either to be based on a standard approach that has also been performed for other countries or Switzerland has to be included in studies on inequality of that are specifically designed to analyse cross-country variation in inequality and account for differences in the provision of in-kind transfers.

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A Procedure of the Empirical Analysis

The empirical analysis on the consumption of education is based on the SHP data sets of Wave 14 for the year 2012. To be more precise, the data sets on the household level ($SHP12\_H\_USER$) and on the individual level ($SHP12\_P\_USER$). The analysis on the consumption of RCR services is based on the data sets of wave 10 for the year 2008 ($SHP08\_H\_USER$ and $SHP08\_P\_USER$). [39]

A.1 Education

The SHP data set on the household level does not provide a variable that directly allows to identify households that are consuming education. For this reasons, the identification of the respective households has to be performed by relying on information on the individual level.

On the individual level the variables *P12E14 (Education: Current training at school)* and *P12E15 (Education: Current training: Type)* provide information on the education status and of the education type of the individual.[40] However this information is not provided for individuals at the ages below 15 years. But since up to this age participation in education is compulsory, individuals consuming compulsory education can be identified by the variable *AGE12*. The identification is based on the assumption that all children above 6 years and below 15 years of age are attending compulsory education. For all individuals at or above the age of 15 the attendance of education is explicitly asked and can be directly identified by the variable *P12E15 (Education: Current training: Type*). The value *0 (incomplete compulsory school)* identifies all individuals at or above 15 years of age participating in compulsory education. The values that allow the identification of individuals participating in upper secondary and tertiary education are exhibited in table A.1.

Once the individuals consuming the respective educational services have been identified, it is possible to identify households consuming compulsory, upper secondary and tertiary education. This is approached in two steps and for each education level separately. In the first step households with at least one member participation in

[39] The detailed R code is provided by the author upon request.

[40] The expression in italic is the official variable name and description used in the SHP data sets. Detailed information on the SHP and the variables are provided in Voorpostel et al. (2013) or on the FORS website (http://forscenter.ch/en/)

Table A.1: Values of Variable *PE12E15 Education: Current Training: Type*

P12E15	Current Training Type	Level Education
0	incomplete compulsory school	Compulsory
2	elementary vocational training (firm + school)	Upper Secondary
3	apprenticeship (CFC/EFZ level)	Upper Secondary
4	2 to 3 years: full-time vocational school	Upper Secondary
5	vocational maturity	Upper Secondary
6	2 to 3 years: general training school	Upper Secondary
7	bachelor/maturity (high school)	Upper Secondary
12	Vocational high school with master or federal certificate	Tertiary
13	technical or vocational school	Tertiary
14	vocational high school ETS, HTL etc.	Tertiary
15	University, academic high school, EPF, ETH	Tertiary
16	university of teacher education HEP, PH	Tertiary
17	university of applied sciences HES, FH	Tertiary
18	teacher training school	Tertiary

Source: FORS (http://forscenter.ch/en/)

the respective education level are identified. In the second step it is switched from the individual to the household data set and a subset for all households with at least on member participating in the respective education level is created. In addition to that, also a subset of all household with no member participating in the respective education level is created.

After all subsets on the household data set have been created, it is examined if the subsets differ in terms of equalised household income. This is done by comparing descriptive statistics on the variable *I12EQN (Yearly household income equalised according to the modified OECD scale, net)* for all subsets consuming the respective educational services and comparing them to the corresponding subsets not consuming the respective educational services and to the total population of all households. This is performed for compulsory, upper secondary and tertiary education separately.

The significance of the results (i.e. if the mean equalised income significantly differs across households consuming education and households that do not consume education) is tested by the following regressions

$$I12EQON_i = \beta_0 + \beta_1 CEDU_i + u_i \tag{4}$$

$$I12EQON_i = \beta_0 + \beta_1 SEDU_i + u_i \tag{5}$$

$$I12EQON_i = \beta_0 + \beta_1 TEDU_i + u_i \tag{6}$$

where $CEDU$, $SEDU$ and $TEDU$ are dummy variables identifying households consuming compulsory, upper secondary and tertiary education. The regression outputs are reported in figures A.1, A.2 and A.3.[41]

Figure A.1: Output Regression Compulsory Education

```
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)  69670.3     1754.9 39.7004 < 2.2e-16 ***
CEDU        -12557.6     2206.1 -5.6923 1.342e-08 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Figure A.2: Output Regression Upper Secondary Education

```
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)  68618.5     1659.3 41.3537 < 2.2e-16 ***
SEDU         -9013.6     2151.6 -4.1893 2.857e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Figure A.3: Output Regression Tertiary Education

```
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  67803.2     1627.5 41.6610   <2e-16 ***
TEDU         -1514.6     2275.7 -0.6655   0.5057
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

[41] Linear models have been estimated with a heteroscedasticity robust estimation procedure implemented in R. The reported standard errors, t-tests and p-values are hence heteroscedasticity robust.

In addition to the descriptive statistics, also the method of the relative quantiles used by Verbist et al. (2012) has been applied. Following this approach, the total population of all household has been subdivided into 5 quintiles according to equalised income *I12EQON* and all households have been flagged with a newly constructed variable that identifies the quintile the household has been assigned to. The execution of the analysis of the relative share of quintiles is straight forward and the results are presented in section 3.3.1.

A.2 Health Care

The empirical analysis on equalised income for the subset of households with at least once member above the age of 65 ($SHP12\_H\_SUB\_A\_old$) and the subset of households with no member above 65 ($SHP12\_H\_SUB\_A\_not\_old$) is based on the SHP data sets of Wave 14 for the year 2012. The identification of the subsets has been proceeded in the same way as for education. In the first step, households with at least one member above 65 are identified by observing the variable $AGE12$ on the individual level. It is then switched to the household level and the subset of households with at least on member above the age of 65 and the subset of households with no member above the age of 65 are created. Figure A.4 exhibits the two sample t-test on the mean equalised income for the two subsets. It can be seen that the mean equalised income for the subset of households with at least one member above the age of 65 ($SHP12\_H\_SUB\_A\_old$) is significantly lower that for the subset of households with no member above 65 ($SHP12\_H\_SUB\_A\_not\_old$). The two-sample t-test reveals high significance with a t-value of well above |6|.

Figure A.4: Two Sample T-Test for the two Subsets of Households

```
    Welch Two Sample t-test

data:  SHP12_H_SUB_A_old$I12EQON and SHP12_H_SUB_A_not_old$I12EQON
t = -6.145, df = 4042, p-value = 8.785e-10
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -18949  -9782
sample estimates:
mean of x mean of y
    57367     71732
```

A.3 Recreation, Culture and Religion (RCR)

The information in the SHP data set (wave 10) on the consumption of RCR services is provided by the variable *P08A18 (Leisure: Theatre, opera, exhibition: Frequency)*. The relation between income and the frequency of visiting theatre, opera and exhibitions is directly analysed by building subsets of individuals according to the frequency they consume these services and by observing descriptive statistics and relative frequency for each of the subsets. The results are presented in section 3.3.3.

B Government Expenditure

Table B.1: Government Expenditure Break Down on Education Level - Switzerland

		[%]
	Expenditure	Share of Expenditure
Compulsory Education	14'601	43.1
Upper Secondary Education	5'858	17.3
Tertiary Education	10'996	32.5
Other	2'390	7.1
Total	33'845	100.0

Note: Expenditures are reported in million Swiss francs and for the year 2011.
Source: Authors calculation based on BFS data on government expenditure by function.

Table B.2: Government Expenditure (COFOG) - Total Expenditure per Capita

	010: GPS	020: DEF	030: POS	040: EA	050: EP	060: HCA	070: HC	080: RCR	090: EDU	100: SP	T: TOTAL
NOR	2'634	932	628	2'806	467	439	4'831	805	3'616	11'501	28'659
DNK	3'840	640	478	1'566	171	153	3'688	719	3'369	10'795	25'419
BEL	3'289	396	762	2'823	271	167	3'278	526	2'562	8'250	22'324
SWE	3'093	613	613	1'884	147	308	3'045	470	2'922	9'176	22'271
FIN	2'907	633	597	1'899	99	177	3'205	492	2'486	9'709	22'205
NLD	2'357	545	892	2'304	726	258	3'862	750	2'519	7'631	21'844
AUT	2'839	308	631	2'288	216	256	3'333	423	2'391	9'037	21'723
FRA	2'256	722	680	1'410	418	736	3'152	551	2'335	9'291	21'552
USA	3'016	2'168	1'126	1'890	0	355	4'510	146	3'277	4'200	20'690
DEU	2'559	444	656	1'435	245	192	2'940	326	1'817	8'116	18'730
IRL	2'555	178	726	1'563	351	367	3'120	346	2'286	7'175	18'666
ISL	3'575	8	580	1'936	243	450	3'030	1'285	3'145	4'391	18'643
CHE	1'675	515	946	2'487	386	116	1'186	477	3'300	7'230	18'317
ITA	3'178	483	680	1'183	311	228	2'564	256	1'451	7'332	17'665
GBR	2'043	838	845	986	322	290	2'829	364	2'146	6'395	17'058
ESP	1'984	313	681	2'507	264	136	2'008	424	1'457	5'777	15'551
JPN	1'602	326	465	1'543	402	238	2'620	126	1'257	6'382	14'962
GRC	3'584	619	476	841	145	57	1'501	163	1'067	5'503	13'958
SVN	1'660	306	508	1'111	199	214	1'980	507	1'826	5'374	13'686
ISR	1'853	1'906	499	772	181	153	1'573	488	2'186	3'445	13'056
PRT	2'363	297	473	722	123	152	1'580	248	1'470	4'874	12'302
CZE	1'381	245	496	1'530	374	196	2'153	750	1'331	3'794	12'251
HUN	2'046	186	445	1'408	161	208	1'192	426	1'085	3'865	11'023
SVK	1'553	268	622	910	241	195	1'595	255	995	3'127	9'760
EST	874	454	508	1'105	212	168	1'252	427	1'565	3'083	9'649
POL	1'355	272	395	1'060	128	188	1'053	265	1'244	3'664	9'625
KOR	1'323	754	364	1'756	213	285	1'328	193	1'378	1'141	8'734

Note: Government expenditure by Function (COFOG) in $ PPP and current prices for 27 OECD countries. The functions are General Public Services (GPS), Defence (DEF), Public Order and Safety (POS), Economic Affairs (EA), Environmental Protection (EP), Housing and Community Amenities (HCA), Health Care (HC), Recreation, Culture and Religion (RCR), Education (EDU) and Social Protection (SP). The countries are listed in decreasing order by total government expenditure per capita.

Source: Authors calculation based on OECD data for Government Expenditure by Function (COFOG) and population for the the year 2012. The data for Austria and Korea is for the year 2011 and the population data for Iceland and Switzerland is also based on 2011 data.

C Note on the Provision of the Data

This study has been realised using the data collected by the Swiss Household Panel (SHP), which is based at the Swiss Centre of Expertise in the Social Sciences FORS. The project is financed by the Swiss National Science Foundation.

D Plagiatserklärung

Ich bezeuge mit meiner Unterschrift, dass meine Angaben über die bei der Abfassung meiner Arbeit benutzten Hilfsmittel sowie über die mir zuteil gewordene Hilfe in jeder Hinsicht der Wahrheit entsprechen und vollständig sind.
Ich habe das Merkblatt zu Plagiat und Betrug vom 22. Februar 2011 gelesen und bin mir der Konsequenzen eines solchen Handelns bewusst.

Joel Graf
Basel, 22. July 2014