Does inequality matter? The effect of income inequality on private consumption

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Author’s Declaration

Unless otherwise indicated in the text or references, or acknowledged above, this thesis is entirely the product of my own scholarly work. Any inaccuracies of fact or faults in reasoning are my own and accordingly I take full responsibility. This thesis has not been submitted either in whole or part, for a degree at this or any other university or institution. This is to certify that the printed version is equivalent to the submitted electronic one.

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Victoria Endl-Geyer
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1 Introduction

The societal inequality in wealth is an omnipresent topic in present time. Current observations of its evolution and potential consequences in society, especially for the political system, are discussed continuously.\(^1\) According to an Oxfam report from 2016, the richest 62 people possess as much wealth as the poorest half of the world population, 3.6 billion people (Hardoon et al. 2016). A statistic of Credit Suisse reveals that millionaires constitute less than 1% of the world’s population and own 46% of the global fortune.\(^2\) A high income inequality helped to this development. According to Piketty (2014), an inequality in incomes can be referred to as high if approximately half of the total income is gained by 10% of the working population. Such a distribution can be seen in the US nowadays. Income inequality is considered as unjust and different tax systems, among other topics, are discussed as solution in politics. Piketty (2014), for example, argues passionately for an annual wealth tax with a progressive rate structure. Normative debates quickly arise and it becomes clear that a concrete measure is required to define negative consequences of income inequality in order to discuss it adequately. This study aims to point to the welfare consequences of income inequality, using aggregate private consumption as a welfare indicator.

It is established empirically that inequality affects private consumption in a country (Cutler et al. 1991, Krueger and Perri 2006, Heathcote et al. 2010, Attanasio et al. 2012, Fisher et al. 2013, Meyer and Sullivan 2013, Aguiar and Bils 2015). Intuitively, a re-distribution of income in favor of the upper income class causes a reduction of consumption of the disadvantaged and only a slight rise in the consumption expenditure of wealthier people. This is due to a non-linear association between consumption and income at the micro level. As a result, the aggregate private consumption in a country would decrease with an increasing inequality. However, there is little research on the channels through which income inequality affects private consumption. In other words,

Since sources such as the Forbes list are used, the figures are to be considered with some caution. However, they seem to point to a high level of wealth inequality in the world.
the causal relationships between inequality and consumption are for the most part unexplored. Yet, this is of great importance as it provides information regarding suitable policies for a prevention of the negative consequences of income inequality.

To the best of my knowledge, only two studies have dealt empirically with the effect of income inequality on aggregate private consumption, and only one of them aims to find a causal relationship between income distribution and private consumption: Albig et al. (2017) analyze the development of income inequality in Germany using a simulation model and state that in the long term, income inequality diminishes private consumption. Jin et al. (2011) find that, after having controlled for household income, income inequality has a negative effect on the household consumption rate in China. They argue that status seeking could be accountable for this effect.

Partly following Aloi and Tournemaine (2013), an endogenous growth model is developed in this thesis, where the long term effect of income inequality is implemented. The remainder of the paper proceeds as follows. In section 2 common measures of inequality are introduced and “income inequality” is defined as it is crucial for an economic analysis and discussion of the effects of income inequality. A suitable welfare indicator is chosen in section 3. Section 4 sets the stage for the model in section 5 by a survey on the different macroeconomic effects that inequality can have, including the two standard effects, substitution effect and income effect, as well as behavioral reasons like status-seeking. A discussion follows and the last section concludes.

2 Defining income inequality

Inequality can be seen as a political or social problem and lengthy, abstract debates are the consequences. Some inequalities can be identified qualitatively only, such as inequalities of national origin, race, or gender. In contrast, it is impossible to investigate economic inequality without measuring it. An explicit definition is required in order to analyze and discuss economic inequality. It is crucial to distinguish between income inequality and earning inequality. A further step is then to select a suitable inequality measure. This is done in the following two subsections.
2.1 Income inequality versus earning inequality

The choice between income inequality and earning inequality should be by no means arbitrary. Earning inequality stems from an unequal development of labor earnings, whereas income inequality results from an unequal distribution of wealth which includes both labor and capital incomes. The impacts of inequality and therefore the analysis of causal relationships depend on the choice between earning and income inequality and can be fundamentally different, as we shall see in section 3.1. When considering the effects of inequality on private consumption, we are primarily interested in the manner in which “distribution” can affect aggregate private consumption through its impact on various variables such as aggregate savings, human capital and work incentives, or behavioral reasons (see section 4). What is pertinent regarding this analysis is the distribution of total income, whereat it is secondary whether this income consists of capital income (and) or labor earnings. Therefore, the expression “income inequality” refers to the unequal distribution of total income within this thesis.

2.2 Measures of inequality

Even though inequality has long been an important field of research for not only sociologists but also economists, the minority of researchers explicitly defined the term inequality. This creates little difficulty as long as one is interested in the distinction between perfect equality and a state of inequality. However, the existence of different states of inequality requires differentiating between the dimensions of inequality in order to rank distributions. The solution is vital in order to examine determinants and consequences of social inequality. The question why some countries are more unequal than others has required the application of specific measures of inequality such as the Gini index or the coefficient of variation. Due to the lack of explicit selection criteria and the numerous measures of inequality, researchers have often based their choice on familiarity or convenience. However, theoretical and methodological implications come automatically with the decision to rank one distribution as more unequal than another. This is because the choice of an inequality measure is not only a choice among alternative methods of measuring a single theoretical construct but is also closely linked to a selection of different definitions of inequality (Allison 1978). Therefore, the choice of the inequality measure can make a difference. Atkinson (1970) stresses that using alternative measures of
inequality leads to essential differences in the rank ordering of countries by income inequality.

One approach to specifying inequality is to select one of the common measures of inequality. However, it is necessary to be aware of what characteristics such a measure should possess. The minimum condition that it takes the value zero when all individuals observed have identical incomes and a positive value when there is an unequal distribution of income among two or more individuals is satisfied by all common measures of inequality. This includes familiar measures such as the range or the variance (Allison 1978). Two further characteristics are desirable, namely scale invariance and the principle of transfers.

Scale invariance is examined first. It requires that multiplying everyone’s income by a constant does not lead to a change in the degree of inequality and rules out many measures. Since several economists and sociologists question this criterion, Allison (1978) discusses some arguments in its favor. Firstly, as variables are often measured in different units, it is necessary to take into account that a change in the unit does not constitute a real change in the distribution of that variable. This means that it should make no difference in inequality whether income is measured, for example, in dollars or yen. This is ensured by scale invariance. Adjustments for inflation or currency conversions are not necessary which can be very convenient. Secondly, real proportionate increases in everyone’s income imply that the ratios of all pairs of income remain the same and should, therefore, indicate a sustained level of inequality. Blau (1977) demonstrates that it is desirable having an inequality measure responding to relative income differences and leaving inequality unchanged when it comes to absolute differences. A further argument is that scale invariance allows for comparisons across completely different types of quantities. It allows for statements like “power is more unequally distributed than wealth in nation A.”, which would be meaningless without scale invariance. Lastly, it can be said that an addition of a constant to everyone’s income leads intuitively to a reduced level of inequality. A three-person society is considered, for example, with the incomes $3.000, $13.000, and $23.000, where the distribution of income depicts most certainly essential differences for the persons concerned.

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3 The variance, for instance, is thus excluded as it quadruples when everyone’s income is doubled.

4 It is stated by Kelley and Klein (1977) as well as Kolm (1976) that proportional increases in income implicate an increase in inequality. In contrary, Dalton (1920) and Sen (1973) argue that inequality decreases with a proportional increase in income.
However, if a million dollars were added to everyone’s income, the remaining differences would become meaningless. While the standard deviation would remain unchanged, scale invariant measures respond reasonably, indicating that inequality declines.

A useful feature of most distribution measures is the possibility of conversions into scale invariant measures of inequality by dividing them by the mean or a function of the mean (Allison 1978). For instance, the coefficient of variation $V$ is defined as the standard deviation divided by the mean

$$ V = \frac{\sigma}{\mu}. $$

The mean deviation is defined as the value function divided by twice the mean (Schutz 1951)

$$ D = \frac{1}{n} \sum_{1 \leq i \leq n} |x_i - \mu| \frac{2}{2\mu}. $$

The probably most commonly used inequality measure, the Gini index $G$, depicts a measure of dispersion divided by twice the mean (Allison (1978))

$$ G = \frac{1}{n^2} \sum_{1 \leq i \leq n} \sum_{1 \leq j \leq n} |x_i - x_j| \frac{2}{2\mu}, $$

where the numerator is the average absolute difference between all pairs of individuals, also known as Gini’s coefficient of mean difference (Kendall and Stuart 1977: 48).

A fourth measure of inequality was established by Theil (1967) and is based on information theory

$$ T = \frac{1}{n} \sum_{1 \leq i \leq n} \left( \frac{x_i}{\mu} \right) \log \left( \frac{x_i}{\mu} \right). $$

This formula can be reduced to the following with simple algebra (Allison 1978):

$$ T = \frac{1}{n} \sum_{1 \leq i \leq n} x_i \log x_i - \frac{\mu \log \mu}{\mu}, $$

which shows that $T$ is also a measure of dispersion divided by the mean. It is important to note that when $x_i = 0, x_i \log x_i$ is also defined to be 0.

The variance of the logarithms $L$ is a scale invariant measure that cannot be converted to a ratio of a measure of dispersion to the mean. The logarithm is taken of each income and then the variance of the transformed scores is
computed (Allison 1978)

\[ L = \frac{1}{n} \sum_{1 \leq i \leq n} (z_i - \bar{z})^2, \]

where \( z_i = \log x_i \) for all \( i \), and \( L \) is not defined when incomes of zero are included in the distribution.

Many other inequality measures have been suggested (Alker and Russett 1964, Martin and Gray 1971, Ray and Singer 1973), however, they either do not fulfill the preceding conditions, cannot be broadly used, or are simple monotone functions of mentioned inequality measures.

The second criterion is that inequality measures must satisfy the principle of transfer. Dalton (1920) states that measures of inequality should increase when there is income transferred from a poorer to a richer person, whereat it is irrelevant how rich or how poor the persons are or what amount of money is transferred. This principle has not only an intuitive appeal but provides the possibility to relate an inequality measure to the Lorenz curve and the social welfare approach, as we shall see. Two of the five scale invariant measures presented above fail to satisfy the principle of transfers (Allison 1978). The relative mean deviation does not respond to transfers between two people who are both above the mean or both below it. The transfer at lower income levels affects appropriately the variance of the logarithms, however, it fails to respond correctly at a transfer from a poorer to a richer household as it causes the inequality to decrease.\(^5\) Thus, both the relative mean deviation and the variance of the logarithms are not considered as an appropriate inequality measure.

In order to choose the appropriate inequality measures, the sensitivity to transfers is examined of the coefficient of variation \( V \), the Gini index \( G \) and the Theil measure \( T \). Atkinson (1970) argues that substantial differences in the sensitivity to transfers at different points in the distribution exist that can extremely affect the results. While measures which are most sensitive in the lower tail of an income distribution rather point to more inequality in developed countries than in developing countries, measures that are most sensitive to changes in income in the higher ranges show the opposite. Atkinson attributes this to the fact that developing countries tend to have a large and homogeneous population

\(^5\)Even though Creedy (1977) stresses that this does not depict a serious limitation as the extent of the violation of the principle of transfers is very little for most empirical distributions.
of poor people and face a high inequality among top income earners. For ex-
ample, the transfer of h dollars from an individual with income $x_i$ to another
individual with income $x_j$ is considered, where $x_i < x_j$. The incomes of all other
individuals of the society that is observed remain unchanged. It can be shown that

$$V_2^2 - V_1^2 = ch(x_j - x_i) + ch^2, \quad (7)$$

where $V_1$ and $V_2$ are the coefficients of variation before and after the transfer,
respectively, and $c$ is positive and depends on the number of observations and
the mean (this holds as well for $c'$ and $c''$ introduced below).6 The equation
shows that the sensitivity of $V$ is the same for transfers at all income levels. In
other words, a transfer of $100$ in the lower tail of the income distribution from
a person earning $4,000$ to another person earning $5,000$, has the same effect as
in the higher tail if the transfer is occurring between a person earning $49,000
and another earning $50,000$.

In contrary, the sensitivity of the Gini index depends on the income levels,
however, rather on the persons’ ranks than on their numeric scores. If we
consider again a transfer of $h$ from $x_i$ to $x_j$, one can show (Allison 1978) that

$$G_2^2 - G_1^2 = c'h(j - i), \quad (8)$$

where $G_1$ and $G_2$ are the Gini indices before and after the transfer, respectively,
and $i$ and $j$ represent the ranks of incomes $x_i$ and $x_j$. This result reflects that
the number of persons earning less than $x_j$ and more than $x_i$ determine the
change in $G$, which has fundamental implications. Considering a typically
bell-shaped income distribution such as a distribution in the US today there are
not only many more individuals in the $25,000$-$50,000$ bracket than there are in
the $70,000$-$100,000$ bracket, but also fewer individuals in the $5,000$-$25,000
bracket than in the $25,000$-$50,000$ bracket.7 Therefore, it is easy to conclude
that the Gini index responds most to transfers in the middle of the income
distribution, and least to transfers among very poor or very rich individuals.

The analysis of the impact of a transfer on Theil’s measure $T$ requires the use
of a limiting argument (Allison 1978). Once more a transfer of $h$ from $x_i$ to $x_j$
is considered and $\Delta T$ be the resulting change in $T$. As $h$ goes to 0, the limiting

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6See Dalton (1920).

7U.S. Census Bureau: https://www.census.gov/data/tables/time-series/demo/
income-poverty/cps-pinc/pinc-01.html#par_textimage_14 (last visited 01.10.2017).
term for $\Delta T$ can be represented by

$$ \Delta T = c'' \log \left( \frac{x_j}{x_i} \right). \quad (9) $$

It is important to remember that the change in $V$ depends on the differences in the incomes. Here, the ratio of the incomes determines the change in $T$. As a consequence, $T$ is most sensitive to transfers among very poor individuals. A transfer of $100$ from a person with an income of $4000$ to another with income $5000$ has approximately the same impact on $T$ as transferring the same amount of money from a person with an income of $40000$ to another with an income of $50000$. This change is nearly nine times as large as when $100$ are transferred from an individual earning $40000$ to another earning $41000$. The poorer the people who are involved, the more sensitive $T$ reacts to transfers.

Now enough differences are examined to have a basis for choosing among $G$, $V$ and $T$. Following the assumption of diminishing marginal utility of income, then a transfer among less endowed people would be of greater importance (to them) than a transfer of the same amount among people with high incomes. Since this is reflected by Theil’s measure, it seems that it proves more advantageous than the other two measures in this sense. However, one has to choose carefully and be aware of the fact that the suitability of a measure depends very much on the variable of interest. If the variable is not characterized by diminishing marginal utility or does not possess a (relevant) value or utility, the coefficient of variation might be more appropriate due to its “flat” response. Therefore, inequality of age or years of schooling, for instance, may be best measured by $V$. As regards the Gini index, it is hard to think of research questions where the characteristic of being dependent on the shape of the frequency distribution is desirable. Yet, if the purpose of a study is to investigate income inequality among middle income recipients, the Gini index is more advantageous.

8Note that these three measures have different upper and lower bounds. In infinite populations, the Gini index varies between 0 and 1, while the coefficient of variation as well as Theil’s measure vary between 0 and infinity. However, as any desired bounds can be produced by simple transformations, the differences in the bounds should imply no preferences. To produce an upper bound of 1 for the coefficient of variation, take $V/(V+1)$. To let the Gini index vary between minus and plus infinity, take $\log(G/(1-G))$ (Allison 1978).

9Visualizing income inequality, many economists additionally use different ratios to give consideration to certain parts of the income distribution, such as the 90/10 ratio or the 50/10 ratio. The latter, for example, would reflect changes in the income distribution between the median and the 10th income percentile of the population. Generally, the ratio of the incomes of two different groups is taken, mostly “higher over lower”. However, ratios do not show
An important feature of measures that are not only scale-invariant but also satisfy the principle of transfers is that they can be simply related to the Lorenz curve. To demonstrate this, we first rank order all incomes in a population, from lowest to highest, and calculate then for each rank both the proportion of the population at that rank or below and the share of the total income that is generated by the people at that rank or below. We may possibly find that only 0.05 of the total income generated is earned by the 0.25 poorest of the population. The Lorenz curve is obtained by plotting the relationship between these two proportions for every rank (Gastwirth 1971). In Figure 1, three such lines are shown; line A represents the Lorenz curve under the condition of perfect equality and serves as a reference point for the other curves. If any individuals of a population gain unequal incomes, the corresponding line falls below the straight line A, reflecting that the poorest X percent of the population earns less than X percent of the total income. Consequently, in Figure 1, line C illustrates a more unequal distribution than line B does. Stating it differently, if a Lorenz curve for a given distribution Y is never above and is somewhere below the Lorenz curve for another given distribution Z, then the distribution Y is more unequal than distribution Z. The lower a Lorenz curve lies below the equality line, the higher is the corresponding value of the employed inequality measure. Many authors have demonstrated (e.g. Morris 1972) that this holds for any scale-invariant measure which satisfies the principle of transfers. Therefore, if one Lorenz curve dominates another (as long as they do not intersect), it makes little difference which of the three inequality measure, V, G or T is used, since all three will point to the same rank ordering.

The question whether an ordering of the Lorenz curves implies an ordering of social welfare is now considered. In 1920, Dalton argued that the decision whether one distribution of income is better than another constitutes a normative judgment, which is implicitly involved in the choice of an inequality measure. He further stated that it would be easier to choose and devise inequality measures, if one were able to clarify precisely these normative criteria. In other words, suppose the problem is to distribute a fixed total income among n persons. We assume that the desirability of a distribution is indicated by a number W that exists for any possible distribution

the overall level of inequality, but rather depict the shape of an income distribution. See, for examples, Krueger and Perri (2006) or Meyer and Sullivan (2013).
W represents the social welfare function. If it is possible to specify the form of W and if W takes the maximum value when all incomes are equal, then a decreasing function of W is suggested to be taken as a measure of inequality (Allison 1978). This approach was not further developed until Aigner and Heins (1967) proposed alternative functions for W and deducted appropriate measures of inequality. Atkinson (1970) provided a major contribution by demonstrating the existence of an important relationship between the social welfare function W, the Lorenz curve, and the principle of transfers under certain conditions: an ordering of the Lorenz curves represents at the same time an ordering of social welfare. He assumes

\[ W = W(x_1, x_2, \ldots, x_n) = W(x). \]  

(10)

where \( U(x_i) \) is the utility of income \( x \) for individual \( i \). Consequently, the total social welfare consists of the sum of all individual utilities. Further assumptions are that everyone has the same utility function, the utility function is concave, and income can be characterized by diminishing marginal utility. This implies that W reaches a maximum when all incomes are equal. These constraints on W imply that whenever a Lorenz curve X dominates another Lorenz curve Y\(^{10}\), it can be said that \( W(X) > W(Y) \). This result can be formulated in terms of the

\[ W = \sum_{1 \leq i \leq n} U(x_i), \]  

(11)

\(^{10}\text{Dominating means that X is somewhere above Y and never below it.} \)
principle of transfers. \( W(X) > W(Y) \), if there is a distribution \( X \) that can be obtained from another distribution \( Y \) by a sequence of transfers from richer to poorer persons. There are several generalized versions of this theorem, showing that \( W \) is not necessarily required to be a sum of individual utility functions. What has to hold for \( W \), however, is that it is symmetric, continuous, monotonic and "locally equality preferring".\(^{11}\)

We return now to Dalton’s claim to derive a measure of inequality that is based on the social welfare function. This is proving to be difficult as there has not been an agreement on what exactly the welfare function should be. Using the perhaps most accepted class of functions that is the additive, concave welfare function presented in (11), Atkinson (1970) proposed a corresponding measure

\[
A = 1 - \frac{n}{1} \left( \sum_{1 \leq i \leq n} \left( \frac{X_i}{\mu} \right)^{1-e} \right)^{\frac{1}{1-e}}, \tag{12}
\]

where \( e > 0 \) determines the "inequality aversiveness". Thus, a higher value of \( e \) makes \( A \) become more sensitive to transfers among poor individuals and at the same time less sensitive to transfers among rich individuals. This measure is not only scale-invariant and satisfies the principle of transfers, but also can its sensitivity be adjusted flexibly and be based on different theoretical approaches. Consequently, \( e \) can be chosen corresponding to the portions of the distributions that are most relevant to the analysis.\(^{12}\)

In sum, the requirement that inequality measures are scale-invariant and also satisfy the principle of transfers leaves three measures: the coefficient of variation, the Gini index and Theil’s measure. While the coefficient of variation does not react on the disposition of the distribution and is therefore characterized by "flat" sensitivity, the Gini index is most sensitive to transfers among middle income recipients and the Theil measure is most sensitive to transfers among the less endowed. Consequently, if we assume diminishing marginal utility of income, Theil’s measure arguably represents the most suitable measure for income inequality. Many economists have taken the position that inequality measures should be derived from a social welfare function, which is to be speci-
Table 1. Measures of inequality

<table>
<thead>
<tr>
<th>Measure</th>
<th>Scale invariance</th>
<th>Principle of transfers</th>
<th>Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficient of variation, V</td>
<td>x</td>
<td>x</td>
<td>Flat</td>
</tr>
<tr>
<td>Mean deviation, D</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gini Index, G</td>
<td>x</td>
<td>x</td>
<td>In the middle of the distribution</td>
</tr>
<tr>
<td>Theil’s measure, T</td>
<td>x</td>
<td>x</td>
<td>In the lower tail of the distribution</td>
</tr>
<tr>
<td>Variance of the logarithms, L</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atkinson Index, A</td>
<td>x</td>
<td>x</td>
<td>Flexible</td>
</tr>
</tbody>
</table>

(Source: Own representation)

fied first. However, there has not been an agreement on the form of a welfare function. In contrast, the Lorenz dominance criterion is virtually unquestioned. In this study, marginal diminishing utility of income is assumed and Theil’s measure will be used as the inequality measure in part 5.

3 A selective literature review

Since this paper aims to point to welfare consequences of income inequality, a welfare indicator is required. It is obvious to consider economic growth, which is mostly (albeit questionably) associated with welfare. Thus, the first subsection discusses the relationship between income inequality and growth. In the second subsection, evidence is illustrated that shows that private consumption is a more suitable welfare indicator.

3.1 Inequality and growth

Welfare is often associated with economic growth. Both cross-country and country case studies provide overwhelming evidence that economic growth is the most influential instrument for worsening as well as improving the quality of life in developing countries. Rapid and sustained growth is essential for progress towards the Millenium Development Goals13 and a positive relation-

13See, for example, Adams (2003), Ravallion and Chen (1997), OPPG (2005), Rodrik (2008).
ship between income and quality of life in general is found. Key research findings include that higher income levels diminish infant mortality\textsuperscript{14} and are positively related to the primary and secondary school inscription rates.\textsuperscript{15} Moreover, fewer diseases occur in wealthier countries.\textsuperscript{16} In addition, per capita income levels are positively associated with life expectancy.\textsuperscript{17} It has been established that economic growth increases human development by creating employment opportunities and giving incentives for parents to invest in their children’s education. Human development that has been advanced by growth, in turn, can promote economic growth if an investment in education leads to a strong and growing group of entrepreneurs: a greater amount of entrepreneurs can be able to generate pressure for improved governance.\textsuperscript{18} However, the extent to which growth reduces poverty is dependent upon the speed and the pattern of growth. Growth reduces poverty faster the closer poor people are involved in the growth process.\textsuperscript{19}

The question arises whether income inequality is related with growth. Simon Kuznets was the first economist who attempted to measure inequality in society and to determine the relationship between inequality and growth, using US data based on income tax returns from 1913 to 1948. He theorized that inequality follows the form of a bell-shaped curve. He argued that inequality increases in the progress of industrialization and economic development and decreases afterwards.\textsuperscript{20} Before the industrialization, small freeholds and family farms formed agriculture. The natural scope of family labor and the abilities of the village craftsman determined the income from work. The emergence of cities and factories introduced a division of labor that brought a higher standard of living for the working class in the growing cities. This development let economic inequality increase since the urban group obtained more income than the people living in rural areas. Later, the rural population diminished due to migration to the cities and the industrialization of agriculture which displaced the farmers from their land. As the rural population declined in relation to the total population so too did the income gap between the two groups. Thus, inequality would diminish as incomes continued to increase due

\textsuperscript{14}Pritchett and Summers (1993), Bhalotra (2006).
\textsuperscript{15}HMT (2005).
\textsuperscript{16}UNDP (2004).
\textsuperscript{17}Barro and Sala-i-Martin (1995).
\textsuperscript{18}UNDP (1996).
\textsuperscript{19}HMT (2015).
\textsuperscript{20}See Kuznets (1955).
to a population transition from primarily rural to primarily urban. Because Kuznets was aware that cities are characterized by economic diversity and are naturally more unequal than rural areas, he thought it was unlikely that the distribution of income would return to an egalitarian starting point. However, he argued that as industrial development deepened, unionization and social democracy would be reinforced and prevent an increase in inequality. It had the consequence that overall inequality would fall as industrialization matured. The result is a clear bell-shaped relationship between income inequality and growth.

Empirical studies on the existence of the Kuznets-curve have been inconclusive. Tsakloglou (1988) defends the inverted-U hypothesis, while Anand and Kanbur (1993) and List and Gallet (1999) criticize the standard form of the relationship between inequality and growth. Randolph and Lott (1993) find a negative nexus between inequality and growth but argue that the impact of development upon equalization is weak and the effects are slow. More recent studies on the relation between income and globalization find evidence for an existence of the Kuznet’s curve (Milanovic 2005, Kratou and Goaied 2016). These mixed results should be no surprise considering that a sample from a bell-shaped distribution can show a positive, negative, or zero slope. This is because the analysis depends on the places and times that fall within the sample.

Piketty (2014) emphasizes that Kuznets did great work in developing the first statistical series on inequality. However, he claims that the empirical basis of Kuznets’ “magical theory” is questionable; the decline in income inequality between 1914 and 1945 is rather a result of the world wars in almost all rich countries. Furthermore, inequality has increased from the 1970s on in high income countries such as the US. Figure 2 represents the process of the income share of the upper decile in the American national income from 1910 to 2010. Inequality declined in the period 1913-1948 and leveled off in the years from 1950 to 1970 at a lower level. It followed an opposing change in the 1970s where inequality increased. In the period 2000-2010, the upper decile enjoyed a share of 45%-50% of the national income.

Kuznets was aware that external shocks related with the global economic crisis and World War II played a significant role in the development of income inequality.

21 For an overview of more studies on this topic see Thorbecke and Charumilind (2002).
inequality. Nevertheless, he was convinced of the internal logic of the economic development that could have led to the same result, regardless of political interventions: inequality rises in the beginning phases of industrialization\(^{22}\) and gradually recedes of its own accord during the later process of development\(^{23}\) (Kuznets 1955: 12-18). Piketty stresses that inequality is increasing since the 1970s and that the rapid growth of less developed countries such as China has reduced global inequality (Piketty 2014: 31). This casts serious doubt as to the inevitability of the balanced growth path described by Solow and Kuznets and the assumption that everything proceeds at the same speed (Piketty 2014: 32). He not only emphasizes the fact that capital is gaining in importance but also predicts a further increase in income inequality in the next decades. Figure 3 shows the total value of private wealth in Germany, France and Great Britain in the period 1870-2010 in relation to the annual national income. In the end of the 19th century wealth flourished. There was a downward trend afterwards in the years from 1914 to 1945, but wealth has risen continuously again since the 1950s. At the beginning of the 21st century private wealth appears to reach the same high percentage level it had before the World War II; privately held capital amounts to five times annual national income.

Galbraith (2012) developed an augmented version of the Kuznets curve by focusing only on earnings. He highlights that the relationship between income

\(^{22}\)Only a minority benefits from the newly created wealth.

\(^{23}\)Now a growing proportion of the society switches to the promising economic activities, which automatically yields a decline in inequality.
inequality and growth based on Kuznets’ theory is strictly limited to earnings. Furthermore, he argues that the essence of it is no general pattern in the relationship between the two variables of interest but rather a statement of principle: the change in earning inequality is determined to a substantial extent by intersectoral transitions. Galbraith (2012) limits his investigation of the potential relationship between inequality and development proposed by Kuznets to earnings (pay for work), using the UTIP-UNIDO global data set.\textsuperscript{24} He finds a correlation: in most countries it is a downward sloping relationship; strong growth mostly lowers inequality. What is to say, though, is that there are exceptions at the lower and the higher tail of the distribution. China as a low-income country is still transforming from agriculture to industry, thus inequality is positively associated with more rapid growth there. It is characterized by a vast reserve of peasantry (even though it is known for the world’s largest cities), which is why it represents Kuznets’ classic version of early development. Yet, apart from sub-Saharan Africa where the canonical transition of agriculture to industry never seriously got underway, most countries have already passed the early stages of industrialization. Rich countries, such as the US, UK and Japan are on upward-sloping income inequality surfaces. They are engaged in the world’s capital market and supply financial services, implying that the highest incomes vary with the business cycle (Galbraith 1998, Conceição and Galbraith 2002). During booms where investment is rapidly growing and exports are rising the high income sectors (i.e. technology and finance) are associated with rapidly rising income, since activities in the capital markets mostly form part of these incomes. Thereby, rising income is accompanied by increasing inequality of incomes. The augmented Kuznets curve created by Galbraith shows these

\textsuperscript{24} For more details on the data set, see chapter 2 in Galbraith (2012).
phenomena and has the form of a sideways inverted S. Figure 4 represents a stylized illustration with selected countries in illustrative positions.

![Galbraith's augmented Kuznets curve](image)

**Figure 4. Galbraith’s augmented Kuznets curve.** *(Source: Galbraith (2012), own representation)*

Overall, Galbraith finds a clear negative relationship between inequality and national income for most countries, while China as a less developed country remains on a trajectory with a positive slope and the relationship may reverse for the highest income countries. This result is consistent with great parts of Kuznets’ argumentation, except the persisting equality after industrialization. Therefore, if only earning inequality is considered the Kuznets curve can be defended to a certain extent. However, it is without doubt that total income inequality is increasing in high income countries in recent decades, which contradicts Kuznets’ theory.

Several economists have turned to another research question. Instead of investigating a possible pattern of inequality in the development process, they are interested in finding out whether the level of inequality has an impact on the speed of growth. This approach presumes that Kuznets was incorrect in regards to the determination of inequality; the initial level of inequality is more often than not a policy choice than a structural outcome. Yet, it is difficult to test a consistent impact of the level of any variable on a subsequent rate of change in another variable. Different starting points, with different initial levels of income inequality and various time intervals will bring diverse results. Empirical evidence on the effect of inequality on growth has been inconclusive so far (Alesina and Rodrik 1994, Persson and Tabellini 1994, Perotti 1996, Barro 2000, Forbes 2000, Dollar and Kraay 2002, Panizza 2002, Banerjee and Duflo
De Dominicis et al. (2008) show in a meta-analysis of more than 400 estimates that the estimation method, data quality and sample play a significant role in estimating the impact of income inequality on growth. Therefore, evidence constitutes an empirical puzzle and no general consensus exists.

The inconclusive empirical results are no surprise considering the theoretical ambiguity. Various countervailing mechanisms might be at work and the direction of the causation is unclear. Inequality could affect growth positively. According to the classic approach, wealthier people have a higher saving rate and as there is a positive relationship between the investment rate and the saving rate, countries that are more unequal experience faster growth (Smith 1776, Keynes 1920, Lewis 1954, Kaldor 1957, Bourguignon 1981). Inequality could also affect growth in a negative way; mainly, through three channels. First, through socio-political instability, which can be the result of large inequalities as people are more likely to engage in illegal activities. This, in turn, deters investment (e.g. Perotti 1996). Second, through endogenous fiscal policy. The demand for re-distribution is higher in countries with high inequality, which creates distortions and affects growth negatively (Alesina and Rodrik 1994). Third, through credit market imperfections. If people are not able to borrow, inequality leads to an under-investment in human capital and therefore a lower productivity and less economic growth (e.g. Galor and Zeira 1993).

Galor and Moav (2004) provide a rationalization of the supposedly contrary impacts of income inequality on growth at different stages of development. In their growth theory, the prime engine of economic growth is endogenously changed; in the course of the Industrial Revolution there is a replacement of physical capital accumulation by human capital accumulation. This replacement alters the way in which the process of development is affected by inequality. In the early stages of the industrial revolution, inequality ensures that the resources are channeled towards people with a higher marginal propensity to save. Hence, the process of development is stimulated. In the further course, equality alleviates the detrimental effect of credit constraints on human capital accumulation and enhances the growth process. With their theory, the authors provide an intertemporal reconciliation of the two fundamental approaches. The classical approach (inequality channels the resources to the part of the population that saves the most, which enhances capital accumulation and therefore development) and the capital market imperfection approach (the inverse effect of credit
constraints on human capital investment is alleviated by equality in sufficiently wealthy economies and thereby economic growth is stimulated). The former reflects the state of a country in early phases of industrialization with physical capital accumulation as the prime engine of growth. The latter approach reflects later stages of development with binding credit constraints and human capital accumulation becoming the driving force. It is essential to recognize the asymmetry of human capital accumulation and physical capital accumulation: unlike physical capital, human capital is inherently embodied in people, which brings physiological constraints and therefore diminishing returns of individual accumulation. Consequently, the level of human capital would be higher if its accumulation was broadly spread out in society, while distribution is largely irrelevant for the productivity of the physical capital stock. This asymmetry points out that with binding credit constraints equality has a positive impact upon human capital accumulation, whereas provided that the saving rate rises with income, inequality lets physical capital accumulation increase (Galor and Moav 2004).

There are supporting empirical findings concerning the theory of Galor and Moav (2004). Both Abramovitz and David (2000) and Goldin and Katz (2001) propose that from 1890 to 1999 in the U.S. human capital accumulation nearly doubled in its effect on economic growth, whereas physical capital declined significantly in its contribution to the growth process. There is also evidence from the process of industrialization in England where a gradual gain in importance of the human capital accumulation can be observed relative to physical capital. In the early stages of the Industrial Revolution (1760-1830), literacy rates did not increase and working skills were obtained primarily by on-the-job training, while physical capital accumulation as a fraction of GDP rose significantly (Green 1990, Mokyr 1993, Sanderson 1995). In the later stages of development, however, skills became indispensable for production and the education of the working force rose considerably while capital accumulation subsided. This is evidenced by the investment ratio which experienced an upward trend from 6% percent in 1760 to 11.7% in 1831 and maintained the level of 11% on average from 1856 to 1913 (Matthews et al. 1982: 137, Crafts 1985: 73). In contrast, the school enrollment rates of 10 year olds markedly rose from 40% to 100% in the period 1870-1900 (Clark 2003).

The essence of this theory is that the impact of inequality upon growth hinges upon the relative return to human capital and physical capital. This means inequality is beneficial for economic growth in countries in which the return on
physical capital is greater than the return on human capital. Equality, in contrast, is profitable in economies that are characterized by a lower return on human capital than on physical capital. However, according to Galor and Moav (2004), the prime insight of their study is in regards to the nexus between growth and development in less developed countries (LDCs). The change of the prime engine for economic growth (from physical to human capital accumulation) in the currently well developed countries may be essential for explaining the role of income inequality in their development process. Yet, in some of the current LDCs, credit constraints are alleviated through international capital inflow and thus the stimulating effect of inequality on physical capital accumulation is diminished. Moreover, the positive impact of equality upon human capital and therefore growth is strengthened through the adoption of skill-based technologies, which leads to a greater return on human capital.

To summarize, Galbraith (2012) has shown that there is no universal relationship between growth and income inequality as Kuznets proposed. Piketty (2014) highlights that inequality is increasing in rich countries and also contradicts Kuznets’ theory of a bell-shaped correlation between income inequality and economic growth. The research question asking whether income inequality fosters slow or rapid growth has been inconclusive so far (e.g. Forbes 2000, Baumol 2007). Galor and Moav (2004) argue in this context that the effect of income inequality on economic growth depends not on income but on the relative return on human capital to physical capital. The missing consensus concerning the empirical evidence may be ascribed to the fact that empirical studies use samples with different time periods. In chapter 4, it will be pointed out that the prime channel through which inequality operates becomes obvious only after about 25 years.

### 3.2 Inequality and welfare

As seen in the previous subsection, the research on the relationship between income inequality and economic growth (which often is associated with economic welfare) has been inconclusive so far. Therefore, it is necessary to find an alternative indicator for welfare.

Since at least the research of both Pigou (1920) and Dalton (1920), the inequality-welfare relation has been becoming a subject of intense scrutiny. Pigou argued that inequality might primarily affect welfare through two channels, namely
The distributive efficiency argument is based on the law of diminishing marginal utility, meaning that one unit more of income has a greater effect on utility at the lower tail than at the higher tail of the income distribution.\textsuperscript{25} In the welfare-based inequality evaluation literature, this proposition has been extensively investigated with specifications of different social welfare functions; under certain conditions, there is a positive relationship between the social welfare function and the per-capita income and a negative relationship between the former and inequality (Atkinson 1970, Sen 1976).

If incomes are sufficiently high and basic needs are satisfied, well-being may not only be affected by individuals’ absolute level of income but also by their relative income.\textsuperscript{26} Empirical findings support this theory and income and wealth are included in the OECD’s “Your Better Life Index” (OECD 2011). Studies on the economics of happiness point to the “Easterlin Paradox” (Easterlin 1973). The Easterlin Paradox states that within countries happiness is related to higher income according to reports, although across countries there is no significant correlation between the two variables. Furthermore, numerous choice experiments have given rise to fairness as a personal motive affecting people’s behavior. Feelings of inequality aversion are accountable for people resisting outcomes they perceive as unfair (Fehr and Schmidt 1999, Carlsson et al. 2005, Dawes et al. 2007).

The traditional welfare approach has been criticized over the years. This is because different value judgments automatically come with different welfare functions (see section 2). Therefore, choices involve opinions on values and as a consequence varying policy recommendations on improving the well-being of people are suggested (Hoeller et al. 2012).

In addition, many economists argue that GDP is a weak measure of economic

\textsuperscript{25}On this issue Pigou (1920) wrote: “Nevertheless, it is evident that any transference of income from a relatively rich man to a relatively poor man of similar temperament, since it enables more intense wants, to be satisfied at the expense of less intense wants, must increase the aggregate sum of satisfaction. The old ‘law of diminishing utility’ thus leads securely to the proposition: Any cause which increases the absolute share of real income in the hands of the poor, provided that it does not lead to a contraction in the size of the national dividend from any point of view, will, in general, increase economic welfare.”

\textsuperscript{26}Pigou (1920) stated: “[...] a larger proportion of the satisfaction yielded by the incomes of rich people comes from their relative, rather than from their absolute, amount. This part of it will not be destroyed if the incomes of all rich people are diminished together. The loss of economic welfare suffered by the rich when command over resources is transferred from them to the poor will, therefore, be substantially smaller relatively to the gain of economic welfare to the poor than a consideration of the law of diminishing utility by itself suggests.”
welfare.\textsuperscript{27} Albig et al. (2017) state that the development of income inequality in Germany might have brought a rise in the external trade balance. In particular, the imports might have been restrained due to the lower domestic demand resulting from inequality. According to the authors, this clearly shows that the debate on the consequences of increasing inequality is wrongly focused on the negative impacts on the GDP. In fact, these are diminished by the expansion of the external trade, which is contrary to the domestic economic slowdown. In their view, with regard to welfare and the quality of life of the people private consumption should rather be taken as a benchmark.

On an individual level, ample research establishes that income is not a good indicator for well-being. The trend of increasing income inequality contributed to increases in the dispersion of the permanent component of income as well as to an increase in the volatility of the transitory component of income.\textsuperscript{28} However, considering the distribution of current income might not be sufficient if the aim is to point to the welfare impact of these changes. As most studies measure inequality using annual income data, one must deal with the difficulty that current income indicates greater inequality than that which actually exists in permanent income, if everyone goes through a life-cycle current-income path.\textsuperscript{29} Additionally, transitory changes in income that many people may experience cause the distribution of annual income to suggest more inequality than actually exists.\textsuperscript{30} Moreover, the impact of current or permanent income inequality on welfare distribution is very much dependent on the structure of credit and insurance markets available to agents for smoothing income fluctuations.\textsuperscript{31} Thus, income might not represent an appropriate measure of welfare.\textsuperscript{32} On these grounds, several authors have moved beyond income and earnings as indicators of well-being and have examined the distribution of individual or household consumption. Cutler et al. (1991) and Slesnick (2001) were among the first to exhibit different trends in income and consumption inequality. Further contributors include Johnson and Shipp (1997), Mayer and Jencks (1993), Slesnick (2001), Deaton and Paxson (1994), Dynarski et al. (1997), Blundell and Preston (1998), Fisher et al. (2013), and Krueger and Perri (2003).

\textsuperscript{27}Stiglitz et al. (2010) give an overview of the criticism.
\textsuperscript{28}See, for example, Katz and Autor (1999) or Gottschalk and Smeeding (1997).
\textsuperscript{29}See Fisher et al. (2013).
\textsuperscript{30}See Fisher et al. (2013) for examples.
\textsuperscript{31}See, for example, Krueger and Perri (2006).
\textsuperscript{32}Blundell and Preston (1998) establish theoretical conditions under which the cross-sectional distribution of current consumption is a sufficient indicator for the cross-sectional distribution of welfare.
Further alternatives to income have been suggested as a welfare indicator. The approach of Nussbaum and Sen (1993) is based on capabilities rather than on income, whereat capabilities mean the opportunities people have to achieve their goals. Therefore, equality of opportunity is advocated and even a high level of inequality may be justified if it is ensured that it does not result from an inequality of opportunity. However, inequality of opportunity can also be affected by income inequality if necessary services such as health care depend on income. Income inequality would then be reinforced and inequality of opportunity constitutes a significant reason for it.

Related to this issue, researchers also explored the nexus between income inequality and health, which is reasonably related to individual welfare. Yet, the evidence on the link between the two variables is still inconclusive, particularly in rich countries (Leigh et al. 2009, Wilkinson and Pickett 2010). This is very likely due to data limitations which prevent studies from finding significant results on the direction of causality between inequality and health (Hoeller et al. 2012).

Other economists combine different indicators such as consumption, leisure, and mortality to create a measure of welfare, using an expected utility framework (Nordhaus and Tobin 1972, Jones and Klenow 2016).\(^{33}\)

To recapitulate, the traditional welfare approach has been criticized due to value including social welfare functions (Hoeller et al. 2012). Also, (national) income has not been considered as a suitable welfare indicator by many economists (Stiglitz et al. 2010). Instead, different measures of welfare including several indicators have been created by using an expected utility framework (Fleurbaey 2009). Yet, there is no consensus of what exactly welfare or well-being is defined by. What most economists have in common, however, is that they include private consumption in their welfare considerations. As this paper intends to show the macroeconomic effects of income inequality on the basis of a model, a single variable is preferable which reasonably captures the welfare of a country. Thus, private consumption is used as a welfare indicator in this thesis.

\(^{33}\)Fleurbaey (2009) sorts through the attempts at constructing measures of welfare.
4 The macro economic effects of inequality

In order to be able to make a statement on how income inequality affects social welfare, one needs to be aware of the different channels through which inequality affects the welfare indicator (private consumption). In this section the macroeconomic effects of income inequality are examined. Relevant theories are introduced and supporting empirics that have been found are put forward. This thematically focused survey sets the stage for section 5 in which the long term effect of income inequality is then shown on a basis of an endogenous growth model.

4.1 Standard effects of inequality

According to the Slutsky equation, there are two economic standard effects; the income effect and the substitution effect. First, we give consideration to the income effect. With increasing inequality, rich people become richer and poorer people hold less money. According to the textbook approach, wealthy people save more which yields a higher level of aggregate saving and enhances productivity and growth. Yet, development economists argue that the less endowed are not able to invest in human capital and a higher level of inequality deteriorates this situation. This, in turn, lowers the productivity. Second, the substitution effect means that adverse effects are at work. If we follow again the textbook approach the work incentives increase with rising inequality and therefore overall productivity rises, too. It is crucial, therefore, to carefully investigate the impact of income inequality upon aggregate saving, human capital and work incentives and its consistencies.

4.1.1 Income effect

The correlation between income inequality and saving is analyzed before the correlation between the former and human capital is investigated. As regards saving, there are two different strains of literature that are of great importance. On the one hand, the historical growth literature and the neoclassical consumption theory and on the other hand the political-economy research. While the former deals with direct effects and states that aggregate saving increases with rising inequality, the latter considers indirect effects (e.g. through investment or socio-political instability) and concludes from different theories, saying that aggregate saving can increase or decrease. However, the important point
concerning the political-economy research approach is that there are several approaches suggesting that inequality causes the aggregate saving to decrease, which contrasts with the first literature strain.

The historical growth literature and neoclassical consumption theory primarily constitute four direct effects: (i) links between saving and functional distribution of income; (ii) interrelations between saving and the personal distribution of income; (iii) precautionary saving; and (iv) implications of borrowing constraints.

The relation between the functional distribution of income and saving (and growth) is the core of both the neoclassical growth model (Solow 1956) and the neo-Keynesian growth models (Lewis 1954, Kaldor 1957, Pasinetti 1962). They are all characterized by an equilibrium by nature, with saving and income distributions as endogenous variables. However, they differ in there assumptions about saving patterns. In the neoclassical approach, workers and capitalists have the same saving behavior. In contrast, Kaldor (1957) and Lewis (1954) assume that capitalists save more than workers. Lewis (1954) argues that entrepreneurs save a high fraction of their incomes and contribute most to the national saving. In the simplest version of Kaldor’s 1957 model, the worker’s propensity to save is zero and the capitalists’ propensity to save inversely determines the share of profits in national income. The assumptions of Pasinetti (1962) focus more on the classes of individuals than on classes of income; however, the implications for the share of profits in income correspond to those obtained by Kaldor.

The links between saving and the personal distribution of income in neoclassical consumption theories result from the assumption of consumer heterogeneity and a non-linear relationship between individual saving and income (unlike the exogenous distinction between savers and non-savers the classical theories just referred to). A starting point is the life-cycle hypothesis that has been amended to include bequests (e.g. Kotlikoff and Summers 1988). The original hypothesis is that old people dissave and younger people save more to accumulate income for their old age. However, there have been found high saving rates among elderly people which let economists consider bequests as a saving motive as well. If bequests are seen as a luxury then the saving rates among wealthier consumers are higher. An alternative way through which income inequality may matter for aggregate saving is that if there are diminishing returns to human capital the poor invest more (Becker 1994). As in the national income accounting
investment in human capital is classified as consumption, a higher investment level indicates a lower saving rate. Consequently, low income recipients appear to have a higher saving rate than rich people.

Precautionary saving also implies a correlation between income distribution and saving. Less endowed consumers who hold low assets tend to compress consumption. Therefore, their marginal propensity to consume out of additional income is higher compared to consumers with large assets as they want to avoid a reduction of their precautionary balances. This suggests that a redistribution towards the poor would lead to a lower level of aggregate saving since the poor would devote most of any extra income to consumption (Carroll and Kimball 1996).\(^{34}\)

If some consumers are not able to borrow, binding borrowing constraints exist which forge another correlation between saving and income distribution. Given the inability to borrow against future income, assets are used to buffer consumption. Particularly, consumers accumulate assets in good times and live by them when earnings are low (Deaton 1991). If poorer individuals are more likely to be affected by borrowing constraints than wealthier individuals, then a re-distribution from the latter to the former makes borrowing constraints less likely to bind and cause the aggregate saving to decrease (Schmidt-Hebbel and Serven 2000).

In sum, the theories examined so far imply that there is a positive impact of income inequality on saving. The main declarations are that capitalists save more and the propensity to save is higher among wealthier consumers, with the result that a more unequal distribution enhances aggregate saving.

The political-economy literature has an alternative approach and points to indirect effects of income inequality through third variables, primarily investment and socio-political instability. One line of argument is that a high level of income inequality causes social tension and political instability; this, in turn, reduces the returns to investments because of an increased uncertainty. As a result, investments drop along with negative effects for productivity and thus growth (Alesina and Rodrik 1994, Persson and Tabellini 1994, Alesina and Perotti 1996, Perotti 1996).

Additionally, taxation may be a way through which an unequal distribution

\(^{34}\)The opposite can also be the case. If poor individuals appear to be more risk averse or face greater uncertainty than the rich, a transfer from the latter to the former would yield a higher level of aggregate saving (Schmidt-Hebbel and Serven 2000).
affects growth. If in a voting process, the decisive voter is poor compared to the average, the tax price of redistribution is relatively low for this individual. As a consequence, inequality is positively associated with the level of taxation, as shown in voting models by Romer (1975), Roberts (1977) as well as Meltzer and Richard (1981). Therefore, in more unequal societies, the demand for redistribution (and therefore taxation) is higher; the implication is that returns to investments in physical and human capital fall and thus suppress investment, productivity and growth (e.g. Alesina and Rodrik 1994). Relating these links with the impact of income inequality upon saving, it implies that if saving is positively correlated with economic growth (as in the growth models), income inequality affects saving negatively through the mentioned channels. This is in contrast with the theories of the historical growth literature and neoclassical consumption theory presented above, stating that inequality decreases saving.

As the two differing literature strains that were discussed point to opposite effects, it is necessary to consider what effects have been empirically observed. However, empirical studies on the effect of income inequality on saving are rather scarce. Tests based on micro-data indicate mostly that aggregate saving increases with rising inequality. Saving out of non-labor income is found to exceed the saving out of labor income, which supports the Neo-Keynesianism (Houthakker 1961, Williamson 1968, Kelley and Williamson 1968, and Gupta 1970). Moreover, households surveys typically show that the saving rate of high-income households is greater than the one of low-income households (Bunting 1991, Dynan et al. 2004). This is in line with the neoclassical consumption theory, particularly, with the link between saving and the personal distribution of income. Precautionary saving is another link put forward by the neoclassical consumption theory. It is demonstrated by a proof of the concavity of the consumption function. To summarize, empirical studies which are based on micro-data often provide evidence of the theories of the first literature strain, namely the historical growth literature and the neoclassical consumption theory.

However, studies which are based on macro-data (cross-country data) are more ambiguous. While there are papers pointing to a positive nexus between income inequality and saving (Sahota 1993, Cook 1995, Hong 1995, Edwards 1996), there are also studies indicating a negative relationship (e.g. Venieris and Gupta 1986) or no consistent effect at all (Della Valle and Oguchi 1976, Musgrove 1980, Schmidt-Hebbel and Serven 2000). This is consistent with the theoretical ambiguity. Yet, it may be caused by the fact that cross-country
studies have different time coverages and use various saving measures (gross domestic savings or gross national savings) and income distribution data of highly heterogeneous quality, applying both income-and expenditure-based measures (Schmidt-Hebbel and Serven 2000, Smith 2001).

Cross-country research suggests that rising inequality increases saving if there are credit market imperfections; otherwise the effect diminishes or even disappears. This is supportive of the theory of borrowing constraints from the first literature strain. Countries with greater financial depth face a weaker effect of inequality on saving. Therefore, credit market imperfections, which occur primarily in less developed countries, may be a reason for the occasionally observed positive pattern between inequality and saving (Smith 2001).

The political-economy research approach that considers third variables through which inequality affects saving, makes primarily use of cross-country data and points to a negative relationship between the two variables of interest which contrasts to the theories of the first literature strain. It is therefore of particular interest to give considerations to the empirical findings of this approach. Its first line of argument is supported by the finding that income inequality leads to socio-political instability, which, in turn, lowers aggregate saving. Alesina and Perotti (1996) show that a higher level of income inequality leads to socio-political instability and a lower level of investment, lessening the productivity. They further test for a direct link between higher income inequality and lower investment and find only a small effect after controlling for political instability. Socio-political instability is measured by a constructed index, using the method of principal component to variables capturing social unrest.\textsuperscript{35} Perotti (1996) uses the same index for socio-political instability and can replicate the findings of a positive relationship between inequality and instability and subsequently less investment. From the viewpoint of saving, the positive nexus between inequality and instability implies that saving decreases, as Venieris and Gupta (1986) find a negative dependency of saving on socio-political instability.

Regarding the inequality-redistribution link, stating that in more unequal societies the demand for redistribution is higher, which lowers the level of investment and therefore growth, there is adverse empirical evidence. Perotti (1996) and Easterly and Rebelo (1993) find no effect of income distribution on investment and Venieris and Gupta (1986) argue that a redistribution favoring the middle and lower income groups actually enhances saving and growth.

\textsuperscript{35}For example, the number of the politically motivated assassinations, the number of successful coups and the number of people killed as a fraction of the total population.
Alesina and Perotti (1996) provide a theory why this might be the case. On the one hand, according to Neo-Keynesianism, saving and investment increase with increasing inequality as rich people save more than the poor; on the other hand, referring to Alesina and Rodrik (1994), the demand for redistribution might be higher which lowers the investment. As the two channels go in opposite directions, these effects may cancel each other out. After testing for socio-political instability they only find little effect of inequality on investment which the authors consider as a proof of their theory.

To recapitulate, empirical tests that are based on micro-data often support the theories of the historical growth literature and the neoclassical consumption theory, stating that inequality causes the aggregate saving to rise (e.g. Dynan et al. 2004), whereas macro-data based studies come to diverse conclusions but also show that inequality operates through third variables and yields a lower level of saving (Perotti 1996, Venieris and Gupta 1986). Moreover, cross-country studies as well demonstrate that credit market imperfections are accountable for the occasionally observed positive nexus between income inequality and saving (Smith 2001). However, two additional points are important to mention. First, national income accounting classifies human capital as consumption. This may explain at least part of the positive effect of income inequality on saving. With higher inequality and binding borrowing constraints fewer people are able to borrow and invest in human capital (=consume). Thus, human capital (consumption) drops and the savings seem to rise (Smith 2001). Second, a very recent study that investigates the macroeconomic implications of changes in income distribution in Germany, makes an important contribution. In a simulation model, Albig et al. (2017) find that inequality only has an effect on saving in the short run (<10 years) and is compensated afterwards through other effects. Therefore, it can be arguably concluded that the effect of income inequality on saving (if any) may be only temporarily.

The correlation between income inequality and human capital forms the second aspect of the income effect. Development economists state that a higher level of inequality decreases the human capital of the poor as they cannot afford to invest in it and, therefore, economic growth is hindered. This process is intensified by dissaving or unproductive investment by the rich (To-daro 1997). There are three major theories: (i).links between borrowing constraints and human capital; (ii).links between human capital and the fertility

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36 Increasing work incentives in the medium term and decreasing human capital in the long term, as is explained later.
decision; and (iii) the nexus between volatility and the level of human capital.

If individuals are not able to borrow freely, the level of human capital drops and consequently there will be a downturn of the productivity and growth. This link between income distribution, borrowing constraints and society’s aggregate investment in human capital was emphasized in a pioneering paper of Galor and Zeira (1993). With existing borrowing constraints, the initial endowment of resources of the people is decisive for the pattern of investment and hence for growth. Such a model puts forward that people in the lower tail of the income distribution are likely to be most affected by borrowing constraints. The general conclusion is that a re-distribution favoring low income recipients would cause the level of human capital to increase and consequently growth to rise. This can lead to a so-called dynasty caught in a poverty trap. Since the marginal utility of consumption is very high at low levels of consumption, poor individuals who cannot borrow, rather consume than invest in human capital and children find themselves in the same starting position as their parents (for a representative agent model based on this chain of effects, see De Gregorio (1996)). As a result, the aggregate level of human capital decreases with increasing income inequality.

The theory of the education and fertility decision deals with the interaction of income distribution, education, fertility and capital market imperfections. The model of Galor and Zang (1997) is the only one including all these components. Given the distribution of income, a higher fertility rate is associated with fewer children enrolled in school, as with fixed costs of education and borrowing constraints a higher fertility rate goes along with lower financial resources for the education per child in a family. To put it differently, given the fertility rate, a more unequal distribution is correlated with lower school enrollment ratios due to the inability to borrow against future income. It is important to note, however, that the fertility decision is not endogenized in the model. Representative agent models of growth have been used instead to study the joint decision about fertility and education (e.g. Becker and Barro 1988 and Becker et al. 1990). If one interprets the representative agent as a dynasty and uses a simple compositional argument to vary the initial level of human capital of a dynasty, it is possible to surmise the predictions of these models concerning the

37 However, in very poor societies, there is the possibility that only the rich can afford to invest in human capital and thus a concentration of wealth among them would maximize the level of human capital. Consequently, there would be a positive nexus between inequality and human capital (Aghion and Bolton 1997, Perotti 1993).
nexus between the distribution of human capital and the decision of investment and fertility (Perotti 1996). The decision about fertility and education is based on the interaction of the direct costs of raising a child and the opportunity costs of investment in human capital of the parents. An increase of the parents’ human capital affects the fertility rate in two ways. The income effect causes a higher demand for children on the one side, but due to an increase in the opportunity costs of raising children the substitution effect implies less demand for children. At low levels of human capital, the opportunity costs of human capital are low and the direct costs of raising children are paramount. Thus, an increase of the parents’ human capital affects the total cost of raising children only slightly; the income effect prevails and the demand for children increases. On the contrary, at high levels of human capital, the opportunity costs of human capital are significant, which is why the substitution effect prevails; with an increase of the parents’ human capital the demand for children falls. If we now imagine a redistribution of human capital favoring the less endowed, anticipating that the substitution effect of a rise of human capital prevails, the rate of return on investment in education for poor individuals would increase with the result that their demand for children would probably fall. The redistribution would likely yield higher aggregate school enrollment ratios if, at low levels of human capital, the elasticity of the demand for children to human capital and the elasticity of the demand for human capital investment to the rate of return is given to be sufficiently high. We can extend this thought now and speculate reasonably that a distribution of income would indicate a positive correlation between equality and investment in human capital (Perotti 1996).

With respect to the link between income inequality and volatility, there is a theory of the so called vicious cycle, stating that income inequality causes volatility, which is accountable for higher unemployment and a downturn of wages and investment in physical as well as human capital. This causes again a higher level of income inequality. Thus, Stiglitz (2012) argues that volatility not only has a direct effect on the level of human capital but also an indirect effect through income inequality. A higher level of income inequality causes economic fluctuations. With a skewed income distribution, the aggregate demand is likely to decrease and the interest rate is lowered in order to maintain full employment. This, in turn, causes an economic bubble and temporarily a sustaining consumption. As bubbles break at some point, the economy faces inconsistency. Volatility brings unemployment and, therefore, depresses the wages. The skills of unemployed individuals decrease, implying a lower aggregate level of human capital (ceteris paribus), and subsequently enhances income
inequality. Moreover, since unemployment is typically strongest among the least skilled, individuals at the lower end of the distribution have less human capital at the end of a crisis. This makes inequality more persistent. There are two more chains of effects starting from volatility. First, with existing economic fluctuations, the risk premiums rise and the wage shares are depressed in order to maintain the level of investment; depressed wage shares, in turn, are a source of income inequality. Second, volatility causes the risk premiums to increase, resulting in a fall of investment and an economic downturn. During downturns, the government expenditure for public education diminishes, leading to a lower level of human capital of the poor who are dependent on a public education system; and as already mentioned, a lower level of human capital is likely to increase income inequality. In sum, there is a two-way relation between income inequality and volatility. The latter may adversely affect human development directly through the loss of skills during unemployment as well as indirectly through the impact on income inequality (which weakens social expenditures through political economy effects). Stiglitz (2012) stresses that especially developing countries are likely to be affected by negative effects on human development as the combination of typical characteristics of less developed countries such as worse access to international financial markets, tighter budget constraints and weaker social protections make them more vulnerable to adverse shocks. Alesina and Perotti (1996) also emphasize the link between income inequality and economic fluctuations through the impact of inequality on political instability.

Empirical results testing the theories of the impact of income inequality upon human capital just presented are now considered. To econometrically evaluate the role of credit market imperfections in the transmission of the impacts of an income distribution, a measure of credit market imperfection is needed. If such a measure were available, one could interact it with the inequality variable and estimate its coefficient (Perotti 1996). However, this has proved to be complicated to implement, as only certain aspects of credit markets are captured by credit market imperfection data (Smith 2001). For example, one of the two variables from the IMF International Financial Statistics, the relative size of the financial sector to the economic activity as a whole or the share of credit to the nonfinancial private sector of GDP, are used to proxy credit market imperfections (King and Levine 1993, De Gregorio 1996, Edwards 1996, Smith 2001). Regressions using these variables often give inconclusive results (Perotti 1996). Another measure was assembled by Jappelli and Pagano 1994,
namely the loan-to-value ratio for home mortgages. Yet, it is only available for a few high-income countries. Perhaps not surprisingly, in their regressions, the coefficients of both the income distribution and the interaction terms are insignificant. In consequence, it is not trivial to test for the link between borrowing constraints and the level of human capital. Two sources can be mentioned. First, Perotti (1996) uses no direct measure for credit market imperfections but concludes indirectly that borrowing constraints do play a role as he finds that the investment in human capital (secondary school enrollment) is higher in more equal societies. Second, Smith (2001) as well supports this line of argument by finding that increasing income inequality together with credit market imperfections leads to a higher level of saving. As mentioned earlier, in national income accounting investment in human capital is classified as consumption; consequently, as saving increases consumption and therefore human capital decreases.

There is also empirical evidence for the theory that income inequality causes volatility, which reduces the investment in physical as well as in human capital. Income inequality is found to be positively correlated with volatility, whereat the standard deviation of the annual GDP growth rate is used to measure volatility (Hausmann and Gavin 1996, Breen and García-Peñalosa 2005). Cross-country studies also put forward that more fluctuations of the growth rate lead to a consistent reduction of the average rate of growth during that period. A significant source in this regard is the deterring effect of volatility on physical and human capital investment (Ramey and Ramey 1995, Inter American Development Bank 1995, Hausmann and Gavin 1996).

To summarize, income inequality adversely affects human capital directly and indirectly. The direct nexus exists because of the inability of the poor to invest and their lower opportunity costs for investment in human capital (Smith 2001, Perotti 1996). Human capital is indirectly affected by inequality through economic volatility and its deterring effect on investment in physical as well as in human capital (Ramey and Ramey 1995, Inter American Development Bank 1995, Hausmann and Gavin 1996). At his point, it is again important to mention the paper of Albig et al. (2017) in which the authors find in their simulation model that the negative effect of income inequality on human capital is a long term effect (>25 years). It is characterized by a delayed impact, whereat the negative effect of inequality on human capital increases with time. As already mentioned above, the negative effect of income inequality on saving exists only in the short term and is then overcompensated by its positive effect on
the work incentives (see next subsection). However, in the long term, income inequality appears to have a negative effect on human capital and thus productivity.

**Table 2. Effects of income inequality - Income effect**

<table>
<thead>
<tr>
<th>Theories</th>
<th>Empirics</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Saving</strong></td>
<td>Historical growth literature and neoclassical consumption theory</td>
<td>Studies based on micro data</td>
</tr>
<tr>
<td>- Ineq ↑ → Saving ↓</td>
<td>- Ineq ↑ → Saving ↓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Political-economy research</td>
<td>Studies based on macro data</td>
</tr>
<tr>
<td>- Ineq ↑ → Saving ↓</td>
<td>- Ineq ↑ → Saving ↓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Simulation model</td>
<td>- Ineq ↑ → Saving ↓ in the short term (&lt;10 years)</td>
</tr>
<tr>
<td><strong>Human capital</strong></td>
<td>Development economists</td>
<td>- Ineq ↑ → Human capital ↓</td>
</tr>
<tr>
<td>- Ineq ↑ → Human capital ↓</td>
<td>Simulation model</td>
<td>- Ineq ↑ → Human capital ↓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Ineq ↑ → Human capital ↓ in the long term (&gt;25 years)</td>
</tr>
</tbody>
</table>

(Source: Own representation)

### 4.1.2 Substitution effect

The textbook approach states that income inequality stimulates work incentives and therefore enhances productivity and growth (Aghion et al. 1999). However, there is also a theory of decreasing effort incentives in connection with borrowing constraints. Banerjee and Besley (1990) and Aghion and Bolton (1997) suggest that moral-hazard is the source of credit market imperfections; and the reason for moral hazard is the existence of limited liability, meaning that borrowers cannot pay back more than their wealth. Limited liability has crucial consequences. Suppose an individual without wealth borrows to invest in a risky project. It is assumed that the effort exerted by the agent determines the probability of success of the project. If the project scores success, the borrower gains the output minus the loan. However, if the project fails the individual incurs no loss as she has not used own funds. As a result, the lender would want the agent to choose a higher amount of effort than she would choose herself. Aghion et al. (1999) illustrate in their model that effort increases with the wealth of the agent. This is because the higher the amount the individual
needs to borrow in order to be able to start the project, the less is the amount of effort she chooses to devote, in that she has to share a greater proportion of the marginal returns with the lenders. The conclusion of their model is that re-distribution would have a positive effect on effort incentives.

In addition, three theories of development economists are relevant regarding the relation between income inequality and productivity in general. These theories should be taken into account as they suggest a negative effect of an income dispersion on productivity which contrasts to the idea of stimulated work incentives, enhancing productivity. As they are already presented partly in the preceding subsection, they are only explained briefly. The first proposes endogenous fiscal policy. In more unequal societies the demand for redistribution (and therefore taxation) is higher; the consequence is that returns on investments in physical as well as human capital fall and hinder investment, productivity and growth (e.g. Alesina and Rodrik 1994). The second emphasizes the impact of inequality upon socio-political instability. A higher level of income inequality causes social tension and political instability; this, in turn, reduces the returns on investments due to an increased uncertainty. This results in a drop in investments along with negative effects for productivity and growth (Alesina and Rodrik 1994, Persson and Tabellini 1994, Alesina and Perotti 1996, Perotti 1996). Lastly, the so called vicious circle is accountable for a lower level of investment and thus less productivity. Recall, that the chain of effects is such that income inequality causes economic volatility, which, in turn, lowers investment in physical and human capital and therefore productivity, making income inequality more persistent (Stiglitz 2012).

The empirical studies on these theories are considered once more to get an insight into which of them hold in practice. To observe the inequality and work incentives link is rather difficult. However, Albig et al. (2017) find with their simulation model that the negative effect of income inequality on saving and therefore productivity is overcompensated in the medium term (10-25 years) by a positive effect of income inequality on productivity. The authors suggest that the source of the latter effect is higher effort incentives.

No empirical evidence is found regarding the inequality-re-distribution link, stating that in more unequal societies the demand for redistribution is higher, which subsequently lowers the level of investment and therefore growth. Perotti (1996) and Easterly and Rebelo (1993) find no effect of income distribution on investment and Venieris and Gupta (1986) argue that a re-distribution favoring the middle and lower income groups actually enhances saving and growth.
The theory of socio-political instability is supported by Alesina and Perotti (1996) who show that a higher level of income inequality leads to socio-political instability, which, in turn, lowers the investment as well as the productivity. They also test for the direct link between higher income inequality and lower investment and find only a little effect after controlling for political instability. Moreover, Perotti (1996) finds a positive relationship between inequality and instability and subsequently less investment in his study.

There is also empirical evidence for the so called vicious circle. Income inequality is found to be positively correlated with volatility, whereat the standard deviation of the annual GDP growth rate is used to measure volatility (Hausmann and Gavin 1996, Breen and García-Peñalosa 2005). Moreover, cross-country studies put forward that more fluctuations of the growth rate lead to a consistent reduction of the average rate of growth during that period. A significant source in this regard is the deterring effect of volatility on physical and human capital investment (Ramey and Ramey 1995, Inter American Development Bank 1995, Hausmann and Gavin 1996).

Table 3. Effects of income inequality - Substitution effect

<table>
<thead>
<tr>
<th>Theories</th>
<th>Empirics</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work incentives</td>
<td>Textbook approach</td>
<td>- Ineq ↑ → Work incentives ↑ → Productivity ↑</td>
</tr>
<tr>
<td>Development Economists</td>
<td>- Ineq ↑ → Work incentives ↑ → Productivity ↑</td>
<td>- Ineq ↑ → Work incentives ↑ → Productivity ↑ in the medium term (&gt;10 years)</td>
</tr>
<tr>
<td>Simulation model</td>
<td>- Ineq ↑ → Work incentives ↑ → Productivity ↑ in the medium term (&gt;10 years)</td>
<td>- Ineq ↑ → Productivity ↓ in the long run (&gt;25 years)</td>
</tr>
</tbody>
</table>

(Source: Own representation)

In sum, studies on the inequality-productivity link point on the one hand to a negative impact of inequality on productivity through socio-political instability and volatility (e.g. Alesina and Perotti 1996, Breen and García-Peñalosa 2005), and on the other hand to a positive nexus between the two variables of interest through stimulated work incentives (Albig et al. 2017). From the preceding subsection we know that the former effect is driven to a consider-
able extent by less investment in human capital and that this link prevails in the long term (>25 years). However, work incentives appear to be positively affected by inequality in the medium term (Albig et al. 2017). Thus, it can be concluded that in the medium term a dispersion in income causes an increase in productivity.

4.2 Behavioral reasons

There could also be an effect of income inequality on social behavior, such as status seeking. Jin et al. (2011) use Chinese urban household survey data from 1997 to 2006 and find that a higher level of income inequality causes the household consumption to decrease and the savings to increase (even after controlling for household income). The authors’ idea is that the incentives of status seeking savings are strengthened by increasing income inequality as it enlarges the level of wealth that is required for status upgrading. They demonstrate that inequality is negatively correlated with consumption and that the effect is larger for poorer and younger people. Moreover, inequality goes along with higher investment in education, which is consistent with the status seeking hypothesis.

The authors’ aim was to investigate the reason for the declining Chinese consumption rate in the last two decades. Different potential explanations such as demographic changes, increasing sex-ratio, or income growth could not be observed empirically. In their view, rising inequality might be an alternative source. If rising inequality implies a lower propensity to consume at the micro level, then at the macro level an income inequality would cause the consumption rate to decrease. Once it is controlled for household income, consumption should not be affected at the micro level if the only effect at work is at the macro level. The finding of a negative effect of income inequality on the household consumption rate let Jin et al. (2011) suggest that there exist other mechanisms than the “macro-mechanism”. Seeking an explanation for the negative nexus, the authors test for different variables that could depict a source for this correlation. However, in their regressions, neither the sex ratio, the return on education, a provincial housing index, income risk, nor precautionary saving account for it; the size of the negative coefficient remains almost unchanged. There has been little research on the status seeking motive only. There are studies proposing that status seeking can enhance economic growth, but this hypothesis is rarely confirmed by micro evidence (Futagami
According to Weiss and Fershtman (1998), social status is defined as a rank in a given society. The rank can be the one of an individual or of a group of individuals and is based on commonly agreed-upon criteria such as occupation, origin and education. Moreover, social status is often related to a particular group, in which all members have the same status, regardless of their individual characteristics. The literature on social status also demonstrates that there is a dependency of social status on ranking in the wealth distribution: "Investors accumulate wealth not only for the sake of consumption but also for wealth induced social status." (Bakshi and Chen 1996). Max M. Weber refers to this desire for wealth as "a leading spirit of capitalism" (Weber 1958: 53). Furthermore, Corneo and Jeanne (2001), Futagami and Shibata (1998), Gong and Zou (2001), and Pham (2005) emphasize the mechanism that status seeking promotes economic growth by stimulating more savings.

There are three theoretical explanations why status seeking may be intensified by an increasing income inequality. First, low-status and high-status groups differ more in their endowment of resources and it becomes more attractive to belong to a high-status club (Corneo and Jeanne 1999). Second, due to the wider wealth gap, low-status individuals need to save more to enter a high-status club (Jin et al. 2011). Third, an increased stratification may be the result of inequality in income and intensify the competition for social status; the marginal returns of savings increase (Corneo and Jeanne 1999).

Empirical findings of Jin et al. (2011) support the status-seeking hypothesis. The negative effect of inequality on consumption declines with income. This follows a certain logic as the poor and the middle class wish to climb up the social ladder and, therefore, accumulate wealth; while the rich have fewer incentives to save for the purpose of entering a club, having already a sufficient income (Van Long and Shimomura 2004). The results also indicate a stronger effect for young individuals. The authors argue that it is likely that the status-seeking motive varies with age. The benefit of achieving a higher status naturally lasts longer for the young than for the old. Furthermore, a positive relationship between income inequality and education is found in the data. As education is associated with better social status and higher wages, it can encourage people to invest in education (Jin et al. 2011). Lastly, the engagement of the poorer and younger individuals in conspicuous expenditure is lower. As the membership of a social club depends on the level of wealth, conspicuous consumption cannot give access to a wealthy club but rather lowers the chance
of entering, which is why the poor may be less likely to do so (Corneo and Jeanne 1998).

However, Corneo and Jeanne (2001) state that it is also possible that an increasing income inequality weakens the incentive of status-seeking savings when the dispersion of income becomes too large. The marginal status gained by individuals who accumulate additional wealth might decline or it becomes infeasible to move up. Jin et al. (2011) conclude that income inequality has a positive (negative) impact upon savings (consumption) unless the dispersion of income induces individuals to switch from status-seeking to giving up. Therefore, the status-seeking mechanism may be seen as similar to the channel of increased work incentives. As put forward in section 4.1.2, this effect only prevails in the period of 10 to 25 years. In the medium term, there may be incentives for poorer individuals to save and to make an effort in order to improve their standard of living, but with increasing inequality and time it may end in frustration. The data coverage of Jin et al. (2011) would be in line with this hypothesis.

Table 4 presents all described macroeconomic effects of income inequality: in the short term the saving rate might be affected, in the medium term increased work incentives and status seeking play a major role and in the long term the level of human capital is diminished.

<table>
<thead>
<tr>
<th>Income effect</th>
<th>Impact</th>
<th>Time</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affected variables:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saving</td>
<td>No consistent effect</td>
<td>Temporarily (if any effect)</td>
<td>4.1.1</td>
</tr>
<tr>
<td>Human capital</td>
<td>Ineq ↑ → Human capital ↓ → Productivity ↓</td>
<td>Long term (&gt;25 years)</td>
<td>4.1.1</td>
</tr>
<tr>
<td>Substitution effect</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Affected variable:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work incentives</td>
<td>Ineq ↑ → Work incentives ↑ → Productivity ↑</td>
<td>Medium term (&gt;10 years)</td>
<td>4.1.2</td>
</tr>
<tr>
<td>Social behavior</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Affected variable:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Status seeking</td>
<td>Ineq ↑ → Saving, Human capital ↑</td>
<td>Medium term (&gt;10 years)</td>
<td>4.2</td>
</tr>
</tbody>
</table>

(Source: Own representation)
5 A model of endogenous consumption decision and inequality

Partly following Aloi and Tournemaine (2013), an endogenous growth model is developed in which income (= labor income and capital income) is unequally spread across the population and the variables representing human capital accumulation, consumption, and earnings (= labor income) are endogenous. The aim is to implement following effect that was elaborated in section 4: a higher income inequality leads to less human capital investment, which, in turn, affects private consumption (and therefore welfare) negatively. Thus, the focus is on the long term effect of income inequality.

Model structure. A closed economy in continuous time populated by infinitely lived individuals is considered. There are two groups of individuals. Heterogeneity between the two groups stems from the assumption that individuals have different innate skills. As regards the notation, unskilled \((u)\) and skilled \((s)\) individuals are denoted by \(i = u, s\) and \(\beta\) and \(1 - \beta\) depict the size of the two groups, respectively. As becomes clear shortly, the ability to learn of individuals \(s\) is greater than the one of individuals \(u\), implying that \(H_{st} > H_{ut}\). Thus, at equilibrium, heterogeneity in skill causes the level of human capital of individuals to differ even if they face the same exogenous influences.

The combination of skilled and unskilled labor is required for the output production. Accordingly, the technology is represented by

\[
Y_t = A[\beta H_{ut} + (1 - \beta)H_{st}],
\]

where \(A > 0\) is a constant productivity parameter and \(H_{it}\) is the human capital of individual \(i\), where \(i = u, s\).

The exogenously given income inequality is measured by the Theil index (see section 2). To simplify, the measure is divided by its upper bound \((T/\log(n))\) to obtain a measure that varies between 0 and 1, independently of the population size \(n\) (Martin and Gray 1971). The so-called relative Theil index is denoted as \(T_r\). Income inequality is given by

\[
I_t = T_r^\gamma,
\]

where \(\gamma > 0\) is a parameter measuring the impact of income inequality.
Turning to human capital, as elaborated in section 4 of this paper, one main consequence of income inequality is the deterioration of individuals’ human capital. To capture this feature, the technology of human capital is defined as

$$\dot{H}_{i,t} = \phi_i I^{-1} M^{-\alpha}_i H^\alpha,$$

where $M_i$ denotes investment in human capital of individual $i$. The variable $\phi_i > 0$ depicts the innate skill and is an idiosyncratic and time-invariant productivity parameter. Each of the two groups of individuals has a specific parameter, with $\phi_s > \phi_u$. As can be seen below, the assumption of different innate skills allows for different equilibrium levels of human capital, earning and consumption (i.e., inequality) to occur, although all individuals experience the same negative impact of the society’s income inequality. This ensures that inequality is not completely endogenous but partly pre-determined.\(^{38}\) The term $0 < \alpha < 1$ represents the degree of the spillover effect, meaning that it weights the existing human capital relative to material resources. The average level of human capital in the economy is given by $H_t = \beta H_{u,t} + (1 - \beta) H_{s,t}$. It is common practice in the growth literature to introduce average skills in the technology production of human capital as spillover effects. Tamura (1991) and De la Croix and Doepke (2004), for example, argue that such spillover effects are essential for the convergence of human capital (for empirical support, see also Alonso-Carrera 2001). There is no labor explicitly modeled in the production function of human capital. However, the existence of teachers is implicitly assumed.

To summarize, equation (3) representing the human capital technology shows that skills improvement depends on two factors. First, the fraction of material resources invested in human capital accumulation, $M_{i,t}$, and second, the external spillover effect indicating the average level of teachers, $H_t$. It also implies that, ceteris paribus, a higher initial level of society’s income inequality leads to a lower human capital accumulation.

Finally, preferences of individual $i$ are set as follows

$$U_{i,t} = \max \int_0^\infty \frac{C_i^{1-\sigma}}{1-\sigma} e^{-\rho t} dt,$$

where $\rho > 0$ is the rate of time preference and $\sigma$ represents the reciprocal of the elasticity of intertemporal substitution. According to empirical evidence, $\sigma > 1$ is imposed (e.g., Karabarbounis and Neiman 2013).

\(^{38}\)It could also be interpreted as a parameter indicating specific social classes. However, in this thesis, it is considered as an innate skill parameter.
**Equilibrium.** In the next step, the maximization problem of the agents is considered and the steady state of the model is analyzed. The efficiency conditions are derived before the steady state is characterized. The markets of output and human capital are assumed to be perfectly competitive. Furthermore, output is used as the numeraire. Notation wise, the wage rate for human capital supplied by individuals $i$ is denoted by $w_{i,t}$. The competitive firm in the output sector maximizes

$$\pi_{Y_t} = A[\beta H_{u,t} + (1 - \beta) H_{s,t}] - w_{u,t} \beta H_{u,t} - w_{s,t} (1 - \beta) H_{s,t}. \quad (5)$$

It implies that real wages are given by: $w_{u,t} = w_{s,t} = A$.

Turning to the consumer side, each individual $i$ takes as given the level of society’s income inequality and chooses consumption, $C_{i,t}$, investment in human capital, $M_{i,t}$, and the path of human capital $H_{i,t}$ that maximize the utility (4), subject to the human capital motion (3) and the budget constraint

$$C_i = (1 - \eta_{i,t}) w_{i,t} H_{i,t}, \quad (6)$$

where $\eta_{i,t}$ represents the share of earnings (=labor income) devoted to human capital accumulation ($M_{i,t} \equiv \eta_{i,t} w_{i,t} H_{i,t}$). For simplicity, the capital market is not modeled. Thus, lending is assumed away and people only devote a certain share of their labor income to human capital accumulation; capital income is not used. Furthermore, there is no tax system (and therefore no re-distribution). Hence, the current value of Hamiltonian of this problem reads as

$$CVH_{i,t} = [(1 - \eta_{i,t}) w_{i,t} H_{i,t}]^{1-\sigma} + \mu_{i,t} \phi_i \xi_i (\eta_{i,t} w_{i,t} H_{i,t})^{1-\alpha} H_{i,t}^\alpha, \quad (7)$$

where $\mu_{i,t}$ is the co-state variable associated with the law of motion of human capital (3). The first order conditions can now be derived

$$\frac{\partial CVH_{i,t}}{\partial \eta_{i,t}} = -[(1 - \eta_{i,t}) w_{i,t} H_{i,t}]^{1-\sigma} + \mu_{i,t} (1 - \alpha) \frac{H_{i,t}}{\eta_{i,t}} = 0, \quad (8)$$

$$\frac{\partial CVH_{i,t}}{\partial H_{i,t}} = [(1 - \eta_{i,t}) w_{i,t} H_{i,t}]^{1-\sigma} + \mu_{i,t} (1 - \alpha) \frac{H_{i,t}}{H_{i,t}} = -\dot{\mu}_{i,t} + \rho \mu_{i,t} \quad (9)$$

The transversality condition is $\lim_{t \to \infty} \mu_{i,t} H_{i,t} e^{-\rho t} = 0$. Simple algebra leads to
Equation (10) states that one extra unit of earnings devoted to human capital accumulation leads to a marginal utility loss in consumption that equals the marginal gain of the production of an additional unit of human capital; while equation (11) expresses that the return to human capital equals the discount rate, $\rho$.

The steady state is characterized by a constant growth rate of any variable and a constant share of earnings allocated to human capital accumulation. From the first order conditions, it is obtained with straightforward computations

$$\eta_i = \frac{\sigma g_i + \rho (1-\alpha)g_i}{(1-\alpha)g_i},$$

where $g_i$ is the growth rate of both, human capital and consumption, for individual $i$. By use of (3) it reads as

$$g_i = \phi_i T^{-\gamma} (\eta_i w_i) (1-\alpha) H_i \left( \frac{H_i}{H_{i,t}} \right)^{\alpha}. \tag{13}$$

From (12), the steady state share of earnings devoted to human capital accumulation can be expressed as

$$\eta^* = \frac{(1-\alpha)g^*}{\rho + \sigma g^*}, \tag{14}$$

where the superscript "$^*$" is used to denote any variable in steady state. It is important to note that the share of earnings devoted to human capital accumulation is the same across individuals, owing to the equality of the growth rates. However, due to different earnings the amount allocated to human capital differs across individuals.

Equations (6), (13), an (14) are used to determine the growth rate. The human capital and consumption ratio between unskilled and skilled individuals is given by

$$\frac{H_{u,t}}{H_{s,t}} = \frac{C_{u,t}}{C_{s,t}} = \left( \frac{\phi_u}{\phi_s} \right)^{1/\alpha}. \tag{15}$$
It follows that the steady state growth rate corresponds to the solution of

\[ g^* (\rho + \sigma g^*)^{1-\alpha} = T_r^{-\gamma} (A(1 - \alpha))^{1-\alpha} [\beta \phi_s^{1/\alpha} + (1 - \beta) \phi_u^{1/\alpha}]^\alpha. \quad (16) \]

As seen, the higher the society’s income inequality \( T_r \) the lower is the growth rate for consumption and human capital and the share \( \eta_i^* \) that is devoted to human capital accumulation. As earnings are dependent on human capital (see (3)) overall income inequality is reinforced.

**Example.** To illustrate, the following case is considered. A relatively low income inequality of \( T = 0.2 \) is assumed. Furthermore, the time preference rate be \( \rho = 0.02 \), the elasticity of substitution \( \sigma = 1.2 \), the weight of existing human capital relative to material resources \( \alpha = 0.5 \), the innate skill of skilled individuals \( \phi_s = 2 \), the innate skill of unskilled individuals \( \phi_u = 1 \), the fraction of unskilled individuals \( \beta = 0.5 \), \( \gamma = 1 \), and \( A = 1 \). By use of (16), the steady state growth rate corresponds to the solution of

\[ g^{0.5} (0.02 + 1.2g^*)^{1-0.5} = 0.2^{-1} [(1 - 0.5)]^{1-0.5} [0.5^{1/0.5} + (1 - 0.5) \times 2^{1/0.5}]^{0.5}, \]

with two solutions for \( g^* \). Assuming away the possibility of negative values for \( g \), it remains \( g^* = 3.60\% \). This implies a share of earnings devoted to human capital accumulation of \( \eta^* = 41.47\% \) and serves as reference example. To compare, a relatively high income inequality, \( T = 0.8 \), is assumed, ceteris paribus. \( g^* \) drops now to 0.89%. Also \( \eta^* \) falls to 40.90%. It can be shown, therefore, that a higher income inequality leads to a lower growth rate and a smaller share of earnings devoted to human capital accumulation.

As already mentioned, inequality is partly pre-determined through different innate skills. A change in the fraction of unskilled individuals in the society is thus demonstrated. \( \beta \) be now 0.7, meaning that the fraction of unskilled exceeds the one of the skilled people (0.3). All other variables take the values from the reference example, having a \( T = 0.2 \). In this case, \( g^* = 2.29\% \) and \( \eta^* = 41.36\% \). Compared to the reference example, where the number of unskilled equals the

\[ a = 0.5 \] is chosen as there are only three values for which a solution by hand is possible (0, 1, and 0.5) and a weight of 0.5 seems to be more realistic. \( \sigma \) is set according to empirical studies, e.g. Chirinko (2008) and Karabarbounis and Neiman (2013) and for \( \rho \), it is common practice in economic models to assume a discount rate that corresponds to a realistic annual long term real interest rate. The values for \( A, \phi_i, \) and \( \gamma \) are taken to avoid complexity.
one of skilled people, the common growth rate of human capital and private consumption is remarkably lower. Also the share of earnings allocated to human capital accumulation decreases, although only slightly. If the society faces now a high initial income inequality $T = 0.8$, ceteris paribus, this results in $g^* = 0.57\%$ and $\eta^* = 40.49\%$. Therefore, the effect of the exogenously given income inequality is dependent on the existing distribution of skills in a society.

Turning to the consolidation of income inequality, a closer look at the investment in human capital is needed: $M_{i,t} \equiv \eta_i,t w_i,t H_i,t$. For $\eta_i,t$, the value of the reference example is taken, and $w_u$ be 1 and $w_s$ be 2. Furthermore, $t$ is assumed to be 1. It follows that

$$M_{u,1} = 0.4147 * H_{u,1},$$

$$M_{s,1} = 0.4147 * 2 * H_{s,1}.$$

From (3), the law of human capital motion, it is known that $H_{u,1} < H_{s,1}$, owing to different innate skills. Consequently, earnings ($w_{i,t} H_{i,t}$) are higher for skilled individuals. Even though $\eta^* = 41.47\%$ applies to both groups of individuals, the absolute amount of money devoted to human capital accumulation by unskilled people is lower. If now a rise in the exogenously given income inequality is considered, from $T = 0.2$ to $T = 0.8$, $\eta^*$ changes to 40.90\% (see examples above). This implies that for both groups the investments in human capital decrease, however, for low income recipients it is more fatal as they invest even less in absolute amounts and are caught in a poverty trap. Therefore, overall income inequality is reinforced.
6 Discussion

In section 5 it has been theoretically shown in a simple setting that a higher level of income inequality leads to a slower motion of human capital and a lower growth rate for private consumption. Moreover, earnings are dependent on the level of human capital. Thus, income inequality is reinforced through a decrease of the share of earnings allocated to human capital accumulation. This is in line with empirical studies of development economists who find that income inequality hinders human capital investment (see section 4) and the results of Jin et al. (2011) and Albig et al. (2017), revealing that income inequality affects private consumption negatively.

The analysis serves three important insights. First, the prime channel through which income inequality operates is the reduced human capital accumulation. Second, income inequality harms welfare through its negative impact on private consumption. Third, negative consequences affect the whole society but most unskilled people. This is fundamental for defining policies in order to prevent negative economic consequences of income inequality: the promotion of human capital and thus education is essential for the welfare of a country. The theory of Galor and Moav (2004) states that the role of human capital is not only of significant importance in well developed countries but also in developing countries (see section 3.1). This suggests that education plays a major role in terms of development assistance. Furthermore, equality and therefore re-distribution enhances welfare and should be desirable.

Yet, it is important to keep in mind that the model cannot reflect all aspects of reality and only exhibits one line of argument focusing on the possibly most important long term effect and its momentum.

The economic analysis of the impact of income inequality on human capital is challenging. The problem is that educational decisions are not purely economic but can also be influenced by politics. Two levels need to be considered. First, system decisions and second, individual decisions. A typical system decision would be the introduction or non-introduction of tuition fees. This can be an economic decision if, for example, the aim is to provide free education in order to promote human capital to improve a country’s competitiveness. However, it can also be a non-economic decision if the objective is driven by normative incentives like opportunity equality. At the individual level, educational decisions can be non-economic if they are resulting from idealistic
or normative standards. However, even if the system decision is a non-economic decision individual educational decisions can still be economic: people take into account the college wage premium\textsuperscript{40}, the opportunity costs and direct education costs. Yet, the latter is affected by the system decisions, which play a major role for the monetary constraints of the individuals. Therefore, it must be considered that the impact of income inequality on human capital is much dependent on education policy. The described effect only occurs if direct education costs and borrowing constraints exist.

The analysis of potential consequences of income inequality for human capital accumulation in this thesis is only moderately impaired by the influence of education policy on the human capital sector. This is caused by two reasons. First, individual education decisions appear to be primarily economic as they are affected by other sectors that are market based: labor market signals have an influence on the demand for education (e.g. Albert 2000) and the social return to higher education plays an important role in decision making (Kane 1994, Moretti 2004). Second, direct education costs are essential for human capital investment and affect it negatively (Kane 1994, Ganimian and Murnane 2016, Zuilkowski et al. 2017). Besides opportunity costs that always exist, in most well developed countries school education is free and financed by the government. However, in less developed countries this is not necessarily the case and in some advanced countries tertiary education is still costly, like in the US for example. Therefore, the assumption of direct education costs is realistic, although it allows only for a very general statement about the effect of income inequality on human capital. The effect may differ significantly throughout the world due to varying education costs. The lower the costs the weaker is the effect. Furthermore, borrowing opportunities would probably reduce the extent of the effect.

The question arises how models on income inequality and human capital can be modified to implement the described issue. Most important may be the inclusion of average per capita costs for education. Higher per capita costs weaken the negative effect of income inequality on human capital accumulation. Thus, the parameter of income inequality should be dependent on per capita

\textsuperscript{40}The term “college wage premium” is used for the general return to higher education. It is important to note that a high college wage premium can be a cause for earning inequality. However, high returns to higher education also provide incentives to invest in education. Furthermore, Jan Tinbergen stressed that if the supply of high educated people precedes the demand for them the inequality of earnings can be reduced: “[...] it is a race between supply (by education) and demand (by technological development) which determines the changes in relative scarcity of any type of manpower.” (Tinbergen 1975: 55).
education costs. Moreover, it has to be ensured that the returns on education are sufficiently high. This means that the minimum condition for an investment in human capital must be that the individual expected discounted lifetime earnings exceed the overall per capita costs of education and training. Further to mention are possible fix costs of education that might not be covered by the share of earnings that is devoted to human capital accumulation. Even though every individual devotes the same share of earnings to human capital accumulation, the absolute amount of money varies due to unequal earnings. Poorer people might not be able to cover the fix costs, which results in a zero investment in human capital. Therefore, a modification of the budget constraint may be reasonable.

Besides an expansion of the model presented in section 5, the development of an econometric model to test the effects of income inequality is left to further research. Most empirical studies on the different macroeconomic effects of income inequality are outdated and conflicting (see section 4). This is due to observations of varying periods of time, use of different measures of inequality and a utilization of obsolete income inequality data.
7 Conclusion

This thesis contributes to the theoretical literature on the relation between income inequality and welfare, where private consumption serves as a welfare indicator. More specifically, the impact of an exogenous change in income inequality on human capital accumulation and its consequences for private consumption is studied.

A motivation for this paper is provided by the stylized fact that income inequality is increasing and countermeasures have to be taken to prevent or reduce negative consequences. In order to circumvent a normative debate and to make negative consequences concrete, private consumption is used as a welfare indicator.

The study of theories and empirical evidence on the macroeconomic effects of income inequality has shown that the effects can be divided into three time spans. In the short run, the saving rate is affected; in the medium term, work incentives and status seeking play an important role; and in the long term, human capital is the prime variable of interest. The focus of this thesis is on the long term effect of income inequality: educational decisions are negatively affected which leads to less human capital accumulation.

The theoretical framework for the analysis is an endogenous growth model based on the approach of Aloi and Tournemaine (2013). The model provides the result that the higher the society’s income inequality, the lower is the growth rate for consumption and human capital and the share of earnings that is devoted to human capital accumulation. Thus, income inequality harms welfare. Furthermore, as earnings are dependent on human capital income inequality is reinforced. The outcome of the model is consistent with empirical results of development economists.
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