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# Income Inequality and Higher Education

*A Review of the Empirical Evidence*

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## **Abstract**

Income inequality is considered one of the most pressing issues of our time, which has prompted a large body of scientific research. Education is often mentioned as one of the main factors to decrease inequality. Tertiary education plays a specific role with regard to inequality since it is associated with higher returns than lower levels of education which is thought of as an initial driver of inequality but a means of combating inequality in the long run. Yet the literature seems inconclusive on the matter as research find varying results. This review examines the empirical evidence in order to determine the effect of higher education on income inequality. The findings are still ambiguous since the direction of the effect of an increase in higher education on income differs across studies.

**Keywords:** Income inequality, tertiary education, skill premium, welfare economics

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## Introduction

There is a famous saying that the rich get richer and the poor get poorer. The idea that the rich get richer and the poor get poorer is closely related to the ‘Matthew effect’ which originates from the gospel of Matthew and can be described in a way in which people disproportionately benefits from a system (Holmberg 2016, 13). The Matthew effect is prevalent in different fields and parts of the society. For example, Merton (1968) finds that already established researchers/scientists from different fields have an advantage compared to less well-known scientists with regards to rewards and recognition for similar work. In a similar fashion, an already cited scientific article can generate more citations than an equivalent article with less citations. In economics the concept of ‘network effects’ is similar to the Matthew effect in the sense that as more people sign on to a service or buy a certain product, the demand for the product or service increases which creates a positive feedback loop which generates even more customers (Pepall, Richards & Norman 2014, 82). It’s a phenomenon where success generates success. Regarding economic inequality this effect can be seen in the distribution of wealth and income around the world where those in the top of the income and wealth distributions have a disproportionately large share of both wealth and income.

Income inequality and the distribution of wealth is a recurring topic of discussion in the economic and political debate as well as a topical issue for policymakers around the world. The main reason for this could be attributed to the fact that economic inequality seems to be ever growing. Wade (2004, 164) describes the prevailing Matthew effect as “increasing returns in income generation [...] prevails over diminishing returns”. Data shows that income inequality increased in almost all OECD countries between 1985 and 2012, on average income inequality in the OECD countries grow steadily during the time period (Cingano 2014, 8-9). According to Credit Suisse, the top/richest decile of the wealth distribution own 85 percent of the global wealth, the top percentile – 47 percent while the bottom half own just below one percent of all wealth in the world (Credit Suisse 2018, 112-113).

Much empirical research has been done to determine the main drivers of income inequality over the years as well as the effects of income inequality. Research has shown that the level of income inequality affects multiple factors of importance for a society such as health, democracy, political stability and crime rates (Thorbecke & Charmulind, 2002), which explains the increasing body of empirical research on the subject as well as its relevance in political debate. Redistributive policies are often suggested as key factors to decrease income inequality. Equal educational opportunities are among the most important factors mentioned for increasing social and economic outcomes as well as decreasing income inequality (OECD 2018, 38-40). Nevertheless, an OECD report on income inequality from 2011 concludes that the factors driving inequality remain unsettled (OECD 2011, 26). As much research has been conducted to determine the drivers of income inequality, the same is true for the relation between education and income inequality. Education and especially tertiary education have been argued to be one of the main determinants of income differences (Rodriguez-Pose &

Tselios, 2009). At the same time, it's been argued that the link between education and income inequality is ambiguous (Földvari & Van Leeuwen, 2011). As more research piles on to the scientific literature, it gets increasingly difficult to justify even further empirical research. The literature does however vary in terms of time period, level of education, scope, operationalization of variables, effect size etc. At the same time are social conditions ever changing, in this case meaning that the labour force's educational attainment and income inequality change over time. This in turn makes it relevant to review and summarize the empirical evidence of the link between tertiary education and income inequality.

## *Background*

One might wonder how resources became so unevenly distributed in the first place. Is there a 'Big Bang' of economic inequality? Before societies started to emerge, when humans were hunter and gatherers, the human population was a fraction of what it is today. Resources were scarce in the sense that there weren't enough resources for the population to grow in a significant way. However, when humans began to settle down and learnt how to grow crops and harvest, the population started to grow since more people could survive with the available resources. At some point, resources grow faster than the usage of those resources which lead to an abundance of food or surplus (for at least some people). As farming technology became more sophisticated and efficient, productivity increased and people could specialize in other areas, since farmers could produce more food than they needed for their own consumption, thus creating new markets in which people could trade goods and services (Johnson, 1997). The generated surplus could in turn be traded for other goods or lent to other farmers or people in more need of those resources, eventually generating a profit for the lender. This makes sense economically since unused resources implies an opportunity cost. The most accepted theory of inequality of wealth is the surplus theory or 'Surplus theory of social stratification' which in essence states that the accumulation of wealth was made possible by producing above and beyond the necessary amount to keep producers alive (Angle 1986, 297-301). In the literature voluntary trade is merely one of many explaining factors for the concentration of wealth (Angle 1986, 298-299). The central component, however, is that the creation of surplus and the ability to extract this surplus in on way or another made it possible for wealth to be concentrated. The theory isn't without empirical merit. A recent archaeological study which used house size as a proxy for household wealth, suggests that inequality particularly increased after the agricultural revolution and that the distribution of wealth was more unequal in societies with higher levels of food surplus (Nature, 2017).

This reasoning doesn't necessarily explain why inequality increased or the discrepancy between those who accumulated wealth and those who didn't. Even though there probably were other contributing factors, the accumulation of wealth or capital has been highlighted as one of the main factors. The association between capital and inequality has been of importance for economic as well as political debate and research since the 18<sup>th</sup> century (Piketty 2013/2015, 12-29). Prior to the industrial revolution, the total capital or wealth in Great Britain and France was mainly made up of agricultural land but during and after the

industrial revolution, the value (computed as share of national income) of agricultural land diminished in favour of other forms of capital, mainly buildings, machines etc. (ibid., 128-143). During the 1800s, the share of income from capital (the difference between national income and share of income from labour) was presumably high since the economy grew faster than wages and income inequality was high. The role of capital and its effect on income inequality has been an increasingly discussed and researched subject in recent decades (Bengtsson & Waldenström, 2018). There are a couple of reasons for this. One is that the value of private capital has increased steadily since the 1950's, especially in Europe (Piketty 2013/2015, 180). Another regards capital accumulation, the return on capital and its effect on inequality. The share of income from capital compared to labour tends to be higher in the top of the income distribution (Piketty 2013/2015, 323-324) leading to wealth being more concentrated than income and hence more unequal (Dabla-Norris et al. 2015, 16). National income can be defined as the sum of two income sources – income from labour and income from capital. A person with income from both sources is naturally better off than one with income solely from labour (given the same income from labour of course). A central aspect with regard to inequality is the rate of return on capital and particularly its relation to economic growth. Piketty (2013/2015, 35) argues that if the return on capital 'r' exceeds economic growth 'g' for a longer period of time it will increase the inequality of wealth since those who inherit wealth need only to save a small amount of income from capital in order to see it grow faster than the economy as a whole. In terms of the distribution of wealth then, someone without initial or inherited capital can of course accumulate wealth over time but will, on average, be unlikely to catch up. If we then compare someone with inherited wealth to someone without, who is also on the lower part of the income distribution (labour from income below average), then the divergent effect of  $r > g$  on wealth and income distributions become even greater since someone with low or minimum wage most likely will spend the entire amount of his or her budget on necessary goods. If the growth in average income from capital outpaces that from labour, one could also see how income concentrates and skews the distribution given that capital/wealth is unevenly distributed in the first place. Data shows that the share of capital income has increased over the last decades (OECD, 2015) and is correlated with income inequality (Bengtsson & Waldenström, 2018). The role of capital and income from capital with regard to income inequality is not the central purpose of this study since the potential effect of education on income inequality will most reasonably be through wages and hence income from labour. However, it is touched upon for a couple of reasons. One being that capital has been argued to play an essential role in the evolution of income inequality (Piketty, 2013/2015; Ryckbosch 2016, 2). Another being that education could affect the distribution of wealth or capital through savings if the marginal propensity to save increases with income from labour, leading to accumulation of wealth over time. A third reason being that income inequality usually is measured by the Gini coefficient which takes income from capital into account.

Since the industrial revolution economic inequality has increased globally leading to the rise of left-wing parties around the world (Piketty 2013/2015, 15-19; Bourguignon 2015, 26-27)<sup>1</sup>. Some attribute the economic inequality we see today to capitalism and globalization, others argue that free trade and globalization has decreased poverty and raised living standards around the world, sometimes referred to as the ‘neoliberal argument’ (Wade 2004, 163-164; Dabla-Norris 2015, 18-19). At the heart of the discussion lies the notion of fairness and justice. While some may argue that capitalism and globalization lift all boats, so to speak, others take more of an egalitarian stance and question the fairness of a system which produces variations in income between social groups (O’Neill, 1976).

Education has played a central role in the discussion of how to decrease income inequality and correct for unequal distribution of initial endowments (see O’Neill, 1976; Kodolja, 2016). The logic of subsidized education would then be that people should have an equal right and opportunity to acquire education, independent of socio-economic background, consequently facilitating economic mobility. In other words, the ability to receive formal education should not depend on the economic conditions in which one’s born. This idea is congruent with the philosophy of commodity egalitarianism (which will be discussed further under *theoretical framework*) in the sense that some goods should be provided to all by the public. Research in the U.S, shows that the return to college degrees has grown since the 1970s and in effect has increased real wages over time for those with higher education while the opposite is true for those without higher education. One could therefore see why subsidizing education is not only about fairness but could also decrease inequality in terms of income from labour<sup>2</sup>.

### *Problem*

One could wonder why inequality is considered a problem in the first place. The very word has negative connotations. Inequality is something we disapprove of and equality something to strive for. One should however be clear what is meant by equality and hence, inequality. Inequality implies that something is unevenly distributed, whether it’s income, opportunity, wealth, power etc. Which in turn means that inequality can be an economic, political, judicial, societal issue and so forth. For this essay however, the focus will be on income inequality.

When discussing wealth and income distribution, whether in media or scientific literature, one usually compares the concentration of wealth and income in the top one percent of the distribution to the bottom 99 percent. In 2011 the “Occupy wall street”-movement protested

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<sup>1</sup> The level and evolution of income inequality differ, partly due to how income is measured and whether one looks at the evolution of income inequality within a country or globally (see Bourguignon 2015 for an in-depth discussion).

<sup>2</sup> Not accounting for other indirect effects that publicly provided goods might have on income inequality, such as higher taxes (OECD 2015, 53) in order to finance the goods, compared to a country with less publicly provided goods. This seems at least to be true if the tax system is progressive *ceteris paribus* (see Sammartino, 2017).

the unequal distribution of wealth and income in the US with signs saying: “We are the 99%”. Protests and demonstrations are part of a free and democratic society and are mostly benign. However, when a problem reaches a certain point, it can turn into violent conflicts and in some cases revolution. Inequality, whether in terms of wealth, property rights, political rights etc., has played a role in many revolutions throughout history. The French, American and Russian revolution can all be related to economic inequality at the time. Lichbach (1989) finds that almost all studies of political conflicts use economic inequality as an explaining factor. MacCulloch (2005) examines the relationship between economic inequality and the probability to revolt based on survey data and finds a positive relation although only statistically significant at a ten percent level. One can see why much emphasis has been put on the subject of income inequality and why it’s considered a problem in society. The unequal distribution of wealth and income around the world isn’t just a societal problem or perceived as an issue by the public. It’s also a problem of scientific value and, for the purpose of this essay, an economic problem. Why is income inequality growing and what can be done to alter the increasing trend?

In Sweden, from 2013 to 2017, total real expenditure on all forms of education increased with 19 percent (SCB, 2018). At the same time, within the EU, total government expenditure on education in 2017 (measured as a percentage of GDP) varied from lowest 2.8 percent and highest 7.5 percent (Eurostat, 2019). For a government to intervene in the education market to some degree or another there is reasonably a justification or rationale underpinning such a decision. Rosen and Gayer (2014, 133-134) suggests two reasons, from the point of economic efficiency, for government intervention – when a good can be characterized as a public good and generates positive externalities. Whether education is compulsory or voluntary, regarding lower or higher level, education is rarely nonrival in consumption, meaning it can’t be considered a public good. One could however make the argument that it generates externalities in form of a more enlightened population which spills over into other fields. Even though this notion has been contested by empirical research, it has been argued that a more educated population translates into a more democratic state (Rosen & Gayer 2014, 133-134). Other externalities due to more education could be lower crime rates and less political instability attributed to lower levels of income inequality (Thorbecke & Charumilind, 2002). Aside from efficiency-arguments a value-argument could be made that income inequality is undesirable and unfair in a modern society. If spending on education is a way to decrease inequality one can see why government expenditures has increased.

From 2008 to 2018 the share of people with a higher education in the OECD countries rose, on average, with nine percentage points from 35 to 44 percent in the ages between 25-34 while the share of people with less than upper secondary education decreased during the same time period (OECD 2019, 38-42). At the same time, income inequality has continued to increase which begs the question if tertiary education is a determinant of income inequality and what the effect might be. If more access to education in general and tertiary education in particular is a pathway to lower income inequality, the opposite should be true. While the subject is of interest from a scientific perspective it’s also of interest with respect to policy. Since educational policies are about redistributing scarce resources it would be irrational to use those resources on interventions that don’t work. For the purpose of this study – if tertiary education doesn’t affect income inequality.

## *Purpose and research questions*

The ultimate purpose of this review is to examine the rationale for government intervention in higher education<sup>3</sup> as well examine if there is a relation between higher education and income inequality. The questions that will guide the research are:

- (1) What is the economic rationale for subsidizing tertiary education?
- (2) Does tertiary education affect the level of income inequality in a country and how?

## **Theoretical framework**

The role of theory is fundamental in the scientific method whether it is derived from observing the real world or tested through hypothesis in order to determine the validity of a theory (Bryman 2016/2018, 43). One could even argue that an empirical result is of limited value if it can't be grounded in theory, giving the result a more general or universal value than just the result itself. This is contiguous to the epistemological concepts of deduction and induction which in short terms can be described as a difference in perception of how to obtain knowledge about the world where the former deduces hypothesis from theory in order to test the validity of the theory to empirical observations in a top-down fashion, while the latter is more of a bottom-up approach where the research starts with observations which in turn lead to result and theory (Bryman 2016/2018, 47-50). What the two branches, or approaches, have in common is the positivistic view of scientific study, whether stated or not usually is the underlying assumption in most of economic research as well as in this essay. Positivism can be described as an approach to understanding the world based on the assumption that there is a real world which can be observed and studied in an objective way (Bryman 2016/2018, 51). This is usually done by models and quantitative methods. By observing the world one can describe and explain real world phenomena, which are independent of the observer/researcher, and make general claims based on empirical data which in turn can be tested. This approach can be contrasted to an interpretivistic approach in which the social world (societies, institutions, human interaction etc.) is distinguished from the natural (physical) world. The epistemological/methodological assumptions a researcher makes is thereof contingent on his or her conception of the world which in turn affects how one will go about answering a research problem (Hart 2018, 72-73). This study is positivistic and deductive in nature, meaning, it relies on the assumption that regularities can be observed, and real-world phenomenon can be explained by theoretical models.

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<sup>3</sup> Higher education and tertiary education will be used interchangeably throughout the review.

How does education decrease income inequality? Even if everyone in the workforce had the same level of education, we would still expect some degree of income inequality to occur due to individual variation in terms of productivity, negotiation skills etc. as well as variation in demand and supply for different type of jobs and skills. To say otherwise would be to assume that educational attainment is the only determinant of wage differences. However, educational attainment has been argued to be an essential factor and the potential casual link needs to be underpinned by both empirical research as well as a theoretical conception of the mechanisms at work. The two main arguments for how tertiary education affects income inequality are as follows:

- (1) Education affects income inequality since tertiary education leads to higher wages and hence income. Higher education makes a worker more skilled and productive. In terms of productivity, a more productive worker generates a higher wage if one assumes that a worker's salary is reflective of his or her productivity. Higher education is therefore a way to obtain a higher income which facilitates social/economic mobility if education is accessible but can perpetuate or increase income inequality if the opposite is true. The ability to generate a higher income from labour due to education can also spill over to capital income if the marginal propensity to save increase as income from labour increase, which potentially can decrease inequality if education is easily accessible.
- (2) The difference in wage between workers with upper secondary and tertiary education is sometimes called the 'college premium' or 'skill premium'. The skill premium depends on the demand and supply for skills or educated workers. The demand for higher education can be assumed to depend in part on preferences and costs. If entry fees to higher education is low one would expect demand to increase and the opposite if higher education is costly. When the supply of educated workers increases, the skill premium is reduced which levels out differences in labour income.

The first argument is multifaceted. In macroeconomic theory, it is assumed that the real wage depends on the marginal product of labour<sup>4</sup> (Carlin & Soskice 2006, 48). A person's productivity depends in turn on his or her skill level and hence education (Piketty 2013/2015, 327), which establishes a casual mechanism between education and income. The normative side of the argument adheres to the concept of equality of opportunity that everyone should have an equal opportunity to acquire higher education and consequently income. The other side of the argument regards efficiency and welfare economics in the sense that one's utility depends on other citizen's welfare. Granting access to higher education enables people to

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<sup>4</sup> This is assumed for a competitive market. In a market with imperfections other factors such as monopoly power of firms and bargaining power of unions affect the real wage depending on the underlying assumptions of the price setting curve (labour demand).

move between income groups and higher income improves peoples living standards which can affect social welfare (depending on the assumptions of the function). On the flip side, if higher education is a pathway to higher income and education is costly and therefore inaccessible to a large proportion of the population, one can reasonably assume a higher income disparity between those with tertiary education and those without<sup>5</sup>. With regard to income and savings, it is sometimes assumed that higher income groups save a higher proportion of their income than lower income groups, empirically recognized by economists like Milton Friedman and Simon Kuznets (Dyan, Skinner & Zeldes 2000, 4; Kuznets 1955, 6-8). In theory, it is easy to see how someone with a high income could save more than someone with a low income, assuming they have roughly the same expenditures. If tertiary education leads to higher income and consequently savings, education could affect income inequality through the channel of capital income assuming savings are invested. The second argument refers to demand and supply of skilled labour and is one of the most common explanations to wage inequality. If demand for skilled labour is high in relation to supply, skilled workers will be able to negotiate a high wage, or in other words that unions will have an increased bargaining power if there is a shortage of skilled workers (Carlin & Soskice 2006, 110; Piketty 2013/2015, 327; Becker & Chiswick 1966, 360). Furthermore, if there is a shortage of skilled labour in relation to unskilled labour, the skill premium can be expected to increase and affect income inequality and conversely if the relative supply of workers with tertiary education increases, the premium decreases which reduces income differences between the groups in terms of wages (Carlin & Soskice 2006, 110; Acemoglu 2002b,76)<sup>6</sup>. Knight and Sabot (1983) argue that an expansion of education follows a Kuznet curve or inverted U-curve, in the sense that inequality initially increases, regarded as the ‘composition effect’, but starts to decrease past a certain point where competition in the labour market, due to the increased supply of educated workers, reduces the wage premium called ‘compression effect’. One way to decrease income inequality would therefore be to subsidize tertiary education effectively increasing the supply of skilled labour beyond a certain threshold. As an example, Sweden has low or zero tuition costs but has also one of the lowest premiums in OECD while the U.S. has higher tuition costs but one of the highest premiums in the OECD (OECD, 2011). Acemoglu (2002a, 16) note that the average wage in the U:S. stagnated from 1970s and onwards while the premium has exhibited an increasing trend fuelling inequality. Although there is some merit to the argument that increasing supply of skilled labour depresses the premium, Acemoglu (2002b, 76) argue that this only holds in the short run. In the long run however, as the supply of skilled labour increases, it reaches a threshold where the effect is reversed since it becomes more profitable to create high quality jobs aimed at skilled labour therefore increasing demand for skills, effectively driving up the skill premium while low-wage jobs are created for the unskilled, resulting in increased inequality. This could explain why the premium in the United States has continued to increase despite the fact that the supply of skilled labour has increased simultaneously (Acemoglu 2002a, 15). The essence

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<sup>5</sup> This is a rather simple example since it assumes that there are only two homogenous groups. In reality, there are more than two levels of education and educational attainment varies and income inequality depends in part on educational discrepancy. However, for the sake of the argument two groups are assumed.

<sup>6</sup> For simplicity tertiary education and skill are used interchangeably and only two groups are assumed – skilled and unskilled workers.

of the hypothesis is that the increased supply of skilled labour in the U.S. during the 1970s created the demand for skilled labour since it became more profitable to develop technology that favoured skilled labour. This leads to a third argument – that there is symbiotic relationship between technology and skill and that technological change during the second half of 20<sup>th</sup> century has been skill-complementary due to the rapid increase in the supply of skills compared to the 19<sup>th</sup> century when the labour force was mainly constituted by unskilled labour, which made technology suited for unskilled workers more profitable (Piketty 2013/2015, 326-327; Acemoglu, 2002a). Assuming that new technology enhances labour productivity rather than replacing labour and that technological change only favours skilled labour, inequality will increase since skilled workers will see their wages increase in line with technological developments while unskilled workers wages will stagnate. If this premise is true, increasing income equality by subsidizing tertiary education will not be an effect of depressed skill premium through increased supply, but rather a way of adopting unskilled workers to new technology and to meet the demand of skilled labour.

One incentive for government spending on education is the generally accepted fact that education promotes economic growth. On one hand, spending on education leads to a more efficient workforce through increased human capital which in turn leads to more productive workers and therefore growth. On the other hand, human capital accumulation in later stages of economic development generates growth due to the complementary relationship between human and physical capital, according to growth theory (Thorbecke & Charumilind 2002, 1481). When the labour force becomes more efficient and productivity increases, the cost of production decreases which makes a country more competitive (on an aggregate level) against other countries which could be another incentive for government to subsidize education. Gylfason (2000) for example argues that countries which are abundant in natural resources tend to spend less on education and invest less in human capital, compared to countries which economies' rely less heavily on natural resources, which impedes economic growth as a result. Barro (1996, 15-17) finds that there is a positive statistically significant effect of secondary and higher level of education in growth. As soon as one assumes diminishing marginal productivity, subsidizing higher levels of education for reason of economic growth becomes inefficient and an unsatisfactory explanation. In terms of positive externalities from higher education however, if the higher productivity (caused by a more educated work force) is reflected in earnings or real wage, then there are no positive externalities (Rosen & Gayer 2014, 134-135). Acemoglu (2002a, 16) for example, finds that college graduates in the U.S. have a higher real wage on average which implies no positive externalities. Looking at the OECD are in general, a person with a tertiary education earns on average 50% more than a person with upper secondary education (OECD, 2011). But even if higher education generates positive externalities, the extent of externalities would probably differ across scientific fields, although they're subsidized equally.

There are surely multiple reasons why a government would spend on lower as well as higher levels of education. From an economic perspective the “efficiency argument” is insufficient. In fact, redistribution of income via taxes and subsidies are usually considered as market

imperfections in economic theory, which impede the efficient allocation of resources<sup>7</sup>. In welfare economics however, economic efficiency can only partially explain government intervention. In order to understand and explain government intervention in markets which could operate more efficiently without intervention, one needs to consider normative and equity argument. If education is a normal good, one would expect a positive correlation between income, level and quality of education in a free market (Rosen & Gayer 2014, 135) which could be argued to be unfair but would likely also reduce economic mobility, perpetuate or even increase income inequality since the return to education (especially the higher education/college premium<sup>8</sup>) has increased since the 1970's (Acemoglu 2002a, 7; OECD 2015, 45; Dabla-Norris 2015, 18-19). When it comes to education, especially in countries where education is heavily subsidized or free, one could make the argument that the underlying philosophy which justifies such a policy, at least in part, is the view that on average we are born with similar abilities and capabilities to succeed in life given the right tools and opportunity. That is, what separates us and determines the path we take are the social milieus we are brought up in and our socioeconomic backgrounds oppose to biological differences and heritage. A simplified example: if two people were born roughly around the same time, education isn't subsidized and hence costly, one of them ends up with a white colour job and the other with a blue colour job, the difference between them would, on average, be their ability to pay for school<sup>9</sup>. If this isn't part of the philosophy, one needs to explain why some countries make lower levels of education, not only free, but compulsory. If this assumption is true however, then the moral argument is that everyone should have the right to an education and not depend on whether one is born to a family that can afford school or not. This view is in line with the philosophy of 'commodity egalitarianism' which posits that some goods should be provided to everyone (Rosen & Gayer 2014, 261). This philosophical point of view could explain why some goods like education is free in some countries.

A person's decision to attend university or invest in oneself in terms of human capital will reasonably depend on many factors – preferences, the sum of the returns on the investment, opportunity costs or income forgone while studying. If one assumes rationality, efficient markets and that people are risk-neutral, people will acquire higher education if the premium is high enough, meaning if benefits outweigh the costs of education. Alternatively, up to the point where the marginal rate of return intersects the marginal cost of investing in education (Becker & Chiswick 1966, 359). One can therefore question the efficiency and necessity of "free" education on one hand. On the other hand, a society may consider it unfair that some people have money to invest by none other reason that their parents are well off or have saved for tuition while others have to borrow, for example from a bank, in order to able to acquire

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<sup>7</sup> The trade-off between equity and efficiency has been questioned in the economic growth literature since some empirical findings show a negative effect of income inequality on growth and a positive effect of redistributive policies (see Aghion, Caroli & Garcia-Penalosa, 1999).

<sup>8</sup> The difference in wages between college and high school graduates.

<sup>9</sup> Assuming people on average would prefer getting an education to some degree or another. One could also argue that preferences is a determinant of future occupation, which it most likely is, however whether our preferences are formed by social environment or is a biological factor is still up for debate.

education. This is where the concept of equality of opportunity becomes relevant. When speaking of the matter, one of two definitions is usually referred to – ‘equality of opportunity’ and ‘equality of outcome’. While the definitions may vary somewhat between and even in the same scientific field (Kodelja, 2016), in a broad sense one could describe the former as everyone having the same formal opportunity to succeed in life regardless of background while the latter means that the result or outcome is equal, that is, that everyone attain the same success (ibid., 19). The former implies that in a society, a system or process is equal in opportunity while the outcome may differ depending on exogenous factors. Take a game of poker for example, equality of opportunity would then mean that everyone starts out with an equal amount of chips or money while equality of outcome means that everyone ends up with an equal amount of chips which, to my knowledge, never happens since other, exogenous factors affects the outcome such as skill. For philosophers as André Comte-Sponville, Alain Renaut and John Rawls the essence of the concept is one of justice and equity (Kodelja, 2016; Roemer & Trannoy, 2016). There is however a distinction in the literature between a liberal and an egalitarian view of equality of opportunity and hence a difference in the conception of justice and equity, which translates directly to educational opportunity and policy. The liberal view of equal opportunity is one analogous to everyone being equal before the law, where actors are considered autonomous, and choice, ability and effort - exogenous or independent variables (O’Neill 1976; Kodelja, 2016). From this premise, if an educational system is equal, the outcome is independent of the system and therefore dependent on individual differences in exogenous factors. This is a more formal view than the egalitarian/socialist view, which considers individuals and hence their abilities and choices as products of their social environment (O’Neill 1976, 292-293; Kodelja 2016, 21). Since individuals are not considered autonomous in the liberal sense, variation in educational attainment and success between different groups of people cannot be exogenous. Formal justice or equality is therefore not enough to ensure equality. Thomas, Wang and Fan (2001) express it in a different and more formal way by arguing that if ability is normally distributed, then an unequal distribution of educational opportunity implies a welfare loss.

This, in turn, has implications for income inequality since the liberal view is that variation in educational success and sequentially success in the job market is due to variation in individual choice, ability and effort which affects income. The distribution of income (outcome) can then be considered fair if the system is fair and reflective of individual choices while the egalitarian view argues that differences in success and income between social groups wouldn’t occur if there were equal opportunities (O’Neill 1976, 275; Kodelja 2016, 21)<sup>10</sup>. The liberal view is a narrower concept of equality of opportunity and doesn’t compensate for initial differences as much as it equalizes opportunities. The concept of equality of opportunity and equity are therefore central in welfare economics, redistribution policies and hence education policies (Rosen & Gayer 2014, 135). In terms of redistribution policies in

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<sup>10</sup> Emphasis should be on “between groups” rather than between individuals. Success, income etc. can vary within groups but not between.

general, one need to explain why it's not flat out stealing and, education in particular, justify subsidies on grounds that cannot be explained by efficiency alone.

If inequality is something that affects society negatively and equality is something to strive for then publicly provided higher education can be justified on those grounds if education is a mean to achieve a socially optimal goal. More formally, if the level of welfare in a society is described by a welfare function and this function depends negatively on the level of income inequality, redistributing income to increase equality could be justified on the grounds that welfare is increased. Let's assume that a society's welfare is a function of  $n$  individual utilities denoted  $W=F(U_1,U_2...U_n)$  where  $W$  is welfare and  $U_i$  is the  $i$ th individual's utility. If we assume that this function is additive in that total welfare is the sum of individual utilities, that individual utility functions are identical and depend on income, diminishing marginal utility of income and that total income is fixed, welfare would be maximized when income is equally distributed (Rosen & Gayer 2014, 257). Welfare functions can work as a theoretical framework for evaluating redistributive policies, for example how educational policies affect welfare in terms of the income distribution. The optimal outcome depends however on the assumptions made or in other words – the form of the function. This begs the question of what level of equality maximizes welfare or is most desirable in a society and the problem of ranking different income distributions. The distribution of income can be described by a Lorenz curve (which is discussed further below) and perfect equality by a straight 45-degree line. If perfect equality maximizes welfare a Lorenz curve that lies completely above another Lorenz curve, that is closer to perfect equality, implies a higher level of welfare. However, if two curves intersect, redistributive policies can't be justified by ordering the income distributions without knowing more about the form of the function, that is, how society values transfer along the distribution (Tresch, 2015). Nevertheless, if we assume on a conceptual level, that an individual's utility depends not only on his or her income but also on other people's consumption of certain goods like education and/or health care which affect their utilities educational policies which redistribute income could be justified if social welfare is increased, formally if the gain in marginal utility of consuming education for one person is greater than the loss in marginal utility from less income.

## **Method and design**

One could say that the method used in research is indicative of the quality of the research itself. Randomized controlled experiments are often considered the gold standard of scientific methods. In social sciences however, controlled experiments are often rare since they're difficult to perform, unethical and not necessarily desirable (Davis et al. 2014, 4). Research design and method of choice depends on many factors, one being the ability to generalize the results of a study to other populations, fields, similar phenomena than the one observed which relates to a study's 'external validity'. One could even argue that a study which can't be generalized in any way is of little or no scientific value since every case, group of people,

phenomena and so on would need a specific explanation and hence a study of its own. In terms of this essay for example, the argument could be made that studying the relation between education and income distribution in just a single country and not being able to generalize the findings to other countries would be of less scientific value than examining the relation in the OECD countries. In this case it's quite easy to see how a large controlled experiment would be next to impossible to conduct. Most studies of economics therefore rely on other statistical methods.

Even the most well-done scientific study can rarely prove a relation between two phenomena or variables alone. Theories are constantly tested against reality in order to determine its validity or relevance and new empirical evidence generates new theories or revise already existing theories. In order to establish a relation between phenomena or with some degree of confidence determine if a relation exist, some form of meta-analysis or literature review is usually conducted. Building on previous research and relating to existing knowledge when conducting a study is a fundamental pillar in the scientific method (Snyder, 2019). Based on the result of individual studies however, it can be difficult to say something about the scientific consensus of a phenomena when research design, method, data collection and variables differ across studies. Literature reviews are included in some form or another in most scientific research whether the purpose is to identify a gap of knowledge in existing literature which can be filled by new research or to summarize and evaluate all previous research regarding a specified subject. The review can therefore play different roles in research where the review, in the former part, constitutes a background to a study, what has already been done or 'review for research' while the latter is a 'review of research' or literature review as a method (Bryman 2016/2018, 131; Hart 2018, 34-35). A literature review can be described as a systematic way of collecting and analysing the empirical evidence of previous research relevant for the research problem and purpose of a study (Hart 2018, 3-4; Snyder 2019). This is one reason why literature review as a research method bears a scientific value since it can accomplish what a single study cannot. By combining multiple studies, one can reduce the impact of errors on a single study as well as say something more definite about a casual relation than a single study can offer. By summarizing the existing knowledge, one can also identify potential gaps in the literature (areas that need more research) thereof facilitating the advancement of knowledge and theory (Snyder, 2019). The method can be suitable if the purpose is to evaluate the evidence within a field, answer a specific question or examine the validity of a theory (Tranfield et al., 2003). Since the purpose of this study is to an evaluate the existing knowledge in order to provide an answer to the research question if there is a casual relation between tertiary education and income inequality, the method of literature review seems appropriate. Another reason for doing a review of the evidence rather than doing an empirical study is that much research has already been done which makes a review more relevant than another single study.

There are different ways of conducting a review. Hart (2018, 93) distinguishes between two main strands within the methodology – traditional scholastic review and systematic/interventionist reviews. Which type of review is preferred depends in part on

scientific field, epistemological assumptions and purpose of the review. As with any scientific research one needs to clarify how a question will be answered. This doesn't mean that it's necessary or desirable to classify a review since the different approaches can overlap in practice (Hart 2018, 99-101). For example, systematic reviews tend to rely on, or at least prioritize, RCT (randomized controlled trial) studies (ibid.). This is especially true within the field of medicine where RCTs are naturally more common and important. In social studies, RCT studies are not as common or desirable as mentioned above. This doesn't mean that systematic reviews aren't carried out within the field of economics or any other field within social science, it just means that every review article doesn't necessarily follow a strict formula in line with the name of the review. As a result, reviews can vary in structure and information included, which can give rise to findings that would have otherwise been left out. On the other hand, deviating from a certain approach or formula can result in reviews with lower quality due to failure of meeting certain scientific criteria for reviews (Moher et al., 2009).

Reviews can be of varying quality which depends on how it is conducted and what is found, which steps are taken, if it is valid and reproducible etc. (Moher et al., 2009), which implies that some sort of procedure is appropriate in order to minimize bias and ensure sound results. In this study, a systematic review will be conducted. If meta-analyses of randomized controlled experiments are the gold standard of reviews (Davis et al., 2014), the systematic review is close behind in terms of scientific value since evidence from multiple studies are collected and synthesized. The systematic review can be described as a technique to collect and critically evaluate all empirical evidence on an effect that fits pre-specified inclusion criteria in order to answer a hypothesis or research question (Snyder, 2019; Davis et al., 2014). It's a systematic, transparent and reproduceable process to figure out what works and doesn't based on the available evidence, sometimes used for evaluating policy and informing officials (Hart 2018, 99-105). In this case the scientific evidence within in the field of economics will be reviewed in order to determine with some certainty if there is a relationship between tertiary education and income inequality and what the main arguments are. A number of procedures have been established by different organisations for how to conduct systematic reviews, for example 'Cochrane Handbook' and 'Evidence for Policy and Practice Information and Co-ordinating Centre'. These procedures or formulas can be used through the whole process, as methods of collecting articles as well as method of analysis. Which one to use depends mostly on scientific field since, for example, reviews in the field of medicine assess and include studies based on different grounds than in social science (Davis et al., 2014). This review will use 'Evidence for Policy and Practice Information and Co-ordinating Centre' method as a guideline. The steps in the procedure are illustrated in *figure 1*. Every step consists of subcategories with more specific considerations, for example: define the research question, search-strategies, quality assessment of articles and extracting information, making recommendations based on the findings and communicating those findings for the intended audience (EPPI-Centre, 2006). Some steps will be more relevant than other, especially the first three. The last two steps mostly regard recommendations for policy development and publication.

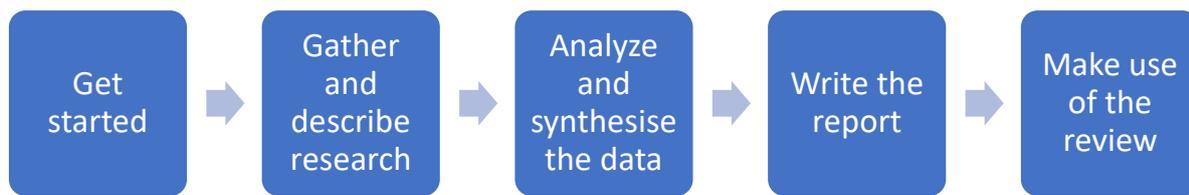


Figure 1. *Steps in the research process of conducting a systematic review in chronological order from left to right. Source: EPPI-Centre*

Meta-analyses and systematic reviews are sometimes used interchangeably but are different in the sense that meta-analyses are based on information gathered in systematic reviews and uses specific statistical techniques to estimate overall effects in populations (Davis et al., 2014). A meta-analysis will not be conducted in this study, but some descriptive statistics will be reported in the results of the study. Meta-analyses and systematic reviews are most common in medical research but have become increasingly important and applied in social sciences the last decades (ibid.). Be that as it may, they're not suitable methods for answering every research question. The most obvious reason being when a field lacks enough scientific research for a review to be relevant. Another example regarding meta-analyses is that the effects used for statistical analysis need to be independent of each other which means that the individual studies can't be based on the same empirical studies/data sets (ibid.). The method of choice is not straightforward. A traditional or narrative approach could be applied as well, partly because it's a more conventional approach within social studies but also because income inequality and education are subjects not confined to the field of economics. This type of review usually has a more broad research question, aims at analysing a subject or research problem from a meta-perspective with the purpose of getting an overview of the scientific progress and is sometimes preferred when a subject has been studied in multiple scientific fields, making it nearly impossible to review all existing evidence (Snyder, 2019). What makes a systematic approach more relevant in this case is that the evidence and effect of educational policy on income inequality is the focus of analysis rather than theoretical development or identifying gaps in knowledge. In other words, this review has a narrower scope in terms of purpose and research question than narrative reviews usually have. At the same time is the study restricted by a time schedule which means that every peer-review article can't be analysed as is commonly done in systematic reviews. This in turn puts particular pressure on the sampling process and especially why the specific articles are chosen, which will be discussed further below.

### *Selection of data*

The data used in this analysis will be the articles chosen for review. The validity and reliability of the results rely in part on the method of selecting data. In order to avoid bias, one usually relies on some sort of randomized process of sampling observations. For the purpose

of this essay, not every scientific paper treating income inequality and/or education will be of interest for the analysis, hence a randomized process is not optimal. In systematic reviews, all the available evidence meeting certain criteria is supposed to be evaluated. This can be a time-consuming process if the research question is broad in essence. A mere search on “education and income inequality” generates 7436 hits on ‘Web of science’. With regard to the time frame available for this review, all evidence can’t be reviewed if the research question is broad which implies a narrower question in order for the review to be relevant. For example, if the purpose was to appraise all evidence regarding education in general and income inequality in the world, the review would have to contain more articles in order to say something valuable and avoid bias compared to a review with a more specific purpose and scope. On the flip side, if the review gets too narrow in scope, the relevance and scientific value of conducting a review may be lost.

Google scholar is used as the main database for searching articles since it’s the largest database for scientific articles in the world. Other databases such as ‘Web of science’, Scopus, Taylor and Francis Online and ‘Econlit’ are also searched to reduce bias, bias in this case meaning that only the most accessible articles are chosen for the review (EPPI-Centre, 2006). As mentioned, every article can’t be considered for the review despite the research question being narrower than in the example above and hence, every database won’t be searched either which poses a limitation to the review. This is a shortcoming since valuable evidence might be overlooked in the process of selection. For example, relevant articles regarding effects of tertiary education might be found in other databases than those focused on economic literature. At the same time is the focus of this review the economic rationale of subsidized education as well as the effect of tertiary education on income inequality which is economically relevant. ‘Econlit’ is arguably a more relevant database in this case compared to a review of educational effects on crime for example where relevant articles might more likely be found in another database.

Inclusion and exclusion criteria are used to determine which studies are relevant and qualify for the review. The criteria are of importance for choosing relevant articles as well as evaluating the evidence or effects in the studies, minimize bias and errors (Davis et al., 2014). Criteria are used to ensure an efficient and systematic sampling of articles, enabling more successful searches and thereof increasing validity (EPPI-Centre, 2006). The criteria will be determined by the purpose of the review and include the methods used in the studies, variables, time periods, unit of analysis and research design in order to increase validity and reliability. Income inequality can be measured on different levels and education can be used as a predictor of future earnings on an individual level, income distribution within a country or a predictor of inequality between countries. In order to get sufficient data and a more complete picture of the effect, both studies measuring the effect of education on inequality within and across countries will qualify for the review. Furthermore, research design plays an important role in quality assessment, especially in medical research where RCT studies are preferred (ibid.). As mentioned above, this type of study is rare in social studies and will not be a prerequisite for inclusion. This doesn’t mean that research design doesn’t matter as much, but

rather than one need to take into consideration which designs will be eligible for inclusion and if studies with different research design are to be mixed in the review. In medicine, it is generally advised against to use studies with different designs and methods, for example randomised designs with non-randomised designs since the former are regarded as of higher quality, while others have argued that the articles sampled should be assessed by their validity in terms of the research question and purpose of the review (Davis et al., 2014). The arguments aren't mutually exclusive however and will both be considered in the selection process. Research can differ in nature and have different objectives ranging from exploratory and descriptive to critical and prescriptive. This study can mostly be described as explanatory since the purpose is to examine if there is evidence that variation in income inequality can be explained by the way they differ with regards to the proportion of people with a higher education. The data or articles chosen for analysis are therefore explanatory in nature as well, meaning, they aim to explain variations in income inequality by using higher education as an explanatory variable. The purpose of explanatory research is to unveil regularities and patterns in the real world (Hart 2018, 67). This is usually done by using some form of quantitative method, qualitative research will therefore be excluded in the sampling process. The studies included will be based on panel or time series data and use quantitative methods of analysis. In other words, cross-sectional studies are excluded since the scientific value or quality can be considered less valuable due to the difficulty of establishing a causal effect between variables. Furthermore, to limit the review in scope due to the type of review and time frame, papers published in economic journals are prioritized. Another reason is that this is an economic review which uses economic theory compared to other fields that analyse the problem from other perspectives and use other theories.

There are a couple of different search techniques or methods for finding relevant studies. Pearl growing is one of them where the researcher first finds one or a few relevant articles called "Pearl/s" which meet the inclusion criteria and use the thesaurus terms from that or those articles in the search process which facilitates the finding of relevant articles (EPPI-Centre, 2006). This process can be more or less comprehensive and hence more or less representative (more comprehensive – larger sample and hence more representative of the population of articles). Another technique is simply to use free text/keyword search or alternatively both. For this review, keyword searches are used with Boolean operators (e.g. AND, OR and NOT). This means that certain terms relevant for the reviews purpose, which likely are used in abstracts and/or titles, are searched for, like "tertiary education and income inequality". After relevant articles (meaning studies that primarily examine the relation between tertiary education and income inequality) have been identified, elimination begins by first excluding duplicates and then studies that don't meet the pre-specified criteria called 'Title/abstract screening stage' (Hart 2018, 103). Thereafter the articles will be read in full in order to single out the studies that meet all criteria and exclude those that don't. In the final stage data will be extracted from the remaining articles and constitute the base for analysis.

The search words that were used to identify articles: higher education, tertiary education, enrolment, expenditure, educational attainment, income inequality, Gini coefficient, wage

inequality, income distribution, developed countries, developing countries, OECD, panel data. Most research were excluded in the initial stage of the search process due to incongruency with the purpose of the review. The most common factors were: examination of the implications of tertiary education on other factors than income inequality, the casual direction of the relationship (the effect of income inequality on educational outcome, enrolment etc.), scientific field (sociology, education etc.), operational definitions of education and income inequality not congruent with the review, unable to receive access to the article.

### *Validity and reliability*

The objective of scientific research is to explain something that is unexplained and get as close to the true value or explanation as possible. Methodology is essential to this process. The terms validity and reliability are central to most scientific research<sup>11</sup>. The former can generally be described as how well a certain purpose is achieved or how close/far the outcome of a study is to the objective of the study while the latter concerns the consistency of the outcome and if repeated trials give consistent results. Both can be said to be means of evaluating scientific research. The method/methods used to obtain knowledge about the world is crucial in terms of achieving valid and consistent results since the analysis will be based on the observations one make. For example, if the objective of a study is to obtain results which can be generalized to a larger population, then conducting in-depth interviews with a few people or doing a discourse analysis of a policy document are clearly not the most appropriate methods to use in order to fulfil the purpose of the study. Another example would be to issue a standardized test in school with the purpose of measuring reading comprehension among students, but the test only includes a certain type of text, or you only have thirty minutes to complete the test for example. The validity of the test/method and hence results can therefore be impaired by the lack of diverse texts and measures how fast you can read rather than comprehension. This also relates to research design. For example, a case study or experimental design with only one or a few observations would be less suitable when the objective is to generalize the results to a larger population.

The validity and reliability of this review will mainly depend on two things: the research method and sampling of articles. In order to avoid invalid and unreliable results, which is even more crucial when the sample size is relatively small compared to a large review, pre-specified criteria for inclusion and exclusion of articles will be used as described above. Operational definitions are essential with regard to validity since multiple measures of income inequality and tertiary education exists in the literature. For example, measuring income

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<sup>11</sup> In some scientific fields, especially within social sciences, validity and reliability are of less importance when the researcher takes a postmodernist stance to ontology and epistemology. This is especially true when the researcher's presuppositions and assumptions influence the "production of knowledge" itself, meaning if another researcher examines the same research problem he or she would be likely to end up with a different conclusion since the conclusion itself is based on the researcher's interpretation and pre-conceived notions.

inequality with the Palma ratio when the distribution of income for a whole country's population is of interest would be a poor choice of operationalization/variable and decrease a study's validity. This doesn't mean that bias and/or errors will automatically be eliminated. The method of choice could be suitable for the purpose of the research, though the study could still suffer from systematic errors, meaning errors done consistently during the process of collecting and/or analysing data. Possibly the most common bias in science is confirmation bias which means that research in some way is tilted or favoured in a direction which confirms a scientist's presuppositions. For the purpose of this essay, it could for example manifest itself through the selection of articles which prove the hypothesis that education affects the distribution of income, in order to find a connection which isn't reflective of reality. This speaks to the importance of having criteria based on a clear objective, which reduces the risk of errors. For example, if the objective is to reach a conclusion on how higher education affects income inequality through a review of the literature, then only selecting articles which use "government expenditure on tertiary education" might lead to faulty conclusions due to a systematic error since government expenditure doesn't necessarily translate to a more educated workforce. Some other examples of potential biases would be to use only one database which could lead to relevant research being left out, using snowball sampling which in this scenario would mean to select articles referenced to in other articles which could favour frequently cited research articles<sup>12</sup>. Since the objective is to say something more general about the relation between higher education and income inequality than a single study can, a review seems suitable to achieve this objective.

### *Income inequality*

When discussing and comparing a social phenomenon between countries it's useful to have a measure or number which describes the phenomenon as well as a reference or benchmark. It is also a way of operationalizing theoretical terms and concepts. The 'Gini coefficient' is a descriptive measure of income distribution and one of the most conventional and applied measure in research about income inequality. It describes the unequal distribution of values of a variable where a higher coefficient indicates that the values are more dispersed than a lower coefficient. It ranges from 0 to 1 where zero indicates total equality (everyone has identical incomes) and one equals total inequality (all income goes to one person) (OECD 2011, 22). The Gini coefficient is derived from the Lorenz curve and is demonstrated in *figure 2*. The straight 45-degree line demonstrates perfect equality, also called the egalitarian line. The Lorenz curve is the line below the egalitarian line in the figure and measures the distribution of income in a population. The graph plots the cumulative proportion of a population's income on the y-axis and percentile of the population according to income, from lowest to highest, on the x-axis. For example, 60 percent of the population owns 34 percent of total

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<sup>12</sup> This has been disputed by Lecy and Beatty (2012) who argue that constructed snowball sampling can be an effective alternative when conducting a literature review since traditional keyword searches can be misleading due to inconsistent use of keywords.

income which is illustrated with the dashed line. The Gini coefficient<sup>13</sup> is calculated by dividing the area between the egalitarian line and the Lorenz curve, that is, area A by the area A+B.

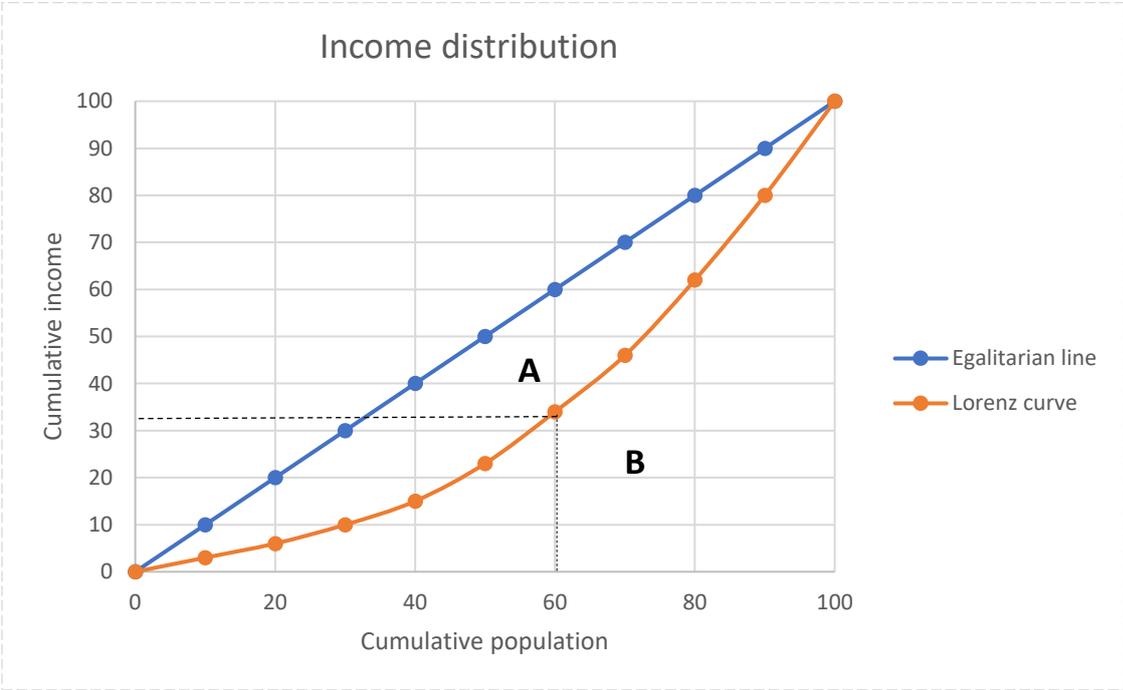


Figure 2 Illustration of a hypothetical income distribution. The axes are in percent. Source: Author

As with most statistical measures of societal phenomenon it has advantages and flaws. Reducing the phenomenon of income inequality to a single digit is convenient for quantitative research, both within and cross-country analysis. In other words, it enables and simplifies the process of comparing income inequality between countries or regions as well as studying changes in income inequality over time whether within or between countries, which speaks to its strength as a measure. On the other hand, when the real world is simplified to a model or measure there is a loss of nuance which implies a trade-off between simplicity and complexity. The question then becomes how much complexity can be forgone in order to gain the scientific value of a simple measure without making the measure irrelevant? Djurfeldt, Larsson and Stjärnhagen (2018, 73) argue that the rule of thumb is to simplify since the gain in clarity of a simplified measure outweighs the loss in complexity. It goes without saying that a single measure can't provide a complete picture of a complex phenomenon. It is however useful to mention the Gini coefficient's limitations and what information it doesn't provide.

<sup>13</sup> In this example the axes are in percent instead of decimals and the coefficient would therefore range between 0-100, also called the Gini index.

The Gini coefficient is usually calculated post-taxes and transfers which means that it measures the distribution of disposable income (Schermer, 2019). This makes sense since what matters with regard to equality is not income pre-taxes but rather what one can do with that income – consume goods and services and save. The coefficient only measures relative income within a country as opposed to absolute income or income levels. This essentially means that two countries with very different living standards and GDP can have the same Gini coefficient-value which can be misleading. It also means that it disregards Pareto improvements since inequality can increase even if everyone's income increases, although disproportionately, thereby ignoring the fact that everyone is better off than before. Furthermore, it can give a skewed picture of how income is distributed. For example, 50% of a population can have no income while the remaining 50% receives all income but it's equally distributed, generating a Gini of 0.5. At the same time, in a country where 75% of the population receives 25% of all income and vice versa, the Gini score can also be 0.5 (Chitiga, 2019). Consequently, the Gini coefficient can fail to capture changes in income between groups. Partially due to the drawbacks of the measure, other measures have been applied in research to capture different aspects of the distribution. For example, sometimes the 90/10 ratio (share of total income earned by the top ten percent divided by the income of the lowest ten percent of the distribution) is used and other times the 'Palma ratio' (income of the top ten percent divided by the lowest 40 percent). Which measure to use ultimately depends on the purpose of the research. The main difference between the Gini coefficient and decile ratios is that the former captures and summarizes the whole income distribution in one measure while the latter focuses on certain parts of the distribution (De Maio, 2007). If the purpose is to measure changes in the discrepancy between the richest and poorest in a country, some decile ratio is preferred to the Gini coefficient. Since this study will examine the effect of tertiary education on income distributions the Gini coefficient seems more appropriate because it doesn't exclude the middle class. Sure, we would expect some effect of education on a decile ratio, for instance a lower ratio if the workforce were evenly educated or high ratio if the opposite was true. However, since capital is more concentrated in the top of the distribution than income (WEF, 2018), the Palma ratio for example may not capture the effect of education as well as the Gini coefficient. Another measure or definition of income inequality, which is arguably as relevant as the Gini coefficient, is the wage premium. The wage or skill premium can act as a proxy for wage and income inequality since it in theory (discussed above) is a key determinant of income inequality. Since variations in education can be expected to affect wages in particular, using wage differences as the dependent variable is both relevant for this purpose and often used in research. For example, Wang (2019) finds that the tertiary premium decreased from 1995-2013 due to expansion of higher education (increase in relative supply of skilled labour). It is a narrower definition of income inequality and serves as a complement to the Gini coefficient for the purpose of this review.

## *Education*

As income inequality, education operationalized differently in the literature. Some studies use government expenditures on education as the independent variable, other studies use average number of years of schooling, standard deviation of schooling, enrolment ratios and

educational Gini (Thomas, Wang & Fang, 2001). Some measures seem more valid than others for the purpose of this review. First, the focus is on tertiary education which, for example, makes average number of years of schooling misleading since the distribution of schooling can vary and doesn't necessarily reflect the effect (if any) of higher education. For example, Coady and Dizioli (2017) test whether average years of tertiary schooling affect income inequality, but according to the theoretical framework outlined above, average years of tertiary schooling doesn't necessarily convey much information without knowing the standard deviation which logically would have a greater effect on income inequality than differences in average years of schooling. Secondly, inequality is partially driven by the skill premium which mainly reflect the difference between tertiary and upper secondary education, at least in countries where most people attain primary and secondary education. This doesn't mean that these factors don't affect income inequality. As a matter of fact, it's seems quite reasonable that educational inequality, measured by the standard deviation of schooling, is an explanatory factor of income inequality, where a more dispersed distribution or larger standard deviation is associated with higher levels of inequality. However, as mentioned above, the proportion of people with an educational attainment below upper secondary is decreasing and constitute only 15 percent on average in the OECD countries (OECD 2019, 38-42). The remaining two groups are those with upper secondary education and those with tertiary education. If the difference between the groups is the skill premium, then the most likely channel through which education affects income inequality is the relative proportion or ratio of those with upper secondary and tertiary education, at least in developed countries. At the same time is higher education the focus of analysis in the review, making the standard deviation or for example Gini education index, poor measures. Therefore, studies using variables measuring the expansion of higher education, such as the enrolment ratio, will be used as one of the independent variables in the review.

It can be of interest to select studies with different operation definitions, both in order to compare effects and increase validity by factoring in different ways that education could affect income inequality. The enrolment ratio is limited in the sense that it doesn't take into account variations within higher education, meaning, different years of higher education or for example, difference in quality, which all could affect income differences. To reduce bias in the selection of variables the review will also include studies that use expenditure on higher education (measured as share of GDP). The level of expenditure could potentially be a better indicator of quality but is also of interest for policy. For instance, if the purpose of public expenditure on education in part is to decrease inequalities in opportunity and income, then there should be a statistical relationship between the two. Otherwise, it's an inefficient allocation of resources or reducing inequalities is not part of the intent behind expenditure on higher education. Using multiple measures of educational inequality could therefore be a more meaningful way to examine the relationship and capture the broader effect than just one aspect of higher education. At the same time, every single study including all measures of education can't be reviewed since such a task would involve much more literature and be a more comprehensive review than this one.

## Result and analysis

Objectivity and transparency are cornerstones of the scientific method. Therefore, it should be clear which research is included and excluded and why. In the initial part of the search process 57 articles were identified which constituted a first sample. After having read the studies, most research was excluded since it failed to meet the criteria. For example, there is an extensive growth literature concerning income inequality which was mostly excluded from the review since the focus of analysis was economic growth with regard to human capital accumulation and income inequality, but also because of the incongruency of the definitions of inequality and education used in the literature and this review. The same is true for literature on social/economic mobility which focus in part on education and income but not income inequality per se and was therefore excluded. As mentioned above, most research from other fields than economics were also excluded in the search process. Furthermore, studies using the same data set were excluded. For example, a large number of articles use Robert Barro and Jong Wha-Lee (2001) data on education variables. It should be noted that the studies are comparable in so far as they use the same or similar empirical definitions of higher education. For example, studies with ‘expenditure’ as the independent variable are not straight forward to compare with studies that use ‘enrolment’, since the underlying mechanisms or channel through which they affect income inequality might differ. However, studies with ‘enrolment’ as the independent variable are fairly straightforward to compare since they use the ratio of the population with higher education to those without. The same is true, in terms of comparability, for the studies with expenditure as the independent variable. The other independent variables are not perfect substitutes to enrolment but are fairly similar since they all constitute proportions or percentages of the population or workforce with some form of higher education. For example, Wang (2019) operational definition of higher education is the ratio of workers with tertiary education (12+ years of schooling) to workers with incomplete secondary education (5-10 years of schooling) while Rodriguez-Pose & Tselios (2009) defines ‘attainment’ as the percentage of the population with tertiary/third level education. Studies which apply the Gini coefficient are straight forward to compare while ‘wage inequality’ as the dependent variable differ from the Gini in the sense that it merely measures income from wage and not capital. The final sample of studies, and hence the result, is displayed in *table 1*.

Income inequality				
Tertiary education	All countries	Developed	Developing	Articles
Expenditure	- (**) - (*)			<i>Sylwester (2000)</i> Period 1960-1990 Significant at both 5% and 10% depending on the amount of control variables.
Expenditure	+ (***)	- (***)		<i>Keller (2010)</i> Period 1960- Expenditure only significant without controls.
Expenditure	+ (***) - (***)			<i>Celikay &amp; Sengur (2016)</i> Period 2004-2011 (EU countries) Positive effect in short term and negative in long term.
Enrolment	+ (**)			<i>Keller (2010)</i> Period 1960-
Enrolment			- (***)	<i>Arshed et al. (2018)</i> Period 1990-2015
Enrolment			+ (***)	<i>Arshed et al. (2019)</i>
Enrolment	+ (***)			<i>Bergh &amp; Fink (2008)</i>
Enrolment	+ ()			<i>Psacharopoulos (1977)</i> , p-value missing
Enrolment	- (***)	'- (***)	- (***)	<i>Sylwester (2003)</i>
Relative supply of tertiary education			- (***)	<i>Wang (2019)</i> Period 1995-2013. Wage inequality used as dependent variable.
Expansion of college graduates			+ (***)	<i>Yang &amp; Gao (2018)</i> Period 2002-2013. Wage inequality as dependent variable. The effect was negative but not significant when Gini was used as dependent variable.
Attainment	- ()			<i>Gregorio &amp; Lee (2002)</i> Period 1960-1990, p-value missing
Attainment	+ (***)			<i>Rodriguez-Pose &amp; Tselios (2009)</i> Period 1995-2000
Attainment	- (***)			<i>Park (1996)</i>
<b>Sum</b>	<b>(+)=6</b> <b>(-)=6</b>	<b>(-)=2</b>	<b>(+)=2</b> <b>(-)=3</b>	<b>Total:</b> (+)=8 (-)=11. <b>By variable:</b> <i>Expenditure</i> (+)=2 (-)=4, <i>Enrolment</i> (+)=4 (-)=4, <i>Rel. supply of tertiary ed.</i> (-)=1, <i>Expansion of college grad.</i> (+)=1, <i>Attainment</i> (+)=1 (-)=2

Table 1. Statistical relationship between different measures of tertiary education and income inequality. Note: All countries=developed and developing countries. “+”=positive effect, “-”=negative effect. (\*\*\*)=statistically significant at 1%, (\*\*): statistically significant at 5%, (\*): statistically significant at 10%. The studies use the Gini coefficient as the dependent variable if nothing else is stated.

The ambiguity of the direction of the effect displayed in *table 1* emphasises the inconclusiveness in the literature. While some argue that education is the key determinant of income inequality (Knight & Sabot, 1983) derived from the fact that education determines skill and productivity which determines wage and income is mainly constituted by wage. Other has also been argued that education can't explain most of the income differences across countries (Sylwester, 2003). A large part of the literature finds that higher education affects

income inequality positively while others find a negative relationship. So, what is true and what can be made of the result above?

The Kuznets curve or hypothesis is frequently referenced to and tested in the literature of income inequality. In short terms, the hypothesis states that during a period of economic development inequality increases in the beginning when people move from a lower to a higher income sector but decrease after a certain point since fewer people are left in the low income sector (Knight & Sabot, 1983). For example, during the industrial revolution when the economy transitioned from agricultural to industrial production and people migrated from rural to urban areas. The hypothesis is mainly used, in the literature, in reference to economic development and economic growth (Oczki, Muszyńska & Wędrowska, 2017), especially to test if the hypothesis holds for developing countries. However, the underlying mechanisms are similar to those of education and income inequality since they're both determined by demand and supply and rate of returns to production factors. The Kuznets hypothesis could be applied to the evolution of multiple industrial revolutions and ties into the composition and compression effects and Acemoglu's hypothesis that wage inequality is due to the evolution of skill biased technology driving up the skill premium. From the logic of the Kuznets curve, an increase or expansion of labour with tertiary education will initially increase inequality when people move from one income group to another, while later on decrease as more and more people acquire higher education. In terms of the composition and compression effects, an initial increase in tertiary education and hence supply of skills will change the composition of the labour force, effectively increasing inequality and later reduce inequality when the premium is depressed, derived from economic theory that returns to a production factor decrease as the supply of that factor increases relative to demand. According to Acemoglu (2002a, 10), an increase in the relative supply of skills reduces the premium and consequently income inequality in the short run but fuels inequality in the long run since it becomes more profitable to develop technology and capital that complement skilled workers, which in turn raises demand. This is the opposite of Kuznets hypothesis unless there are multiple Kuznets curves. Acemoglu's hypothesis is built on observations from the U.S. during the second half of the 20<sup>th</sup> century, meaning an already developed country. Analogous to the first industrial revolution, when people transitioned from being farmers to factory workers, the same could be true for other fundamental economic developments where the composition of the labour force is altered, in this case, from factory workers to high skilled labour. This could be one explanation for the different and opposite effects of higher education displayed above. From this logic it follows that tertiary education has different effects on income inequality depending on where a country is on the curve or which phase of development (assuming there's a generic pattern). Furthermore, it essentially means that both developed and developing countries can experience positive effects of education on inequality, developed countries like the U.S. since the increased supply of skills, at a certain point, generated skill biased technology which shifted demand from unskilled labour to skilled labour creating a new curve, especially since the revolution in information technology, and developing countries since an increase in the proportion of high skilled labour initially increases

inequality<sup>14</sup>. This could be why Celikay & Sengur (2016), for example, finds that increasing expenditure on higher education increases inequality initially but decreases inequality in the long run. It should be noted that this reasoning assumes that there are only two groups – high and low educated workers which obviously is a simplification of reality. It doesn't consider other important factors regarding education that determine inequality, namely, different levels of high and low education (within group variation) and wage dispersion within groups (Knight & Sabot, 1983). From the result above we can't calculate the exact point where further increase in higher education generates lower inequality or the point where inequality peaks, nor is it homogenous for all countries but depends on the premium on education (ibid.), which means that two countries can have the same share of people with a tertiary degree but be on different points of the curve. However, if we make the assumption that developed countries, in general, have gotten to that point where an increase in relative supply of skills decreases inequality, that is, a diminishing Kuznets curve, while developing countries are on their way to that point which mean that an increase in supply of skills increases inequality, we can make some sense of the result in the table since two studies found a positive effect for developing countries and the opposite for developed countries.

Estimating the effect of higher education and underlying mechanisms becomes increasingly difficult in studies conducting regression analysis based on data from both developed and developing countries, especially when the time span is limited. A developing country can exhibit a large proportion of highly educated workers while having a high Gini coefficient and a developing country can have a low proportion of worker with higher education and a high coefficient, which could be the reason why six estimates are positive and six negative. This depends in part on where the country is on the curve. A study focusing on just one country over a longer period of time could therefore generate more meaningful insights. Claudia Goldin and Lawrence Katz studied the evolution of income differences in the U.S. between 1890 and 2005 and found that the return to skill (premium) increased when the growth rate of skilled labour supply decreased in the 1980s which consequently started a consistent growth in income inequality (Piketty 2013/2015, 328-329).

The inconclusive results also speak to the limitation of this review and higher education as a determinant. The results indicate that a lot of other factors determine income inequality, both educational and non-educational factors. In some of the studies, tertiary education became insignificant when non-educational control variables were introduced in the model, Keller (2010) for example. It seems reasonable that inequality not only depends on higher education but on the labour force's educational composition as a whole, like the dispersion of educational attainment in a country. Piketty (2013/2015, 328) notes that France experienced no decrease in wage inequality during the 20th century despite the democratization of the education system which he argues was because the dispersion or variance in educational

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<sup>14</sup> Assuming the proportion initially is on the upward part of the curve or below the point where further supply decreases inequality, more formally where the derivative is positive as opposed to zero at the critical point from where inequality starts to decrease.

attainment between groups remained the same. This implies that a convergence of educational attainment probably would decrease inequality.

One could wonder what this means for educational policy and the rationale for public expenditure on higher education. A rise in inequality due to increased education seems inevitable based on the preceding reasoning. If the rationale for redistribution of resources is to increase equality, and it generates the opposite effect, it's a rationale difficult to justify. This is especially tricky for two reasons. Redistributive policies are usually more difficult to justify (politically unpopular) than other forms of economic policies, for example, distributing "new" resources. Secondly, re-election makes politics a short-term game which leaves little incentive for costly long-term policies. Based on the empirical literature and theoretical framework, an increase in higher education will at some point reduce inequality. However, is this future effect a sufficient rationale for expenditure on higher education? And, if the expansion of higher education leads to skilled bias technology that in turn fuels inequality and hence reduces social welfare, which would potentially require even further expansion to reduce, can subsidized higher education really be justified on the grounds of lower income inequality and higher social welfare? It would be tempting to fall back on the grounds that human capital is a determinant of economic growth and can provide a competitive advantage against other countries. And this still might be a reason for public spending on education but as mentioned above, if higher education is subsidized equally across fields with different effect on growth, it's not a sufficient rationale. However, another rationale for subsidized education discussed above was that of equal opportunities. Since the outcome isn't the focus of 'equality of opportunity' as in 'equality of outcome', but rather the process which produces the outcome, it makes it easier to justify and is not necessarily connected to income inequality per se. If we assume that higher education wasn't provided by the public but could only be consumed on the market. Then as long as this is an option, some people will be able/afford to consume education and will do so as long as future earnings from education outweigh the cost. This in turn could be considered unfair from an opportunity perspective, since differences in socioeconomic backgrounds will affect the ability to consume education and hence future earnings which inevitably will generate inequalities in income. From a theoretical perspective then, subsidies of higher education can be justified on the basis that it equalizes opportunities both in consumption and the ability to earn a higher future wage, whether it increases or decreases income inequality. From an empirical perspective, since people are able to consume higher education, income inequality is inevitable. Public spending could therefore be a measure to reduce inequality, at least in certain points in time. Spending on education has been argued to increase quality of education and decrease inequality. Keller (2010) finds a significant inverse relationship between public spending on tertiary education and income inequality in developed countries. The question is whether this is due to higher quality or that expenditure increases with enrolment. Sylwester (2000) argues that if the level of expenditure only is reflective of the enrolment ratio, meaning high expenditure due to high enrolment, then targeting income inequality by spending more will not have an effect. Berg and Fink (2008) find no relationship between spending and enrolment which means that the effect of spending on inequality is not dependent on enrolment. Based on the result, there seems to be a clearer, negative, relationship between expenditure and inequality than enrolment and inequality. As a policy instrument, increasing educational expenditure and

thereof quality, could be a more effective measure to reduce inequality than targeting the enrolment ratio. As mentioned however, the proportion of people with a tertiary degree isn't the only educational determinant of inequality and other factors such as the spread in educational attainment, wage dispersion and size of the premium affect the extent of inequality as well as how long it will take to reach the point where inequality starts to decrease as the proportion of people with a higher education increases (Knight & Sabot, 1983). At the same time, it was mentioned above that the average level of educational attainment has increased in OECD during the last ten years, effectively reducing the proportion of people with lower than an upper secondary degree and increasing the proportion with a tertiary degree. If this trend continues, the inverse effect of tertiary education on inequality might be more significant in the future.

## **Discussion and concluding remarks**

Searching through the literature on income inequality it quickly becomes apparent that it's prominent topic in scientific research. It is also highly diverse both in terms of field and methodology. The fact that income inequality isn't concentrated to the economic literature speaks to its importance but also the need for a more extensive review of different fields and definitions of income inequality. The fact that there is a connection between education and income inequality seems clear, but the effect differs with regard to operational definition and hence policy intervention (enrolment, expenditure) but also country and how developed a country is (*table 1*; Coady and Dizioli, 2017). This implies that the effectiveness of educational policies differs between countries. The Gini coefficient as a measure of inequality seems to be the most prevalent measure, but other measures are also frequently used. This is even more true in terms of education. Combined, the literature becomes increasingly diverse in methodology as more definitions are used which hampers the comparability of results. Simultaneously, it generates a more diverse picture of different policies and the effects on income distributions than solely one measure of education and income inequality. For example, measuring income inequality as the ratio of deciles or changes in the lower or higher parts of the distribution can give other insights than the traditional Gini coefficient. The variation of definitions and results do however provide a limitation to this review since research examining the link between tertiary education and income inequality is left out. Although the aspect of wealth inequality and education has been touched upon the literature is adjacent to income inequality and has mostly been left out and can be of interest for future research, especially since wealth is more concentrated than income and the evolution of technology and the economy might increase wealth inequality further.

Some say that we're entering the fourth industrial revolution with the evolution of artificial intelligence. As technology continues to evolve and become more efficient, traditional labour markets might become automated resulting in the loss of jobs. The first jobs to go in such a revolution will most likely be unqualified jobs that don't require higher education which

prompts the question if everyone will need a higher education in the future? At the same time, if human labour is replaced by new technology, the cost of production decreases, profit increases for those who own the companies using such technology while workers will lose income since they are replaced by machines. It's evident that some will benefit from such technology and others won't. One might wonder what the implications for income inequality will be in such a scenario.

This is of course a simplified example and speculative to some extent regarding how artificial intelligence will evolve. It's also not a new phenomenon that some jobs become obsolete while new jobs are created which has been evident since the first industrial revolution. AI technology could be beneficial for society as a whole and new job markets might emerge as a consequence of more efficient technology which replaces old jobs and in turn results in a more efficient allocation of human resources since for example, someone who used to drive a truck for a living can do another job that a machine cannot. Take smartphones for example, which has facilitated communication and acquiring information while creating a new market and jobs in terms of app-development and so on. From an economic perspective markets will allocate resources efficiently, meaning that labour will reallocate when the labour market changes. However, it's not pure speculation. Data shows that traditional jobs are declining in the OECD countries, especially mid-level jobs which's share of the total workforce declined from 53 to 41 percent between 1995 and 2010 and has in part been attributed to technological change (OECD 2015, 49-50). OECD estimates also show that 14 percent of jobs are at high risk at being automated in the near future (OECD 2019, 24-25) and that automation has been a major factor of the shift in income from labour and capital, meaning that income from labour has exhibit a decreasing trend while the income share from capital has increased (OECD 2015, 47-49). If large sectors of the labour market will be automated in the near future, it will put more emphasis on education policy, in part because future jobs will be in markets that require education which means that the demand for education will increase, but also because people will be in need of retraining and re-educating themselves. Due to machine learning and pattern recognition computers have become better than humans at certain tasks and games like chess. It would not be unreasonable to assume that in a near future machines will be better than humans at for example detecting cancer and in so replacing radiologists. Except for the first industrial revolution, which saw skilled workers be replaced by unskilled workers, the second and third industrial revolution during the twentieth century was mainly skilled-biased in terms of technological innovation which resulted in an increased demand for skilled labour and the opposite for unskilled labour which in turn fuelled income inequality in the U.S. (Acemoglu 2002a, 7-16). This has led to the notion within the field of economics that there is a complementary relation between educated workers and capital and that technological development favours educated workers (Acemoglu 2002a, 7). As mentioned above, one could of course make the argument that technological innovation and a fourth industrial revolution will create new jobs that one can't foresee. However, what's unique with the fourth industrial revolution is the evolution of artificial intelligence. Meaning, as AI continues to develop, become more sophisticated and efficient, at some point it will outcompete humans at both blue and white colour jobs.

The economic rationale or incentive for AI technology is clear cut – more efficient technology implies lower costs, a competitive advantage, larger market share (if not already a monopoly) and hence higher profits (Pepall, Richards & Norman 2014, 554-557)<sup>15</sup>. The main costs will come from investment in the research and development of the technology but when the technology is in place it will replace labour costs and exhibit economies of scale. How is this relevant for inequality? Looking to the third industrial revolution, it has been argued in the scientific literature that the rapid evolution of information technology since the 1970's has fuelled income inequality due to increasing demand for skilled labour (Acemoglu 2002a, 7-33). This means that new technology has favoured human capital as a production factor, although in an imperfect way, meaning not all human capital has been favoured proportionally. Based on this, the beneficiaries of such technology will be those who own companies which will use the technology, reasonably those who already are at the top of the wealth distribution and income distributions and people whose skills are in line with the technology, while the losers so to speak, will be those whose jobs are automated away. This could reasonably further increase the unequal distribution of wealth and income both within countries and globally since the largest investors in AI are the industrialized countries. If the hypothesis is true that technological change has favoured educated workers at an accelerating pace (Acemoglu 2002a, 11; OECD 2011, 28), and as a result led to higher real wages for skilled workers and the opposite for unskilled workers, then the fourth industrial revolution surely will lead to even higher levels of income inequality the coming decades. This reasoning seems especially true when educational change doesn't develop in the same pace as technological change leading to increasing income inequality while the opposite occurs when education catches up (OECD 2015, 45). This seems reasonable from an economic perspective for the following reason - if there is a significant gap between those with high and low education in the workforce and demand increases for the former group (while supply remains constant in the short term) and decreases for the latter group one can see why income inequality increases since the gap in real wages increases between the groups.

An argument for increased provision of higher education is that when the supply of labour increases, wages decrease. Study finds evidence that when the supply increases the skill premium is reduced, which would then decrease income disparities and hence inequality. So, would income inequality disappear if everyone received higher education? Education isn't the only factor affecting inequality. At the same time, demand and supply of labour differ across fields and hence wages, but also productivity. There is a famous law regarding productivity called 'Price's law' named after Derek J. de Solla Price (Nicholls, 1988), which in a generalized form states that half of the output in a field is produced by the square root of everyone working in that field. Even though one should be cautious in extrapolating the law to other fields and situations<sup>16</sup> it suggests that some will be more productive than others

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<sup>15</sup> Since the cost of labour, especially in the industrialized west, constitutes a large part of companies' costs, one could argue that there always is an incentive to automate labour in order to cut those costs.

<sup>16</sup> It was originally applied to literature in the sense that half of the publications within a given field is produced by the square root of everyone publishing in that field (Nicholls, 1988).

within a given field. Since productivity is a determinant of wage in economic theory, if productivity varies, one expects wages to vary and income inequality to persist.

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## Appendix

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