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Three Essays on Inequality of Opportunity and Intergenerational Mobility

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Three Essays on Inequality of Opportunity and Intergenerational Mobility

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Introduction

In his book *The Epic of America*, James Truslow Adams coined the term *American Dream* as "that dream of a land in which life should be better and richer and fuller for every man, with opportunity for each according to his ability or achievement."(Adams, 1931) It is this ideal that has become ingrained in worldwide citizens with the image of the U.S. as the land of opportunity, the place that promises happiness for those who choose to work hard.

But this noble ideal seems to be contradicted by the statistics provided by the academic community in recent years. In 2014, the French economist Thomas Piketty published his best-selling book *Capital in the Twenty-First Century*, showing that inequality of income and wealth across the world has increased to the high level of the pre Word War I era. The U.S., ironically, is the country with the highest level of inequality. If opportunity is abundant, why are some people reaping much larger payoffs than others? According to the World Prison Population List (10th edition), in 2013 the U.S. had the highest rate of incarceration in the world: 716 per 100,000 of national population, compared with 144 per 100,000 worldwide (Walmsley, 2013). Are there significantly more people in the U.S. who do not want to work hard and follow shortcuts by committing crime, compared to other countries? In November 2015, Angus Deaton, the recent winner of the Nobel Prize in Economic Science, and Anne Case, an economic professor at Princeton University and Deaton's wife, published data on mortality rates, showing that the death rates for middle-aged white Americans have been rising. The main group that drives the

mortality rate higher is the poor and undereducated, who are most likely to abuse drugs, alcohol, and commit suicide. The U.S. is the only developed country that experiences this phenomenon (*The New York Times*, 2015).

Was it merely the prisoners' fault to commit crimes? Did those at the bottom of the income and wealth distribution choose to not work as hard as those at the top? Did people choose to be undereducated, to have low income, and to eventually abuse substance and commit suicide? Mass incarceration, rising income and wealth inequality, and increasing death rate do not seem to go along with a "better, richer and fuller" life for Americans. How do we cope with these bleak statistics? What is the link between these grand-scale numbers and the stories of the individuals who suffer? How did these grim developments all start?

To answer these questions the present project is structured along three separate, yet interconnected, essays. The first essay introduces Roemer's (1998) model, one useful way to define equality of opportunity, and presents some criticisms of it. We provide an argument on how the model can be applicable to the real world, at least to a particular period of life. In the second essay, we leave behind the theoretical framework of equality of opportunity to focus on the real world. We review some findings on income and wealth inequality as well as intergenerational mobility, and introduce a controversial model of social mobility. We point out a drawback these branches of research have in common, and transition to a promising research direction in the third essay. In this essay, we review the literature on the mechanisms of mobility and introduce some major results of the study of early childhood development. We finalize the project by discussing the relationship among the three essays in the conclusion.

This project is a small attempt to understand the process that leads to inequality. We do not presume to finish such a daunting task; rather, we aim to draw attention to a perspective that can potentially lead to productive research in the future.

ESSAY 1 – Roemer's Model of Equality of Opportunity

Generally people have negative attitudes towards inequality, be it inequality of wealth, income, education, or other aspects. The deepest concern is that inequality might be a barrier to bettering one's life. When the playing field is levelled, people celebrate industriousness and discourage idleness. Equality must then take into account relative effort expended. As summarized in Kanbur and Wagstaff (2014), ideally, inequality then can be divided into two sources: legitimate and illegitimate inequality. As long as inequality comes from legitimate reasons, it is more tolerated by society.

In this essay, we introduce Roemer's (1998) model of equality of opportunity, one that takes into account people's willingness to work. We then discuss the problems of the model by analysing it from the perspective of welfare and distributive justice. At the end of the essay, we provide an analysis on the drawbacks of the model, and provide an argument about how the model can be reasonably applied to the early childhood period.

1.1 The Roemer's (1998) Model

Roemer's model aims to provide an algorithm to determine how to level the playing field. The model makes two main assumptions: (1) factors outside of a person's control and factors under a person's control can be separated into circumstances and efforts, and (2) within each

group of people whose factors outside of their control are the same, we can determine how much they differ in the amount of effort they exert. With these two assumptions, Roemer proceeds to define what he means by "equality of opportunity."

The foundation of Roemer's framework is the separation of circumstances and effort. Circumstances are all factors that are beyond the control of a subject, and effort is the amount of work that the subject exerts (we postpone detailed discussion of circumstances for now). Roemer supposes that vectors of circumstances can be enumerated, and each vector represents one type of person. Types are assumed to be finite, and each type contains a subset of the population under discussion. To ensure that the size of each type is viable for analysis, the number of types is limited to a manageable level. Note that by this definition, individuals in each type would have the same resources.

Within each type, there is a distribution of effort exerted by its members. Roemer assumes that the distribution of effort in a type depends on the type itself. The amount of effort an individual invests would determine the outcome for that individual. Here, the only variable within an individual's control is his or her effort; autonomous choice decides the position of a person on the effort distribution.

Formally, let $\mathcal{T} = \{T_1, T_2, \dots, T_n\}$ be the set of types (assumed to be finite), where each $T_i = (t_1, t_2, \dots, t_m)$ is a vector of m factors determining a circumstance (we also assume that the factors are finite). Each T_i consists of all individuals with the same circumstances. Each T_i has a different distribution of effort.

An example would help clarify Roemer's model. Suppose there are only two factors in our analysis: wealth and innate intelligence. Since these factors are beyond the control of any subject, they are deemed circumstance factors. Each factor has two levels: high and low. With this setup, there are four types of people: wealthy – more intelligent, poor – more intelligent, wealthy – less intelligent, and poor – less intelligent. With the requirement of Roemer's model, each type needs to have enough subjects for a viable distribution of effort. In this simple setting with very few factors, this requirement is easily met. Note that autonomy is satisfied by the assumption that each individual in our hypothetical population can control how much effort he or she exerts for different endeavors.

From the point of view of formal notation, this example means that there are two factors:

t_1 represents wealth, where $t_1 = \{high, low\}$, and

t_2 represents intelligence, where $t_2 = \{high, low\}$.

The set of types is

$$\mathcal{T} = \{T_1 = (high, low), T_2 = (high, high), T_3 = (low, high), T_4 = (low, low)\}.$$

Roemer emphasizes an important distinction between the level of effort and the degree of effort. The level of effort is the *net* effort an individual expends compared to the total population, while the degree of effort is the amount of effort expended *relative* to a particular type. With this framework, Roemer proposes that equality of opportunity should satisfy the following condition: *the reward of the individual be the same across all types as long as he or she exerts the same degree of effort* (in his work, he specifies it as individuals with the same centiles in their types).

This criterion means that no matter what the background of a person is, the reward should only depend on his or her effort. This ideal would be attained by redistribution. Roemer acknowledges that, in general, it would not be possible to attain a redistribution scheme such that all people with the same centile across groups would have the same reward; but there are designs that approximate this ideal case (which is not the interest of this essay).

To continue our current example, let's consider the amount of hours spent for studying per day as an outcome. It suffices to demonstrate the idea on two types; without loss of generality, we choose the wealthy – more intelligent and poor – less intelligent types (types T_2, and T_4, respectively). The T_2 type has a distribution of effort ranging from 5 to 8 hours, with the median effort of 6 (say, because people in this type are well-prepared by family financial resources and are fond of studying since they are naturally good at academic work). The T_4 type has a distribution of effort ranging from 3 to 5 hours, with the median effort of 4 (say, because they have to work part-time, and are not fond of studying due to their less elevated academic ability). If we compare students of these two types who stand at the median of their group, the level of effort might be different (6 vs 4), but their degree of effort is the same (they are both 50th percentile in their groups). In Roemer's model, it is unfair to hold the person in the T_4 type accountable for doing less work than the one in the T_2 type because the effort distribution is beyond any individual's control.

The main contribution of this model is the metric of effort as a way to determine equality of opportunity. According to Kanbur and Wagstaff (2014), De Barros et al. (2009) use another related metric to determine equality of opportunity, but the main assumption also lies on the

separation of circumstances and effort. We shall discuss this empirical study briefly later on since it motivates some interesting inquiry to Roemer's model.

1.2 Ex Ante and Ex Post Utility - Where Roemer's Model Stands

While Roemer's model provides a useful way to define equality of opportunity, it does not view opportunity in the context of interconnected generations. Since parents are responsible for creating an environment for children to grow up (that is, they affect the *circumstances* of their children), equality of opportunity should be examined in a multi-generational context. To this end, we turn briefly to a discussion of social welfare distribution: the ex ante and ex post perspectives. As we will see, this discussion provides a bridge between equality of opportunity and mobility. We adopt the summary from Kanbur and Wagstaff (2014) for this debate, and we provide a discussion on how to view the debate from the perspective of Roemer model.

*Ex Ante and Ex Post - Some Concept*s

According to Kanbur and Wagstaff (2014), ex ante utility refers to the utility before an event and ex post utility refers to the utility after an event. An event can be any decision an agent undertakes, be it choosing a job or buying a house. Ex ante and ex post equality can be understood in the same manner.

Kanbur and Wagstaff use Milton Friedman's (1962) case to illustrate the point. Friedman considers a case where two people with equal resources and circumstances enter a lottery. While both are free to enter the lottery, the outcome of the lottery is very unequal, one favorable and one not. Friedman argues that even if there is an inequality of outcome after the lottery takes

place, there should be no redistribution intervention since doing so means tampering with the freedom of the agents to enter the lottery from the outset. Authors such as Kanbur (1982) and Bourguignon, Ferreira and Walton (2007) argue that there still should be redistribution even in the ex post inequality case. They believe that extreme ex post inequality creates a moral obligation for society to alleviate the results. In the current example, supposing one agent receives next to nothing, while the other receives millions of dollars when the circumstances of both are equal before the lottery, then it is necessary that the "loser" should at least receive some benefit if the situation pushes him or her to poverty or starvation. Generally accepted moral principles would prevent us from not redistributing even if it means violating the ex ante equality situation.

It is easy to see that this simple case can be extended to more realistic situations, because essentially, when people go through life, they often have to enter a multitude of lottery. The point this case illustrates is the possibility of the coexistence of ex ante equality and ex post inequality, when chance and preference towards risk are involved. Thus, when we observe ex post inequality, it does not imply that there is no ex ante equality. In practice, however, inequality might arise both before and after the event.

This ex ante and ex post inequality problem is very important for mobility since it is the link between equality of opportunity and mobility. The complication comes when we view two consecutive generations, since the outcome of the first generation constitutes the initial resources of the second generation. If we are to choose the ex ante equality standpoint, then we are facing a second generation with potentially unequal opportunity (supposing that attitudes towards risk are

different across people in the first generation and that chance plays a role in the outcome). To maintain equality of opportunity for this second generation, there must be some redistribution, but that in turn violates our assumption of equality of opportunity for the first generation, as Friedman has claimed. This logical incompatibility of the ex ante strand means that the ex post view is preferable.

Roemer's model can be viewed from both the ex ante and ex post perspective by linking two generations. By requiring that the outcomes of each effort centile for different types be the same, Roemer is applying ex post equality as a way to define his equality of opportunity theory. This is because in Roemer's model, we take for granted circumstance vectors, and only redistribute after the event. This is essentially opposed to the view of Friedman, who maintains that there should be no redistribution.

The ex ante and ex post perspective also helps clarify one problem that can happen in Roemer's model, the case of redistribution among people within the same type who exert the same amount of effort. Without loss of generality, consider two people in the same type both of whom exert the same amount of effort (at least if we use "centile" as a way to rank effort). Now, since these people are not identical, chances are that their propensity for risk is different, which mean they might end up with different outcomes. Even if their risk tolerance is the same, "chance" can get in the way and still make them achieve different outcomes[1]. According to Roemer's model, then, they should both receive the same compensation by redistribution since their efforts are the same (in this case, since both persons are in the same type, their degrees of

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[1] We are taking a non-deterministic view of the world, as in everything can be affected by "chance". Our definitions are rather loose; we avoid delving into the realm of philosophy on determinism.

effort and levels of effort are identical, respectively). The ex ante and ex post perspectives informs us that in Roemer's model, we still need redistribution even if people are in the same type with the same levels of effort.

Limitations

Approaching equality of opportunity from the ex post utility perspective is not without its drawbacks. If we rejects the notion of ex ante equality due to our compromise position in order to curb extreme outcomes, we have to take into account the incentive effect: people might be aware of <u>redistribution</u>, and they might lower their effort to attain the desired benefits. For example, a very self-driven person who is also born in a very favorable family might be discouraged if she knows that the reward of her work is going to be equal to that of her peer, who tries as hard, but whose the level of effort is much lower than hers. Roemer is aware of this issue and he argues that the redistribution policy is designed to maximize effort for the disadvantaged group, not to maximize the average effort. Also, he proposes that there are alternatives for policy design that achieve this goal. For the purpose of this essay, we are not going too deep into that direction. For now, we explore another view of equality that helps shedding light on Roemer's model.

1.3 How Roemer's Model Fits into the Rawls and Nozick Debate on Distribution

In the prior section, we observed that there are two main reasons to take an ex post point of view when it comes to redistribution: the logical incompatibility of the ex ante position in a multigenerational context, and the moral obligation against extreme social outcomes due to mere

chances. As far as we have seen, Roemer's model is compatible with the ex post position. Since Roemer's model argues for redistribution to attain equality of opportunity, it would be useful to ask where the model stands in the debate between Rawls and Nozick on redistributive justice.

The Basics of Rawls and Nozick's Theories

Rawls uses a thought experiment of rational actors who would approach the problem of justice from a perspective where they don't know their exact identity or the conditions of the society that they are to live in: as Rawls puts it, they operate from behind a "veil of ignorance." Since they don't know exactly where their advantages and disadvantages are, to maximize their self-interest, these actors have to agree on a social system where basic rights are guaranteed. Rawls separates justice into two principles:

1. Each person has an equal claim to a fully adequate scheme of equal basic rights and liberties, which scheme is compatible with the same scheme for all; and in this scheme the equal political liberties, and only those liberties, are to be guaranteed their fair value.

2. Social and economic inequalities are to satisfy two conditions: (a) They are to be attached to positions and offices open to all under conditions of fair equality of opportunity; and (b), they are to be to the greatest benefit of the least advantaged members of society. (Rawls, 1993)

Accordingly, the first principle deals with basic liberty and is inalienable for each person; the second one deals with social and economic equality. The first one has priority over the other principle. A just society in Rawls' view is thus a redistributive one, so that everyone has basic

rights and opportunities. This does not entail equality of all resources. In fact, from Rawls' point of view, inequality can exist when the purpose is to better the conditions of the least advantaged.

Nozick holds the entitlement theory perspective. Accordingly, there are three principles:

1. A person who acquires a holding in accordance with the principle of justice in acquisition is entitled to that holding.
2. A person who acquires a holding in accordance with the principle of justice in transfer, from someone else entitled to the holding, is entitled to the holding.
3. No one is entitled to a holding except by (repeated) applications of 1 and 2. (Nozick, 1974)

In this theory, Nozick focuses on the process by which property is acquired. Nozick claims that as long as inequality does not violate any of these principles, it is acceptable. When any of the principles is infringed upon, there should be compensation for disadvantaged groups. Nozick thus favors reparations if there is injustice; he opposes Rawls' idea of redistribution to benefit the least advantaged. If the condition of the least advantaged person in Nozick's world is not a result of prior injustice, there should be no action to alleviate the condition.

In mainstream economic and political debate, Rawls' theory is championed by the left, and Nozick's by the right. Nozick opposes Rawls' view because he thinks it implies that the government has to constantly interfere with people's lives by implementing redistribution policies (Phillips, 1977). Proponents of Nozick's view often favor market forces as a way to gauge inequality. Proponents of Rawls' theory, on the other hand, claim that the root of injustice cannot be traced, and redistribution is crucial to level the playing field (Srinvasan, 2013).

On the one hand, Roemer's model leans towards the left side, politically, since it argues for a redistribution policy for each generation, according to circumstances (aiming to level the playing field). On the other hand, the model also takes into account the process of acquiring holding, because redistribution depends on effort. However, since compensation in Roemer's model only depends on the degree of effort within each type (determined by circumstances), it does not entirely agree with the principle of free-exchange in Nozick's theory. For example, inheritance would only count as a circumstantial factor, and thus would not place a big role on compensation in Roemer's model. Yet, if free-exchange comes from an effort of a salesman to advertise his or her goods, for instance, then it can be counted towards compensation. On a spectrum of left to right in the Rawls and Nozick debate, Roemer's model can be considered as occupying the moderate left.

1.4 Preferences Versus Resources View

Another view of equality of opportunity that would shed light on Roemer's model is the view using *preferences* and *resources* (as opposed to using *circumstances* and *efforts,* as in Roemer's model). In this section, by using preference as a medium to explain effort levels, we point out two main problems with Roemer's model: the separability of circumstance and effort, and the limited application of the model on certain life periods. Kanbur and Wagstaff (2014) attribute this *preferences* and *resources* view to Dworkin's attempt to introduce responsibility to egalitarian philosophy. In a nutshell, the main idea is that inequality due to resources is unacceptable, yet inequality due to preference is acceptable. Dworkin claims that people should be responsible for the preferences that they are glad to have. Just as in Roemer's case, this standpoint requires a separation of preference and resource. The question is: what if resource helps shape preferences? A lavish lifestyle or a frugal lifestyle could well be a result of the resources surrounding a person as he or she grows up. If the separation of resource from preference is dubious, then it is hard to trace if a person should be responsible for his or her preference.

A small excursion to the empirical realm would shed further light on the problems with Roemer's model. The studies from Barros et al (2009) on inequality of opportunity in Latin America and the Caribbean adopt a framework very similar to Roemer's theoretical model while also using the concept of preference. In this study, circumstances are chosen as factors beyond people's control (gender, race or ethnicity, birthplace, educational attainment of mother, educational achievement of father, etc.). People are then arranged into "types" (as defined above

in Roemer's model). Outcomes (access to education, safe water, vaccinations, etc.) are then incorporated to calculate the probability for each types to deviate from the average outcomes of the population. The key assumption here is that children's outcomes result from circumstances, rather than from their preferences.

Barros et al.'s assumption is not unreasonable. For example, small children do not have any say in whether they should eat healthily, stay in a safe environment (to avoid cigarette smoke or potential physical accidents, etc.), or to spend time studying. Their behaviors are shaped by the effort that their parents impose upon them. The only factors affecting children's "preferences" are resources (which can be arranged by parents' preferences as well) and chance. One might argue that there is some inner force coming from a child that eventually forms his or her preference, but before the child is able to make decisions of his or her own will, nothing can influence him or her, except for resources. This conclusion that resources influence preferences, even partially, is inevitable unless one assumes to the contrary that even infants have free will to choose a way to react to outer environment in the first place. While research in childhood psychology and neurology would help us make a better judgement on which assumption to follow, with common sense, Barros et al.'s assumption seems reasonable.

This key assumption on children's inability to have effort forces an inquiry into the heart of Roemer's model. Rather than using "preference" and "resource," in Roemer's model we deal with "circumstance" and "effort." The important question is this: if we consider the very beginning part of a child's life, is the Roemer model still applicable?

Supposing Roemer's model can be applied to this period, then, it is reasonable to use the assumption in Barros et al.: children have no say over their effort. In other words, all children's effort can be assumed to be *zero across all types*. The issue here is similar to the problem mentioned above: if children have no say in what they want to do, then how can we have a distribution of effort for each type? Roemer's model does not deal with this issue at all since it assumes the existence of effort from the outset. With this similarly defined level of zero effort across types for each child, then there should be *equal redistribution for each and every child*.

Now, supposing the Roemer model cannot be applied to the very early stage of life, then it means that there exists some period where we can't separate "circumstance" and "effort." For Roemer's model to work for other periods besides this particular one, naturally, there must be a moment in life that signifies the inception of autonomy[2], which allows us to separate *circumstance* and *effort*. How should we determine this autonomy formation point? This question is hard to answer, both conceptually and empirically. It is unclear for now how we should agree on forming this crucial autonomy formation point. The main problem with Roemer's model lies in the assumption that circumstance and effort are distinct.

But, the matter does not stop there: supposing we can divide people's lives into non-autonomous and autonomous periods, why should we stop dividing the autonomous period into sub-periods when using Roemer's model? This question does not aim to complicate the issue by disregarding the model. Rather, we are looking at "effort" in a more realistic and, arguably, more progressive manner. If we treat the redistribution mechanism using one period of life only, we

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[2] *Autonomy* can be understood as the ability to make one's own decisions in this context.

are assuming that effort distribution is unchanged throughout life. This idea is troublesome since effort might change over time. A person's attitude towards work in his or her teenage years is drastically different from that in adult years. Using "average" effort of life for purposes of redistribution entails over-penalizing "low effort" periods in early years, when effort is still highly dependent on circumstances outside of one's control. Ultimately, the heart of the problem lies in the imperfect separation of circumstance from effort: we can at most assume that they are separable in certain periods, but we need to deal with the untidy details of the dynamic interaction between all periods, especially in the formative early years of life.

While it is interesting, the dynamic interaction of circumstance and effort (or between preference and resources, if one looks at equality of opportunity from that view) pertains to a separate discipline (possibly psychology, neurology, sociology and related fields). For the purpose of economics, it is sufficient for now to acknowledge that we have to separate a lifetime into appropriate periods to counter the negative effects of circumstance on effort distribution when applying Roemer's model. This normative measure by no means assumes that it is socially preferable for a distribution of effort to be skewed to higher level. What should be striven for is the avoidance of a correlation between negative circumstances and a negatively skewed distribution of effort. In simple terms, we should try to avoid situations where people are born in very disadvantaged positions and the general level of effort of that type is too low compared to the general effort level of other types. For example, while it is questionable if it is better for a society in which everyone is working a sixty-hour work week (even if they all want to), it is definitely undesirable for a society to be one in which everyone is homeless and spends little time working productively. The homeless population is not necessarily responsible for their

"laziness"; they might be too sick – or too discouraged, have behavioral problem, or be unable to attain skill sets demanded by the labor market.

1.5 Conclusion

This section introduced Roemer's model as a way to view equality of opportunity. By using "effort" as the main determinant for rewards, the model aims to bypass the differences in circumstances of different people in a population while still comparing their effort with their peers' in the same type. The model shares a similar point of view with the ex post equality perspective. In the debate on redistributive justice between Rawls and Nozick, Roemer's model leans towards the politically liberal view of Rawls, as opposed to the libertarian view of Nozick. Though there are different limitations, it can be argued that Roemer's model can be applied to the early childhood period with the crucial assumption that each child exerts zero effort for his or her outcomes. The implication of this assumption is that in a world of equal opportunity, even after we take into account effort levels, each child should receive an equal amount of reward for each outcome category, be it health, education, or consumption. As we will see later on, this theoretical implication and other results from empirical research on early childhood development will strongly suggest that we focus on early childhood period to curb inequality and promote equality of opportunity.

ESSAY 2
The Big Picture: The Facts of Inequality and Mobility

In the prior essay, we discussed Roemer's model of equality of opportunity and issues related to it. Implementing this model of equality of opportunity is by no means easy, not only because of the conceptual difficulty, but also because of the state of inequality and mobility[3]. In this essay, we leave behind the theoretical discussion of equality of opportunity to focus on the state of inequality and cross-generation mobility across the world. By doing so, not only will we understand how far apart the equality of opportunity literature and the inequality and mobility literature are, but we will also see a theoretical gap within the latter that will eventually lead us to the third essay on the mechanisms that create inequality.

We start by surveying income and wealth inequality trends since the early twentieth century (section 2.1). Within this context of the state of inequality, we attempt to observe how generations fare differently. After that, we examine two consecutive generations – the study of intergenerational mobility – and then we briefly talk about multiple generations – the social mobility theory (section 2.2). In section 2.3, we present a discussion on how the different branches of research fit together and how they as a whole miss an important aspect that relates to opportunity.

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[3] "Inequality" and "mobility" are used in general terms, not limited to dimensions such as income or wealth. We adopt this meaning throughout the essay, unless stated otherwise.

2.1 Trends of income and wealth inequality

To understand intergenerational mobility, it is useful to start with the current state of inequality. A picture of income and wealth inequality today would inform us of the prospect of mobility for the current generation: how much does a person have to earn and own to be better off than his or her parents? In a relative way, standard of living depends on inequality. Not only does John Doe want to earn twice (say) his father or mother's income when he reaches a certain age, but he also wants to be ranked higher on the income and wealth ladder compared to his parents' rank (or at least not worse off)[4].

Since income and wealth inequality is itself a big topic within the discipline of economics, we have to limit the scope of our discussion. We only survey some stylized facts of inequality trends for the U.S. and some European countries, namely France and Sweden. We choose these three main countries because, as we will see later in the third essay when we reach the literature on the mechanisms of intergenerational mobility, a large body of research comes from the U.S. and Sweden (a typical representation of Nordic countries). As for France, it is a typical example of non-Nordic European countries, a region too important to leave out. In addition, these three countries represent the three main groups of developed countries that have different levels of inequality, from low to high. Due to the scope of the project, we limit the discussion to these developed countries. However, although our treatment is not all-encompassing, it by no means omits important issues.

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[4] This cannot be achieved by everybody at the same time since, by definition, when some people move "up", some must move "down", relatively speaking.

While many scholars have attempted to work on income and wealth inequality, perhaps the source of research with the longest range of historical data is that of Thomas Piketty, Anthony Atkinson, Emmanuel Saez and their associates. By using historical tax data, the team of researchers created a rich historical dataset of the share of top income earners in more than twenty countries, dating as far back as the late nineteenth century (The World Top Income Database, 2015). There are two main reasons to focus on the share of income of top earners. First, by looking at the evolution of the share of income for the top earners, we can deduce the trend of the share of income for the rest. Second, historically, universal income tax records were not available until a certain point; before that, only the richest were required to file tax records. While we also use some other sources to illustrate inequality in the U.S., for other countries, we will rely mostly on historical data from the World Top Income Database (WTID).

Income Inequality

For the U.S., besides the estimated data from Piketty-Saez, another source of historical data is from the *Congressional Budget Office Average Household Income and Federal Taxes by Income Group*. Generally, the pattern of the share of top income (the top 10% and higher) followed a U-shaped curve over time. It went down from the early twentieth century to about World War II, stayed stable until the 1970s, and went up from then (WTID, 2015) (See Figure 1). The growth rates of income for the top income cohorts are larger than the income growth rates of the lower and middle income cohorts, especially since the 1970s (See Figure 2). When viewed in a long-term historical context, income concentration at the very top (the top 0.5% and 1%) has returned to the levels of the 1920s, a period with various class and political conflicts (Stone, Trisi, Sherman, DeBot, 2015; Piketty, 2006).

Figure 1

Income inequality in the U.S.
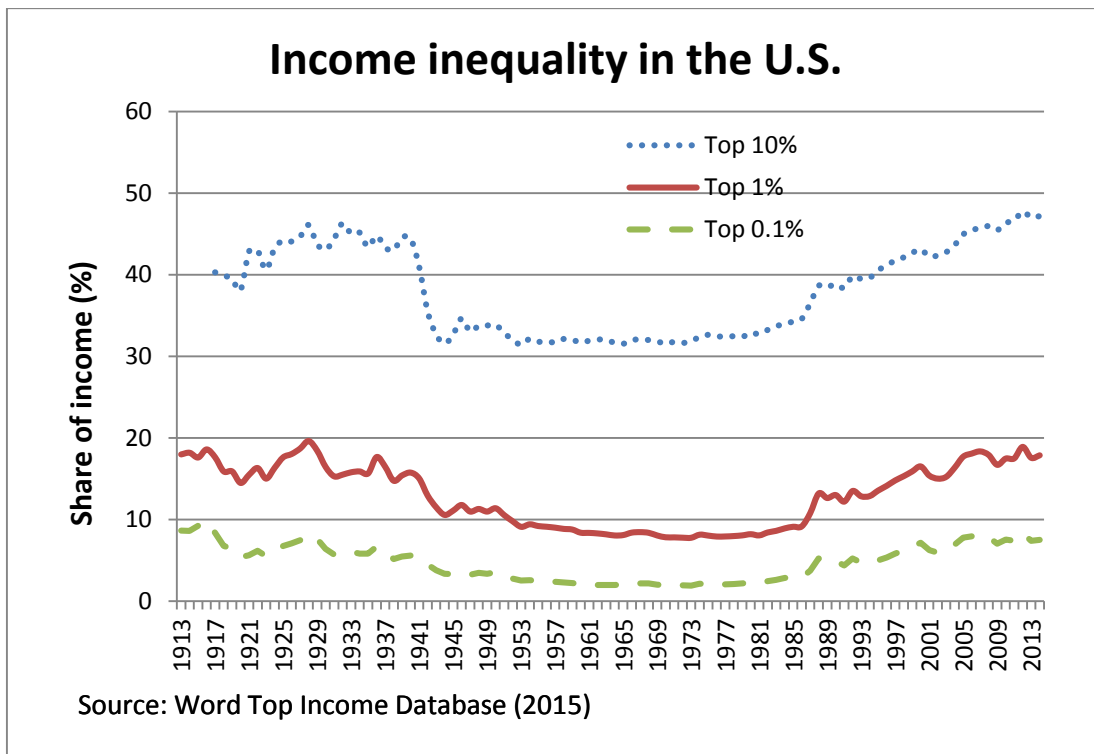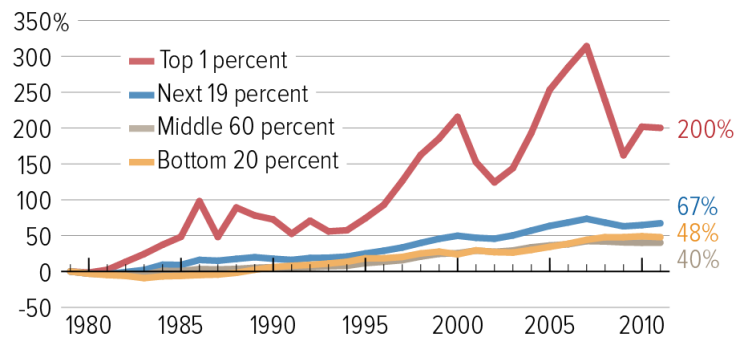

Source: Word Top Income Database (2015)

Figure 2

Income Gains at the Top Dwarf Those of Low- and Middle-Income Households

Percent change in real after-tax income since 1979

Source: Center for Budget and Policy Priorities

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While income inequality in the U.S. has been increasing in recent years, the situation is quite different in European countries. In France, for example, the trend of income inequality was similar to that of the U.S. up until WWII – the share of the top income cohort decreased. After the war, however, the share of the top 10% slightly increased until the 1960s, where it slightly diminished and has stabilized since the 1980s (See Figure 3). The top 1% earners and higher have seen their share of income mostly remain unchanged since the end of the WWII. The main difference between France and the U.S. is that the top share of income in France is not expanding: inequality is held at bay, at least from the view of the top (See Figure 4). Indeed, in his bestseller *Capital in the Twenty-First Century*, Piketty claims that the strong increasing inequality in the past few decades is an "Anglo-Saxon" phenomenon since Britain also exhibits the same pattern as the U.S. (Piketty, 2014).

As for Sweden, between the beginning of the twentieth century and the 1990s, the share of the top income steadily decreased. Though it has come back recently, influenced by the market liberalization across the world, the share of the top 10% in Sweden is still less than 30%, the mark which France has barely touched since the beginning of the last century (See Figure 3 and Figure 4). Sweden is among the most egalitarian of the Nordic countries.

Commenting on the phenomenon of the rapid increase of income inequality in the U.S., Piketty suggests that part of the cause is the ability of super management to increase their compensation. He notes that the phenomenon is specific to the U.S. and Britain since the top CEOs of these countries are highly rewarded, unlike their counterparts in Europe (Piketty, 2014).

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Figure 3

Income Share of the top 10%

Source: Word Top Income Database (2015)

Figure 4

Income Share of the top 1%

Source: Word Top Income Database (2015)
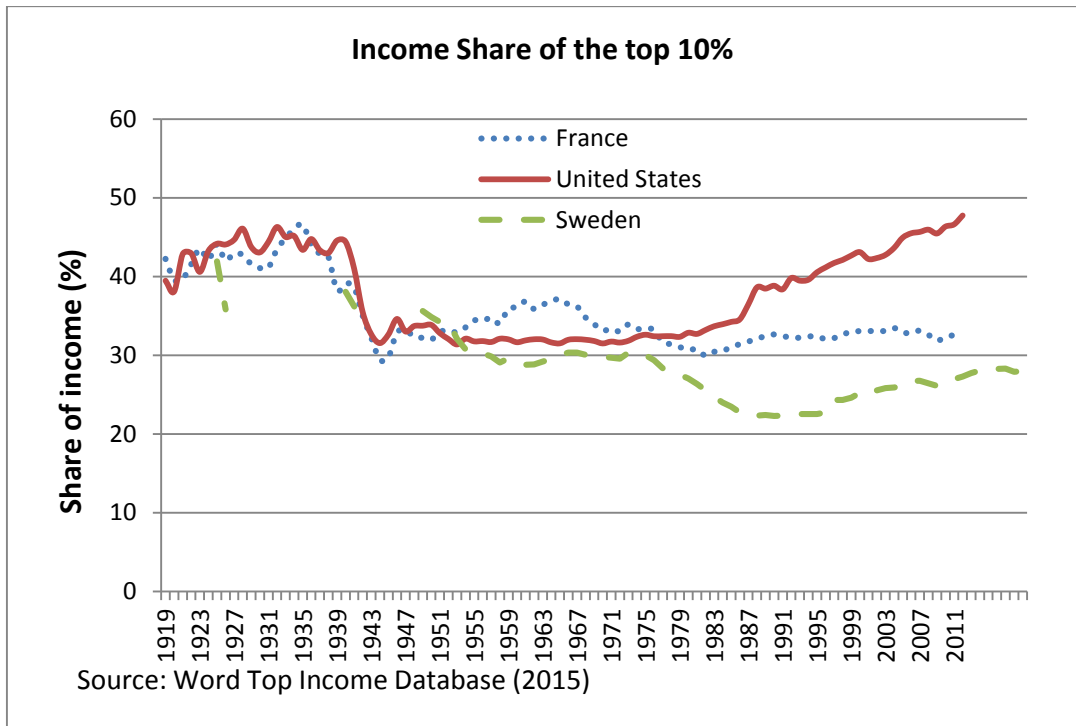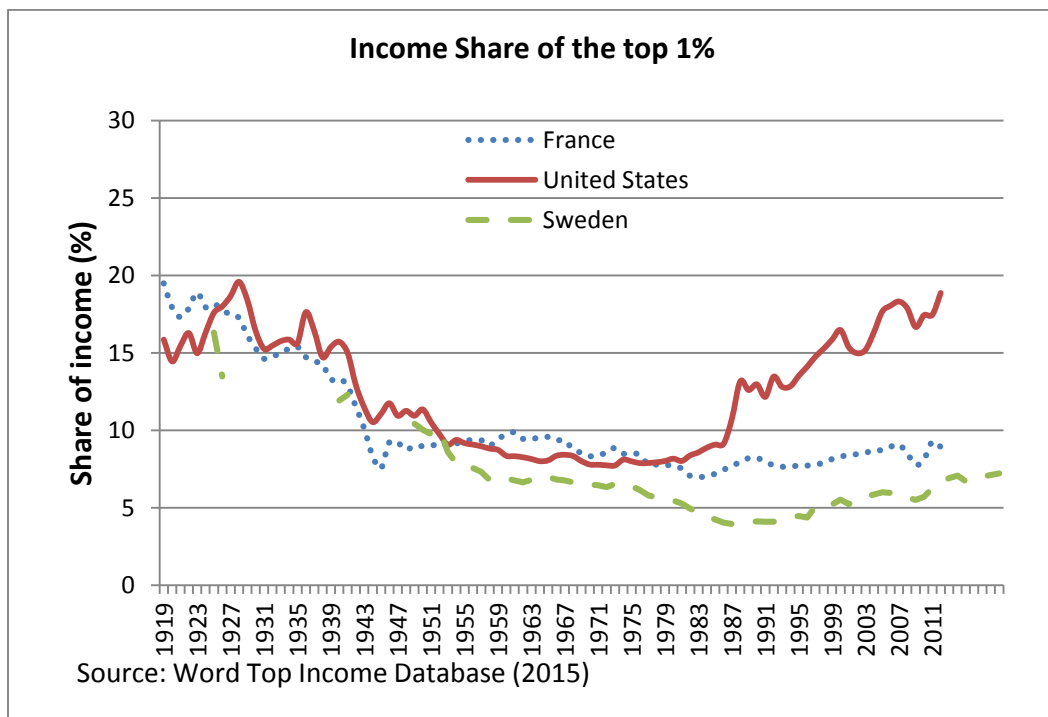
Wealth inequality

Unlike income inequality, which can be calculated using tax data, there is no direct data for wealth inequality because people are generally not required to declare how much they own. Estimation of the historical evolution of wealth share at the top is often projected from estate tax data, survey data, and lists of wealthy individuals (Saez and Zucman, 2015). Despite their imperfection, these estimates provide us with a general picture of how much the top owns over time.

Saez and Zucman (2015) use capitalized income data from income tax returns and data from the Federal Reserve's Flow of Funds to estimate the evolution of wealth in the U.S. from 1913 to 2013. They find that the concentration of wealth has returned to its high levels of the 1920s. Particularly, the top 0.1% has recently owned more than 20% of the total wealth in the U.S. (the highest level was 25% in the 1920s), up from about 10% in the years following World War II (See Figure 5). They note, however, that in recent decades, not all people at the top have seen their share of wealth increase. The wealth of the next 0.9% has remained stable, while the 9% below the top 1% actually have seen their fortune shrink slightly.

Figure 5

Top 0.1% wealth share in the United States, 1913-2012
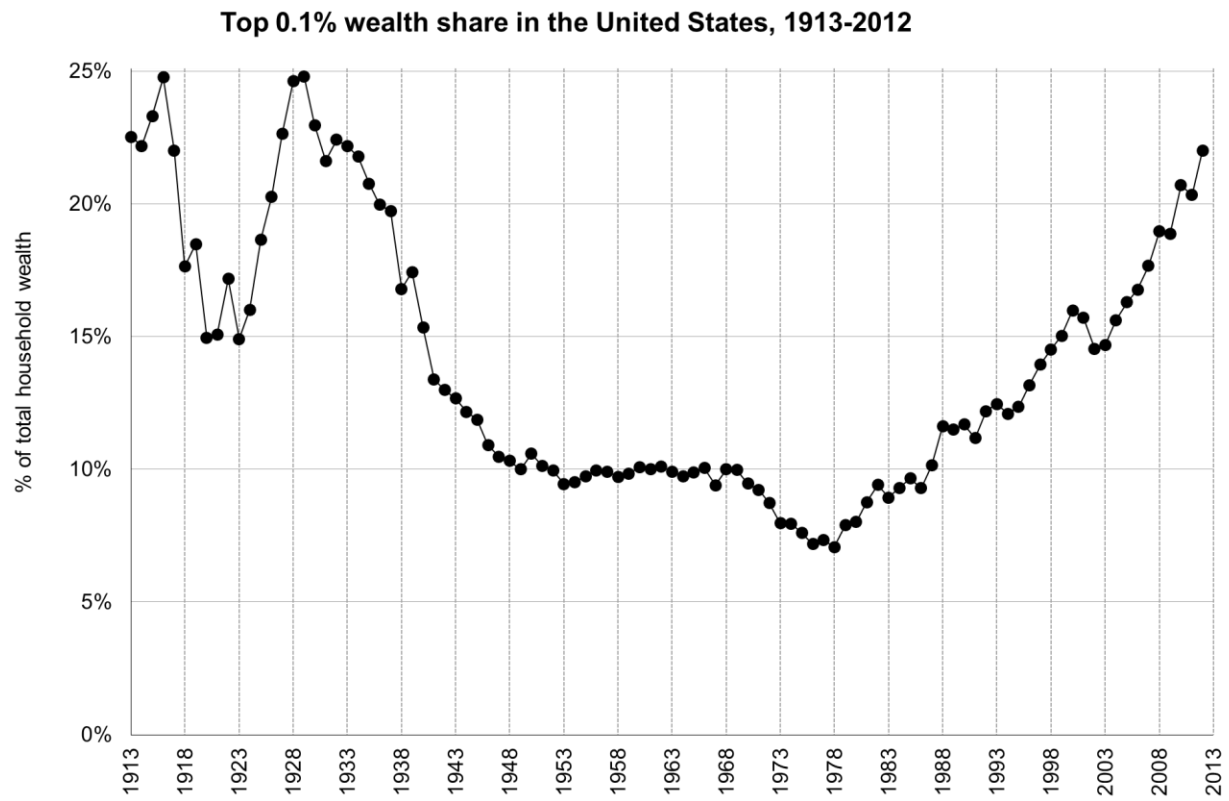
Source: Saez and Zucman (2014).

Figure 6
The share of total U.S. wealth owned by the bottom 90% of families, 1917 - 2012
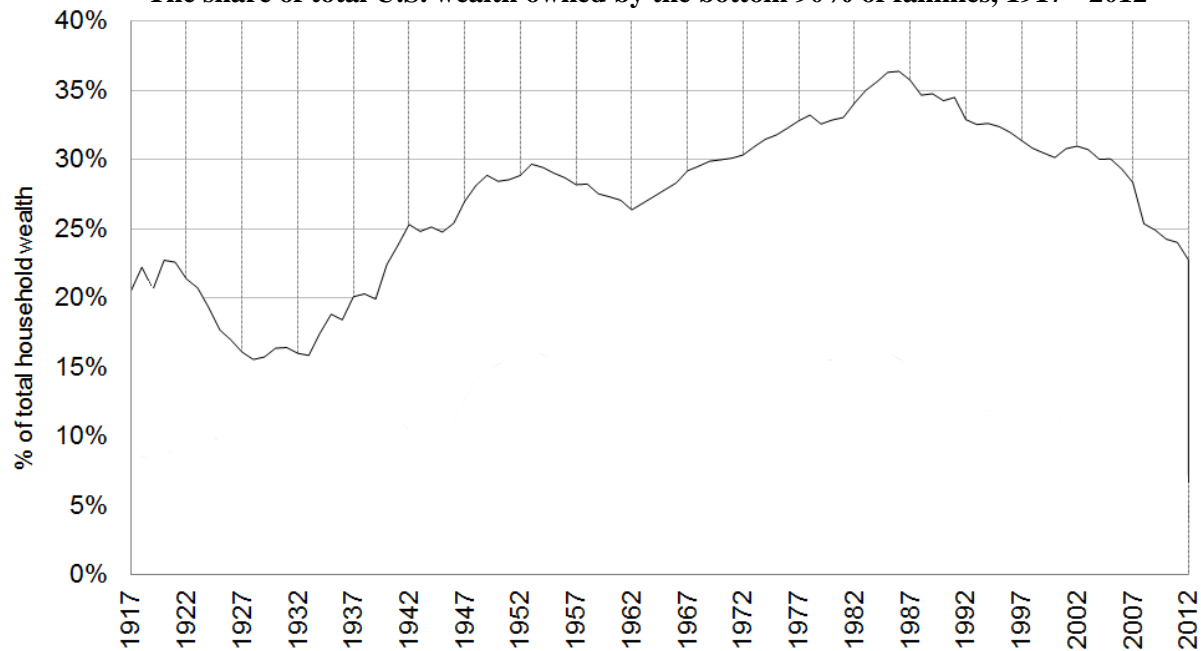
Source: Saez and Zucman (2014).

For the bottom 90%, their wealth share started increasing in the mid-1920s, reached a peak in the 1980s, and collapsed dramatically in recent decades (See Figure 6). It should be noted that not only did the *share* of wealth of the bottom 90% decrease in the past few decades, the *level* of average wealth also decreased. The stark state of inequality can be seen when the average wealth of the top 1% and the bottom 90% are juxtaposed in one graph (See Figure 7).

Figure 7

Real average wealth of bottom 90% and top 1% families
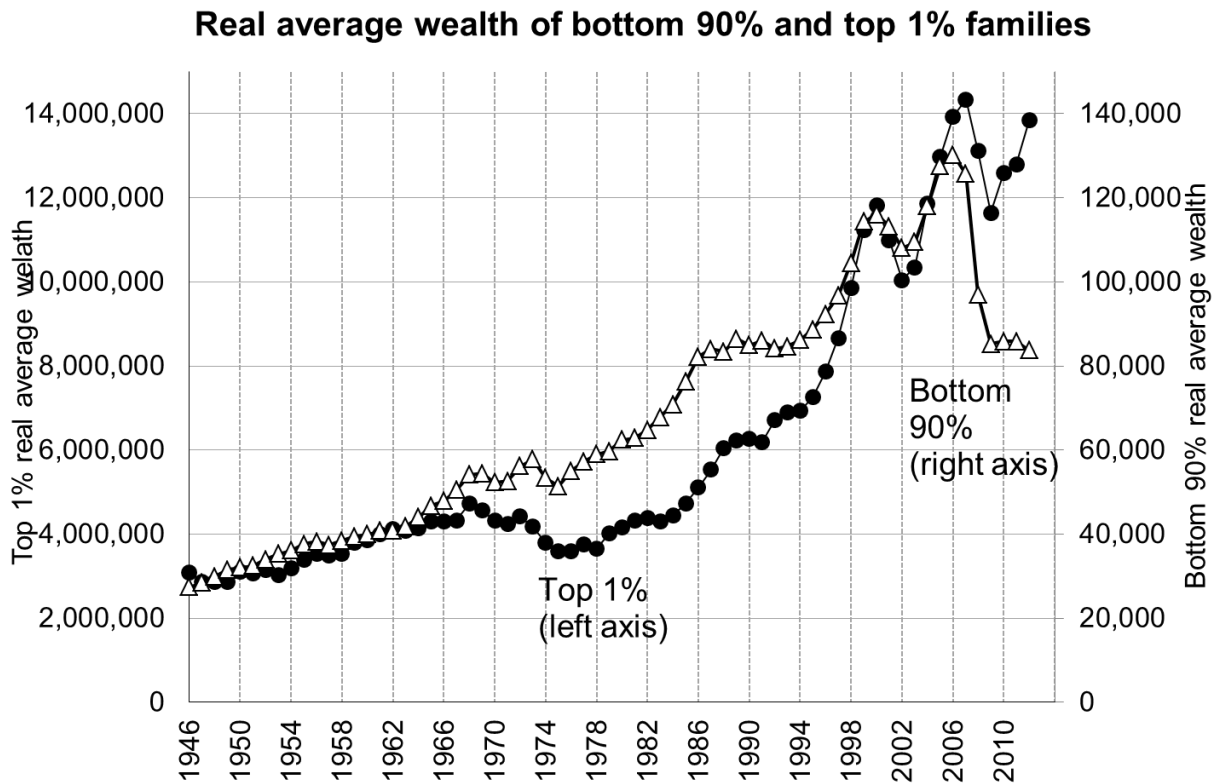
Source: Saez and Zucman (2014).

Wealth inequality in Europe is less extreme than the wealth inequality in the U.S. According to the two graphs extracted from Piketty (2014) (See Figure 8 **Error! Reference source not found.**and Figure 9), we can see that both France and Sweden have the same pattern of top wealth share since the beginning of the twentieth century. Wealth shares of the top 10% and 1% decreased up to around 1970, and the shares then stabilized for France and slightly increased for Sweden. As a point of comparison, note that in France and Sweden, it takes the entire top 1% to own about 20% of the total wealth; while in the U.S., just one-tenth of the top 1% owns more than 20% of the total wealth (See Figure 5).

Figure 8

Wealth Share of Top 10%

Source: Data from Capital in the Twenty First Century, Piketty (2014)

Figure 9

Wealth Share of Top 1%

Source: Data from Capital in the Twenty First Century, Piketty (2014)
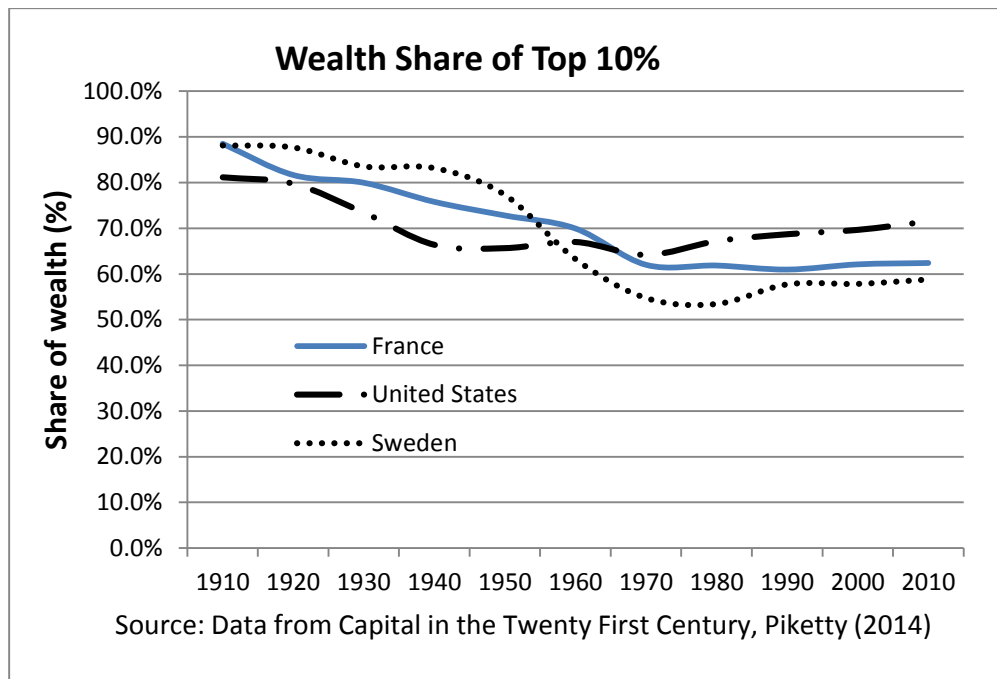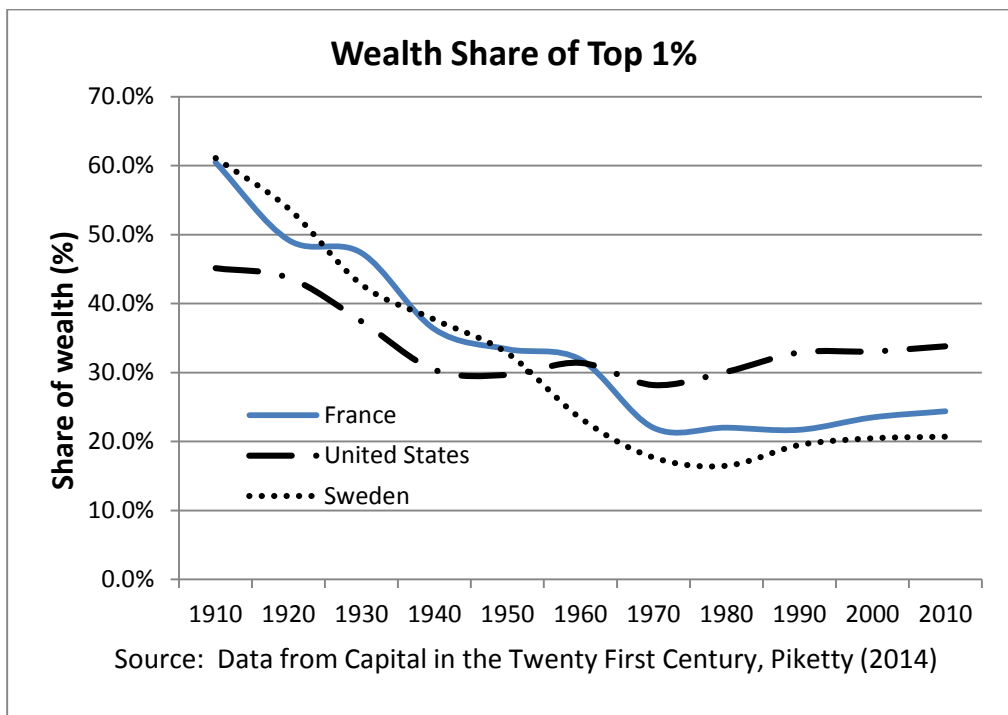
The trends of income and wealth inequality presented above help explain why the general population is concerned about the prospect of mobility. When income and wealth are so concentrated in one generation, it is very likely that the cohorts that possess the majority of the wealth will pass along their fortunes to their children. The more capital one owns, the more one has to give to descendants. With this common sense, it follows that the difference in the degree of inequality of the U.S., France and Sweden (in increasing order) should lead to less mobility in the U.S., moderate mobility in France, and high mobility in Sweden. Often, when there is extreme inequality and low mobility, the political environment is quite unstable due to social unrest. Indeed, we are reaching the level of inequality of the early twentieth century, the period with political turmoil that led to World War I.

2.2 Intergenerational Mobility

There are two separate ways to look at mobility: mobility within a lifetime, and intergenerational mobility. The former deals with how one person can improve his or her outcomes from early life to later life. The latter deals with how descendant generation(s) fare in comparison with the original generation. Mathematical measurements for the former are more complicated than those of the latter. While mobility within a lifetime is interesting, within the scope of our project, we only focus on intergenerational mobility.

2.2.1 Methodologies and their issues

Black and Devereux (2010) mention two major measures of earnings mobility: the intergenerational elasticity (IGE) and the intergenerational correlation. The IGE is the coefficient β of the regression:

$$\log(y_1) = \alpha + \beta \log(y_0) + \epsilon,$$

where y is the permanent income, the subscript 1 refers to the child, and the subscript 0 refers to the parent. β shows the predictability of a child's income when we know his or her parent's income.

The intergenerational correlation is:

$$\rho = \left(\frac{\sigma_1}{\sigma_0}\right)\beta,$$

where σ is the standard deviation of log income.

While there is no theoretical reason to prefer one measure to another, the IGE has the advantage of not being "biased by classical measurement error, and so it is often easier to estimate with real world data" (Black and Devereux, 2010). It is also highlighted in the literature review by Black and Devereux (2010).

Besides the IGE and the intergenerational correlation, researchers also rely on the *transition matrices* (or mobility matrices) to study intergenerational mobility. Transition matrices provide "quantiles of the child's earnings conditional on the parent's earnings quantile" (Black and Devereux, 2010). Often, it can be interpreted as a table showing the *probability* of a child ending up in different earnings quantiles, based on the quantiles that his or her parents were in. This method provides a general view of the distribution of the whole population coming from families of different quantiles, rather than just one group.

Methodological Issues

There are some technical problems in estimating the IGE. Black and Devereux (2010) quote several theoretical and empirical works and categorize the kinds of problems into *persistent transitory shocks*, *age use of fathers and sons*, and *lifecycle bias*. Due to the complicated econometrics nature of these issues, which is beyond this project, we gloss over the results, rather than discuss deeper technical details. However, to measure IGE, the incomes of fathers and sons must be permanent income. This requires averaging income over many years as well as choosing an appropriate age to record incomes. The simulation by Mazumder (2010) shows that in the case of the U.S., a large value of average time is required to measure IGE. This is a contrast to the Norwegian case, where Nilsen et al (2008) find that increasing the time of

fathers' earnings does not influence IGE as much, possibly due to lower transitory shocks in the Norwegian case. Overall, the main point is that an accurate estimation of IGE is hard to achieve because of persistent transitory shocks.

As for the ages of fathers and sons used to measure income, Haider and Solon (2006) demonstrate by a simple model that when using the earning of one period as an estimator for lifetime earnings, some years work better than others. The model shows that IGE suffers from attenuation bias, which in turn depends on the father's age. Baker and Solon (2003) and Mazumder (2005) demonstrate that the bias of IGE in general is not limited to attenuation bias, and the size of the bias also depends on the son's age.

For lifecycle bias, when measuring sons and fathers' yearly earnings by regressing over lifetime earnings, the coefficients of lifetime earning might be different in different years[5]. Haider and Solon (2006) and Bohlmark and Lindquist (2006) use historical earning data in the U.S. and Sweden, respectively, and find that the estimates of the coefficient vary significantly over a lifetime. In particular, for sons, estimates of the coefficient have a high growth before age 30, peak and stabilize in 30s and 40s, and gradually decline in late 50s. This means that a large attenuation bias is underway if the analysis includes earnings data of sons under age 30. The case is also similar with the coefficient of fathers' earnings. Grawe (2006) provides consistent

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[5] For example, assume earnings for father or son is measured at a particular age a, then the equation used is: $y_{0a} = \mu_a y_0 + v$,
where 0 refers to the father generation, a is the age of the father when earnings is measured, y_0 is permanent earnings, and v is the deviation between permanent earning and measured earning.
Life cycle bias might happens when μ_a takes different values at different years. An analogous situation can happen for the equation for the son's generation. Consult Black and Devereux (2010) for a more detailed model.

evidence of the lifecycle bias. Using estimates from 20 studies with different datasets from different countries, he finds strong evidence that there is a negative correlation between the father's age and IGE. Other studies by Reville (1995) and Nilsen et al (2008) also show that lifecycle bias is present in estimating IGE.

Black and Devereux (2010) note that there are also some problems when using transition matrices to study mobility. The first is the arbitrary choice to separate the population into quantiles rather than other groups (quartiles, for example). Some researchers such as Bhattacharya and Mazumder (2008) propose a measure of upward mobility by calculating the chance the son is ranked higher than father in earnings. However, this method overemphasizes small change (for example, moving 1 percentile up across generations is the same as moving 20 percentiles up). In addition, transition matrices suffer the same problems with the IGE when it comes to how to measure the "permanent" earnings.

2.2.2 Empirical Results

Before we survey the empirical results of intergenerational mobility research, it is important to acknowledge two issues with the data. First, as noted in both Corak (2005) and Wolff (2009), some of the survey data about the prior generation's income or wealth depended on "recall" data: survey participants were asked to estimate their parents' earnings when they were at the participants' age. Though there is some validity in this form of survey, the method is vulnerable to significant errors. Second, other research studies depend on longitudinal data, which makes it hard to estimate "lifetime earnings". In particular, when we vary the time used to calculate earnings, the IGE changes dramatically.

In the empirical literature using the methods discussed above, income is the main dimension utilized. In this section, we also focus on this dimension, starting with the U.S.

Results for the U.S

For the U.S., most studies use datasets containing both parents' and children's information. The main idea is to separate the data into father-child pairs and analyze their respective dimensions. Here, we draw from the literature review in Wolff (2009) and provide some updates.

Recall from the prior section that IGE (or β) provides the level of predictability of a child's income when his or her parents' income is known. The higher β is, the lower the mobility of a society is. Empirical studies show that the IGEs across countries lie between 0 and 1 (Corak, 2006). According to Wolff (2009), early studies of intergenerational mobility such as that of Becker and Tomes (1979) show low IGE, at the level of 0.15. But later studies such as that of Mazumder (2005) show that low results come from large measurement errors. After correcting for these errors, the level is at about 0.3 to 0.4. Solon (1992) uses Panel of Income Dynamics (PSID) data and different ways to define a father's earnings, using averages from different numbers of years; he finds that the higher the number of years used, the higher the IGE – up to 0.41 when it comes to a 5-year average. Zimmerman (1992) uses data from the National Longitudinal Survey (NLS), and finds that IGE is about 0.4. Mazumder (2005) uses the U.S. Social Security Administration longitudinal earning files, and argues that the large year coverage of the dataset allows for a good estimation of permanent earnings. In particular, when the 16-year average income is used, the IGE is about 0.65.

Rather than estimating IGE using the income of all fathers without categorizing them into different groups, Hertz (2005) looks at different cohorts of the income distribution and calculates IGE for each cohort. The general IGE is about 0.42, but the probability of coming from and staying in the same cohort is higher for the top and bottom cohorts. The effect is particularly high for blacks, as compared to whites. Hertz (2006) uses transition matrices to show the probability of people moving across quintiles (See Table 1) with the data coming from PSID. The bottom and top quintiles show significant "stickiness;" children born into a particular cohort tend to stay within that cohort when they grow up, with the probability 41.5% and 51.1%, for the bottom and top quintiles respectively. The middle cohorts have less extreme distribution, but still, one's chance of staying within one's parents' cohort is higher than moving to other cohorts. The author also notes that there is a large and significant difference between black and white cohorts.

Table 1

Probability of Attaining Each Income Quintile in 1994-2000
Based on Parents' Income Quintile in 1967-71

Total Household Income		Income Quintile (1994-2000)					
Parental Quintiles (1967-71)		[1] $0 to 32,700	[2] $32,701 to $51,900	[3] $51,901 to $70,800	[4] $70,801 to $98,000	[5] $98,001 and above	[Top 5%] $166,100 and above
1	$0 to $29,900	41.5	24.0	15.5	13.2	5.9	1.1
2	$29,901 to $42,000	22.6	25.8	23.1	18.5	10.0	1.5
3	$42,001 to $54,300	18.7	25.8	24.1	19.6	16.9	1.8
4	$54,301 to $72,300	11.1	19.0	20.7	25.1	24.0	5.6
5	$72,301 and above	6.1	11.1	17.2	23.7	41.9	14.2
[Top 5%] $108,000 and up		2.9	9.0	15.5	21.5	51.1	21.7
Expected value, if there were no intergen. correlation		20	20	20	20	20	5

Source: Herzt (2006) - Center for American Progress.

An updated study by Auten, Gee and Turner (2013), using transition matrices and data from Statistics of Income and IRS Compliance Data (covering different time periods), shows slight differences from Hertz (2006) (See Table 2). The probability of staying within the cohort one was born into is generally lower. The probability of staying within a cohort is high for the bottom and top quintiles, about 30% for the lowest quintile and 40% for the highest quintile. In particular, the probability for a child born into the top 1% family to stay in the highest quintile is very high, 57.2%.

Table 2

Probability of attaining each income quintiles, top 10% and top 1%

| 1987 Income quintile or top centile class | 2007 Income quintile or top centile class | | | | | | | |
| | Income quintiles | | | | | | Top income centiles | |
	Negative	Lowest	Second	Middle	Fourth	Highest	Top 10	Top 1
Negative	0.6	10.7	16.4	26.8	21.8	23.7	16.9	1.7
Lowest	0.6	29.6	19.4	20.6	19.1	10.8	4.7	0.4
Second	0.7	17.9	20.4	22.4	23.1	15.4	6.3	0.5
Middle	0.4	14.2	15.8	22.3	25.4	21.9	10.7	0.8
Fourth	0.8	10.7	13.7	19.9	25.6	29.2	14.4	1.3
Highest	0.6	8.4	9.4	16.2	24.9	40.6	26.0	4.4
Total	0.6	16.7	16.3	20.7	23.5	22.3	11.4	1.3
Top 10 percent	0.8	8.9	7.8	12.7	22.4	47.5	31.0	5.7
Top 1 percent	1.4	6.6	7.8	11.0	16.0	57.2	44.5	14.1

Notes: Dependents age 15 to 18 are classified in 1987 using the income on the tax return on which they were claimed as a dependent. 1987 centiles are based on 1987 taxpayers age 25 to 65. 2007 centiles are based on taxpayers at each age from 35 to 38. Taxpayers with negative incomes are shown separately from other taxpayers in the lowest income quintile. The five quintiles plus negative incomes sum to 100 percent.

Source: Auten, Gee and Turner (2013).

Another branch of studies tries to capture trends in intergenerational mobility. These studies measure the IGE across different cohorts born in different years and observe the trend of IGE. Data pertaining to these cohorts are taken from different datasets. Below, we present a table summarizing the articles cited in Wolff (2009).

Table 3

Summary of IGE trends by different studies

Studies	Cohort (birth year of sons) (IGE)	Data source	Conclusion on IGE over time
Levine and Mazumder (2002)	1940 – 1956 (0.12) 1951 – 1966 (0.49)	General Social Survey (GSS)	Increasing IGE
	1944 – 1952 (0.23) 1957 – 1965 (0.33)	National Longitudinal Survey (NLS)	Increasing IGE
	1946 – 1954 (0.45 – married parents) (0.37 – general) 1957 – 1965 (0.29 – married parents) (0.29 – general)	PSID	Decreasing IGE
Hauser (1998)	Four cohorts between 1922 – 1963	GSS	No discernable pattern
Fertig (2003)	Five cohorts between 1945 – 1972 (0.50 to 0.22)	PSID	Decreasing IGE
Mayer and Lopoo (2005)	Continuous time trend data 1949 – 1952 (0.35) 1953 – 1956 (0.47) 1962 – 1965 (0.28)	PSID	Increasing and then decreasing. Changes are not statistically significant.
Lee and Solon (2009)	(Covers both sons and daughters, defines income as family income. Unlike other papers, IGE is calculated for each year – continuous time trend). Sons: 1977 – 1982 – 1990 (0.34 – 0.52 – 0.36) Daughters: 1977 – 1985 – 2000 (0.05 – 0.53 – 0.46)	PSID	No particular up or down trend
Aaronson and Mazumder (2008)	1940 - 2000	Match U.S. decennial Census Data with "synthetic" parents of the earlier	Mobility was low in 1940, increased to 1980, then decreased sharply in 1980s and steadily until 1990s. Suggests that mobility

		generation.	in 2000 was as low as in 1940.

In general, the research results of earning mobility in the U.S are quite inconsistent. The consensus is that when lifetime earning is estimated by multiple years, the IGE goes up. The level of IGE varies around 0.40 to 0.60, depending on the data used, the birth year covered, the cohort surveyed, and the methodology adopted. Trends of IGE are ambiguous; some studies even show contradictory results for groups born in the same years when two different datasets are analyzed. We should note that these results are ambiguous or contradicting because data for both parents and children are limited (statistical agencies started collecting longitudinal data in the 1960s) and often estimation is accompanied by large errors. As more longitudinal data are collected, more precise conclusions will be available.

International Comparisons

According to Wolff (2009), there have been several attempts to compare IGE across countries. Solon (2002) presents a report on the estimates of IGE from six different advanced economies, using data from the 1990s. Corak (2006) provides a different study with nine different countries. The general pattern is that English-speaking countries -particularly the U.S. and the U.K. - have a high IGE. They are followed by European countries, and then Scandinavian countries. The exception in North America is Canada, whose IGE is at the level of its Scandinavian counterparts. Corak's (2006) table is reproduced below:

Table 4

IGEs by countries

Country	Father – Son earnings elasticity
Denmark	0.15
Norway	0.17
Finland	0.18
Canada	0.19
Sweden	0.27
Germany	0.32
France	0.41
United States	0.47
United Kingdom	0.50

Source: Corak (2006).

The IGEs provided by Corak (2006) are the "preferred" IGEs. For each country, there is a range of estimation by different studies (consult the appendix of Corak (2006) for an excellent list of estimates by authors, sorted by countries). The ranges of estimates have upper bounds clear enough to see some distinction among countries.

Jantti et al. (2006) analyze data from four Nordic countries, the U.S. and the U.K., and create mobility matrices of these countries. One of the highlights includes the probability of a son staying in the bottom quintile conditional on having a father in the lowest quintile: the probability is 0.422 for the U.S., 0.303 for the U.K. and generally below 0.3 for all Nordic countries. The authors also find higher mobility from the bottom quintiles to the top quintiles for the Nordic countries, as compared to the U.S. and the U.K. Mobility among the middle quintiles is not particularly different across all countries. Interestingly, for daughters, Jantti et al. (2006) find somewhat different results. IGEs across countries are typically lower for women than men (except for the U.K.).

To shift focus from using men's income, Raaum et al. (2007) study intergenerational mobility with an emphasis on gender and marital status for Denmark, Finland, Norway, the U.S. and the U.K. They confirm the previous result that Nordic countries have a higher mobility than the U.K. and the U.S. But when the authors used married women's own income (as opposed to income earned with their partners or family members) to find IGEs, the results are similar across countries. They also find that in the U.S. and the U.K., married women with children who have high-income husbands tend to work fewer hours. The potential reasons are "assortative mating" and "labor supply response": women from a wealthy background tend to marry high-income men, and they also tend work less after marriage which leads to lower wage income.

2.2.3 Intergenerational Mobility and Inequality

In general, what we have observed so far is a pattern that Nordic countries and Canada seem to have higher mobility, while the U.S., the U.K., and France seem to have lower mobility, at least for income and wealth dimensions. The statistics vary across countries, but the pattern nevertheless holds. Some authors, such as Jantti et al. (2006), attribute this particular pattern to the welfare state of Canada and the Nordic countries. They suggest that the welfare state leads to lower inequality and with lower inequality comes higher mobility. This hypothesis goes along with what we present above in section 2.1 about inequality. Recall from that section that inequality falls when we move from the U.S. to France and to Sweden. Similarly, IGEs of these countries follow the same pattern. When IGEs are plotted against the Gini coefficients (a classic index of inequality) of various countries, we observe what is called "the Great Gatsby Curve," introduced in a speech by Alan Krueger, chairman of the Council of Economic Advisors (See Figure 10). The Great Gatsby curve shows a negative correlation between inequality and mobility.

Figure 10

Source: Corak (2012)
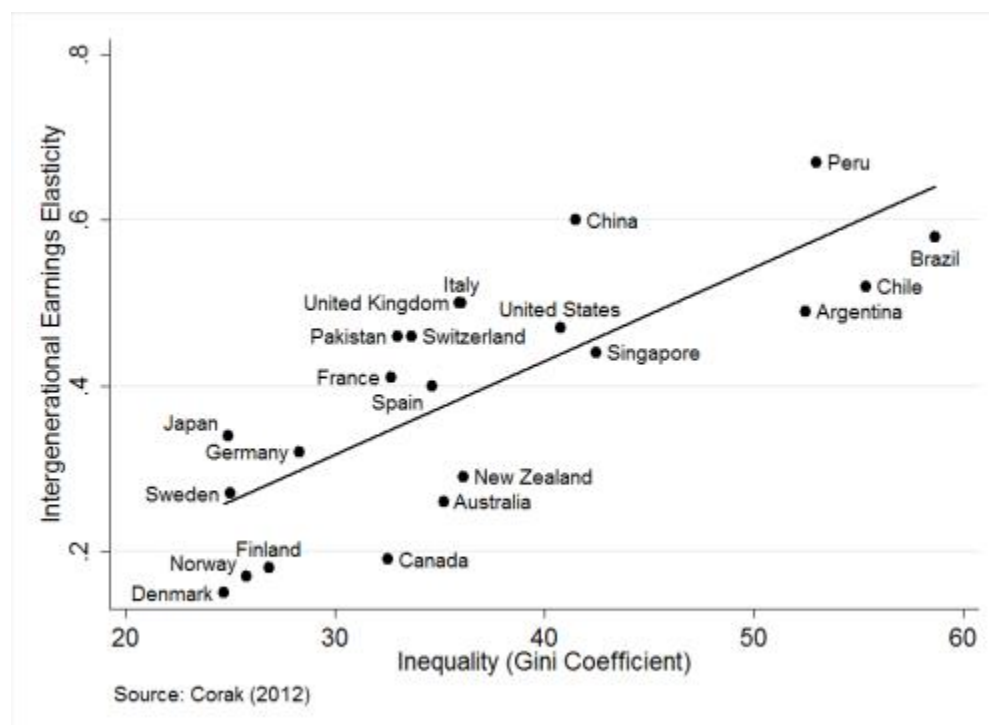
While acknowledging the explanation that the welfare state of Canada and the Nordic countries helps with mobility, Corak (2013) cautions against such a definite conclusion. He points out that systematic differences among countries could have contributed to the differences in IGEs. In particular, he notes that the Nordic countries have a relatively homogeneous population, which makes it hard to compare them with the U.S., a multicultural country. A more reasonable comparison would be one between the U.S. and Canada, which also has diverse racial and ethnic groups.

In addition, what the Great Gatsby curve provides is mostly a snapshot in time: we observe inequality and intergenerational mobility (approximately) at a point in time. What would be interesting is to view how both trends of inequality and mobility interact *over* time. Though,

as we saw in section 2.1, we know the trends of income and wealth inequality across time for different countries, we have yet to observe trends of intergenerational mobility in individual countries.

There is also an intrinsic difficulty in combining intergenerational mobility with inequality: *the former can only be observed over a period of time (between two generations), while the latter can be observed at an instance in time (at least theoretically)*. If we let t denote time, then intergenerational mobility is a function of a range of t, while inequality is a function of only one value of t. What the Great Gatsby Curve shows us is an interaction of two functions: one is one variable and the other is multivariable. It would be interesting to view the interaction of mobility and inequality as that of two multivariable functions. In other words, perhaps we should view the impact of the evolution of inequality over some period of time on intergenerational mobility. The key to this direction of research is to choose appropriate ranges of time for both factors. It is unclear if the current literature has tackled the problem in this manner.

As we can see later on after the third essay, this view on the interaction between inequality and mobility has a stronger theoretical motivation when early childhood development is taken into account.

2.3 Comment on Inequality, Intergenerational Mobility and Social Mobility

2.3.1 Social Mobility – A View by Gregory Clark

As we can see from the above section, intergenerational mobility is hard to study, partly due to the limitations and inconsistency of the data and partly due to the difficulty of defining precisely what we mean by lifetime earnings (or other lifetime levels of the dimension under study). One might think that without understanding mobility between two generations, it would be impossible to study multigeneration mobility. Surprisingly, however, researchers have attempted to study multigenerational mobility.

A prominent figure in this branch of research is Gregory Clark, an economic historian at University of California, Davis. In his book *The Son Also Rises*, Clark uses surname data to track the resilience of social status. By categorizing surnames into low or high social status, he wants to know how long it takes for a certain surname to lose its status. For example, Clark asks questions such as

> If surname such as *Pepys* or *Brudenell-Bruce* had a high status in 1800, how rapidly does that surname regress to average status? If *Baskerville* was an elite name in the Domesday Book of 1086 in England, is there any echo of that distinction in 1300, 1500 or now?

Since surnames and their associated data (wealth, occupation, etc.) are available in records dating back centuries, there is a base to study mobility over a very long time. The finding of this branch of research is striking: it often takes a very long time for social status to regress to the mean, often as long as ten to twelve generations. This means that social mobility is extremely

low, much lower than the rate at which we see in the literature of intergenerational mobility. Clark notes that this result agrees with the common sense that it is hard for people to move out of the social class that they are born in.

Furthermore, Clark finds that the phenomenon is similar across countries and continents: there is not much difference between the English-speaking countries and their Nordic counterparts. The result is also applicable to Asian countries like China, Korea, and Japan.

With this finding, Clark provides a theory of social mobility. There are two assumptions in Clark's theory. The first is that there is a distinction between an apparent social status and a deeper *social competence*. The observable social status could be income, wealth, health, education, etc. The social competence is an unobservable factor which influences other apparent factors. If y_t is a measure of some observable social status factor (income, for example), and x_t is the social competence for a generation t, then the assumption becomes:

$$y_t = x_t + u_t,$$

where u_t is a random component. This u_t random component reflects luck as well as choices of the person to invest in some status factor rather than others. For example, u_t might reflect a person's preference for income (choice to be a banker) rather than for very high level of education (choice to be a professor).

The second assumption is that there is a high level of transmission of social competence across generations and thus social status regresses very slowly to the mean. In other words, mobility is inherently slow. The second assumption can be expressed formally as:

$$x_{t+1} = bx_t + e_t,$$

where e_t is another random factor, and b is a persistence rate (which shows how much social competence retains across two generations). Clark claims that the persistence rate b is very large across countries and culture. The expected value of IGE β in section 2.2 above, accordingly to Clark, is not b; rather it is some θb, where θ is a number less than one. That is why we observe very low levels of β in intergenerational mobility research. Throughout his book, Clark presents empirical analyses on surname data to test this simple theory. Due to the scope of this project, we do not delve too deep into the detailed technicality of the studies Clark cites. Generally the analyses show that the persistence rate b is about $0.70 - 0.80$ across countries.

If Clark's theory on social mobility is correct, perhaps what is most striking in the view of mobility is his conclusion. In the introduction of his book, he states that

> The practical implication is that if you want to maximize your children's chances, you need to pay attention not to the social phenotype of your marriage partner but instead to his or her status genotype. That genotype is indicated by the social group your potential partner belongs to, as well as the social phenotype of their siblings, parents, grandparents, cousins, and so on to the nth degree of relatedness. Once you have selected your mate, your work is largely done. You can safely neglect your offspring, confident that the innate talents you secured for them will shine through regardless.

Clark's conclusion, for the most part, is genetically deterministic: how one's life turns out is mostly determined by one's genes. This conclusion undoubtedly would cause great controversy, since it means that, for the most part, the social order is predetermined. The only way for one to move up in society is to marry the "right" person with a "superior" genotype. The American Dream which promises mobility with hard work is, indeed, just a dream. Fortunately, Clark's theory is not flawless. But since Clark's approach shares the same drawbacks with that of the studies of inequality and intergenerational mobility surveyed above, we incorporate all three branches of research into one discussion below.

2.3.2 The Mechanism of Mobility – The Missing Piece of the Puzzle

Up to now, we have surveyed very broad issues related to inequality and mobility. In section 2.1, we presented general trends of income and wealth inequality since the early 20th century, using income and estate tax data. Currently, the pattern across countries is that income and wealth inequality has increased once again to the level of the early 20th century, especially in the U.S. and the U.K. In section 2.2, we looked at intergenerational mobility, the analysis of how children's generations differ from parents' generations. The IGEs across countries show us once again that the U.S. and the U.K. seem to have higher IGEs than the Nordic countries, which means mobility seems lower for the former countries. At the beginning of this section, we presented a branch of study on surnames and social status that tracks social mobility over multiple generations. The result of the study is a controversial theory stating that "social competence" is highly correlated across generations, and that social mobility is inherently slow for all countries, and there is nothing to be done about that.

The content of the first section is of high interest mainly because income and wealth are arguably one of the most important quantifiable concepts used in economics. Viewing the distribution of income and wealth allows us to see an important part of social welfare. Though there is no consensus on what the distribution should look like, society (aside from the very few economic winners) generally agrees that extreme inequality reflects low social welfare of the general population. This extremely unequal state of welfare prompts an inquiry into the heart of the American Dream: social mobility. Is the state of inequality a trade-off that society has endured in exchange for a higher mobility for future generations? In other words, does everyone accept a smaller portion of the economic pie today in exchange for a much larger piece tomorrow for their children? Are some people in the society sacrificing a smaller *share* of the pie today because they know that their children will have a bigger *share* tomorrow? The intergenerational mobility study is another step to answer these questions. If inequality turns out to reflect low social welfare, intergenerational mobility reveals how this bleak result transmits across generations. Intergenerational mobility can then be viewed as an extension of the study of inequality to more than one generation.

The study of intergenerational mobility has its own limitations, however. At least until now, this branch of research can only study as far back as two generations since data for multiple generations is not available. The use of last names as a means to track social mobility can be considered as an attempt to go around the data limitation to study mobility across generations. However, there is a distinction between the two branches. Intergenerational mobility research often analyzes particular dimensions such as income, education or health, while social mobility research uses "social status" as the main factor for analysis. Both branches try to capture the

notion of mobility, but the "social status" concept used by the latter is not as quantifiable as the dimensions used in the former. Though social status might come with high earnings and wealth, the two concepts are by no means identical.

In any case, there is a similarity among the study of income inequality, intergenerational mobility and social mobility: they focus on people's "final outcomes." In income and wealth inequality, the variables of analysis are adults' incomes and wealth. In intergenerational mobility, dimensions of analysis such as income, education, or wealth are measured as "lifetime" factors. There is an implicit assumption that there exists some number for each dimension to represent the "lifetime" value of it; these could be prime age income, highest level of education, or lifetime expectancy, etc. For social mobility theory, "social status" can only be considered when a person has reached his or her heyday. Indeed, it takes years of education as well as practice for a person to become a doctor, a lawyer, or a professor. In income and wealth inequality study, income and wealth can be measured at different ages; in intergenerational mobility, lifetime earning is measured by averaging income across multiple prime years; and in social mobility, only the highest social status over a life time is considered. As we move from the first branch of research to the third one, at least when we consider their ages, the levels of maturity of the subjects under analysis increase.

While it is useful for these three branches of research to focus on people when they are adult or are at the peak of their life, the method of inquiry does not pay enough attention to *why and how* people arrive at these results. By looking at the problem in a "big picture" view, we miss out on the details that create the differences in development. Because of this big picture

view, the policy suggestions to curb inequality or to boost mobility only solve the problem at an outcome level. We only deal with an aftermath of something inherently wrong that leads to inequality. If the lack of mobility is a disease, then the policy suggestions from a big picture view are just a treatment for the symptoms: what we need is a medicine for the cause of the illness.

When Clark attributes the slow rate of regression to the mean of social status to "social competence," he is attempting to answer the question "What drives social mobility?" Unfortunately, Clark succumbs to the easy answer of "genes." To arrive at such an answer when observing different results of *adults* is to overlook the eighteen (and perhaps longer) years that help form the characteristics of the subjects. If a mere *four years* of college education for a young adult can lead to a significant income increase (presumably from learned skills during that four years), how profoundly might the period of roughly two decades after birth affect that person's achievement? Using "genotype" as an answer to the difference of outcomes is to ignore the very important process of growing up.

More research should be conducted on the mechanism that leads to the differentiation of adults' outcomes or social status. It is not until the complexity of development is understood that we can figure out the driver of inequality and lack of mobility, and can have appropriate policy suggestions. In the next essay, we introduce what has been done in this research direction and suggest an alternative explanation to the bleak deterministic results presented in the current essay.

ESSAY 3
The Mechanisms of Inequality Transmission

As we can see from the prior essay, research on income and wealth inequality for the most part focuses on the "outcome" of inequality, not the process that lead to such inequality. In this essay, we attempt to understand the process that leads to inequality. In section one, we survey the recent methodologies utilized to study the potential causal mechanisms of differences in intergenerational mobility. In section two, we present some interdisciplinary research showing the importance of the early childhood periods in deciding the outcomes in adulthood. In the third section, we then integrate the information in the first two sections to the context of equality of opportunity.

3.1 Summary of methodologies to mechanisms that can influence inequality of mobility.

There have been several attempts in social science to separate the forces of nature and nurture that influence development. Since both factors are intertwined in collected data, various econometric methods are employed to disentangle them. In this section, we adopt the encompassing literature review by Black and Devereux (2010) to categorize the methodologies. The first sub-section focuses on income dimension, and the second sub-section explores other dimensions.

3.1.1 Methodologies and results in education and income dimensions.

Recall from our prior chapter that intergenerational elasticity (IGE) is the coefficient of the parental independent factor (i.e. income or education) on the regression[6] with the children factor as dependent variable. IGE is used extensively throughout the methods surveyed below. There are six major approaches employed in studying the causal mechanism of parental income and education on children's outcomes.

Method 1: Sibling and Neighborhood Correlations

a. Sibling correlation:

This method uses correlation of log earnings among siblings to determine the degree of transition of parental characteristics to children earnings. The logic is that siblings' correlation is supposed to be positive and higher than correlation with strangers due to inheritance of similar traits from biological connection. Results show that sibling correlations are high for the US, about 0.4 and 0.5 for brothers, depending on datasets and methods by different researchers (Mazumder (2008) and Bjorkklund (2002)). The results are much lower for Nordic countries, 0.2 for brothers, and 0.15 for sisters (Raaum, Salvanes and Sorensen (2006)).

b. Neighborhood Correlation:

Using cluster-based sampling procedure, Page and Solon (2003a) try to estimate how much of brother earning correlation is from neighborhood effects. Their general main result is that correlation for unrelated boys (only data for males is available in this study) in the same neighborhood is about 0.16, one half that of brother correlations. Similar studies, such as those of

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[6] $\log(y_1) = \alpha + \beta \log(y_0) + \epsilon$

Raaum, Salvanes, and Sorensen (2006), and Oreopoulos (2003), show that the effect is much lower for Norway (0.05) and Canada (close to zero). Results for education correlation are much lower still. In general, the evidence suggests that neighborhood does not seem to be a major factor explaining similarity among siblings. Note that no conclusion about causal effects can be made.

Method 2: Structural analysis of different types of siblings.

As an attempt to study difference of nature and nurture determinants of income, Bjorklund et al (2005), following works done in 1970s (such as that of Behrman et al. (1977)), utilize differences among Swedish identical twins, fraternal twins, full siblings, half siblings, and adopted siblings to estimate the effects of *genetic, shared environmental,* and *idiosyncratic* factors. Their simple model is:

$$y_i = gG_i + sS_i + uU_i,$$

where G, S, and U represent the above factors, respectively. Using different sets of assumptions, from strong to relaxed ones, they are able to estimate covariance of different forms of siblings. When assumptions are stringent, the result shows that genetic factor (with coefficient *g*) has stronger effect than shared environment (coefficient *s*). However, when assumptions are relaxed, *g* and *s* are closer; yet the estimation is imprecise. Overall, the largest impact comes from non-shared environment for all models (coefficient *u*). However, the result might not be generalized since data is only available for 3 years, and the variance decomposition is limited to the sample.

Method 3: Decomposition of intergenerational persistence

This approach interprets IGE as a compound of direct effects from parental income as well as indirect effects from other immediate factors. Examples of indirect factors include cognitive ability and education of sons (as affected by parents' income). Empirical results from Bowles and Gintis (2002) imply that cognitive ability and educational attainment can explain up to ⅗ of IGE. With further assumptions, they show that genetic can explain only a small portion of IGE (this by no mean implies that gene is unimportant). Blanden, Gregg, and Macmillan (2007) add non-cognitive skills as an immediate factor; they find that a large portion of IGE can be explained by cognitive and non-cognitive skills that affect educational attainment. This method is hard to interpret since these immediate factors can be influenced in the first place by both genetic and other environmental factors themselves. Again, the evidence found here is only suggestive, not causal.

Method 4: Sibling and twin differences

This method uses similarity in genes of identical twin mothers to identify the effects of mother's education on children's education (fixed effects method). The method can also control for effects of father's characteristics.

Empirical results by Behrman and Rosenzweig (2002) using the Minnesota Twin Registry show that the mother's education might have a negative impact on children schooling (might be because of neglect of mother on children due to mother's labor force participation); Antonovics and Goldberger (2005) suggest that the result might be because of the coding of the

data. Different sets of results are found based on different studies from Bingley, Christensen, Myrup, and Jensen (2009), Pronzato (2009), and Holmlund, Lundahl, and Plug (2008): positive effect or not significant effect of mother education, or differences of parents born before or after 1945, etc.

Overall, despite the innovative approach of using twin data, it is not without weakness: parents might treat children differently; even identical twins have different personalities, or there might be interaction among children of identical twin mothers (aunt's influence on nephews or nieces), etc. The main problem of the approach is its reliance on these strong assumptions.

Method 5: Regression analysis using adoptees.

There are two main assumptions for this method: (1) adoptees are randomly assigned to families and (2) adoptees are treated exactly the same as non-adoptees. There are three main approaches for this method: bivariate regression approach, multivariate regression approach, and an approach integrating information of both biological and adoptive parents.

The *bivariate regression approach* compares factor λ of between adopted children and non-adopted children using the regression:

$$y_1 = \alpha + \lambda * y_0 + \epsilon,$$

Where y_1 is an outcome variable (i.e. log earning) of the child, and y_0 is the corresponding variable of the adoptive parents. The expected effects are:

(1) if nurture is unimportant and nature is important, then λ is zero for adoptees and positive for non-adoptees

(2) If nurture is important and nature is not, then λ is positive and equal for both

This means that the relative difference of both is also important.

The usual problem is that assignment of adoption is definitely not random; parents have to pass certain conditions chosen by agencies. Sacerdote (2007) uses data of Korean-Americans adoptees assigned by first come, first serve basis. The result shows very large difference between λ of adoptees and non-adoptees, 0.09 versus 0.32; this implies that genetic is very important. Plug (2004) uses data from the Wisconsin Longitudinal Survey (WLS) and finds a large coefficient of 0.28 for adoptive mother education, but the adoption assignment is not random. Bjorklund et al. (2006) find a strong effect of adoptive parents' log income on children's log income in Sweden; Liu and Zeng (2009) find insignificant evidence of log income when using PSID data for the U.S.

The second regression approach uses *multivariate regression*. This approach tries to identify particular parental factors that affect children the most by adding many factors into the regression. This approach has its limits since we cannot control every possible factor, and some factors are highly correlated with others. Nevertheless, some important potential causal factors are: mother education, family size, and family income. Careful incorporation of data from adoptee can show causal effects: adoptees assigned to families with high socio-economic status (high parental education, small family size, high income) have a greater chance of development

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(A list of studies using this approach is available at panel B, table 3 in Black and Devereux (2010)).

The last approach integrates *information of both biological and adoptive parents* into the regression of children's outcomes. The data mainly comes from the Swedish registry (data of both biological and adoptive parents is often limited). The main result from Bjorklund et al (2007) is that both genetic and nurture factors are important. Moreover, there is evidence of the interaction between genetic and environment in determining children's outcomes.

Method 6: Natural Experiments/ Instrumental Variable (IV) Approach

The natural experiment approach utilizes the unusual variations in parents' income or education to identify any effects on children's outcomes.

Income:

There are two approaches with regard to income: the first one analyzes influences of welfare programs, and the second one analyzes the effects of income or job-related shocks. Welfare programs included in the first approach range from Earned Income Tax Credit (ETIC) to Food Stamp. A more comprehensive summary of programs and results of the first approach can be found in Almond and Curie (2010).

For the second approach, shocks on parental income mainly relate to parents' job loss; effects on children are measured on outcomes such as income or education attainment. Typical works on this approach include Shea (2000); Oreopoulous, Page and Stevens (2008); Rege, Telle, and Votruba (2007). Though the results are not entirely conclusive on causal effects (for

example, the events can lead to changes in other intermediate factors that eventually affect outcomes) the second approach generally implies that parents' income shocks do have effects on children's outcomes.

Education:

Various educational policies changes have been used as instruments to explore causal relationship from parental generation to that of children. For example, policies include: lengthening of compulsory education in Norway (Black, Devereux, and Salvanes (2005)), change in education policy due to students' riot (Maurin and McNally (2008)), or maternal education's diversity due to variation in educational cost (Carneiro, Meghir, and Parey (2007)), etc. The dependent factors in children's generation include total years of education, retention rate, or grade repetition, etc. A summary of instrumental variable approach on education is available on panel C of table 3 in Black and Devereux (2010). There are some results suggesting positive impacts of additional parental education on children's outcomes.

Black and Devereux (2010) qualify that despite the innovative strategies utilized in the IV approach, it is always vulnerable to two main problems: instrument credibility and generalizability. An instrument might be argued to cause a change to another factor which in turn has a direct effect on outcomes, or the effect of the instrument is only locally applicable to a subset of the population.

The main problem with the studies on income and education dimensions:

Black and Devereux (2010) note that across the research body using twins, adoptees and IV on income and education dimensions, results vary tremendously. Holmlund, Lindahl, and Plug (2008) attempt to reconstruct the studies with different methods on only one dataset from Sweden; they find that part of the differences is methodology-specific, rather than country-specific. Different methods affect different cohorts of the population (twins are independent of the distribution of the population, adoptees are more prevalent at higher income families, and IV is often relevant to lower cohort). They also find that OLS overestimates the intergenerational relationship. This means that there is a potential non-linearity effect. Black and Devereux note that there are research studies looking into this issue, but inconsistency is still widespread (as illustrated by their summary table 3) – additional research in this direction is warranted.

3.1.2 Some results in other dimensions.

Research on intergenerational mobility extends to dimensions beyond income and education, including: IQ/ability, jobs and occupations, welfare receipt, health, attitude and social behavior, consumption and wealth. These studies utilize available data of both parent and children generations on respective dimensions to determine the level of intergenerational elasticity. A summary table of articles cited in Black and Devereux (2010) is provided at the end of this project.

3.1.3 Comment on the causal mechanism research

As we can see from the literature review above, the body of research into causal mechanism of intergenerational mobility involves very innovative approaches to identify different impacts of genes and environmental factors on children's development. There are many

different methodologies to explore the cross-generational relationship, but all target three main aspects: twins, adoptees and instrumental variables. In addition, dimensions of research extend beyond income and education to others such as ability, job and occupation, health, etc. The main goal of this trend of research is to explore if there is evidence of transmission of traits from parents to children and how the transmission works.

So far, results are inconsistent across the literature. The general pattern, however, is that both gene and environment are important for children's outcomes. We should also note that most of the results found in the studies are available thanks to the data from Nordic countries. As data similar to Nordic countries' is available in other parts of the world, more research with the same direction can be conducted. This does not mean that there is no direction for application of the results. For example, Black and Devereux (2010) note that results from Nordic countries imply that education policy changes that head towards longer time of compulsory education in one generation might have positive impacts on earnings of future generations. It is these suggestive evidences that prompt the need for more innovative methodologies in the direction of causal mechanism of intergenerational transmission.

We also should note that for the methods surveyed so far, the factors of both parent and children generations mainly focus on adulthood period. Since childhood and other lifetime periods are very different from one another, perhaps looking at each period separately would allow some insights into the intergenerational transmission of traits. In the next section, we draw attention to the early childhood period.

3.2 Summary of inequality of opportunity in early life

Among many different developmental stages, the early childhood period is arguably the most important phase. Knudsen, Heckman, Cameron, and Shonkoff (2006) provide an excellent literature review of neurological, behavioral and economic foundations for this hypothesis. It is maintained that in the early childhood period, neural circuits are plastic, highly malleable with stimulation, helping the subject adapt to the environment. A nourishing environment early in life allows the brain to efficiently acquire foundational skill sets. And since skill sets are sequential, mastery of these basic skill sets leads to further efficiency in learning more advanced skills.

Evidence for the hypothesis at the neurological level includes case studies for animals as well as humans[7]. For humans, children younger than age 7 are significantly better at learning a new language compared to those who are older or who are adults. When prompted with the environments they experienced in early life, the subjects can re-adapt easily. Knudsen, Heckman, Cameron, and Shonkoff (2006) conclude that "early learning establishes a brain architecture in juveniles that enables increased functional plasticity in adulthood."

Evidence of the importance of early childhood development goes beyond the neurological level to the behavioral realm[8]. These studies show that early childhood experience

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[7] For example, experiments on owls show that manipulation of auditory experience in juvenile owls leads to structural change in their brains (to adapt to the manipulated environment); adult owls did not show changes when exposed to the same conditions.

[8] For example, an experiment on monkeys shows that infant monkeys separated from their mothers in the early months tend to have self-comforting rather than groups-supporting behaviors. These same monkeys tend to behave aggressively later in life. The infant monkeys which are adopted by female figures early enough after separation from their mothers do not show significant aberrations. Experiments

can significantly impact later life behavioral characteristics, which in turn implies that adversities in early life might cause long-term deficiencies which are hard to alleviate.

Knudsen et al. (2006) explain that research studies such as these support the neurological and behavioral general principles that neural circuits are highly amenable during the early life period, and the structure of the brain becomes more rigid and harder to change over time. These principles work across species, and thus play a crucial role in the study of inequality of opportunity. Children born in disadvantaged environments might not be able to develop strong neural, behavioral and emotional foundations to further acquire skills that are necessary for their later development. Born in an environment with not enough attention from adults (possibly from parents' economic constraints, or lack of government's child support), poor health care, low investment in early education, a child cannot expect to catch up with his or her peers who do not suffer from such adversities. The sequence of achievements which eventually leads to economic outcome in adulthood is highly determined in the very initial starting point.

One might argue that intervention later in life might help. A study in the same review by Knudsen et al (2006) shows that intervention later in life for disadvantaged children does help, but only for a short time; the impact lasts for a longer time if intervention happens much early in life. The result is consistent with the basic brain plasticity principle. The disadvantage caused in early years might be too large, which leads to harder intervention later in life. For example, Hart and Riley (2003) conduct an experiment with 42 families of different income levels by tracking how many words children are exposed to from age 1 to age 3. They find that by age 3, the gap of

on rats also show that those brought up by attentive rats became calm, adventurous and attentive parents, regardless of their biological parents' behaviors.

words heard between a child born in a families of parents who are professionals and a child born in a families who are on welfare programs is 30 million words. This tremendous difference would lead children to different development tracks.

Put in a larger inequality context, it might be projected that a major part of income inequality at the moment was already determined a long time ago when the now adults had very unequal early life development. The claims that unequal economic outcomes are mainly due to differences in genetics, and that there is a big-trade-off between equality and efficiency as mentioned in Mankiw (2013) do not give enough weight to the impacts of environment on shaping early development. It's not until the upbringing environments for children are equal that we can attribute the differences in economic outcomes to genetics.

As mentioned above, any phases of human development are affected by a multitude of factors. With such importance of the early childhood period, inequality of opportunity should be studied by analyzing this period from the diverse contributing factors. These include but are not limited to: health care, child support, parents income, education, neighborhood, etc.

Researches focusing on these factors during childhood period have yielded some results. For example, Hoynes, Almond, and Schanzenbach (2012) discover that children having benefited from Food Stamp Programs during childhood show, decades later, "significant reduction in incidence of 'metabolic syndromes'" and "for women, an increase in economic self-sufficiency". Another study by Chetty, Friedman, Hilger, Saez, Schanzenbach and Yagan (2011) analyze the long-term effects of attending small classes (compared with attending large classes) in kindergarten. The study is based on Project STAR - a random experiment assigning 11,571

students to different classes. The main result is that higher quality kindergarten experience has a significant impact on test scores as well as earnings in adulthood. The research suggests that the high quality classroom experience provides children with non-cognitive skills such as "effort, initiate, and lack of disruptive behavior". In another paper, Lugwig and Miller (2007) use regression discontinuity design to study the impact of Head Start Program (a program helping poor children aged 3- 5 and their family) on children, and the main finding is that the program seems to help reduce the mortality rate of children as well as increase educational attainment.

In particular, the Equality of Opportunity Project led by Raj Chetty and Nathaniel Hendren produces some interesting results on early development. In particular, Chetty and Hendren (2015) find *causal* effects of neighborhood on children's earnings in adulthood. The team of researchers gather data of families who moved across areas in the U.S.; they look at impact of the new neighborhood on children's future income, conditional on their ages when the families moved. Applying quasi-experimental approximation technique, Chetty and Hendren (2015) find that neighborhood can have positive or negative impact on children outcome. The earlier a child is exposed to a neighborhood (the earliest age the data allows is 9), the larger the impact has on him or her; furthermore, after a certain age (about 20), moving to a better or worse neighborhood does not affect the child's outcome. The research is so able to calculate the percentage change in income resulted from being exposed an additional year to a good or bad county (among the 100 largest counties) in comparison with the national average for families having income at 25th percentile level. For example, they find that a year spent in DuPage, IL increases a child's earning by 0.76%, which results in 15% increase for a person spending 20 years growing up in the neighborhood, relative to the national average. The researchers find that

there are five factors associated with a "good" neighborhood: less racial segregation, better school, lower income inequality, lower violent crime rates, and lower portion of single-parent households. Even though data for children with age lower than 9 were not available, with the evidence of early development at the beginning of this section, it is likely that the effects of neighborhood on children's outcomes in Chetty and Hendren (2015) are analogous for younger children. The important point here is that the younger the kids, they more impact environment has on them. Research studies such as these help shed light on the potential impacts of different factors on the crucial early childhood period.

3.3 Implication on equality of opportunity

From section one, we can see that both genetic and environmental factors are important for development, but from section two, it is suggestive that in the very early stage in life, genetic characteristics are highly amenable. Passing a certain age, however, it is harder, if not impossible, to change the structure of the brain. This carries a profound implication on equality of opportunity since it means that the majority of cognitive and social ability, the innate ingredient to utilize available opportunity, is formed in the very early stage of life. Note that the effect of early formed ability goes both ways: a strong ability will create positive impact, while low ability create negative one. Extreme cases such as a genius with socio-behavioral problems or a very social, likeable student with low academic ability are prominent examples. Deficient development in either cognitive or social ability can carry long-lasting impacts throughout life. What should be targeted for each individual is at least a decent level of ability to thrive when he

or she is faced with different circumstances later in life – an early favorable environment is the starting point, if the theory proves to be correct.

Reinforcing the ability for the whole population has impacts both on equalizing opportunity and creating freedom for people to choose what they want to do. When the general level of ability of the population is high, and the variation of ability is low, the number of "types" of people in the society would be controlled to a limited number (recall from essay 1 that a "type" is a set of people with the same vector of circumstances). When the number of "types" is low, it is easier to implement Roemer's redistribution policy algorithm since we are working with a system with fewer variables. In addition, with enhanced ability of the general population, it can be argued that people would enjoy more freedom as well. A person with low ability, for example, would have a lower number of career choices. Indeed, the standardized test system is designed to filter out people with high or low abilities in certain fields. Students who do not perform well in the LSAT, the required test for all law school applicants in the US, would definitely have no chance of becoming a lawyer, even if they desperately want to (assuming they have tried their best, but still failed to do well on the test). In a sense, by improving ability for all, we are eliminating the obstacle arising from ability differentiation barrier.

What is the aim of investing in early childhood NOT about? It is not about equating children's ability to the same level. Rather, it means that children should be nurtured in a higher standard; circumstances for growing up have to be favorable. Looking at it in a different way, we are trying to eliminate the lower level ability, the lower tail of the distribution of ability.

This goal is also not about disregarding the development of older children or adults. Rather, it's about focusing resources on the group with the highest potential of growth. It is a redistribution of redistributive policy. This direction of policy making would create a future workforce with a very strong base.

Summary of redistribution proposal.

Premise 1: Innate and environmental factors affect outcomes.

Premise 2: Brain structure is highly plastic in early life.

Premise 3: Brain structure affects ability. Once formed, ability is hard to change as people age.

Conclusion: Investment from redistribution should focus on early childhood period.

Level of impact of environment on ability: darker = more impact

Early childhood   Teenage years   Adulthood

Proposed efficient redistribution
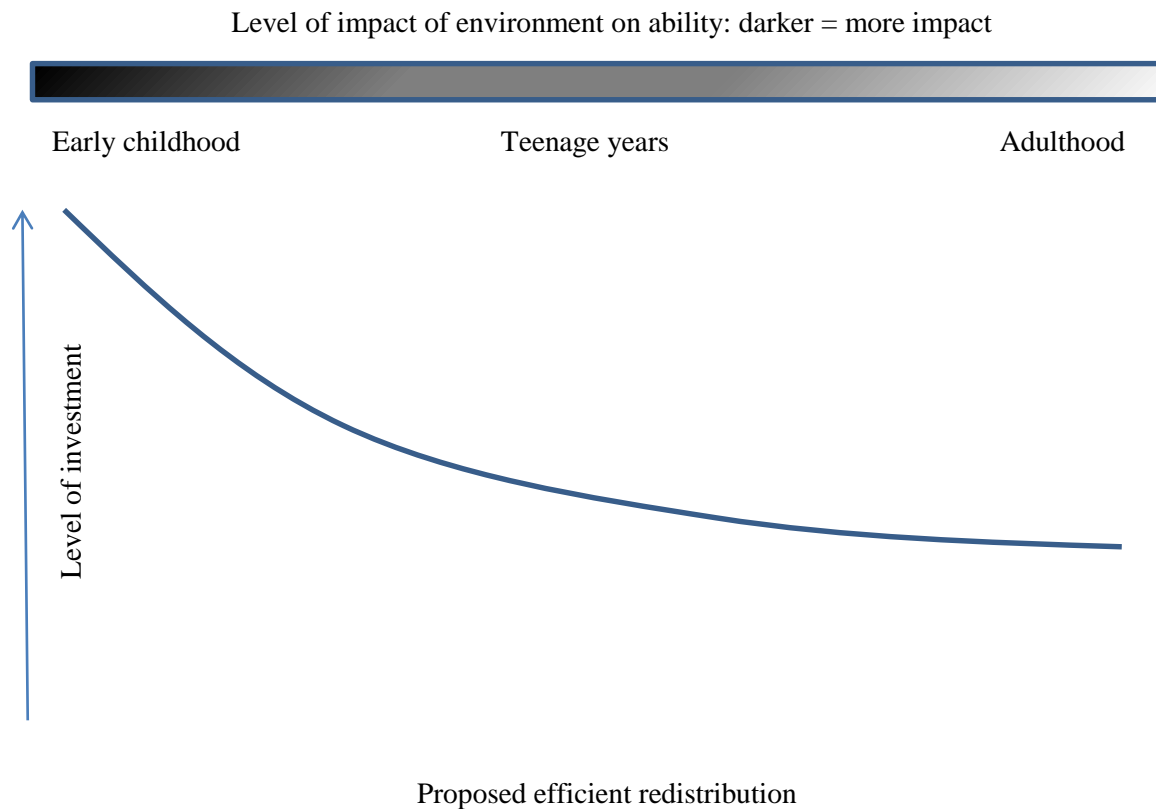
Sections one and two also contribute to the evidence against those who use Nozick's approach towards justice. Particularly, they undermine the viewpoint on the first principle of Nozick's theory. Recall that in Nozick's first principle of justice, it is stated that a person is entitled to a holding if he acquires the holding according to the principle of justice. Now, if we view "ability" as moldable, highly sensitive to surrounding environment, then the product of that molding process is a form of acquirable property: it can be formed by will and can be owned by some people. The interesting thing is, before this property is formed, it is influenced not by the subject himself, but by others around him. After the property is formed, however, it belongs the person alone: he can use it on his own will. Nevertheless, we should not make the mistake of viewing the ownership of this ability-property in all positive light. A person who grows up in a very hostile environment where both cognitive as well as social abilities are inhibited does not have any say towards that "low-quality" property. As long as the authority can influence the process of forming ability yet chooses not to, then the "low-quality" ability property is imposed upon the person. This is injustice.

Nozick's first principle of entitlement theory is not in itself a problem in our line of argument. Rather, what troublesome is the application of it to let the market forces tend to themselves the process of formation and distribution of holdings. In our current case, the particular holding is "ability", a kind of holding that is too important to let the market decide on how to create and where to distribute. With this view, the application of Rawls' theory of justice proves to be more reasonable. Recall that in Rawls' theory, the first principle deal with basic liberty requirements, and the second principle deals with distribution of social and economic resources. An analogous application using our view of formation of ability requires an extension

of "basic liberty" to include more social and economic resources. The reasoning is straightforward: formation of ability requires some endowment of social and economic resources (on top of basic liberty). In order words, our claim encompasses both the first and the second principles of Rawls' theory.

The position we currently hold by no means implies that all nurturing factors are extensive, that we can completely change the effects of genetic factors. Of course people with different genes have different comparative advantages, but the key point here is that there is some basic level of capacity that we can build for children that would allow them to foster later when they get older. The standard for the basic capacity and the corresponding environment are to be decided in further research (and potentially political processes), but it should be noted that such standard is a necessity if we aim for a society with equal opportunity.

Discussion

In essay one, we argued that if we are to apply Roemer's model to the early childhood period, then redistribution should be arranged in such a way that each child lives at a minimum standard that fosters his or her cognitive and social ability. The main reason for this recommendation is that children have little to no influence on their effort – they are mostly affected by the surrounding environment. In the second essay, we pointed to the drawbacks in research on inequality and mobility, namely, that it does not pay attention to the process of human development, which includes the childhood period.

The last essay provides a basis to reinforce the application of Roemer's model in the first essay and solve the problem of the second essay. First, since early childhood development shows a long-term impact on adulthood achievements, applying Roemer's model on this period could allow children to start their life with a higher set of skills, and could potentially decrease differences in skills across children with different circumstances (lower skill differentiation). Second, though there is a long time between early childhood and adulthood, it can be seen from the third essay that the early childhood period has a lasting impact on later development. By investing in early childhood, resulting in lower skill differentiation in children, the prospect of more equitable development in later periods of life is higher. The suggestion of investing in early childhood is thus a direction towards solving the *process of development* problem.

The long-lasting impact of early childhood development also helps explain why Clark's theory on social mobility is deficient. Recall that Clark finds that social mobility is very slow when one uses data on surnames to track social status. He conjectures that there is a latent "social competence" factor that is highly correlated across generations. It is this "social competence" factor that decides the "stickiness" of social status. Clark claims that genes play a significant role in this social competence factor. But from the viewpoint of childhood development, it can be argued that it is not necessarily the genetic factor that influences the transmission of status across generations; rather it could be the case that investment or lack thereof in early childhood development plays a significant role in determining an individual's "fate." When a child is born into a family with a favorable social environment, he or she develops the kinds of abilities and skills that later allow him or her to succeed in life, assuming that the skills are still relevant when the child reaches adulthood. Families with high social status often provide a better environment for children than those with lower status. When the importance of the early childhood period is not well understood by the general public, development is dictated by family traditions. Those families with constructive traditions have a higher chance of staying or moving to a higher social status, and those without such traditions have lower chance for social mobility. The phenomenon of low social mobility across generations might reflect the unawareness of prior generations regarding how important early development is.

As we can see from the above argument, the cornerstone of the current project is the hypothesis that early childhood development has a long-lasting impact on adulthood. Our project is limited in this regard since early childhood development is an interdisciplinary topic, and we cannot provide a definite answer for the hypothesis until further breakthroughs from related

fields (such as psychology, neuroscience, sociology, etc.) are at hand. To this extent, as more research studies in childhood development are conducted, the strengths and weaknesses of our project will become clearer.

Though there have been programs that invest in children such as free public lower-level education, tax transfer for low income families, food stamps, and assisted health care, the scope and intensity of the programs should be widened considering the importance of the early childhood period. This is especially important for families with low income and parents with lower education since the parents themselves are more likely to be unaware or unable (due to lack of time and/or financial resources) to provide an environment that fosters healthy development. We by no means imply that investment in early childhood is the only way to curb inequality. It has been shown that there are fading out effects for some programs[9]. There should also be follow-up programs that aim to sustain the benefits of early childhood investment. The main message here is that if inequality is the result of a process of development, then the solution to the problem has to start at the earliest stage in life.

We should note here that our suggestion of focusing on early childhood development with governmental policies does not undermine the importance of families' private efforts to invest in their children. When we view the main goal of social mobility (adopting Clark's approach) as attaining high social status, individual families' investment in their children might reflect their decisions to take risks in the childhood period in the expectation that when the children grow up, they will attain higher social status. Whether the skills prepared during

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[9] Fading out effect is the phenomenon where the impact of a program does not show in the sample after a long period of time, even though there is some effect in the short term.

childhood will be valuable in the children's adulthood is uncertain, since it also depends on the condition of the future society. There are professions, such as doctors or professors, that have had high social status over a long time, but most professions have undergone changes in social status. Movie stars or entrepreneurs did not have high social status until the society demanded the skills that they offer, be it mass entertainment or creative innovation. For social status to materialize, two ingredients must be present: adequate investment in skills and a favorable social environment. When families decide to invest in their children's development, whether intentional or not, they are supplying skills for the future society, which in turn decides which sets of skills are highly valuable and which are not. The process sounds almost like natural selection in biology, yet the entity involved in this selection process is society itself. To this extent, respecting the unique investment of individual families in their children is the key to preserving diversity for the development of the society as a unit.

We also should caution that the suggestion of targeting early childhood development as a means to address the cause of inequality does not imply that the "big picture" view of inequality is unimportant. For example, when Piketty claims that the driver of inequality of income and wealth is the fact that $r > g$, his argument is valid on a "macro" level. Our claim that the process that leads to inequality starts with early childhood development does not invalidate that macro claim[10]. To curb inequality, policies should be designed to solve problems at both the "macro" and the "process" levels.

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[10] r is the return on capital, and g is economic growth rate. Consult Piketty (2014) for details.

In addition, our suggestion to pay more attention to the childhood development period does not entirely solve the theoretical problem of equality of opportunity as prompted by Roemer. What we suggest is only a partial solution to one period in life. There is still work to be done regarding equality of opportunity. What our suggestion does is to shorten the ability gap among children with the hope of decreasing the number of "types" (the sets of people with the same circumstance vectors). Thus, while Roemer's model might cover the problem of inequality caused by meritocracy (people with different abilities belong to different "types," and thus those with higher abilities can enjoy higher outcomes though they might not expend as much effort), this project does not address that issue. Rather, it serves to promote a fairer form of meritocracy – one in which adults' abilities are not predetermined by their childhood circumstances.

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APPENDIX

A summary of studies of intergenerational mobility using dimensions other than education and income (as cited in Black and Devereux (2010))

Dimension	Author(s), year	Description	Finding
IQ/Ability	Black, Devereux, Salvanes (2009)	Utilize Norwegian military data that include both fathers' and sons' IQ information	Substantial increase in son IQ if father IQ is higher
	Bjorklund, Eriksson, and Jantti (2010)	Same method as the prior study, but with data from Sweden.	Find similar results as the prior study, but data from brothers suggest large influence of environment on IQ.
	Anger and Heineck (2009)	Use the German Socio-Economic Panel Study with cognitive data for men and women.	Esimates are larger than Scandinavian countries'. When using gender specific-data, they find larger effect of mothers' IQ than fathers'. They also find gender-specific effect: moms affect daugheter more and similarly for dads to sons.
	Gronqvist, Ockert and Vlachos (2009)	Use Sweden draft data (male-only) for cognitive and non-congitive skills	Parents' coginitve ability matters more for education, while non-cognitive one matters more for earnings.
Jobs and Occupations	Hellerstein and Morrill (2008)	Compare parents' and childrens' occupation in cohort around 2008	30% sons and 20% daughters have the same kind of occupations, but this depends on the definition of occupations.
	Ermish and Francesconi (2002)	Use occupational prestige rank to correlat fathers' and sons' ranks (British Household Survey)	0.4 to 0.75 for father - child pairs and 0.30 to 0.50 for mother-child pairs, with higher resutl for higher status.

		The former uses British data, the latter use Italian data, employing similar method as Ermish and Francesconi (2002)	
	Carmichael (2000) and Di pietro and Urwin (2003)		Strong father-son relationship.
	Corak and Piraino (2010)	Look at fathers and sons who work for the same firms in Cananda.	40% of men have work in the same company as their fathers'; the effect is higher for highe earners.
	Kramarz and Skans (2007)	Analyze firm-specific data	Boys are more likely to get stable jobs at their fathers' plants, more applicable for lower income families. There's a symmetric relationship between mothers and daughters.
Welfare Receipts	Levine and Zimmerman (1996)	Distinguish welfare trap from poverty trap.	Most persistence in welfare comes from poverty trap. There are two issues: welfare trap and poverty trap. The former deals with the familiarity of children with welfare programs and so they adapt to these programs; the latter deals with poor children coming from poor background and enroll in welfare program.
	Beulieu et al. (2005) and Mitnik (2008)	Both studies look at the intensity of dependence on welfare. The former looks at Canadian data, the latter examines data from California.	The former finds more dependence on welfare from parents lead to more dependence on welfare by children. The latter finds no evidence from length of welfare exposure on future dependence.
Health	Akbulut an Kugler (2007)	Analyze data on correlations of height, weight, BMI, depression and asthma in the US	High correlation between children's and mothers' factors.

		Analyze smoking habits of parents and children	Children are twice likely to smoke if both parents smoke, as compared to if both parents do not smoke.
	Loureiro et al (2006)		
	Currie and Moretti (2007)	Use sibling mothers' data to eliminate family fixed effects.	Children are more than 50% likely to have lower birrth weight if their mothers are in turn lower wieght at birth. Elasticity is about 0.2.
Attitudes and social behavior	Altonji and Dunn (2000)	Study persistence in wage and work preference (NLS dataset)	They propose that preferecences lead to work hour persistence across generation
	Mayer et al. (2005)	Study mothers' and daughters' traits. (PSID dataset)	Very small portion of traits' tranmission is due to socio-economic status.
	Wilhelm et al. (2008)	Examine charitable behavior including religious and secular givings.	Religious elasticity is larger than secular elasticity.
	Dohmen et al. (2008)	Use the German Socio-Economic Panel Study to study attitude towards risk and trust.	There is a positive corrolation across generations in attitude on risks and trust.
	Almond, edlund, and Milligan (2009)	Study cultural persistence across generation by examining Asian immigrants to Canada.	Find evidence that there's preference for having sons.
	Fernandez, Fogli, and Olivetti (2004)	Study men's attitudes towards marriage by mothers' behaviors	Men who grow up with working mothers tend to have wifes who work.

Consumption and wealth	Waldkirch, Ng and Cox (2004)	Use PSID dataset to explore consumption pattern across generation	IGE of food consumption away from home is about .14 to .20; the effects come both from parental taste as well as income.
	Charles and Hurst (2003)	Use wealth data from PSID to estimate IGE of wealth.	The result is about .37, higher than other previous studies' suggestion. The portion of intergenerational cross-quintile movement (parents from the top or bottom having children in bottom or top quintiles) is low, about 20% to 25%.