# Research Plan

# *Essays in the Economics of Education: Throughout the Journey*

## 1. Introduction

In the journey of life, education plays a pivotal role in shaping the trajectory of individuals, from their early stages in universities to their later stages as experienced workers. Understanding the dynamic relationship between education, human capital development, labor market outcomes, and economic growth is crucial for comprehending the broader implications of educational systems on individuals and societies across the life cycle.

In this PhD dissertation, I will explore in three independent papers three interconnected facets that span different stages of life, examining student incentives during university years and extending to labor market risks faced by individuals in later stages of their careers. Through rigorous empirical analysis and theoretical frameworks, this research contributes to our understanding of the multifaceted nature of education and its wider implications. The underlying theme of these papers is the central to empirical economic analysis of education: its interconnectedness with subjects such as labor and population, and its role as a fundamental factor in individual and societal development.

The first paper is a joint work with both my supervisors, Andreu Arenas and Jenifer Ruiz-Valenzuela. It focuses specifically on college education, examining the relationship between college tuition and students' academic performance. By investigating how an increase in the costs of course repetitions impacts student behaviors, this chapter provides insights into the design of educational policies that promote academic engagement and reduce inefficiencies of financial resources allocated to public universities. It is also worth noting that our analysis is based on student record data from the University of Barcelona, through which we dedicate this chapter to the university where we work and study.

The second paper investigates the intricate linkages between education and labor market risks within the context of China. As the Chinese economy continues to undergo rapid transformation, there has been a potential conflict between increasing opportunities accompanied by higher uncertainty and the perception of risks in the labor market performance associated with cultural factors. On the academic side, although extensive research has examined the returns on education investment and "education is the best investment" has become a cliché outside the field of economics of education, the aspect of risk or uncertainty—another crucial facet of investment—has not received sufficient attention. This chapter aims at unraveling the complexities of education and labor market risks.

The third paper centers on human capital investment during the later stages of life, empirically analyzing the effectiveness of training programs in improving the labor market outcomes of older workers. By evaluating a specific training program, we explore its impact on wage premiums and extended labor market engagement for older workers, as well as the net social returns of these initiatives. Population aging has become a global norm, presenting challenges and opportunities worldwide. In this sense, the significance of this paper lies not only in its academic interest but also in its relevance to the current era and the foreseeable future.

By addressing these three distinct yet interconnected questions, this dissertation aims to deepen our understanding of the mechanisms through which educational systems shape human development, labor market outcomes, and the overall well-being of individuals and societies. The rest of this Research Plan is structured to present the details of each chapter, the data management plan, and the work plan I intend to follow in the subsequent years.

## 2. Chapter 1 *Will Students Work Harder When It Is More Expensive to Retake a Course?*

### 2.1 Background and Motivation

Higher education plays a vital role within the education system. At the country level, each year significant resources are allocated to tertiary education institutions; at the individual level, students' performance during this period directly influences their transition from being students to becoming productive members of society in the next stage of their life. In OECD countries, for example, the amount of per-student spending surpasses that of other levels of education, and these public investments have continued to rise at a faster pace than the increase in enrolment rates. However, the utilization of these funds does not seem to be as efficient as expected. Low graduation rates and delayed graduation among university students have long been a serious concern across countries even in the world's most developed countries, as evidenced by recent data showing that only 39% of undergraduates in OECD countries graduate on time and that more than a fifth of enrolled students do not manage to graduate after all (OECD, 2022). It seems that resources have continuously been invested in higher education, but they fail to yield the desired outcomes.

A critical aspect of higher education funding revolves around public subsidies on tuition fees. There has been an ongoing debate in policy practice or theoretical research on whether public universities should charge fees, to what extent the state should provide financial support for students, and what portion of the cost of higher education should be borne by individuals. To this day we are still far from reaching consensus. Over the past few decades, there have been numerous policy attempts addressing the issue of tuition fees in higher education. These policies have sparked considerable discussion and debate. For instance, England implemented tuition fees in 1998 (Murphy et al., 2019; Sá, 2019), while several German states introduced fees in the early 21st century only to abandon them approximately a decade later (Bietenbeck et al., 2023; Bruckmeier and Wigger, 2014).

These examples represent significant shifts in the systems, transitioning from free education to fee-based or vice versa. However, it is important to note that in practice, rather than experiencing radical changes such as complete introductions or cancellations of fees, many educational systems undergo modifications in the levels of tuition fees. How can tuition fees be adjusted to make the financial investment in higher education more efficient? Or, will higher or lower tuition fees motivate students to use higher educational resources more efficiently and produce better academic performance, and to what extent will so? These are not only academic questions to be answered, but also significant in the practice of fiscal and educational policy.

The 2008 financial crisis in the United States spread to the world, leading to the largest global economic crisis in decades. European countries were greatly affected, and many governments fell into difficulties, leading to the European debt crisis. The Spanish government, in order to reduce expenses in this context, increased university tuition fees in the following years. This change was nationwide. The price changes in Catalonia occurred between 2010 and 2012; before and after this period, the university tuition fees in the region remained relatively stable, providing us with an ideal policy change for our research.

### 2.2 Objectives and Expected Contribution

Taking advantage of the change in tuition fees as described above, we attempt to find out whether the increase in tuition fees has an impact on students' behaviors in the university, with a particular focus on the number of retakes for a student to pass a course. In order to answer such a question, some details about the price change. In most regions of Spain, and especially in Catalonia, the levels of tuition fees for enrolling in a course for the first time and for subsequent repetitions of the same course are different. As is shown in Figure 1, before 2010, the raise in fees if one takes more times of a course--considered here as the extra costs--was not significant. For instance, students majoring in economics need to pay at most 5 euros more per credit if they fail a course and take it for the second or more times. However, after the policy change, the highest price per credit for retaking a course (for the fourth and subsequent times of repetition) has become almost four times the price for the first enrolment. Take economics as an example again. In 2011, the extra cost per credit is 18.19 euros, or 100%, if the student fails a course for the second time and needs to take it for the third. Here we are showing the price changes for the system before introducing the Bologna process; the trend behaves exactly the same for the later system, as prices per credit were calculated strictly based on the conversion of credits between two systems (1 ETC = 1.5 Spanish credits).

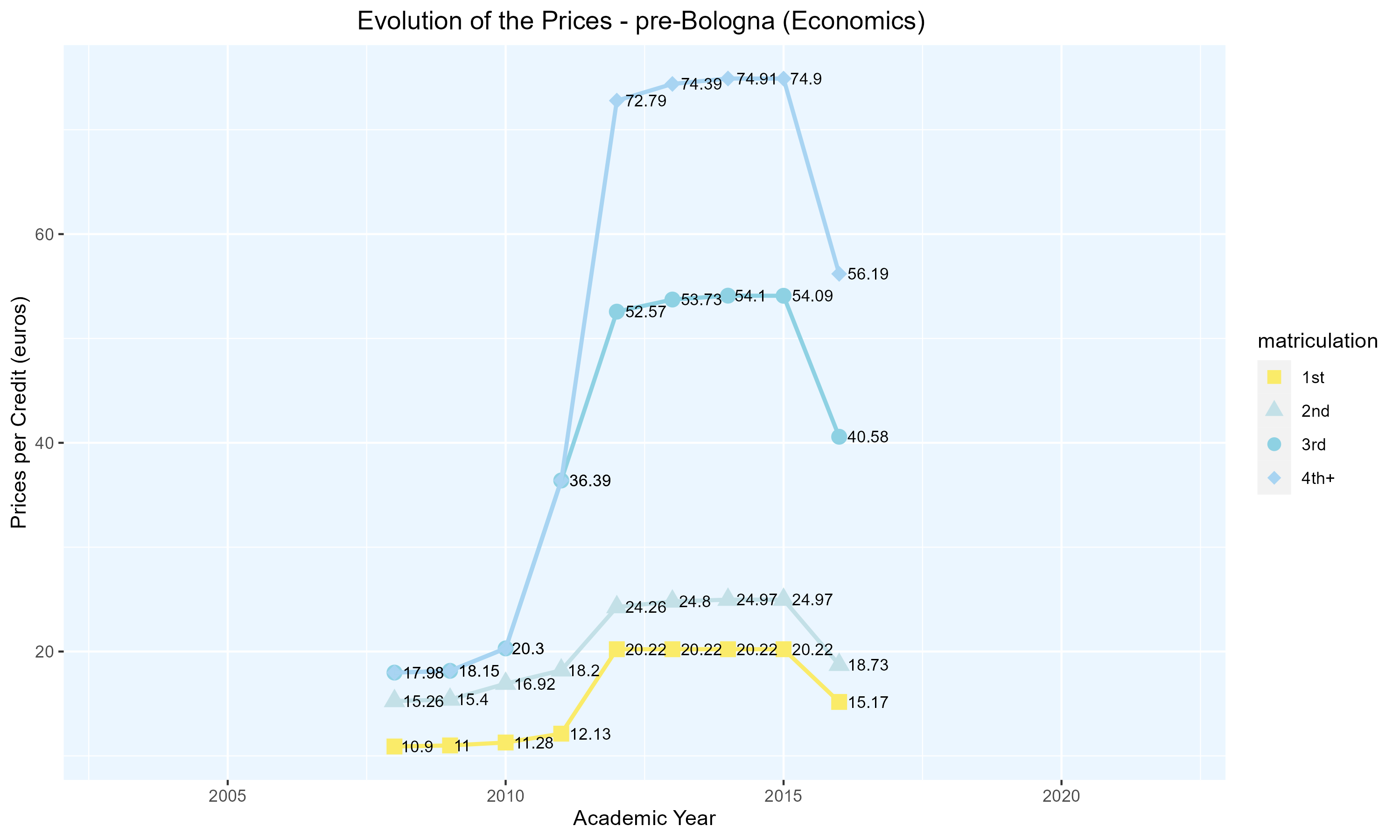


Figure : Price Changes in Catalonia

With this variation, we are able to further explore how tuition fees affect students' behaviors including course retaking. Does reducing the subsidy level for course repetitions and increasing the cost of retraining for students motivate them to make greater efforts so that they retake fewer courses? Does it prompt students to complete their studies faster and reduce the proportion of delayed graduation?

This paper contributes to the strand of literature in the economics of education which looks at the relationship between financial situations and students' performance. Research on this topic in general started several decades ago (Dynarski, 2002; Ehrenberg and Mavros, 1995; Kane, 1994). However, a large portion of papers has studied the impact of various aids and scholarships (Castleman and Long, 2016; Denning et al., 2019; Dynarski, 2003; Fryer, 2011; Murphy and Wyness, 2023). A possible explanation of this is that, compared to the introduction of aids and scholarships, tuition fees are more difficult to change due to procedural complexity, especially for public universities whose fees are regulated by laws. Also, in countries like the United States, grants and financial aid are used often as a tool to target different groups of students, thus attracting more policy-related concerns and examinations.

Recent studies have tried to identify the causal relationship between tuition fees and student behaviors by evaluating relevant policy changes. As mentioned in the previous section, the shift away from England's free higher education system has been a possible policy change to explore. Yet, due to the complication and long progression of the change, past research either found it difficult to separate the pure effect of charging fees (Sá, 2019) or provide descriptive evidence rather than causal inference(Murphy et al., 2019). The introduction of fees for universities in Germany is another most often explored setting. Looking at this change, (Hübner, 2012) and (Bruckmeier and Wigger, 2014)obtain rather controversial results--the former study concludes with a decrease in enrolment in the face of a rise in fees while the latter finds no significant impact. Recently, (Bietenbeck et al., 2023) disentangle the effects in the extensive and intensive margins using this variation, reaching the conclusion that the introduction of fees increases students' effort and degree completion but decreases enrolment rates, thus leading to an insignificant overall effect. Such a lack of consensus exists in other parts of the literature. In Italy, (Garibaldi et al., 2012) exploit a special tuition fee discontinuity at Bocconi University, finding that higher tuition fees do reduce the probability of late graduation. In contrast, (Fricke, 2018) uses an unexpected raise in fees at the University of St. Gallen in Switzerland and finds no significant effect at all on both graduation and grades. For the extensive margin, according to a meta-analysis by (Havranek et al., 2018), though most research reports that increasing tuition fees would lower enrolment rates, the mean effect has become close to zero after adjusting for publication bias. For the effects on the intensive margin, the debate is still going on; this is also what we mainly focus on in the paper.

Pertinent to the particular context we use, there is only one paper looking at a similar change in Spain, as far as our knowledge is concerned. (Beneito et al., 2018) compare students who pay fees to those who are exempt before and after a rise in university prices in Valencia, Spain, using data from three majors in one cohort at the University of Valencia. However, they do not try to investigate different levels of extra costs students face when there are course repetitions, which is our focus in this paper to understand in detail the efficiency of. Besides, with more data available, we are also able to explore the heterogeneity of the effects on different groups of students from various backgrounds, disciplines, etc, when facing a change in prices.

### 2.3 Identification Strategy and Data

#### 1) Data

We use the administrative data from the University of Barcelona (UB), which provides a detailed record of the academic performance of undergraduate students before and after the change in tuition fees. The sample consists of all students who enrolled at UB from 2007 to 2017. Our data includes their course selection, grades, retakes, and graduation dates. It also incorporates the background information of students recorded during the pre-enrollment process, as well as their performance in the college entrance examination. At the moment we have obtained the slices covering three cohorts of students majoring in Economics, as the administrative side is still processing our request for the whole dataset.

The main outcome variables we use to indicate academic behaviors include: 1) grades a student obtained, 2) the number of enrollments for a course before passing it, 3) the number of courses a student enroll in, and 4) a dummy indicating whether a student passes a course for each time of enrollment, among others. These outcomes help us to identify effects in the intensive margin, which is our main target in this research as described in previous sections. Besides, we also investigate the drop-out and completion rates, as well as pre-enrolment characteristics such as relative performance in the College Entrance Exam, which complements our main analysis by looking at the extensive margin.

#### 2) Methodology

**a. Diff-in-Diff**

In order to identify how such a policy shock in tuition fees affects students' performance, we use a staggered Difference-in-Difference specification as our baseline model:

where denotes the outcomes as defined above for individual in cohort at the -th year of study, indicates whether this individual is exposed to the rise in fees, captures the fixed effects for different years of study, captures the fixed effects for cohort , and is a vector of characteristics of individual . We assume that, in the absence of the rise in tuition fees, the pattern of evolution of students' behaviors as they proceed to higher years of study does not change across cohorts, while the absolute levels of performance may change from cohort to cohort. This assumption lays the foundation for identifying the causal effects of the policy change in tuition fees using the above specification. To illustrate, an individual in the 2008 cohort (), was affected by the sharp increase in tuition fees in the academic year 2010/11, which is the third year of her university study (). Therefore, our regression will capture any possible changes in her performance from the second to the third year, which, when compared to that of another individual in the 2007 cohort from his second to third year, will lead us to the effect caused by the rise in tuition fees.

In order to disentangle the effects of the extra costs, we use the rise in 2011, where the prices for the first and second times of matriculation of a course did not change greatly (e.g., around 1 euro in economics), while the price for repeating a course for the third and subsequent times more than doubled (e.g., around 20 euro in economics). We will split the sample and use students that take a course for the second time, to see how such a drastic rise in the punishment of failing affects their behaviors. We then move to the change in 2012, when there a difference in prices for the third and fourth matriculations was introduced. This allows us to further examine another impact of the extra costs.

## 3. Chapter 2 "Good good study, safe safe job?": *Education and Labor Market Risks in China*

### 3.1 Motivation and Background

Unparallel to the literature of financial investment where returns and risks are both well explored, in the field of human capital investment, the estimation of returns to education, training and health has always been at the center of the stage, leaving risks unproportionately little explored. It would be interesting to use the Chinese context for investigating this question, as it involves a traditional risk-averse preference in the labor market, as well as a rapid change in the economic fields after the Reform and Opening Up over four decades ago. Seeking to lower risks in the labour market through education has been the pursuit of many Chinese families for decades. In the first half of the 20th century, China experienced the trauma of the Japanese Invasion and the following civil war; turbulence and unrest together compose the theme of the time, and a sense of insecurity and anxiety about life and future was engraved into the collective memory. Generations afterwards - probably up until the Reform and Opening Up - thus bear the obsession for "stable" jobs and pass the preference onto following generations through the mechanism of expectation. Today, "Study well, find a stable job, and get married." is still commonly heard in Chinese families. It is believed that by studying well, one can promisingly end up with secure jobs (the "Iron Rice Bowls") in the labor market.

### 3.2 Objectives and Expected Contribution

But does more education in effect lead to jobs with lower risks? Therefore, the main objective of this chapter is the examine empirically whether there is a causal relationship between education and risks in the labor market outcomes. And if there is such a relationship, how does it behave as levels of education change? To my knowledge, discussions on the topic started very early. (Weiss, 1972) calculates a risk-adjusted rate of returns to education, and (Olson et al., 1979) try to the correlation between risks and returns to education, so as to obtain a decision rule for choosing the optimal level of education. Yet decades later, as pointed out by (Hartog and Diaz-Serrano, 2015, 2014) ten years ago, the analysis of risks in education investment is still a field that lacks a flexible model and empirical evidence is never consistent. One strand of the literature is dedicated to adjusting returns to education according to risks and obtaining the certainty equivalent returns (Brown et al., 2012; Delaney, 2019; Koerselman and Uusitalo, 2014). Most of these studies find higher rates of return to education when taking risks into consideration. The other strand considers risks as an aspect when analysing the relationship between labor market performance and education. Among all, (Delaney and Devereux, 2019) are the first to estimate the causal effects between education and risks in labor market outcomes using the policy change that raised the minimum years of education in the UK, and they conclude that more years of education will decrease earnings variability and cyclicality for young men. This chapter will contribute to this line of research.

### 3.3 The Analysis

#### 1) Conceptual framework

To start, it is crucial to clarify the definition and corresponding measurement of what I try to investigate--risks of returns to education. Parallel to the ideas of return and risk in financial investment which take the forms of financial market performance, returns and risks to human capital, especially to education, can be defined as labor market outcomes and their uncertainty. First, the returns one receives from higher education compared to high school can be defined as the probability of the marginal increase in expected wages one earns with an increase in education being negative, holding other factors constant. Second, such corresponding definitions can be extended to other outcomes such as employment status - the probability of a marginal decrease in job stability (measured for example as the average time staying in the same job) for receiving more education. Third, considering the perpetuity of the returns to human capital investment, we can also define the risks as income volatility over the life cycle. Based on these definitions, I thus plan to use a measurement with three components, so as to capture the risks in human capital investment.

Next, I will present a simple conceptual framework, which motivates the hypothesis of the U-shape relationship between education and risks of returns. To simplify, education is treated as discrete here, with low, medium and high levels, and risks are classified as low and high only. Start from the low level of education. Low-educated individuals experience more gravity to the traditional economy. It is more likely that they stay in the traditional sector where the mechanism of community support is well-developed and the degree of policy backing is relatively high, thus having a low-risk job (possibly also with low wage). As educational attainment increases to the medium level, one starts to expand their perception beyond the static traditional society. Being increasingly aware of the society in rapid transition, the individual begins to seek a breakthrough upwards and thus is more likely to take higher risks in the labor market in pursuit of higher earnings, especially by entering the fast-developing private sector. Finally, as educational attainment rises further to the highest level, an individual is well-qualified to compete for jobs that are more public in nature, which is also related to the traditional perception mentioned in the previous section, and their risk-taking in the labor market declines relative to that at the previous level of education.

#### 2) Identification and Data

I plan to use an IV strategy to identify the causality of interest. To recover the relationship between education and risks of returns at different levels of education, I need at least two instruments, one shifting compliers from low education level to medium level and one from medium to high. The first is the 1986 Compulsory Education Law. This change has been exploited by many studies on returns to education in urban China (e.g., (Fang et al., 2016)). After this law, students are forced to stay in school until they finish 9th grade, or, graduate from middle school, which I define as the medium level of education in this paper. This means that the compliers who would have left school with a low level of education are moved to the medium level of education. The second is the expansion of higher education in 1999, when there was a sudden increase in university places by nearly 50%. Using this policy change, (Che and Zhang, 2018)are able to identify how human capital affects firm productivity, and (Huang et al., 2022) obtain the returns to higher education in China. Here, this instrument help shift compliers from the medium education level to the high level . Since the risks of returns to education that I study here are also labor market outcomes, the discussions on the validity of these instruments are likely to hold as well in my case. Detailed discussions on the assumptions will be provided as the research proceeds. I plan to use the data from the Chinese General Social Survey (CGSS) published by Renming University of China. The survey is longitudinal and I will use the second round which consists of eight waves from 2010 to 2020.

## 4. Chapter 3 *Make Gray the New Green: Human Capital Re-Investment in Older Workers*

### 4.1 Background and Motivation

Population aging has been becoming the new norm of the world, albeit at varying rates across different regions. Developed countries in Europe and North America find themselves in the middle of this demographic shift, while developing countries such as China are in the early stages. Regardless of their current positions, all countries face similar challenges arising from population aging, including a decline in the working-age population and an increase in the dependency ratio. These may lead to conflicts in the distribution of resources, economic recessions, and social instability. The aging society has emerged as a significant issue on the agenda demanding attention from all countries worldwide.

Current explorations from the practice side have been based on ideas of increasing the consumption of the elderly and reducing the burden of elderly care. These include, for example, developing a "silver market" to target the consumption needs of the elderly and providing more elderly care as public services to reduce the pressure on young people to support their elders. Such approaches are necessary but insufficient, as they are mainly derived *merely* from the point of view that treats the elderly as unproductive piggy banks or social burdens. However, to build a harmonious and sustainable aging society, a paradigm shift in this mindset is necessary.

It is crucial to recognize that elderly individuals can also contribute to socio-economic development, only with appropriate measures in place. This is mainly related to human capital, including enabling them to cope with the fast-changing environment, and activating and utilizing what older workers accumulate during years of work, which is too valuable to waste. One promising approach is by providing further education and training opportunities to older workers. Through such training, these aging individuals can formulate new human capital and reduce the depreciation rate of their existing skills and knowledge, enhancing their adaptability in today's labor market and improving their productivity. Another effective approach involves identifying and leveraging the existing strengths of elderly workers, so as to, for example, increase more opportunities for older workers (Acemoglu et al., 2022). By recognizing and harnessing their unique skills and knowledge, we can enhance efficiency in utilizing their expertise and increase their labor market returns. From a macro perspective, empowering elderly workers allows them to continue making valuable contributions to the economy, fundamentally altering the notion that an "aging society" is synonymous with increasing social burdens and economic slowdown; from an individual perspective, it enables them to lead lives with greater dignity in society.

### 4.2 Objectives and Expected Contribution

In this chapter, I try to answer the question of whether training will improve the labor market situations of older workers by evaluating the effects of a training program for older workers. Specifically, I plan to examine whether on-the-job training brings wage premiums for older workers and helps them to stay longer in the labor market. Moreover, I also plan to investigate whether such training programs brings net social returns based on cost-benefit analysis.

Training targeting older workers is not a new concept, at least in the late 20th century, some researchers have pointed out possible advantages of offering such programs (Morris and Caro, 1995; Samorodov, 1999). The idea seems to be well-discussed in non-academic debates, but there was little evidence to support the effectiveness of such projects, and many discussions on the topic seem to appear on the policy side (e.g., (OECD, 2023)). In spite of this, economists and other social scientists, though not many of them, have tried to provide some insights based on evidence. (Picchio and van Ours, 2013) conclude that on-the-job training significantly improves the employability of older workers based on survey data from the Netherlands. (Belloni et al., 2015) also find out that training can help older workers to remain in employment by slowing their human capital depreciation, yet their research reveals only the correlation between training and employability rather than causality. In another research focusing on wages of older workers across Europe, where researchers find large positive effects in some countries and zero effects in others, but they also fail to address potential selection bias (Belloni and Villosio, 2015). (Dauth and Toomet, 2016) evaluate training programs subsidized by the German government that target older workers, finding positive effects on their remaining in paid jobs. From the viewpoint of the companies, (Dostie and Léger, 2014) find that although training brings a wage premium, it does not proportionately lower the depreciation rate of the productivity of older workers, making the firm less incentivized to provide such training. Recently, (Picchio, 2021) discusses the debate in the literature on the topic. He points out that current studies providing empirical evidence may suffer from weak identification of the causal relationship, lacking (quasi-)experimental analyses. Therefore, this chapter will potentially contribute to this ongoing debate by providing some empirical evidence of causality.

### 4.3 Potential Identification Strategy and Data

The only missing part. Later I will put one paragraph here.

## 5. Data Management Plan

For the first chapter, I am using the administrative data from the UB, which my supervisors have requested for this project. Access to the data is granted to us (Andreu Arenas, Jenifer Ruiz-Valenzuela, and Mengwei Lin) and us only. Therefore I am not going to publish the data or share it without further permission from the UB. Besides, we are authorized to use and reuse the data during the project. In terms of storage, the data will be stored online in a OneDrive folder under my UB account ([mengwei.lin@ub.edu](mailto:mengwei.lin@ub.edu)), and shared with both of my co-authors. We believe that it is safe to store the data in this way. The original datasets are in .csv format, and when processing the data with Stata, the main software package used in the project, they will be converted to .dta files before further operation. This also ensures that the original data will not be manipulated and can be reused whenever necessary. Last, with the provided codebook, the data is understandable. Relevant details of the data will be reported in the main part of the paper.

For the second and third chapters, although I have made a preliminary plan on promising data and methods, relevant details still need to be confirmed with further investigation. As the research progresses, I will be able to provide further details about data management related to the last two papers.

## 6. Work Plan

[insert Table 6.1 Work Plan here]

As Table 6.1 shows, the research of my PhD thesis will involve conducting the three chapters with a simultaneous and slightly staggered approach. Due to some administrative reasons, I commenced my PhD studies in February 2023; the subsequent research progress will be planned out in light of this situation. Currently, my primary focus has been on the first chapter, which is co-authored with both of my supervisors. We have summarized and reviewed the relevant literature, and are processing the data and obtaining some preliminary empirical results. Additionally, I have formulated research questions to be explored and addressed in the next two chapters and reviewed the key literature, and presented possible strategies and datasets to be used, while this still requires detailed consideration and examination in the following years.

For the academic year 2023/24, my plan entails, first, completing the first chapter and presenting it at international conferences that cover the economics of education. Second, I plan to spend a relatively substantial amount of time on the empirical analysis of the second paper. The objective is to finalize the core content by the conclusion of the second year. In the meantime, pertinent to the third chapter, I will proceed to examine in a more careful manner possible datasets and empirical strategies. For the academic year 2024/25, the plan is to finish drafting my second chapter at the beginning of the year and attend relevant conferences for presentations. Concurrently, I will advance the progress of the third article, with a predominant focus on the empirical analysis component. The writing and presentation aspects of the third article will also primarily be completed by the end of the third year.

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