Master's Thesis of Foundations of Education

A Longitudinal Investigation of the Effect of Family Background on Academic Achievement in China:

Based on the Data of CFPS

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Graduate School of Education
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Abstract

As Chinese society enters a period of transformation, whether the class has solidified has become the focus of public concern. Education is regarded as an important way of social mobility, and Chinese parents who always attach great importance to education have made a lot of effort for their children's academic achievements. The influence of family background on academic performance has always been an important issue in the field of Sociology of Education. Existing related studies have only analyzed cross-sectional data and focused only on a certain region of China. To further explore the long-term effect of family background, this article uses the longitudinal data of China Family Panel Survey (CFPS) from 2010 to 2018 and applies the latent growth model to analyze the trajectory of mathematical achievements under the influence of family background.

The research results show that the family background not only significantly affects the mathematical achievements of students in the early time, but also has a positive and significant impact on the long-term changes in mathematical achievements. This shows that the gap in mathematical achievements between students from advantaged families and students from the disadvantaged continues to expand over time. School education seemed not to reduce the educational inequality brought about by family background as expected. The family background functions through mechanisms such as economic capital and cultural capital. The gap in academic achievement begins in childhood, and it is difficult for students with low grades to make great progress due to the increase in the difficulty and amount of knowledge in the later stages. Under the current social and educational background in

China, the predominance of family background accumulates gradually until employment.

This study has a more macroscopic and at the same time, a more dynamic view of China's education and inequality status. It will provide opportunities and wider space for reflection and exploration of the direction of China's education by grasping the rationality of the current Chinese education system and the effects of schooling.

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Chapter I. Introduction

This study aims to explore the long-term effect of family background on the academic achievement gap in China. In recent years, class inequalities have increasingly become the focus of public attention in Chinese society. Relevant vocabulary such as "Pindie"[①], "Family of Origin", "Fuerdai"[②], "Xueerdai"[③] , and "Political Family" are common to see in various traditional and new media. More and more people are beginning to doubt if the famous Chinese proverb "Impoverished Family, Rich Sons", is still possible? In the 2019 Chinese topic-centered TV series "All is Well", the discussion on the influence of the female protagonist's original families has repeatedly ranked first on Weibo's most searched hashtags. It can be seen from the comments of netizens that lots of people think the impact of the original family in one's life is omnipresent and even played a decisive role. And It can be told that whether the class is tending to solidify has become a hot common concern of both academic research and the social public.

Family background is also often quantified as family socioeconomic status. As for the way of class solidification, or how SES achieves intergenerational transmission, a lot of research has been carried out by related subjects. One

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[①] Pindie(拼爹): Competition of Dad. In attending schools, finding a job, buying an apartment and many other situations, young people compete not of their own abilities but their parents', and especially fathers' abilities.
[②] Fuerdai(富二代): The Second Generation of the Rich
[③] Xueerdai(學二代)：The Second Generation of the "Study". Parents with higher income and status generally attach great importance to their children's education and raise their children's human capital by strengthening education investment. Parents with higher education levels will largely make their children also have higher education levels, forming an intergenerational transmission of education levels.

of the most famous studies is the classical status attainment model put forward by Blau and Duncan in '*American Occupational Structure'* (Blau & Duncan, 1967). It shows that family SES can significantly influence children's education and occupation. And they pointed out that the main way and mechanism of the inheritance of intergenerational social status in modern society is indirect inheritance through education.

Education plays an increasingly important role in determining personal life opportunities (Treiman and Yip,1989). Education is always the most important factor in determining the level of an individual's socioeconomic status. (Yang, 2016) The CFPS (China Family Panel Studies) 2010 survey asked the objects about factors influencing a child's success in the future. Nearly 85% of people agreed that higher educated child is more likely to succeed in the future. (CFPS 2010) And as figure 1 shows, so far in China, higher education can do get better jobs and salaries.

Figure 1.Relationship between personal income and education level
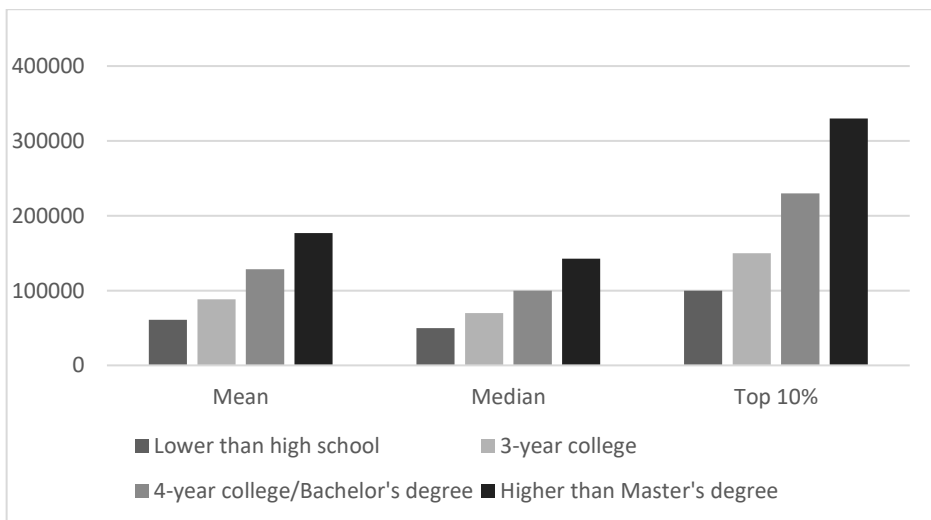
Resource: Shanghai Municipal People's Government. Survey of "post-80s" living conditions

This role of education is mainly attached to the mechanism of university diplomas. One thing that connects the education and work is credentialism, which includes all kinds of certification and licensing. As modern society is a society mainly composed of strangers, diplomas in education provide a reason for identifying the abilities and reliability of strangers. (Bills, D. B., 2004) It is also famous as the sheepskin effect. Since the Chinese economic reform in China from 1978, higher education has continuously expanded its enrollment. However, education expansion has not significantly improved the problem of unequal educational opportunities, so it cannot reduce the indirect impact of family background on the socioeconomic status of children's initial job through education and improve intergenerational mobility. (Yang, 2016) Moreover, until now universities are clearly stratified as famous and key point universities or not in China. Like Liu (2015) classified them as Top 6 universities, Project 985 universities[④], Project 211[⑤] universities, and other general universities (First-tier universities, Second-tier universities, and Second-tier colleges). Entering a key, prestigious university means better job opportunities and salaries in the future. Many companies and employment units distinguish between 985/211 students and non-985/211 students when recruiting. The resumes of the latter are sometimes ignored directly and even are not eligible for recruitment.

[④] Project 985: Project 985 is a constructive project for founding world-class universities in the 21st century conducted by the government of the People's Republic of China. On May 4, 1998, President Jiang Zemin declared that "China must have a number of first-rate universities of international advanced level", so Project 985 was launched. In the initial phase, 9 universities were included in the project. The second phase, launched in 2004, expanded the program until it has now reached 39 universities.
[⑤] Project 211: Project 211 is the Chinese government's new endeavor aimed at strengthening about 100 institutions of higher education and key disciplinary areas as a national priority for the 21st century. There are 112 universities in Project 211.

Therefore, all groups of different classes pay more and more attention to the education of their children. For the advantaged class, education is a prime way to maintain their status to avoid downward mobility, and for the disadvantaged class, education is the basic channel to achieve upward mobility. Parents invested a lot of capital in children's education since childhood so that their children can achieve better academic performance, win the fierce competition in education, and finally enter prestigious universities. We can see the signs of this educational arms race all around us: tiger parents, super tutors, escalating levels of private tuition and private school fees, and inflated house prices in the neighborhoods of the most sought-after schools. But the difference is, parents with more money and support can commandeer more powerful education weaponry for their offspring. (Major, L. E., & Machin, S. 2018).

There is a large gap between the investment that can be made by advantaged families and disadvantaged families. Although tuition and textbooks fees are waived for public primary and junior high schools and tuition fee in public high schools is also very low in China now, advantaged families could not only send children to expensive international schools or other better schools by moving to a better school district but also spend more money on after-school tutoring. Besides, parents' education level and family cultural capital will have a strong influence and leading role on students. These make family background significantly impact students' academic performance. Education, which should have played the role of social mobility, now seems to become a mechanism of class consolidation instead.

In the research context of the sociology of education abroad, the role of schools in the formation of social inequality has always been the focus of debate among scholars. On the one hand, educational philosophy and

functionalists believe that the contemporary education system is based on the idea of egalitarianism and schools should be institutions that reduce social inequality, playing the role of screening talents and equalizer; on the other hand, scholars of conflict theory believe that the education system or schools are institutions to legalized inequality, on the contrary. Just like of Bourdieu's cultural capital, the advantaged class achieves the reproduction of inequality by systematically instilling or promoting their own specific rules, cultural tastes, or ideologies. (Wu, Y., Huang, C., & Huang, S., 2017) Besides, the Coleman report mentions that students' family background is strongly correlated with academic achievement. (Coleman et al., 1966; Coleman, J.S., 1968) However, Heyneman and Loxley's work (1983) then found that in developing countries, school characteristics were more important than family socioeconomic status in determining achievements.

In addition to these theoretical differences, the findings of empirical research are also inconsistent. Many current studies in China have focused on class differences in university admissions opportunities. Some existing empirical studies have found that family capital still significantly affects children's access to the college education. (Lu, 2014) However, in terms of the current allocation of ordinary undergraduate education opportunities, Liu (2015) found students' ability standards are dominant compared with background. And the influence of family background will increase along with the individual's ability when entering the key, prestigious universities.

But in fact, the acquisition of college education is a consequence of childhood education. (Li & Qiu, 2016) China's college entrance examination is a test of 12-year elementary school, junior high school, and high school learning results. The differential academic performance gradually would no doubt finally determine the student's college entrance examination, or college

entrance examination score. Therefore, it is necessary to focus on the education stage before tertiary education, even from elementary school. Many studies have found that family background has a significant effect on academic achievement, but there also exist some studies showing no significant effect, limited in one province or district in China. And most studies only focused on one certain stage in China (mainly junior high school) (Liu, 2019; Zhu, 2018; Yang, 2017; Qiao et al., 2013) or on one aspect of family background (mainly cultural capital) (Liu, 2019; Hao, 2017; Chi, 2019; Wu et al, 2017; Shu et al, 2002). Besides, most of the studies just use one cross-sectional data which may have omitted variable bias problems. The long-time duration effects of family background should be further explored. Also, what is the mechanism of family background effects on academic achievement were left to get a deeper discussion.

These inconsistent theoretical views and empirical findings make it necessary to investigate the impact of Chinese family background on students' academic performance under the background of market transformation and educational system changes. How is the educational gap under the influence of family background? Could school education mitigate the effect by family background as time goes by, or in other words, narrow the gap? These issues require further discussion.

Research Purpose

The relationship between family background and educational attainment is one of the important indicators to measure the equality of education. (Li & Qiu, 2016) Thus, the purpose of this article is to analyze the relationship between Chinese students' family background and academic achievement in

a long-time duration. The academic achievement will be divided into three stages:10-12 years old, 14-16 years old, and 18-20 years old. Thus, it will form a more comprehensive grasp of the relationship between family background and educational output before tertiary education in China.

Family background was often quantified as socio-economic status (hereinafter called "SES"), which is an important factor in education so far. Then is SES important in all China's elementary, junior, and senior high school stages? The panel data used in this study include most of China's provinces and regions from 2010 to 2018, and the effect of family background is divided into three age stages, which could correspond to three education stages. Thus, it can have a more macroscopic view of China's education and inequality status. This study attempts to grasp the rationality of the current Chinese education system and the effects of schooling. Also, it will provide opportunities and wider space for reflection and exploration of the direction of China's education in the future.

Research Questions

The research study focused on providing answers to the following research questions:

How is the long-term impact of family background on academic achievement in China? In other words, is there a gap in academic achievement under the influence of family background? If so, will this gap widen further as time goes by?

Chapter II. Literature Review

2.1. Social Stratification and Educational Inequality

Different historical stages have different hierarchical mechanisms. In the advanced industrialized society, professional skills, academic diplomas, and training certificates are more and more popular. Human capital and cultural capital have replaced economic capital as the main force of stratification in advanced industrial society. Education has thus become the main tool for assigning individuals to different social classes. (Wang, X., 2009) The relationship between education stratification and social stratum structure is getting more and more attention. In the research related to the influence of personal educational achievements, the relationship between school education and family background is a focal issue. Functionalism and conflict theory in the Sociology of Education hold diametrically opposed views. In the achievement of personal educational achievements, the former believes that schools have replaced the influence of families, and the latter believes that schools continue the influence of families. (Liu, L., & Hu, Z., 2012)

The conflict theory in sociology believes that social changes and social conflicts are ubiquitous. The results of conflicts and contradictions have led to changes in the social structure. This basic point of view was applied to the field of education and formed the conflict theory in the sociology of education. The conflict theory emphasizes the mechanism by which education replicates class conflict and the intergenerational reproduction of class status in education. Students bring the advantages or disadvantaged class characteristics inherited from the family into the competition in schooling, and accordingly, bring about the success or failure of education. Therefore,

school education continues the influence of family background by recognizing family class. The classical conflict theory is represented by Karl Marx's class theory and Max Weber's theory of status groups. Marx emphasized the economic differences of class interests, and Weber emphasized the cultural differences of class lifestyles, which led to the differences in whether school education continued the economic conflict or cultural conflict in the family background. (Li, Y., 2010; Liu, L., & Hu, Z., 2012)

Therefore, in the subsequent research, the conflict theory is gradually divided into Neo-Marxism conflict theory, which focuses on analysis and criticism of the capitalist education system and Neo-Weberian conflict theory, which discusses the stratification of education. The former is represented by Bowles and Gintis. In *Schooling in Capitalist America* (Bowles, S., & Gintis, H., 2011), Bowles and Gintis put forward that the education system is an aspect of maintaining the undemocratic economic structure of capitalism and the main tool for replicating the unequal labor division in society. In terms of the relationship between schools and society, they put forward the "correspondence principle", that the economic inequality and the inequality of personal development opportunities are determined by the relationship among capitalist market, wealth, and power relations. In the United States, children of different classes enter different schools, receive different educational contents and values, trained to be different talents to work in different production systems and positions in the future to meet the division of labor force in capitalist society. As a status allocation mechanism, school education, under the cover of meritocracy, is to allocate individuals to unequal economic status according to the socioeconomic status of the family. Because students with higher family socioeconomic status have more opportunities for

good education and better academic performance. They are more likely to pass the exam and have more opportunities for further education. But the students with low socioeconomic status are the opposite. Since school education affects the level of future occupations, a correspondence mechanism is formed between family background, educational achievements, and occupational status. Under this relationship, the school replicated class inequality and rationalized current inequality. Randall Collins is a representative of the Neo-Weberian conflict theory. Collins put forward the Credential Society. (Collins, R., 2019) He believes that society is a stage where different interest groups conflict with each other to obtain wealth, power, and prestige, and education is an important tool used by various groups to realize their own interests. Education itself has a shielding effect, and the degree of education reflected in the credential is used to monopolize highly paid positions in the social and economic fields. Its function has a direct relationship with the fundamental interests of the groups because the nature of school education is essentially restricted by groups with different identities. (Li, Y., 2010; Liu, L., & Hu, Z., 2012)

In addition to Collins, Pierre Bourdieu also borrowed Weber's theory to study the class and proposed cultural reproduction theory. He believes that different classes have different cultural interests and lifestyle habitus. Education is a type of symbolic violence. Schools use symbolic violence to dominate the cultural reproduction of the class. The habitus of the upper class is favored and rewarded by the school, which ultimately promotes the educational success of their children. Under the banner of equality, the standardized examination mechanism selected students through scores to show that educational achievement is the result of personal ability on the surface. However, examination achievement implies a preference mechanism

for social stratification habitus, so actually, it covers up the profound class conflict. In order to control the distribution of cultural capital to reproduce the class, the ruling class dominates school education in two ways, one is to establish the level of education, and the other is to establish the level of knowledge, like "university, middle school and primary school", "academic education and vocational education". Academic hierarchies formed by different importance courses are the epitome of social hierarchies, and also the ladder of social hierarchies' reproduction. Cultural reproduction eventually leads to social reproduction. Higher education cannot play a role in integrating society and breaking down class barriers, and it has further solidified the current status of the class and caused the reproduction of social structure. (Wang, X., 2009; Huang, J.,2018; Liu, L., & Hu, Zhong. 2012)

When Swedish educationist Torsten Husén analyzed the equality of education, he believed that "equality" could have three dimensions of meanings. First, "equality" can refer to the starting point of the individual, and everyone has the opportunity to start their learning career without any discrimination. Second, "equality" can also refer to the intermediary stage, that is, to be treated equally during education, and to treat people of different races, nationalities, and social origins on the basis of equality. Third, "equality" can also refer to the final goal which includes more equal opportunities for academic success, or a combination of these three aspects. (Husén, T., 1972) Husén's notion of education equality is the unity of equality in starting point, process, and result. The indicators of education inequality can also often divide into three aspects: input, process, and output correspondingly. (Shin, H. 2016) Input (resources) includes funding, expenditure per pupil, and teachers relevant. Process (instruction/standard) refers to curriculum, teaching or leadership, accountability, standard or measurement, advanced

courses, etc. Output (academic achievement) is test scores, proficiency level, and so on. Just as Husén's analysis of equality, the three aspects of input, process, and output in education inequality also affect and interact with each other. The essence of the equality of education output does not need that every student from different backgrounds is completely equal in academic performance. But after excluding those variables which cannot be controlled by education, only the variables of the education system itself are considered to influence the academic performance equally. This part of equality is the equality of education output in the true sense. As a quantified index, the output of education equality can not only evaluate the educational results but also evaluate and measure the starting point of education and the educational process. And it can also test the effect of starting points of education and the implementation of the educational process. (Huang, N., 2009)

Thus, this article will focus on inequality in educational outputs. And many existing studies have investigated the impact of family background on the final educational attainment of different levels of college admissions. However, the acquisition of education is a continuous process, and the acquisition of education in the previous stage is both cumulative and opportunistic in the latter stage. (Li & Qiu, 2016) Admissions to universities are influenced by education outcomes at the elementary, junior high, and high school levels. At the same time, the educational results of every education period will also be affected by the previous stage. That is why it is necessary to trace the educational attainment for a long period.

2.2. Chinese Society and Education

Since the reform and opening up, driven by the forces of industrialization, marketization, and urbanization, China's stratum structure has undergone significant changes. On the one hand, the income distribution system has gradually shifted from a redistribution system in the planned economy stage to a market-based distribution system, which has deepened the income differentiation of Chinese residents. On the other hand, due to the deepening of reforms in the fields of finance, securities, capital, and housing, coupled with the process of property accumulation, the degree of wealth differentiation among the residents is also increasing. In short, there has been a clear stratum difference based on socio-economic status among members of society. （Wu, Y., Huang, C., & Huang, S., 2017）

At the same time, class solidification has become an objective trend of the changes in Chinese social class structure during the transformation period. Class solidification refers to a tendency in which the innate factors occupy a clear advantage over the self-generated factors, social mobility channels were congested, and the cross-class mobility, especially the upward flow tends to slow down or even stagnate. It is a representation that social interests tend to solidify, indicating that the process of social development is increasingly controlled by advantaged groups or powerful classes. However, the disadvantaged class is gradually falling into the marginalized and bottomed embarrassment, and the poverty and disadvantaged positions are hereditary. The advantaged second generation and the disadvantaged have formed a series of class gaps in wealth, power, opportunity, and development space. These gaps have been consolidated and inherited through education, especially higher education. (Yang，W., 2014.)

In recent years, China's higher education has continued to expand. Besides, although the number of enrolled students in higher education institutions has increased significantly, it is mainly in newly established or upgraded universities (generally second-tier universities or third-tier colleges). The gates of elite universities have not been opened very much (Liang, et al. 2013). As two famous labels, the "Project 211" universities, the "Project 985" universities, and other types of colleges and universities have formed a hierarchical structure in the Chinese higher education system. The invested resources from the government and the quality of candidates are very different. The job market also makes a clear distinction between students from different types of colleges and universities. Some job advertisements even explicitly suggest that only graduates of "985 Universities" and "211 Universities" are considered. (Wu, 2017)

This obvious stratification of Chinese colleges and universities makes the competition to enter those top-ranked key universities, the college entrance examination, become very fierce. The pursuit of higher education began when children are very young. Due to the long-term existence of China's key middle school system, parents have been preparing for key junior high schools since children's elementary school years, and then followed by preparing for key high schools. As Sui (2017) analyzed, for parents, key schools mean stronger teachers, stronger learning atmosphere and environment, and even better, broad social relationships and networks of "higher quality". In order to enable children to finally get a good grade in the college entrance examination, parents never are stingy in asking for extra-curricular tutoring, choosing schools, etc. In other words, rather than reducing the inequality in education selection, the expanding education just postpones the process of the inequality in education selection to a higher level of

education. (Raftery, A. E., & Hout, M., 1993)

Wu (2013) found that the family's economic background has an important impact on the path of children's progression. The higher the family's economic status is, the more likely it is to enter key schools. According to Zhang (2019), students enrolled in key high schools mean to have better teachers, teaching resources, and a variety of chances and opportunities for further studies (recommended system, exchange to foreign countries, etc.). The cumulative advantage in key high schools would not only affect the student's path of progression but also affect the student's diploma value and the marginal effect of the diploma after graduation. Ye and Ding (2015) told that in the context of the expansion of higher education, students whose families are from the socially advantageous class are more likely to enter better higher education institutions. From this perspective, family background has undoubtedly a great influence on the entire stage of students' education until the final acquisition of higher education. Thus, this may form a recycling mode of advantage and predominance. Education seems to fall into the mechanism of reproducing social inequality (including economic and cultural, etc.).

On the other hand, since 1996 the National Document formally proposed "reform the talent training model and turn test-oriented education into comprehensive Suzhi(quality; 素質) education" [6], schools at all levels, especially high-quality schools, have begun to attach importance to Suzhi

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[6] On March 17, 1996, the Fourth Session of the Eighth National People's Congress passed <The People's Republic of China's National Economic and Social Development Ninth Five-Year Plan and the Outline of the 2010 Vision Goals>. In the "Science and Education Revitalization Strategy" section of the documentary, Suzhi(quality) education was advocated.

education. But in China, "Suzhi education" and "test-oriented education" have always been a combination of contradictions. Although the school emphasizes the comprehensive development of talent training, it will eventually fall to the target of enrollment rate for higher education. This is not only because of the requirements for talent selection, but also the reputation of schools and the quality of students. (Ge, X. & Li, G., 1998; Yang, D., 2016) At the practical level, the content of Suzhi education is often integrated with the examination or selection, and even the former serves the latter. The specific performance is that the content of Suzhi education is included in the usual assessment and entrance examinations. Many high-quality schools have interviews when recruiting students, and they examine "comprehensive qualities or abilities" outside of textbooks. Therefore, "Suzhi education" at the basic education stage is often highly correlated with students' cultural literacy, knowledge, or specialty. (Wu, Y., Huang, C., & Huang, S., 2017) This provides a useful place for the transformation of economic capital and cultural capital in the family background into academic achievements or enrollment opportunities for further studies.

China is now under the background of intensified social class differentiation, class solidification becoming a trend, obvious school level differentiation, and fierce competition for social mobility. In the field of education, "test-oriented education" is the main method of talent selection, but the educational philosophy and practice of "Suzhi education" is increasingly emphasized. All of these make the role of family background in enhancing academic performance or opportunities for further education becoming more and more important.

2.3. Family Background and Academic Achievement

The Influence of school and family background on academic achievement

The main reasons for the gap in the quality of education and the gap in results are schools and students' families. (Yu, 2019) The classic study that assesses the impact of families on academic achievement is the Coleman report. The Coleman report states that families influence students' academic performance more than schools and communities. Since then, a series of empirical studies on the relationship between family background and children's academic achievement have concluded that family socioeconomic status variables have a significant impact on children's academic achievement, and its impact is even greater than that of schools. (Coleman et al., 1966; Coleman, J.S., 1968; Peaker, 1971; White, 1980; Sirin,2005; Cheadle, 2008)

The Heyneman-Loxley work (1983) then presented clear evidence that variation in school resource quality could matter more than variation in family inputs in low and middle-income countries. In low-income countries, the effect of school and teacher quality on academic achievement in primary school is comparatively greater. It is possible to conclude that the predominant influence on student learning is the quality of the schools and teachers to which children are exposed. And later, more researchers found that not only in low-income countries, school effects are also greater in unequal countries. (Gameron & Long, 2007; Chudgar & Luschei, 2009) But in fact, this kind of effect of schools is also affected by the role of the family. Advantaged families can choose a better school district or school for their children, thereby indirectly obtaining better educational resources and greater possibilities to get outstanding academic achievements for their children. The problem is to what extent school education could overcome the original

socioeconomic status brought to students.

The topic of education equity in China is also mainly focused on school and family backgrounds, but people find that family backgrounds are being increasingly influential. Parents of advantaged families can not only choose a better school for their children, such as choosing high-quality schools by purchasing high-priced school district apartments and high-end private schools. The research of Fang, S. and Su, M. (2019) found that family assets have a positive impact on children's academic performance, and different asset types have different effects on children's academic performance. Education savings for children have a significant positive impact compared to other asset types. And even there is the policy of "Zone Division and Admission into the Nearest School", families with high economic status can choose schools for their children through various means within the scope of the system. (Chen & Fang, 2007) Besides, family cultural capital also affects children's educational attainment. Parents in different families have different levels of education, educational expectations, and different abilities and energies to participate in education, which will directly affect children's academic performance. (Yu, 2019)   According to the data of the 2017 China Educational Finance Family Survey, the overall participation rate of off-school training for primary and secondary school students in China is 48.3%, and the average expenditure of a student participating in the training is 5,616 yuan. There are differences in expenditures for off-school training expenditures of different incomes, different regions, and different education levels. For example, the average annual off-school training expenditure of the top 25% of households is 8824 yuan per year, which is nearly 6 times more than students in the families of the lowest 25% annual household consumption levels. The difference between urban and rural areas is also very

large. The average annual off-school training expenditure of rural students is 419 yuan, and that of urban students is 3,710 yuan, which is nearly 9 times more than rural students. (Zhang, 2018) Therefore, many current studies have confirmed the positive impact of family factors on student academic performance. (Liu, 2019; Zhu, 2018; Yang, 2017; Qiao et al., 2013; Changchun, F., & Xiaotian, F., 2008; Li & Qiu, 2016)

Mechanism of family background affecting academic achievement

Coleman believes that the family environment or family capital includes at least three forms: physical capital, human capital, and social capital. French sociologist Bourdieu also distinguishes three forms of capital: economic capital, cultural capital, and social capital (later he put forward symbolic capital for a supplement). These four types of capitals can be transformed into each other with restrictions. Among them, cultural capital is the part that Bourdieu is most interested in. There are three forms of cultural capital. One is the embodied state, which is reflected in the deep-rooted temperament in people's minds and body. The second is the objectified state, which is reflected in those specific cultural objects, such as books, records, paintings, etc. The third one is the institutionalized state, which is reflected in those specific institutional arrangements, such as the qualification for education and so on. (Bourdieu, P. 1973, 1986; Bourdieu, P., & Wacquant, L. J., 1992; Zhou G., 2004)

Based on their findings, some studies have further explored the mechanisms that how family background affects children's academic achievement. The human capital theory believes that education is an important investment in human capital, and the "cost-benefit" measurement

is the main principle of family education investment. The difference in children's educational achievements is mainly caused by the amount of family educational investment. Constrained by family resources, parents of poor families are often lack of enough investments in their children's education, and thus affecting their academic achievement. (Stevenson, D. L., & Baker, D. P., 1992; Becker, G. S., 2009)

The theory of cultural capital emphasizes the impact of family cultural resources and cultural atmosphere on children's educational expectations and academic performance. Compared with families lacking cultural capital, parents with rich cultural capital usually understand the rules of school education, invest more cultural resources, focus on cultivating children's educational expectations and learning interests, help children better master the school curriculum and achieve excellent academic performance. (Bourdieu & Passeron, 1900) For students from wealthy and highly educated families, the choice of an Ivy League institution becomes normalized through the inculcated expectations of families, the explicit positioning of schools, and the peer culture. Without these advantages, less-privileged students more often place elite institutions outside the realm of the possible - in part because of concerns of elitism. (Mullen, 2009) Hart and Risley (1995) tracked the change in the vocabulary of 7-month-old babies until they were 3 years old and found that there are obvious class differences. Parent talkativeness or socialness to their infants accounted for a correlation between SES and the children's later linguistic/academic development. It can be seen that cultural factors such as parents' attitudes, values, parenting styles, and communication styles will have a significant impact on their children's educational achievements.

The social capital theory emphasizes the impact of parental educational

participation on children's learning behaviors and academic achievements. Parents with higher socioeconomic status usually participate more in children's learning activities, pay more attention to communication with schoolteachers and other parents, and reduce dropouts from high school and other risky behaviors, which in turn improves children's academic performance. (Coleman, 1988) In addition to parental school participation, social relationships, intergenerational intimacy, and relationships between relatives, etc., all have an impact on the educational expectations, attitudes, and educational outcomes of the entire family.

In China, there also many studies have further analyzed the process and mechanism of SES on academic achievement. Sun (2019) finds that the socioeconomic status of families affects adolescents' learning engagement in three ways. First, family socioeconomic status directly affects learning engagement. Second, family socioeconomic status indirectly affects learning engagement by affecting parental education involvement. Third, family socioeconomic status affects parental education involvement and self-educational expectations of adolescents in turn, then having an indirect effect on their learning engagement. Gao (2016) further divided parental education involvement into three dimensions: behavioral participation, emotional participation, cognitive participation, and found that behavioral participation, emotional participation, and SES can significantly predict Chinese language, mathematics performance in primary school, and mathematics performance in middle school. Liu et al. (2015) also verified that parents' educational level and family income will indirectly affect children's educational expectations through their parent participation.

Many studies have specifically explored the role of cultural capital in SES. Liu (2019) found that parenting practice in the family is the process of

children's continuous accumulation of cultural capital and the main mean for the transfer of family capital between generations. This process is closely related to the family's class background. The analysis shows that families of different classes have different parenting practices, and parenting practices can be passed between generations. The family background and parenting practices affect their children's academic achievements. Differences in the family background can lead to unequal cultural capital in students. The better the family background is, the richer the cultural capital is. (Hao, 2017) Cultural capital has a significant positive effect on students' academic achievement. (Shu et al., 2002) Moreover, this effect of cultural capital also has class differences. The higher the family's socioeconomic status is, the higher the return of cultural capital can provide. The effect of cultural capital is also affected by the quality of the school attended. Students who study in higher-quality schools have a higher return on cultural capital. But as children from high-level families are more likely to enter higher-quality schools, the effect of cultural capital is currently a "dual reproduction" process in China. (Wu et al., 2017) Especially the educational level of parents, as a cultural capital, has a significant positive impact on the educational level of their children. The effect of mothers is greater compared to their fathers. When the educational level of the mother increases, the probability that children are of low education level decreases and of high education level is greater. (Chi, 2019)

The studies above are all focused on primary or junior high school students. Some scholars have found that the academic achievements of senior high school students have no significant relationship with their father's occupation, educational level, and annual family income (Tao & Yang, 2007). Huang (2016) used the HLM model to statistically analyze three factors that affect

high school students' mathematics academic performance: individual factors, family factors, and class factors. It was also found that from the perspective of the family-level Tier-2 model, the degree of influence of each aspect is very small, and it is not statistically significant. Individual factors and class factors are more important. However, according to Tian (2017), parents' income has a significant impact on academic achievement in high school. But parents' occupational types have no significant impact on students' academic achievement in high school. It can be seen that at the high school level, the relationship between family background and academic achievement needs further and deeper exploration. The long-term effects of family backgrounds on academic performance need to be addressed.

The long-term effect of family background on educational attainment

It should also be noted that in fact social stratification starts young, and differences that take root in the early years have enduring effects. (Bills, D. B., 2004) The effect of family background on academic performance starts at a young age, and since the development of academic performance has strong stability (Wang, Y., 2008), academic performance differentiation is likely to start from an early stage, and the gap will inevitably continue to expand. Zhou, Y. (2020) analyzes the impact of preschool education opportunities on the results of compulsory education based on China Education Panel Survey (CEPS) data. The results show that preschool education experience can significantly improve students' academic performance in junior high school, and the higher the quality of preschool education, the greater the effect of improving junior school academic performance of students. Since children from low SES families also have a lower probability of receiving preschool

education and a lower chance of obtaining high-quality preschool education, thus the development gap of children with different family backgrounds has already appeared at the stage of preschool education and will have a profound impact on academic performance in junior high school continually. Merry, J. J. (2013) traced the education equality to early childhood and find while the Canadian advantage in PISA (OECD's Programme for International Student Assessment) is substantial, this advantage already existed at ages 4 to 5, before formal schooling had a chance to matter. So, the learning gap between U.S. and Canadian students in PISA is largely, perhaps entirely, in place before the start of formal schooling, at ages 4 to 5, which suggests that broader social conditions constitute the driving force of learning inequalities. Leon Feinstein's studies (Figure. 2) also show the strong relationship between British children's subsequent cognitive development and their socio-economic status. (Feinstein, L. 2003) A low-SES child with a top quartile score at 22 months is predicted to fall behind high-SES peers who had low quartile scores at 22 months. It is SES, rather than the early scores, that makes the difference. And there is no evidence that entry into schooling reverses this pattern. Feinstein also found the score at 22 months predicts educational qualifications at age 26.
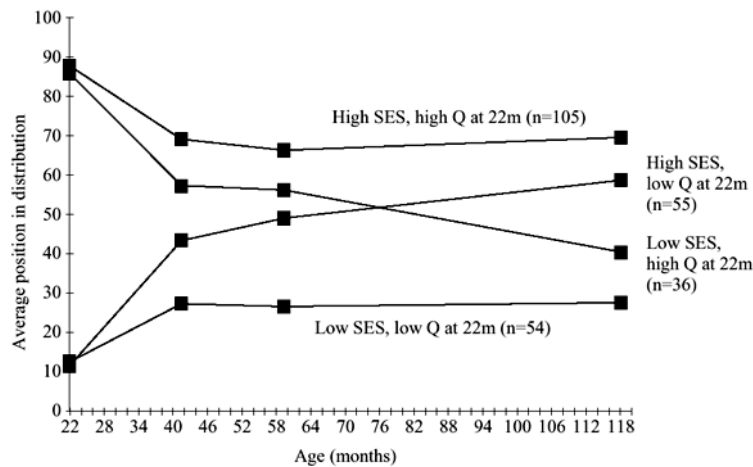
Figure 2.Average rank of test scores of young children by SES of parents

In some previous research, declining background effects on educational attainment were found. For example, Tao, H. and Yang, D (2007) analyzed the relationship between the academic achievements of ordinary high school students and family background through a questionnaire survey of 40 high school students in 10 cities in 2003, and the results showed that there is no significant difference between the academic performance of these high school students achievement and fathers' occupation, education level, and family economic income. American scholar Mare (1981) also found in the study that with the rise of the enrollment stage, the direct relationship between family background and admission decreases, and the degree of indirect correlation between family background and academic performance also decreases. He believes that this is the result of **differential selection**, that is, those children who are at a disadvantage in socioeconomic status and often at a disadvantage in performance have been screened out early, and those who can receive an education are already screened. Their learning motivation, ability, and level in the family background are high and thus, the differences are small. China

has a more different situation nowadays. China has implemented 12-year compulsory education, and according to the National Education Development Report of the Ministry of Education (2019), the gross enrollment rate for high school in 2018 was 88.8%, indicating that the majority of China's new labor force has received high school education or above.

Later Lucas (1996) proposed a different explanation named "**life course perspective**". He believes that declining background effects cannot be understood as primarily the result of selective attrition of the disadvantaged. It is because children have a more economic, social, and psychological dependence on their parents in the early days. And as children grow up, their dependence gradually decreases. The conversion effect of educational expectations, cultural capital, and human capital on learning motivation and ability decreases with age, and the foundation of students' own learning motivation and ability has become the main factor driving the further growth of learning motivation and learning ability. In addition, Tang (2015) further proposed the mechanism of **differential early education**. He found that with the improvement of the enrollment stage, the influence of family socioeconomic status and cultural background was gradually replaced by school levels. There is a difference in the quality of school education. Schools with better education quality can more effectively improve students' motivation and ability to learn, thereby improving students' academic performance more effectively.

All of these studies actually illustrate that the influence of family background exists always and functions continually. Regardless of the students from disadvantaged families, who are screened out and gradually divorced from education, or those who cannot enter good schools due to the differential early education, there is always a gap in academic achievement

between the advantaged class and the disadvantaged. As mentioned above, it is easier for superior families to choose good districts and schools for their children and their children are more likely to enter good schools also with good educational attainment in early times. So, the influence of family background and various capitals could be further extended to schools.

Based on the contents above, this article attempts to explore the long-term impact of family background on academic achievement in China by using longitudinal data and thus proposes the following two research hypotheses.

1.The higher the family's socio-economic status, the higher the academic achievement.

2.The academic achievement gap under the influence of family background is widening gradually.

Chapter III. Methodology

3.1. Data

China Family Panel Studies (CFPS) is a national longitudinal general social survey project. By collecting data at individual, family, community three levels, the project aims to document changes in Chinese society, economy, population, education, and health, so as to provide data for academic research and public policy analysis. (Xie, Y., Hu, J. & Zhuang C., 2014; Xie, Y. & Hu, J., 2014)

CFPS implemented its baseline survey in 2010 and four waves of full

sample follow-up surveys in 2012, 2014, 2016, and 2018. The CFPS baseline sample covers 25 provinces/municipalities/autonomous regions, representing 95% of the Chinese population. The 2010 baseline survey interviewed a total of 14,960 households and 42,590 individuals. All family members who were identified at baseline to have blood/marital/adoptive ties with the household were identified as CFPS gene members. All gene members would be tracked in the follow-up survey permanently. (Xie, Y. & Hu, J., 2014)

In the CFPS surveys, all individuals aged over 10 years old will take cognitive tests when receiving information from personal self-answer interviews. The CFPS cognitive test consists of two sets of questionnaires, with a total of four sets of questions. A set of questionnaires includes word tests and math tests (used in 2010, 2014, 2018 until now), and B set of questionnaires includes memory tests and number series tests (used in 2012 and 2016 until now).

Table 1.The specific arrangements of the CFPS cognitive test questionnaires over the years

		2010	2012	2014	2016	2018
A set	word tests	√	×	√	×	√
	math tests	√	×	√	×	√
B set	memory tests	×	√	×	√	×
	number series tests	×	√	×	√	×

Resource: Cognitive test in CFPS
(http://www.isss.pku.edu.cn/cfps/cjwt/cfpsxkt/1295348.htm)

The two sets of questionnaires were used alternately in the CFPS survey.

In contrast, word tests and math tests measure respondents' educational achievements more, while memory and number series tests reflect the individual's potential abilities more. The theoretical basis of CFPS word and math testing methods is the design of the Guttman Scale in psychometrics. (CFPS, 2018) Therefore, I will use math test scores in 2010, 2014, and 2018 of the students who were 10-12 years old[⑦] in CFPS data, to combine their family background for statistical analysis.

3.2. Variables

3.2.1 Dependent variables

In general, to estimate a polynomial trajectory of degree d, it is necessary to have obtained $d + 2$ repeated observations for identification purposes. So, three repeated measures permit a straight line (e.g., a polynomial of degree $d = 1$); four observations fit a quadratic trajectory $(d = 2)$; and so on. Thus, a minimum of three repeated observations is necessary to estimate underlying linear trajectories and the other parameters in the model. However, if it is a non-linear model, at least 4 observation points at different times are required (Bollen, K. A., & Curran, P. J., 2006).

During the pre-examination of the LGM analysis, reading test scores in 3-year longitudinal data did not show a linear growth change but a non-linear

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[⑦] Generally speaking, normal Chinese students graduate from high school at the age of 18, and I extend the upper bound within a reasonable range to include as many samples as possible.

trajectory. Therefore, it is impossible to verify the trend of reading achievement under the influence of family background with the measurement results of 3 times. So, in this analysis, the dependent variable is the math test score, in the CFPS data, which shows the mathematical achievement.

The theoretical basis of CFPS literacy and math test methods is the design of the Guttman Scale in psychometrics. In the design of the Guttman Scale, each question can be strictly arranged according to the difficulty of the test questions. According to the order of the arrangement, answering a certain question means that all questions that are easier than this question can be answered correctly. Similarly, answering a certain question means questions harder than this one will be answered wrongly. (CFPS, 2018)

In order to further improve the efficiency of the test, the literacy test and the math test set three starting points based on the education level of the respondents. Respondents in elementary school education and below start from the first starting point; respondents with junior high school education start from the second starting point; respondents with high school education and above start from the third. The literacy test and math test have eight sets and four sets of questions of similar difficulty, respectively. According to the design, different interviewees in the same household answered different test questions in the same survey, and the same interviewee answered different test questions in the follow-up surveys. These designs aim to reduce the interference of other members of the household who already answered the question, as well as the practice effect of the previous round of survey on the follow-up survey. (CFPS, 2018)

In the specific design of the math test in CFPS, the respondent answered 24 math questions from easy to difficult in turn. So, the full mark of the test

is 24. If the respondent answered three consecutive questions wrongly, the test will be terminated. The sequence position of the most difficult question that the respondent correctly answered determines its score.

3.2.2 Explanatory variables

Family background or socioeconomic status (SES) is the core explanatory variable of this article. SES generally has three components, which are the family income level, the educational level of the parents, and the occupational status of the parent(s). (Jeynes, 2002) Thus in this study, SES will be mainly measured by these three indices too.

The family income level here is adjusted by taking the natural logarithm of the net family income per capita (RMB/Yuan). And the mean value of the natural logarithm of income in CFPS2010, 2014, and 2018 is calculated as the final family income level. Every CFPS survey asks about family income and other related economic conditions. Here I use the outcome of adjusted net family income per capita, which is the average income with the total income or net income divided by the family size, the number of family members living together. (Xie et al., 2017)

As for the educational level of the parents, I compared the father's and mother's level of education and the higher one is selected to minimize missing data at the same time. The educational level of parents is ranked as illiterate/semi-literate, primary school, junior high school, senior high school, higher 3-year college from low to high. I made it an ordered-qualitative variable after numbering.

The corresponding coding system of occupations in CPFS is the International Standard Classification of Occupation (ISCO-88). (Xie et al., 2017) I converted the ISCO-88 codes to Treiman's SIOPS (Standard International Occupational Prestige Scale) in STATA to better rank the different occupational status. Just like the educational level of the parents, the higher one is left as the final occupational status of the parents.

The three observed variables are used to measure the latent factor SES in the research model.

3.2.3 Control Variables

In some previous studies, the influences of gender (Wei, Y., 2015), age/grade(Xin, T., Li, Y., & Wang Y. 1998), and urbanity (Jiang G., & Yan, G., 2006; Peng B.,2014; Lu X., 2012) on academic achievement have been confirmed. Moreover, considering that China is a multi-ethnic country, it is also worth paying attention to whether there are differences in academic performance among different ethnic groups. Wang, Y. (2002) found that the personality characteristics and reasoning ability of middle school students show obvious ethnic differences, and there is a correlation between personality characteristics and reasoning ability and academic achievement.

In gender, the male is coded as 1, the female is 0. In urbanity, urban is 1, and rural is 0. As for the ethnicity, the Han nationality is 1, and the minority is 0. Because the panel data is used, the age of the students in 2010 is divided into three age groups of 10, 11, and 12.

Table 2.Concepts and Indicators for Variables

Variables	Concept	Definition
Academic achievements	Mathematical achievement	Math test scores in CFPS2010, 2014 and 2018 (from 0 to 24)
Family background/Socioeconomic Status	Family income level	The mean value of the natural logarithm of the net family income per capita in CFPS2010, 2014 and 2018
	The educational level of the parents	Father/Mother's level of education
	The occupational status of the parents.	Father/Mother's Standard International Occupational Prestige Scale
Gender		Dummy variable (1=male, 0=female)
Urbanity	Classification based on the Chinese Census Bureau's definition	Dummy variable (1=Urban, 0=Rural)
Ethnicity	The Han Chinese/Hanzu or not	Dummy variable (1=Hanzu, 0=ethnic minority)
Age	Child's age in CFPS 2010	From 10 to 12

3.3. Analysis process and research model

In order to explore the long-term impact of family background on mathematical achievement, or the trajectory of mathematical achievement under the influence of family background. This article collected data from CFPS 2010, 2014, and 2018, and conducted structural equation modeling (SEM) analysis. More specifically, Latent growth modeling (LGM) is mainly used here. The specific methods of data analysis are as follows.

First, I use STATA15 to process the variables that need to be analyzed and merge the data of CFPS2014 (14-16 years old) and CFPS2018 (18-20 years old) of students who were 10-12 years old in CFPS2010 through appending, merging and other methods. The problem of missing values is also dealt with

within this stage. Then I analyze descriptive statistics and correlation between variables. The former one is mainly to grasp the sample size, proportion, minimum value, maximum value, average, and standard deviation of each variable. The correlation between variables is obtained using Pearson's correlation analysis.

Second, I analyze the structural equation modeling of the processed data in AMOS21 software. The maximum likelihood estimation method is used here. The initial value and rate of change of math scores under the influence of the main independent variable (SES) and other control variables are analyzed. After comparing the model fits, I determine the path coefficients of the final research model and analyze them.

Following the previous literature, I will examine the long-term effects of SES on mathematical achievements. Figure 3 shows a diagram of the relationship between SES and mathematical achievements that I created for this study.
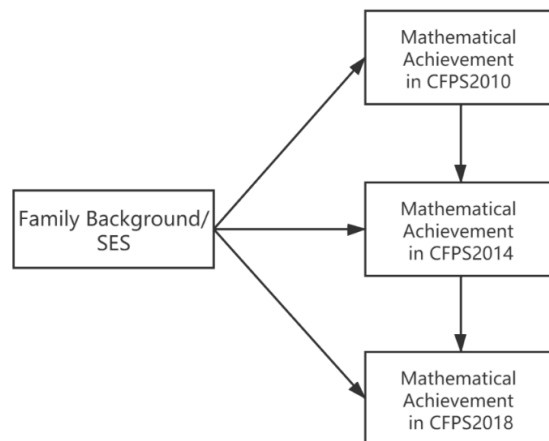
Figure 3.A diagram of the relationship between SES and Mathematical Achievements

Chapter IV. Findings

4.1. Descriptive statistics and analysis of correlation

Table 3 shows the proportion, minimum, maximum, average, standard deviation, skewness, and kurtosis of the variables in this study. The final sample size is 441 for every variable, which means 441 students were tracked every 4 years in mathematics cognitive level with their family background.

Table 3.Descriptive Summary

N=441

Variable	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis
Math test scores in CFPS2010	8.78	3.15	0.00	22.00	-0.01	3.78
Math test scores in CFPS2014	13.90	5.12	0.00	24.00	-0.68	3.15
Math test scores in CFPS2018	18.71	4.56	0.00	24.00	-1.12	5.15
Educational level of the parents	2.89	1.09	1.00	5.00	0.05	2.52
The net family income per capita	10,768.75	10,632.68	331.50	126,666.70	4.43	38.59
The natural logarithm of the net family income per capita	8.65	1.05	4.11	11.62	-0.91	4.91
The occupational status of the parents	40.82	10.26	13.00	78.00	1.58	6.35
Age in CFPS2010	10.90	0.81	10.00	12.00	0.18	1.54
Gender	0.47	0.50	0.00	1.00	0.13	1.02
Urbanity	0.44	0.50	0.00	1.00	0.23	1.05
Ethnicity	0.87	0.34	0.00	1.00	-2.21	5.89

Before conducting a structural equation model analysis, it is important to confirm the distribution of the multivariate normal distribution of the data. As

the confirmation of multivariate normality is not easy, here I confirm it by detecting the distribution of univariate normal distribution. Multivariate normality can be explored through the investigation of univariate distribution. According to Monte Carlo Simulation, there are several criteria in the study of the SEM estimation method. The research results show that when the absolute value of univariate skewness is greater than 3, it is regarded as extreme skewness. Although the study results of kurtosis are inconsistent, generally the absolute value of the univariate kurtosis index between 8 and 20 is considered to be extreme kurtosis. Under a more conservative position, if the absolute value of the kurtosis index is greater than 10, the analysis will have problems, and if it is greater than 20, there will be serious kurtosis problems. (Byung R. Bae. 2011) According to the descriptive statistical results, all variables input in this research model conform to a normal distribution. (Variable "finome" has extreme skewness and kurtosis but it will not be in the model since it was already transformed into the variable "lninc".)

Table 4.Correlation Matrix for the Variables

	1	2	3	4	5	6	7	8	9	10
1.Ethnicity	-									
2.Age in CFPS2010	0.00	-								
3.Urbanity	0.06	0.08	-							
4.Gender	-0.06	0.08	0.02	-						
5.The occupational status of the parents	0.02	0.00	0.12	-0.02	-					
6.Educational level of the parents	0.07	0.01	0.41	-0.08	0.22	-				
7.The natural logarithm of the net family income per capita	0.04	0.01	0.19	-0.04	0.10	0.35	-			
8.Math test scores in CFPS2018	0.12	0.17	0.24	-0.09	0.09	0.31	0.15	-		
9.Math test scores in CFPS2014	0.09	0.21	0.21	-0.06	0.07	0.24	0.11	0.50	-	
10.Math test scores in CFPS2010	0.12	0.41	0.32	-0.07	0.09	0.29	0.14	0.34	0.36	-

The correlation between the variables is shown in Table 4.

4.2. The Trends of Mathematical Achievement

Before conducting the SEM analysis, an overall overview of the changes in mathematics scores under the influence of family background is provided. Here "mtest2010, mtest2014 and mtest2018" mean the math test scores in CFPS2010, 2014, and 2018, respectively.

It can be seen from Table 5 and Figure 4 that in CFPS2010 the higher the parent's education level, the higher the average math scores. And the gap has not narrowed over time but tends to widen further. Especially for children whose parents are illiterate or semi-illiterate, the gap between them and other students is obvious.

Table 5.Mathematical achievement across measurement time points by parents' education stage

parents' education stage	mathtest2010	mathtest2014	mathtest2018
Illiterate/Semi-literate	6.74	10.45	15.32
Primary school	8.31	13.62	18.00
Junior high school	9.06	13.69	19.06
Senior high school	9.35	15.92	20.13
higher than 3-year college	10.43	16.38	20.68
Total	8.78	13.90	18.71

Figure 4. Mathematical achievement across measurement time points by parents' education stage
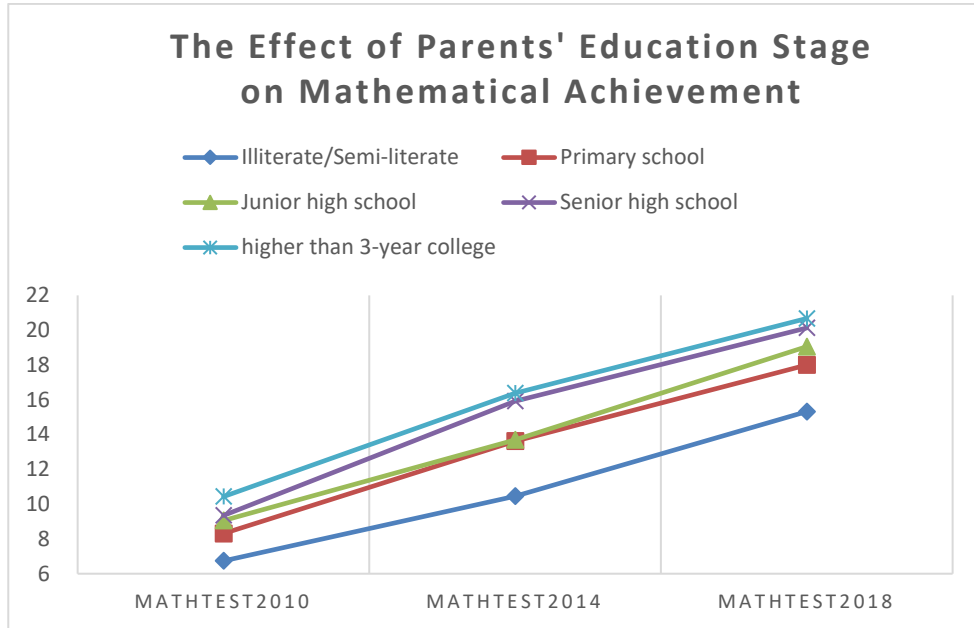
It can be seen from Table 6 and Figure 5 that when measuring in CFPS2010, family income has a certain influence on mathematical achievements and this gap has widened until CFPS2018 and become more and more obvious over time. The interesting point, which is different from the expected, is that the mathematical achievements of students whose net family income per capita lie in the lowest bottom 20% are not the worst group. In the related future researches, it is necessary to conduct a more detailed and comprehensive discussion on the impact of family income on academic performance.

Here I do not analyze the impact of parental professional status alone. Because the results of descriptive statistics show that the professional status of most parents is at a medium level. If the position status is divided into 5 equal parts, the sample size of higher professional status and the lower will

be insufficient, which will have a certain impact on the results.

Table 6.Mathematical achievement across measurement time points by family income

5 quantiles of lninc	mathtest2010	mathtest2014	mathtest2018
1.Bottom 20%	8.17	13.16	18.25
2	8.02	11.79	16.91
3	9.00	13.88	18.88
4	8.95	14.50	19.14
5.Top 20%	9.55	15.74	20.03
Total	8.78	13.90	18.71

Figure 5.Mathematical achievement across measurement time points by family income
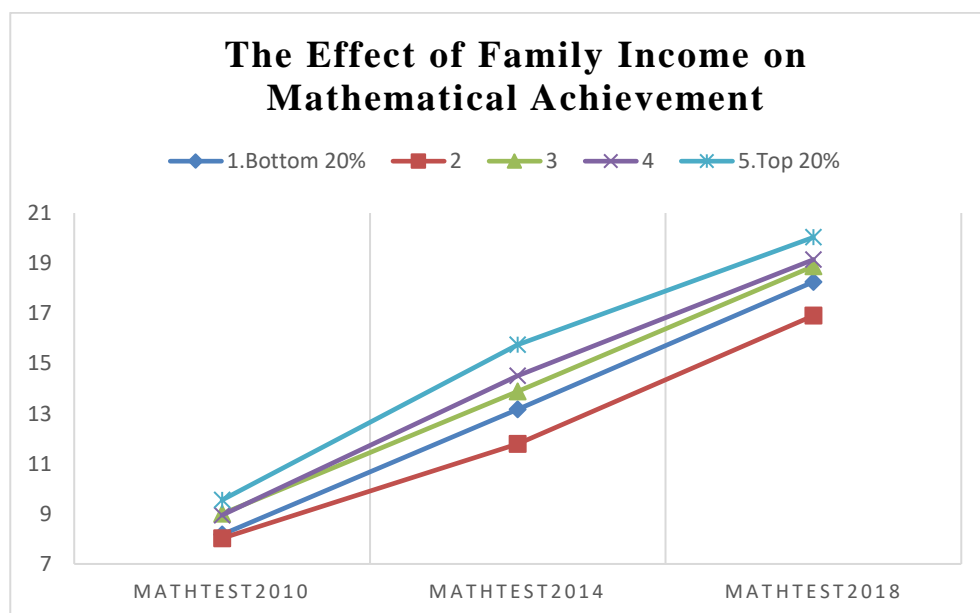
4.3. Analysis of Mathematics achievement within SEM

4.3.1 The trend of longitudinal changes in math scores

Based on longitudinal data or panel data (measured at least three times), LGM or LGCM (latent growth curve model) is an analysis method to estimate the changes of groups or individuals over time. (배병렬, 2018)

To measure the trend of longitudinal changes in math scores at 3-time points, I compare the model fit of the no-growth model (Figure. 6) and linear change model (Figure. 7). The test results of each model are showed in table 7. Here "mtest2010, mtest2014 and mtest2018" mean the math test scores in CFPS2010, 2014 and 2018, respectively. "Peduc" is the educational level of the parents and "poccu" is the occupational status of the parents. "Fincome" is the mean value of the net family income per capita in CFPS2010, 2014, and, 2018 and "lninc" is the natural logarithm of this number. "Poccu" is the occupational status of the parents. "Han" is the ethnicity and if the number of "Han" is 1, then it means this student is Han Chinese or Hanzu.
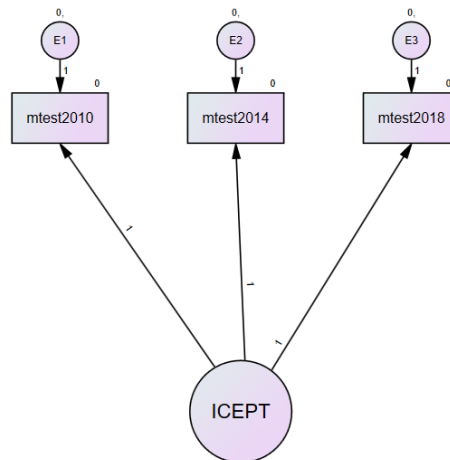
Figure 6.No-growth model
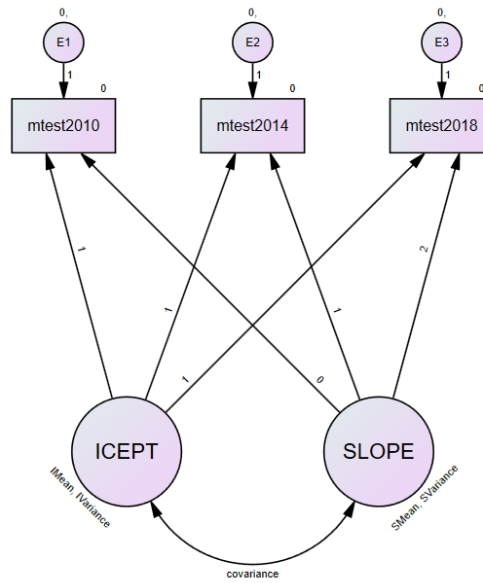
Figure 7.Linear change model

Table 7.The model fits of LGM

Model	X²	df	P	CFI	TLI	RMESA(90% confidence interval)
No-growth model	1097.832	4	.000	.000	-2.781	.788(.749 .828)
Linear change model	0.616	1	.433	1.000	1.005	.000(.000 .116)

In the structural equation model, the chi-square test, relative goodness-of-fit indices (TLI, CFI), and absolute goodness-of-fit indices (RMSEA) are used a lot.

The chi-square test tells the model fit through statistical significance. But it responds sensitively according to the sample size and the null hypothesis

underlying the chi-square test statistic is overly rigid in most cases, so chi-square test statistic could not be the sole basis for determining model fit. (Bollen, K. A., & Long, J. S. 1992)

RMSEA (Root Mean Square Error of Approximation) tests the hypothesis that the difference between the measured data and the research model is less than or equal to .05 (Close fit approach). RMSEA is also expressed as an error since it means the badness fit of the difference between population and the target model. In other words, the smaller the RMSEA index is, the more consistent the research model and observation data are. It means the research model explains the observed data well. A value of about 0.08 or less for the RMSEA would indicate a reasonable error of approximation. (Browne and Cudeck, 1992).

TLI (Turker-Lewis Index) is an incremental fit index. Non-Normed Fit Index (NNFI) which is also known as TLI was developed against the disadvantage of the Normed Fit Index regarding being affected by sample size. TLI compares a proposed model's fit to a nested baseline or null model. Additionally, the TLI measures parsimony by assessing the degrees of freedom from the proposed model to the degrees of freedom of the null model. An acceptable threshold for TLI is .90 or greater. (Cangur, S., & Ercan, I. 2015; Garver, M. S., & Mentzer, J. T. 1999).

CFI (Comparative Fit Index) is also an incremental fit index, directly based on the non-centrality measure. The extent to which the tested model is superior to the alternative model established with the manifest covariance matrix is evaluated. CFI is relatively independent of sample size and performs well in small samples. CFI ranges between 0 and 1 and higher than 0.90 are acceptable. (Hu & Bentler, 1998; Bentler and Bonett, 1990; McDonald &

Marsh, 1990; Chen, 2007) Table 8 shows the SEM model fit indices with acceptable levels.

Table 8. SEM Model fit indices with acceptable level

Fit index	Recommended value
Chi-square ratio(χ^2/df)	≤3.00
RMSEA (Root Mean Square Error of Approximation)	≤0.08
TLI(Turker-Lewis Index)	≥0.90
CFI(Comparative Fit index)	≥0.90

When comparing the no-growth model with the linear change model, the no-growth model shows a relatively large χ^2 value and a poor model fit index. The linear change model was adopted as the final model because the TLI and CFI values were near 1.00 and the RMSEA value was low at .01, indicating a good model fit. Table 9 shows the analysis results of the initial score (ICEPT) and the rate of change (SLOPE) of the linear model which is adopted.

Table 9.LGM estimates of changes in math scores

Parameter	Mean (S.E.)	Variance (S.E.)
Initial score (ICEPT)	8.794(.150) ***	7.715(1.372) ***
Rate of change (SLOPE)	4.960(.109) ***	4.358(.738) ***
Covariance of ICEPT and SLOPE	-1.474(.722)	-

*** p < .001.

The initial score of the math test is 8.794 on average and the variance is

7.715(p <.001). The average score of the math test in CFPS2010 was 8.794 and the variance is significant, meaning that there is a difference in mathematical achievement between individuals during this period. The average change rate in math test scores was 4.960 (p <.001) with variance at 4.358 (p <.001). The change in math test scores increases by 4.96 on average from CFPS2010 to CFPS2018. It means math test scores gradually increase over time and indicates that there is an individual difference in the rate of change. On the other hand, the covariance between the initial score of the math test and the rate of change was -1.474 (p> .05). It means there was no correlation between the initial score of the math test and the rate of change.

4.3.2 Conditional model of changes in math scores

In order to examine the influence of SES (family background), gender, urbanity, age, and ethnicity on changes in math scores, the predicted model, also called the conditional model, is set up and it is shown in Figure 8. The level 1 model in this situation would be like this:

$$y_{it} = \alpha_i + \lambda_t \beta_i + \epsilon_{it} \quad (1)$$

where y_{it} is the value of the trajectory variable y (math test scores) for the ith case at time t, α_i is the random intercept for case i, and β_i is the random slope for case i. Further, λ_t is a constant. In the case of a linear trajectory model $\lambda_t = t - 1$ for all t. The conditional model permits to test these potential influences on the trajectory parameters. The level 2 equations are thus:

$$\alpha_i = \mu_\alpha + \gamma_{\alpha 1} x_{1i} + \gamma_{\alpha 2} x_{2i} + \cdots + \gamma_{\alpha 5} x_{5i} + \zeta_{\alpha i} \quad (2)$$

$$\beta_i = \mu_\beta + \gamma_{\beta 1}x_{1i} + \gamma_{\beta 2}x_{2i} + \cdots + \gamma_{\beta 5}x_{5i} + \zeta_{\beta i} \quad (3)$$

where μ_α and μ_β are the intercepts for the equations that predict the random intercepts [Eq. 2] and the slopes [Eq. 3] across all cases. Especially, μ_α and μ_β are the mean intercepts and mean slopes when x_{1i} to x_{5i} are all zero. The x_{1i} to x_{5i} are 5 covariates or predictors of the random intercepts and slopes, $\gamma_{\alpha 1}$ to $\gamma_{\alpha 5}$ are the covariate coefficients for x_{1i} to x_{5i} in the random intercept equation, and $\gamma_{\beta 1}$ to $\gamma_{\beta 5}$ is the covariate coefficients in the random slope equation.

However, we also have latent covariates for x_{1i}(ses) here. So, the level 3 model is the measurement model for the latent time-invariant covariates:

$$\eta_i = \nu_{\eta i} + \Lambda_\eta x_{1i} + \delta_i \quad (4)$$

where $\nu_{\eta i}$ is a vector of intercepts for the multiple indicators in η_i (peduc/lninc2010), Λ_η is a matrix of factor loading that gives the coefficients of x_{1i} (ses) on η_i, x_{1i} is the vector of the latent covariates and δ_i is the vector of unique components ("disturbances") that are part of η_i not explained by x_{1i}. The δ_i has a mean of zero and is uncorrelated with x_{1i}. I index these variables by the subscript i to indicate that they can differ over cases but are not changing over time. (Bollen, K. A., & Curran, P. J., 2006) The analyzed results are shown in Table 10.
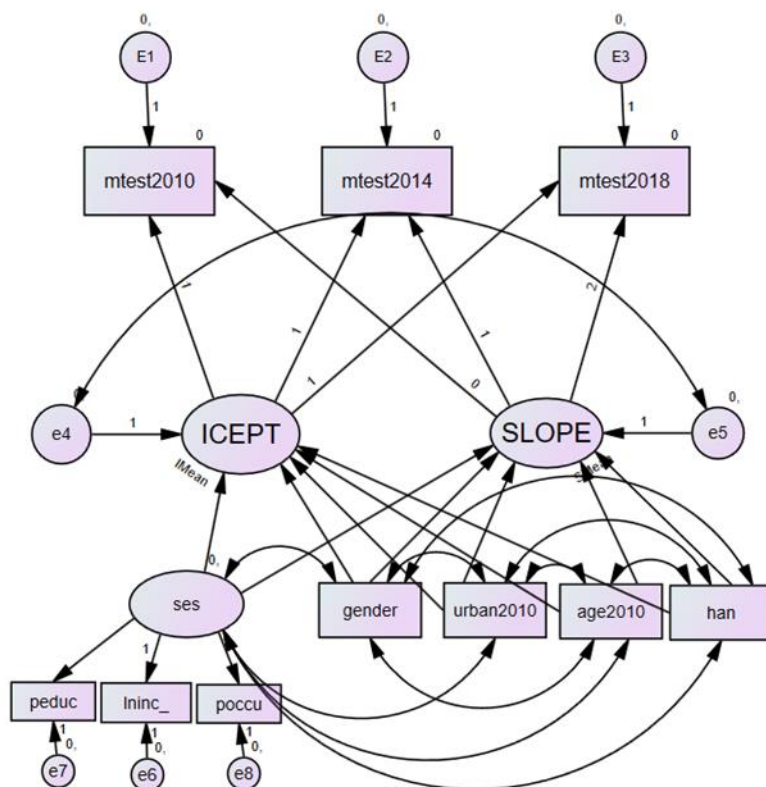
Figure 8.Conditional model

Table 10. The model fit of the conditional model

Model fit	X^2	df	p	CFI	TLI	RMESA
Predict model	29.966	20	.070	.983	.961	.034

The model fit shows χ2 = 29.966 (df = 20, p >.05), TLI .961, CFI .983, RMSEA .034. The result of the conditional model shows a good fit. Table 11 shows the analyzing results of the influences of predictors on mathematical achievements.

Table 11.The Regression Weights of conditional model

			Estimate	S.E	C.R	P
ICEPT	←	The family background (SES)	1.819	0.471	3.859	***
SLOPE	←		0.792	0.366	2.916	*
ICEPT	←	Gender	-0.471	0.256	-1.842	0.066
SLOPE	←		-0.071	0.220	-0.322	0.748
ICEPT	←	Urbanity	1.083	0.325	3.337	***
SLOPE	←		-0.214	0.266	-0.803	0.422
ICEPT	←	Age	1.547	0.156	9.936	***
SLOPE	←		-0.299	0.134	-2.222	*
ICEPT	←	Ethnicity	0.791	0.376	2.103	*
SLOPE	←		0.177	0.325	0.545	0.586

* $p < .05$. ** $p < .01$. *** $p < .001$.

As the table 11 shows, the family background (SES) have a significant effect on both the initial score of math test (B = 1.819, p <0.001) and the rate of change (B = 0.792, p <0.05). That is, the better the family background is, the higher the mathematical achievement is, and the steeper the rate of change is.

Family background has a positive effect on mathematical achievement. Children from advantaged families have a higher level of mathematical achievement when they are 10-12 years old, most of whom are in elementary school age. Moreover, they also grow faster in mathematical cognitive until they are 18-20 years old when most of the students are in senior high school, preparing for the national college entrance exam.

It indicates that the mathematical achievement gap does exist between students from advantaged families and from disadvantaged families. And the differentiation and gaps continue to expand as time goes by.

Among the control variables, age significantly affects both the initial value

(B=1.547, p<0.001) and the rate of change (B=-0.299, p<0.05) of mathematical achievement. Specifically, for students who were 10-12 years old in CFPS2010, the math test score will be 1.547 higher for each additional year of age. But with the pass of time, the older have the smaller rate of change in math test scores, which is, the slower rate of increase in math test scores. This is in accordance with the general laws and development trajectory of human cognitive ability.

Urbanity has a positive and significant effect on the initial value of mathematics achievement (B=1.083, p<0.001). It indicates that compared with rural students, urban students who were 10-12 years old in CFPS2010, have higher math test scores. The results are consistent with some previous cross-sectional studies which have found significant differences between urban and rural students in academic achievement. (Jiang G., & Yan, G., 2006; Peng B.,2014; Lu X., 2012).

Ethnicity also has a significant effect on the initial value of mathematical achievement (B=0.791, p<0.05). This means that in the baseline survey, the mathematics scores of Hanzu students are significantly higher than those of other ethnic minorities. There are 56 ethnic groups in China. Due to the relative limitations of their living areas and resources, ethnic minorities have shown a certain educational gap compared with Hanzu students. This result is consistent with the founding of Wang, Y. (2002).

Chapter V. Conclusion

How is the long-term effect of family background on academic achievement? How does the trajectory of academic achievement change under the influence of family background? According to a series of existing studies until now, it can be found that family background has a significant effect on academic achievement. But will the education gap under the influence of family background continue to increase or to decrease? There is still a big blank in the relevant longitudinal research.

In order to further explore the long-term effect of family background, this article uses the longitudinal data of China Family Panel Survey (CFPS) from 2010 to 2018 and applies the latent growth model to analyze the trajectory of mathematical achievements under the influence of family background.

In Chapter 2, I sorted out the related existing literature and researches. Education and inequality have always been important research topics in Sociology of Education. Education inequality is the same as education equality, which can be measured by three aspects or indicators: input, process, and output. So far, there are a large number of studies that explore the impact of family background on academic achievement, including both empirical research and qualitative analysis. Most of them confirmed the family background or the family socioeconomic status, does affect academic performance, and actually greatly. This kind of influence functions mainly through parental education involvement, education investment (school selection, shadow education, etc.), communication between parents and children, and so on. The role of the school may mitigate this effect to a certain extent, and it could also deepen this gap to a certain extent. Besides, the long-term effects of SES are also discussed in some studies. However, it should be

noted that most studies use cross-sectional data or survey results. It is necessary to further observe the long-term changes in academic achievement under the influence of family background in the longitudinal direction. Therefore, this article intends to use the data from the longitudinal survey to analyze the long-term changes in math achievement under the influence of family background.

Chapters 3 and 4 are the specific research methods and analysis results of this study. I collected the data for the three years of CFPS. After removing the missing values, 441 students who were 10-12 years old in CFPS2010, 14-16 years old in CFPS2014, and 18-20 years old in CFPS2018 constituted the final analysis sample. In order to analyze the relationship between family background and mathematical achievement, the latent growth modeling (LGM) statistical method in structural equation modeling (SEM) is mainly used. The analysis results show that family background has a significant influence on the math test scores. Among them, the initial value of the family background is positive for the math test scores, indicating that the better the family background in CFPS2010, the better the children's math scores. At the same time, the family background also had a positive and significant effect on the rate of changes in math test scores. It means that the better the family background, the faster the children's mathematics achievements grow between CFPS2010-CFPS2018. Combining the results of the initial value and the rate of changes, we can get the conclusion that the mathematical achievement gap under the influence of family background gradually increases with time.

The empirical studies above all prove that the mathematical achievement gap under the influence of family background gradually increases as time goes by. And the research spans 8 years, including elementary school, junior

high school, and senior high school these three stages of education. This is an explanation from another side that school education has not been able to reduce the educational inequality (in mathematical cognitive ability) caused by a family background in China.

Discussion

In a series of related studies so far, it can be known that there are various factors that can affect math performance. In internal factors or individual level, intelligence (Huo, J. et al., 1997; Si, J., & Zhang Q., 1999), learning strategies, learning motivation (Liu, J., 1998), etc. may all affect Students' academic performance. Among the external factors, one is family influence, such as parent's educational investment, educational participation, and communication with children. (Coleman et al., 1966; Coleman, JS, 1968; Bourdieu, P. 1973, 1986; Becker, G. S., 2009; Liu, 2019; Zhu, 2018; Yang, 2017) The second is school factors, including school environment, resources, and equipment, characteristics of teachers in the school, like teachers' cognition ability, personality characteristics, teaching level and educational expectations, etc. (Heyneman, S. P., & Loxley, W. A., 1983; Rivkin, S. G., Hanushek, E. A., & Kain, J. F., 2005; Chen, Y., & Li, W., 2000; Zheng, H., 2005) Among these factors, family background factor is very important, since it not only affects the learning attitude and motivation at the individual level but also has a certain effect on the school factors among the external factors.

In this study, mathematics achievement in academic achievement is the main research object. Wang, D. B (2004)'s study shows seventy-five percent of the family background factors are significantly associated with mathematics achievement for Hong Kong and US students. Nonoyama-

Tarumi et al. (2015) compares the effects of family background and school resources on fourth-grade students' math achievement and find family background effects are stronger than school resource effects in low- and high-income countries. Ismail, N. A. and Awang, H (2008) examines differences in mathematics achievement among eighth-grade students from Malaysia, using TIMSS data. Evidence from the data shows that the language spoken at home, expected educational level, family background, and home educational resources and aids have a significant influence on the students' level of mathematics achievement. Schiller, K. S et al. (2002) explores the relationship between nations' level of economic development and the influence of adolescents' social backgrounds on their academic achievement and found that the positive effect of higher parents' education on middle-school students' mathematics test scores is remarkably consistent among the 34 nations examined. Xie, J. (2016) found that family background has a significant impact on students' math performance in China. However, the degree of this positive influence becomes smaller with the addition of variables such as schools and teachers, indicating that school investment and teacher factors can, to a certain extent, make up for the huge gap in students' academic performance due to inequality of family SES. But at the same time, for students from the advantaged family background, their parents can use more resources to choose schools for them. Therefore, these students would have greater chances for teachers with higher education and schools with more investment, thus having higher mathematical achievements.

As for how family background affects mathematics performance or the mechanism by which family background affects mathematics performance, educational investment and parental education involvement were talked a lot. When exploring whether shadow education will expand the inequality of

education results, Hu Y. et al. (2017) found that students in four regions and countries (Shanghai, Hong Kong, Japan, and South Korea) spend more time each week in math tutoring than other subjects. The proportion of students in Shanghai and Japan who participated in math tutoring even reached or exceeded 70%. And no matter which country or region, the proportion of students whose family SES is higher than the average to participate in extracurricular tutoring in mathematics is significantly higher than that of students whose family SES is low. Xue, H. (2015) studied the extracurricular tutoring activities of students in the compulsory education stage in China and found that students from families with better socioeconomic backgrounds, large and medium-sized cities are more likely to receive extracurricular tutoring. Extracurricular tutoring has an effect on improving students' math performance, but it has no obvious effect on improving reading literacy performance. This shows that most families tend to invest in their children's mathematic achievement. The impact of family background on mathematic achievement is likely to be more intuitive and obvious than other academic performance.

Yan, W. and Lin, Q. (2005) examined the relationships of 3 dimensions of parent involvement (family obligations, family norms, and parent information networks) to 12th-grade students' mathematics achievement. Findings indicate that parent involvement as a form of social capital was generally a salient indicator for explaining the mathematics achievement of the Caucasian students. The close parent-teenager relationship was a major way where minority (except Hispanic) families positively influenced the senior mathematics outcome. Bicer, A. et al. (2013) conducted SEM analysis and the results also revealed that parent's income and parent's education level were related to students' mathematics achievement indirectly through parental

expectations and parental communication. Chen, Y. and Yang, X. (2020) also verified that the family's SES significantly influenced mathematics performance. And parent-child communication and academic self-efficacy have a chain intermediary role between family SES and mathematics performance. Cui Y. et al. (2019) used the 2015 TIMSS data of Hong Kong to explore the impact of parents' early education participation on their children's mathematics achievements before they enter school. The results show that after controlling the relevant background factors and the children's self-concept, parents' early education participation has a positive impact on their children's future mathematics academic performance.

The relevant risk aversion model believes that the starting point of family education decisions is that children's future social status cannot be lower than their current position, so families will try their best to avoid downward social mobility through various educational decisions. (Breen, R., & Goldthorpe, J. H., 1997) But obviously, the educational decisions that could, and would be made between the advantaged and disadvantaged families are very different. Just like the book *Unequal childhoods: Class, race, and family life*, the author examines the lives of children in schools and at home in poor families, working-class families, middle-class families, and rich families. She shows how people in different social strata have different performances in raising children in their daily lives because of occupying different social resources. (Lareau, A., 2011) Just as the findings of Xue, H. (2015) show, students from families with better socioeconomic backgrounds, large and medium-sized cities are more likely to receive extracurricular tutoring. Extracurricular tutoring has an effect on improving students' math performance. Other empirical studies (Bray et al., 2014; Chu,H., 2009; Ho & Kwong, 2008; Xue, H. & Ding, X., 2009; Zhang, W., 2013; Liu, J., & Bray, M., 2017) also find

both household income and parental educational level had a significantly positive influence on the probability of receiving private tutoring. Thus, parents in advantaged families would also better guide their children and cultivate their good learning attitudes and learning habits. And it is also easier for them to choose districts with good schools and good teachers for children, or to help children achieve excellent results through extracurricular tutoring and private education to enter a good school, continue to achieve good academic achievements, and form a virtuous circle.

In addition to this, it should also be noted that academic performance is stable to some extent. (Wang, Y., 2008) Students with excellent grades from childhood tend to maintain excellent levels all the time, and students with middle and low grades are difficult to make great progress due to the initial backwardness and the gradual increase in knowledge difficulty and quantity in later periods. And from elementary school to high school, academic performance is a gradual accumulation process from easy to difficult. Students who have laid the foundations from an early age will be more proficient in their academic careers. On the contrary, students who lagged behind in childhood would tend to give up if they do not get the correct guidance and timely help, and it is difficult to improve their academic performance further. This would inevitably make the performance gap wider.

Therefore, parents are paying more and more attention to cultivating children from an early age. Almost all Chinese parents have great expectations for their children's academic achievements. The slogan "Don't let your child lose at the starting line" is popular and used a lot. China has a tradition of attaching great importance to education. Excellent academic performance in ancient society is an important way to enter the official career

(The imperial examinations system[⑧]) and achieve success. This is inseparable from the fact that Confucianism has a long domination history in Chinese culture since Confucianism gives high regard for learning and education. This tradition continues until today, and the emphasis on education, or examination-oriented education, has become a feature of all East Asian countries affected by Confucianism. (Seth, M. J., 2002)

The educational inequality problem in China can be traced back to the conflict between efficiency and fairness in China for a long time. China established the policy of "efficiency priority" in the early stage of reform and opening up from 1978. The idea of efficiency priority greatly stimulated social productivity and accelerated the process of China's modernization. Under the guidance of this idea, education has also made great strides. Key schools emerged, which provided a guarantee to cultivate talents quickly at that time. But at the same time, under this policy system that allows some people to get rich first, the phenomenon of "the rich get richer, the poor stay poor or even get poorer rather than following the rich" gradually appears. The wealthy class not only demonstrates their status economically but also has an advantage in other aspects including education. (Zhu, Z., 1997; Li, Y., 2016) Many scholars' studies have reached a similar conclusion that in the development process of more than 30 years of reform and opening up, while China has achieved tremendous development, it has also shown a state from optimization to stagnation and then to the gradual imbalance in terms of social structure changes. On the one side, economic elites, political elites, and intellectual elites have begun to build a consolidated "alliance" but on the

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[⑧] The imperial examinations system is the examination to select high ranking public officials or courtiers in the government that tested knowledge in Chinese literature mostly in Confucianism. (Seth, M. J., 2002)

other side, there are "fragmented" vulnerable groups. The result is a relative imbalance in the interests of the two. (Cai, X.2014; Zheng, H.2008) And according to *China Family Panel Studies 2014*, China's property inequality is rising rapidly: the Gini coefficient of China's property in 1995 was 0.45, 0.55 in 2002. And in 2012, the Gini coefficient of China's household net property reached 0.73. Families in the top 1% occupy more than one-third of the country's property, but the bottom 25% own only about 1% of the total property. This increase in social inequality and the imbalance of social group structure is a major disadvantage faced by China in the process of market transformation. (Xie Y., Zhang X., Li J., Yu X. & Ren Q., 2014) Yang, J., Huang, X. and Li, X. (2008) found that rising income inequality will lead to increased education inequality, income inequality directly affects the level of individual human capital investment. And through the role of the rate of return to education, this negative effect is finally reflected in income distribution and education distribution. The income gap can be said to be the direct cause of inequality in education. If it is not improved, according to this cycle mechanism, it is easy to form a vicious cycle of "Matthew effect".

In addition to this, the hierarchy of schools in China is obvious. From the distinction between 985 universities and general universities, the distinction between key high schools and ordinary high schools, and even the distinction between key primary schools and general primary schools. In recent years, 985 universities have begun to further distinguish between the top 6 and general 985 universities. The serialization of schools is consistent throughout the process from basic education to higher education. The difference in teaching within the school is relatively small, but the difference in education between schools is very large. It is possible that a progression conversion could directly determine the quality of education obtained in the next 3-4

years, which will further affect the students' learning motivation and academic achievement. And China's unified examination admission system has made academic achievement the most important determinant in the process of transition. The classification system between ordinary and key secondary schools provides obvious conditions for advantaged classes to compete for school education resources. The study found that students' family background will significantly affect whether students can enter key middle schools. Children from advantaged classes obviously occupy the entry advantages and quantitative advantages of key schools, while children from lower and middle classes are more distributed in ordinary middle schools. (Tao, H. & Yang D., 2007; Li, X., 2008) The current low expenditure on education in China has also resulted in school-selection fees becoming an important source of education funding, and school-selection students have even become a common phenomenon in secondary school enrollment systems. This undoubtedly led to the penetration and control of education by family background, strengthening the education's reproduction function of the social class structure and the social stratum conflict. At the same time, entering a key school means that the next stage of education is also more likely to enter a key school. For example, in the study of Tang, J (2015), graduates of key junior high schools are much more likely to enter key high schools than graduates of ordinary middle schools. Graduates who cannot enter key high schools are more likely to enter vocational high schools. It is not their preferred choice to attend ordinary high schools. This makes the education competition start from a very young age, and students who have obtained high-quality education in the early stage enjoy great advantages in the process of progression. And once lagging behind in early education, students will be at a disadvantage. Therefore, parents pay more and more attention to the so-called not letting children "lose at the starting line."

In recent years, China has paid more and more attention to the issue of educational equality. As the core components of education equity, education starting point fairness and process fairness have always been the main concerns in the field of policy and theory field. The fairness in the starting point of education has been written into the Constitution, and it is also clearly stipulated in the Compulsory Education Law of the PRC. (Huang, N., 2009) China's education equality issues are prominently manifested in urban-rural gaps, regional gaps, and social class gaps. (Long, A. & Fan, W., 2013) In recent years, the Chinese government has tried to make many efforts in these three areas. In general, the policy of "efficiency priority" has gradually been changed to the policy of "balanced efficiency and fairness". (Li, Y., 2016) In the urban-rural and regional gaps, we can also see the three characteristics of government's policies, which are from gradually resolving the "dual opposition between urban and rural areas" to effectively promoting "urban-rural integration", from emphasizing "key support" to "narrow regional gap", from emphasizing "equal rights and opportunities" to "fair process governance". (Du, Y., 2019)

But on the other hand, the problem of the class gap has always been obvious. In order to minimize the gap between schools and reduce competition in school selection, the government has established the policy of Zone Division and Admission into the Nearest School[9] for the Compulsory Education. The original intention of the policy is to promote education equality, solve the

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[9] According to the number of school-age students, school distribution, school district, school size, traffic conditions, and other factors, also according to the principle of the nearest school, street, road section, house number, village group, etc., for each junior high school, a reasonable primary school is assigned. Pupils should be enrolled in counterpart junior high schools that are assigned to their elementary schools. (Ministry of Education of the PRC., 2014)

problem of school selection, and balance the distribution of students at various levels in various regions to a certain extent. However, other institutional arrangements (for example, under the implementation of the policy, the government still allows schools, especially prestigious schools, to reserve some places for school selection, etc.), unequal distribution of educational resources, and direct intervention of family in children's education tracking (household registration migration) have greatly reduced original goal. Most of the better schools are concentrated in urban communities with high socioeconomic development (inhabited areas of upper- and middle-class groups). The housing prices in these communities were originally at a relatively high level. Some families with good economic conditions realize the migration of household registration by purchasing housing in relatively good school districts, so as to achieve the purpose of choosing schools for children. This behavior may further promote the rise of housing prices in better school districts, which in turn makes good school districts an insurmountable threshold for families with disadvantaged economic conditions. (Chen, Y. & Fang, C., 2007)

In order to further explore how family background affects mathematical achievement in the long run, I also explored the impact of educational investment and parental education involvement on mathematical achievement. The sample consists of students who are 10-11 years old in CFPS2010 and 14-15 years old in CFPS2014. The least squares regression (OLS) model is applied, and the robust standard errors are used to deal with heteroscedasticity. The first two analyses were to regress the cross-sectional data of CFPS2010 and CFPS2014, respectively. The third time is the pooled OLS regression after the data of the two years are merged. And then, the interactions between the dummy variables of time and the variables of interest are added to further

explore whether the impact of educational investment and parental involvement changed in different years. The results show that education investment and parental involvement have a significant impact on math test scores, both in CFPS2010 and CFPS2014. And in CFPS2014, the coefficient value of education investment is statistically significantly increased compared to CFPS2010. This shows that the influence of education investment on mathematics performance has increased over time.

Conclusion

The results confirmed in this paper are consistent with the subsequent studies after the Coleman Report (Coleman et al., 1966). The socio-economic background of families, such as parents' educational background and income, has a greater influence on the students' academic achievement than school education. So far, there have been a series of studies that have proved the significant influence of family background on academic performance (Becker, G. S., 2009; Stevenson, D. L., & Baker, D. P., 1992; Bourdieu & Passeron, 1900; Hart &Risley, 1995; Mullen, 2009; Coleman, 1988), and in particular, the influence of family background on mathematical performance. (Schiller, K. S et al.,2002; Wang, D. B., 2004; Yan, W. and Lin, Q., 2005; Ismail, N. A. and Awang, H., 2008; Bicer, A. et al., 2013; Nonoyama-Tarumi et al.,2015; Xie, J., 2016; Cui Y. et al., 2019; Chen, Y. and Yang, X.,2020) This article not only confirms the significant impact of family background on mathematical performance but also finds that the mathematical achievement gap under the influence of family background is constantly expanding.

The China Family Panel Studies used in this article involves changes in China's society, economy, population, education, and health, the focus is on

the economic and non-economic welfare of Chinese residents. This makes the series of studies carried out mainly around economic subjects, such as residents' consumption level and income gap. In addition to this, there are also many studies about rural poverty, personal health, and marriage issues, etc. In the publications related to the sociology of education using CFPS data, there are some studies on the relationship between education and occupation and income, which involves the issue of intergenerational inheritance. However, there are few studies on the relationship between family background and academic achievement. Among them, the one most relevant to this article is Guo Xiao's research in 2010. He explored the correlation between mathematical achievement and family situation of students in junior high school, mainly using correlation analysis and logistic regression. (Guo, X., 2016) In addition, although CFPS is longitudinal data, most studies only select the results of one year to conduct cross-sectional analyses. This article takes advantage of the fact that CFPS is longitudinal data, and combines data of 2010, 2014, and 2018 to explore research questions. This study spans 8 years. Since the age of the student subjects in the initial stage of the baseline survey was 10-12 years old, it can also be said that it spans three stages from elementary school to senior high school. In addition, because the data includes students from different districts in China, it is more illustrative than some previous studies which just show the results of one region.

The research of this article can explain from another aspect that under the educational background in China, school education did not reduce the (mathematical cognitive ability) educational inequality brought about by family background. The advantaged students will always occupy the advantage, but the children who are at a disadvantage at the beginning will have a hard time catching up. Advantaged families began to help children

enter better schools and receive a better education at an early stage. Children who have received a good education have an advantage in the exams, thus entering a better school and continuing to receive a better education. This kind of advantage accumulates step by step until stepping into work. This process of social reproduction is covered up in standardized examinations that seem to be superficially equal. (Tang, J., 2015)

All in all, nowadays China is in the background of fierce competition in social mobility. Education has attracted the attention of parents of all levels as an important intermediary of social mobility. And because of the obvious differentiation of school levels, there is a big gap in education between schools. This makes the educational arms race get fiercer and start earlier and earlier. High-class families have better capital and start helping children enter better schools and receive a better education in the early education stage. Children who have received a good education have an advantage in the exams, thus entering a better school and continuing to receive a better education. The academic achievement gap under the influence of family background starts from a young age, and the gap is wider and wider. Family background advantages accumulate step by step until they step into work. This process of social reproduction is covered up in standardized examinations that seem to be equal superficially. (Tang, J., 2015)

Therefore, the government should pay more attention to the improvement of educational inequality. On the one hand, it should start to promote the fair distribution of income and promote social mobility, so that the acquisition of educational resources is also more equitable, avoiding the vicious cycle of the "Matthew effect". On the other hand, it is necessary for China's future policies to focus on education equity policies on basic education. Since inequality in higher education is a continuation of inequality in junior and

secondary education to a certain extent, the issue of equity in the early education stage, especially the early education opportunities and quality of disadvantaged students must be given more attention. As for the implementation of specific policies, it is to narrow the gap of teaching staff and infrastructures between key schools and non-key schools. And the allocation of resources should be more inclined to public schools with weak foundations, so as to gradually narrow the excessive gap in conditions between public schools. In the school, we should focus on cultivating students' interest in learning from a young age and pay special attention to students who are lagging in the beginning and teach more flexibly according to the student's ability.

Due to the limitation of data, this article only analyzes the changes in mathematics achievement under the influence of family background. The CFPS survey also includes the measurement of Chinese reading(literacy) ability of students over 10 years old. However, during the pre-examination of the LGM analysis, I found that reading test scores did not show a linear growth change. As to estimate underlying linear trajectories and the other parameters in the model, a minimum of three repeated observations is necessary to identify. However, if it is a non-linear model, at least 4 observation points at different times are required (Bollen, K. A., & Curran, P. J., 2006). Therefore, it is impossible to verify the trend of reading achievement under the influence of family background. It is necessary for further research to collect more long-term data to study and discuss the changes in Reading, English, and scientific achievements, and so on, other than mathematics.

In addition, there are also many other kinds of intermediary factors that affect academic achievements in family backgrounds except for educational

investment and parental education involvement. Later researches can explore the impact and changes of other intermediary factors on academic achievements in multiple time dimensions. Since the data of CFPS2018 has not been sorted out and not all data is disclosed, I only used the data of CFPS2010 and CFPS2014 with applying the pooled OLS analysis method, instead of the commonly used panel data analysis methods (fixed effect and random effect). Related researches in the future can also collect more comprehensive data and conduct more panel data analysis. Thus, changes in related intermediary factors, changes in academic achievement, and the relationship between them can be understood deeper.

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차성현, 신혜숙, & 민병철. (2011). 학력향상중점학교와 일반학교의 학업성취도 '차이'를 설명하는 학생 및 학교 특성 분석: 서울교육종단연구 중학교 자료를 중심으로. 아시아교육연구.

국문초록

교육은 계층 이동에 있어 중요한 방식으로 간주되며, 학업 성취도에 대한 가정 배경의 영향은 교육사회학 분야에서 중요한 논점이 되어 왔다. 전통적으로 교육을 매우 중시하는 중국의 학부모들은 예로부터 자녀의 학업성취도 향상에 많은 노력을 기울였으며, 중국 사회가 변혁의 시기를 맞이하고 계층 고착화에 대한 대중들의 관심이 높아지면서 학업성취도와 가정 배경의 관계에 대한 연구가 활발히 이루어졌다. 그러나 대부분의 기존 연구들은 중국의 특정 지역에 초점을 맞춰 횡단면 데이터만 활용했다는 한계를 가진다.

중국에서 가정 배경이 학생들의 학업성취도에 장기적으로 미치는 영향을 자세히 파악하기 위해 본문은 2010 년부터 2018 년까지 실시된 중국 가정 패널 조사 (China Family Panel Survey: CFPS)라는 종단 데이터를 활용하였다. 구조방정식 모델링으로 잠재성장모형을 이용해서 가정 배경에 따른 수학 성취도의 변화 추세를 실증적으로 탐구하였다.

연구 결과, 가정 배경이 학생들의 초기 수학 성취도에 유의한 영향을 끼칠 뿐만 아니라 장기적인 변화율에도 긍정적인 영향을 미친다는 것을 발견하였다. 이를 통해 사회경제적 배경이 좋은 학생들과 그렇지 않은 학생들 간 수학 성취의 차이가 시간이 지남에 따라 계속 확대되고 있음을 알 수 있다. 중국에서 학교 교육은 가정 배경으로 인한 교육 불평등을 감소시키지 못 하는 것으로 보인다. 가정의 경제자본, 문화자본 등 메커니즘으로 인한 학업성취 격차는 어린 시절부터 시작되기 때문에 초기에 낮은 성적을 가진 학생들은 학년이 올라가도 지식의 난이도와 양의 증가에 따른 발전을 이루기가 어렵다는 것이다. 이렇게 중국의 가정 배경에 따른 교육 격차는 사회에 진출할 때까지 단계적으로 누적된다. 본 연구는 중국의 교육 및 불평등에 대한 더 거시적이고 역동적인 이해를 통해, 현재 중국 교육 시스템의 합리성과 학교교육의 효과를 파악하려고 한다. 이는 향후 중국의 교육이 나아갈 수 있는 방향에 대한 반성과 탐구의 기회를 제공할 것이다.

주제어: 교육 격차, 가정 배경, 학업성취도, 수학 성취도, 잠재성장모형

Appendix：Questionnaire Survey

This questionnaire is part of the China Family Panel Studies (CFPS) 2010, the Institute of Social Science Survey (ISSS) of Peking University, China.

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Part F

F6 Last year, what was the approximate amount of your family's total income (including salary, bonus, subsidy, and interest), excluding pension/social security/welfare/government subsidy?   (Approximate)_____

(2500/5000/7500/12000/18000/27000/40000)/60000/90000/140000/210000/320000/480000) yuan

[CAPI]If F6 is in a closed interval, continue to F601 within the range of the interval.

F601 Last year, what was the accurate amount of your family's total income (including salary, bonus, subsidy, and interest), excluding pension/social security/welfare/government subsidy? _____yuan

Part C

C1 What is the highest level of education you have obtained so far?

  1. Illiterate/Semi-literate [Skip to D1] 2. Primary school 3. Middle school

  4. High school 5. 2- or 3-year college 6. 4-year college/Bachelor's degree

  7. Master's degree 8. Doctoral degree 9. No need to go to school [Masked]

F1: "The highest level of education" is the highest level of education received at school.

Part G

G306 What is your occupation:

  Interviewer's Note:

(1) If more than one occupation, record the one that takes the most time.

(2) Record detailed information on the occupation, such as department, job responsibility, position, and title.

Examples:

Chinese language teacher and grade leader of ××Primary School
Accountant of ××Company
Director of xx workshop at ××Factory
Nurse from xx hospital in ××County
Farmer who grows rice in the local village

G307 What is the category of your occupation?

G308 What industry does your occupation belong to?

Part X: Benchmark test

X3 Did you learn about circles in math?

  1 Yes 2 No [Skip to X302 with the hint "five and a half turns"]

X301 How many rotations are equivalent to 1980 degrees? _____rotations

X302 If you rotate the number "6" around by 1980 degrees (5.5 complete circles around), you get the number "9". If you rotate the number "9" 1980 degrees (5.5 complete circles around), you get the number "6". If you rotate the number "69" 1980 degrees (5.5 complete circles around), what number do you get?

1. 69 2. 96 3. 66 4. 99

X4 Math: Please randomly select one of the four lists of questions. [Show card][Math Module]