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Effects of one school meal program on mothers' labor supply: Evidence from China[1]

Master's thesis

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[1] Parts of this paper have been previously submitted as a part of my MAER studies at CERGE-EI.

Declaration

1. I hereby declare that I have compiled this thesis using the listed literature and resources only.
2. I hereby declare that my thesis has not been used to gain any other academic title.
3. I fully agree to my work being used for study and scientific purposes.

In Prague on July 30th, 2023

References

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Length of the thesis: 90129 characters with spaces

Abstract

Female labor force participation is associated with welfare improvement for mothers and also contributes to the welfare for the next generation. I exploit China's school meal program to estimate its effects on the mother's labor supply using a difference-in-differences (DID) strategy. I find that mothers can work longer when children are exposed to a school lunch program, but this program does not change mother's employment status (work or not work). Thus, it increases mother's labor force participation on the intensive but not the extensive margin. Specifically, the program significantly increases their working hours per week by 9%-13%. This paper may help to inform policy and can help the government formulate reasonable policies to promote female labor participation rates.

Abstrakt

Zapojení žen na trhu práce je spojeno se zlepšením blahobytu matek a také přispívá k blahobytu příští generace. Využívám metodu difference-in-differences (DID) k odhadu dopadů čínského programu školního stravování na zapojení matek na trhu práce. Zjišťuji, že matky mohou pracovat déle, když jsou děti součástí školního obědového programu, a zároveň zjišťuji, že tento program nemění zaměstnanecký status matek (pracovat nebo nepracovat). Přesněji, program výrazně prodlužuje jejich týdenní pracovní dobu, tedy o 9 %--13 %. Tato práce může přispět k zavedení rozumných vládních politik na podporu míry účasti žen na trhu práce.

Keywords

School meal program Mother's labor supply

Klíčová slova

Program školního stravování, Zapojení matek na trhu práce

Název práce

Dopady programu školního stravování na zapojení matky na trhu práce: Analýza v kontextu Číny

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1. Introduction

The returns to human capital accumulation far exceed that of other (nonhuman) conventional forms of capital, including material possessions, other types of assets, etc. Galor and Moav (2004) developed a growth theory that captures the endogenous replacement of physical capital accumulation by human capital accumulation as the essential factor of economic growth from the Industrial Revolution to the modern era. Indeed, human capital is of great importance in both macroeconomic and microeconomic fields and has already attracted much attention from researchers. In the macroeconomic field, investment in human capital serves as a significant factor in explaining why national output grows faster (Schultz, 1961). Especially in today's post-industrial age and the era of the knowledge economy, human capital will have a growing potential to add value. By devoting greater investment into human capital, the potential contribution to the growth of gross domestic product (GDP) can rise correspondingly. Mankiw, Romer and Weil (1992) made a significant contribution to the field of economic growth theory by augmenting the classic Solow model with the incorporation of human capital to explain how much of cross-country variation in average income. They found that human capital—a person's knowledge, skills and talents—can produce output and boost economic growth.

Additionally, human capital, referred as the "living capital", is innovative and creative, as it can lead to an increase in research and development. Blackburn, Hung and Pozzolo (2000) claimed that the accumulation of human capital plays an important role in enhancing skills across various productive activities, including research and development. Moreover, investment in human capital also helps in strategies for enterprise development. Above all, it is evident that human capital is essential for macroeconomics, which has a substantial focus on its effects on economic growth. Much research attention has been given to human capital. Therefore, this paper turns to microeconomic field and aims to add more evidence from its perspective, by focusing on nutritional health at the individual

level. Specifically, I estimate the effects of one school meal program in China, which can shed further light on the labor supply of women. Women may be subject to greater constrains on their choices of jobs, including households, family constrains or social norms. For example, Adda, Dustmann and Stevens (2017) pointed out that the impact of having children may be one important reason for women's disadvantages in the job market, and the costs of children for women's careers may be substantial. Therefore, by understanding the implications of investing in human capital comprehensively, policymakers can issue more reasonable reforms to improve individuals' job market performance in cost-effective ways and contribute to a more prosperous and sustainable future.

It is now accepted that human capital is a multidimensional object. Its different dimensions are essential both for the different roles they play in the process of development and outcomes, as they are related to different aspects of well-being. How different dimensions of development interact in the process of formation and how they can be affected by external factors are the key for the design of appropriate policies and the identification of the role played by different inputs in the process (Attanasio, Bernal, Giannola & Nores, 2020). Indeed, governments worldwide have recognized the importance of the early years and have started to introduce services to support children from deprived backgrounds (Attanasio et al., 2022). In this paper, I will focus on one school lunch program initiated by the central government, which aims to invest in health during childhood. In contrast to previous studies that have focused on direct effects on children, I analyze the indirect effects of this program and examine how it affects mother's performance in the labor market.

The correlation between good nutrition and overall health is a fundamental aspect that significantly influences human capital, serving as one of the most reliable predictors of well-being (Greve, Schultz-Nielsen, & Tekin, 2017). Access to proper nutrition is essential for children's survival and holistic development, exerting far-reaching effects. The realization of optimal nutrition contributes to

promoting economic growth and also expands a multitude of opportunities for every child to reach their full potential in various aspects of life (Singla, Kumbakumba, & Aboud, 2015). However, despite its indisputable significance, ensuring that children have access to intake sufficient and quality nutrition during their formative years poses a complex challenge. While family members play a crucial role in nutrition provision, families at the lower rungs of the social ladder can often encounter difficulties providing their children with suitable nutrition (Fitzsimons, Malde, Mesnard, & Vera-Hernández, 2016). Hence, in such circumstances, governments often take responsibility for providing nutrition for children, which can also help to reduce inequality. For example, Glewwe, Jacoby and King (2001) analyzed the relationship between nutrition and learning and showed that nourished children can outperform in schools over those students who did not participate in the school meal program.

Nutrition intervention programs serve as an essential tool for nutrition provision and are widely implemented in almost every country around the world (Drake et al., 2017). For example, in Africa, Whaley et al. (2003) conducted experiments in Kenya to find that the quality of meals has a positive relationship with children's cognitive development. Similarly, Aurino, Gelli, Adamba, Osei-Akoto and Alderman (2023) exploited randomized data about a large-scale feeding program in Ghana and then discovered that students in the program have a competitive edge in math and literacy over those pupils in the control group. In South America, Brazil has initiated a national school meal program since 1955, and it has been shown to help prevent obesity among school aged-children (Kitaoka, 2018). In Europe, students in primary schools benefited from the UK's school meal campaign and improved scores in English and science (Belot & James, 2011). They also found that participating in this program was correlated positively with the rate of students' participation in school.

Indeed, welfare policy can play a crucial role in facilitating human capital accumulation among children, thereby significantly influencing their future

outcomes. As one of the most universal tools, policy-induced school meal programs are designed to provide children with nutritious diets in elementary and junior high schools. In general, the schools provide students with lunches or breakfasts, encompassing students aged approximately six to fifteen years at an important phase of their lives in their overall growth and development. The acquisition of adequate nutrition during this crucial period holds the key to their future health and lays the foundation for their subsequent achievements. Additionally, disadvantaged children substantially benefit from these welfare policies. For example, Carneiro et al. (2021) evaluated an intervention targeted at enhancing early-life nutrition and well-being for households in extreme poverty in Northern Nigeria. They found that there are significant improvements in children's health. Consequently, to some extent, this kind of program can help reduce social inequality among different children groups and provide protection for vulnerable populations. By prioritizing and enacting such welfare policies, governments can create an environment where children from all backgrounds are equipped with the necessary resources to thrive and maximize their potential (Lundborg, Rooth, & Alex-Petersen, 2022).

In evaluating the effectiveness of school meal programs nowadays, most existing studies have focused on direct effects on children's health outcomes (Gundersen, Kreider, & Pepper, 2012; Jomaa, McDonnell, & Probart, 2011), educational attainment (Chakraborty & Jayaraman, 2019), and cognitive skills (Drake et al., 2017). However, there is a lack of evidence regarding the indirect effects of these programs on households. Specifically, the implementation of school lunch programs has the potential to alleviate the household's responsibilities, particularly for mothers, by relieving them of the household task of food preparation. As a consequence, they may increase the female labor market participation rate and potentially improve household finances (Lundborg et al., 2022). A large body of studies have evaluated the effects of school lunch programs in developed countries, including Sweden, the United States, etc. For

instance, Lundborg et al. (2022) revealed that the Swedish lunch program has a positive effect on various aspects of children's development, including children's educational attainment, health and lifetime income. Similarly, Gleason and Suitor (2003) showed that participation in the National School Lunch Program in the United States can increase children's nutrient intake of several key nutrients and enhances overall health. Many developing countries have also implemented school lunch programs, but they pay more attention to the effects on children themselves rather than intergenerational effects. To the best of my knowledge, no empirical studies attempt to investigate the effects of school meal programs on mother's labor supply. This paper aims to evaluate the effects of the one meal program in China and through this, to enrich our understanding of the broader impact of such programs on female labor force participation to contribute to filling this gap. Moreover, this paper also aims to contribute insights that could inform policy formulation and enhance the design and implementation of school meal programs.

In China, recent empirical studies show that since the 1990s, there has been a trend of declining in female labor supply[2]. According to the World Bank Statistics (2022), the female labor participation rate was 73.02% in 1990, and has gradually declined to 61.61% by 2021 (shown in Figure 1). There are several explanations for this phenomenon, including the changing family structure, the child care system after the economic and opening-up reform and social norms. To be more specific, Ke, Yuan, and Ping (2012) pointed out the role of parents' assistance in alleviating the female housework burden, particularly in non-nuclear families, which frees up females and allows them to have more available time for work in labor markets in the past decade. However, due to declines in intergenerational coresidence over the past two decades, more mothers have had to withdraw from the labor market and focus on domestic responsibilities, which could lead to a

[2] Labor force participation rate is the proportion of the population ages 15 and older that is economically active: all people who supply labor for the production of goods and services during a specified period.

more rapid decrease in female labor force participation in China. Additionally, since 1978, China has launched reform and opening-up, and is experiencing the transition from a centrally planned to a market economy, leading to a higher cost of living and more expensive commodities. Therefore, mothers often face a trade-off between income earnings and child rearing because informal care options remain insufficiently systematic and scarce, and formal care services can be financially unaffordable. As a result, female labor participation has declined (Du & Dong, 2010). Furthermore, when it comes to social norms, married women are more likely to stay in their households and not to enter the job market if their mothers-in-law are housewives (X. Chen & Ge, 2018). This adherence to traditional social norms also contributes to the reduction in the female labor participation rate. Hence, policymakers can strive to enhance the female workforce for long-term socioeconomic development and prosperity by understanding factors behind this social phenomenon.

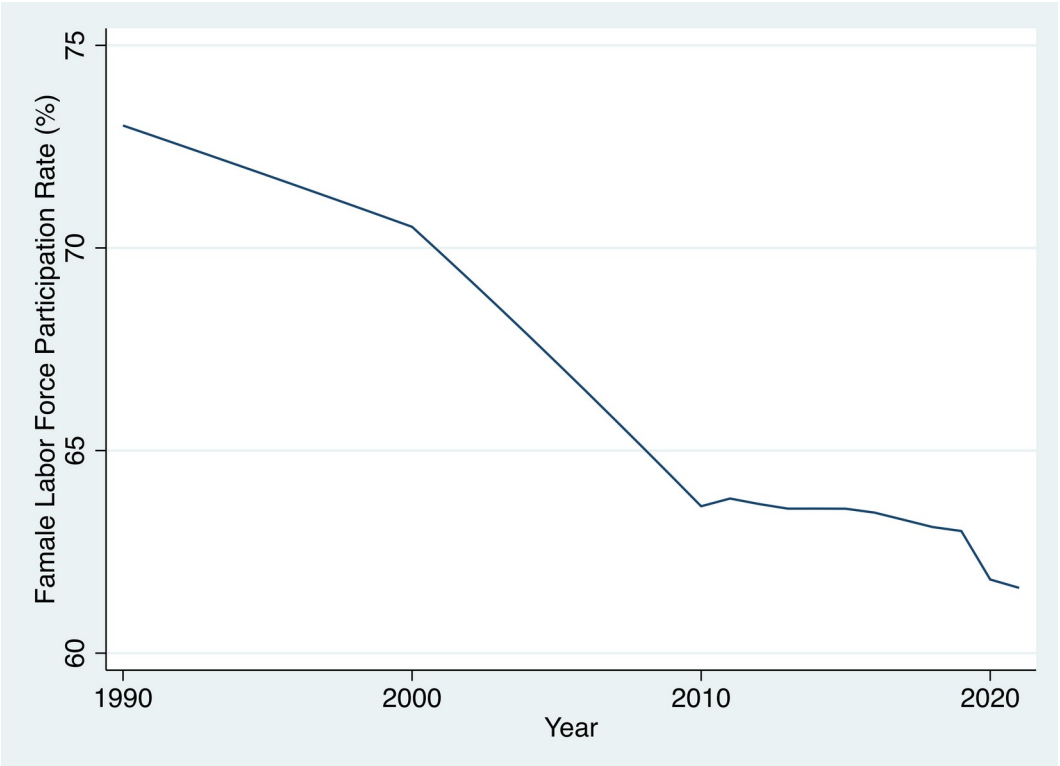

Figure 1 Female Labor Force Participation of China, 1990—2021
Source: The World Bank Statistics (1990-2021)

Female labor force participation is firmly associated with welfare for women themselves and also for the well-being of the next generation (Wu, 2022). The decision for mothers to engage in the labor market is influenced by a string of factors, including costs of child care, access to formal care and informal care, etc. For instance, Blau and Robins (1988) analyzed the data on child care cost and its impact on family labor supply, and found that the relationship is negative, which means that when the cost grows higher, a family is less inclined to purchase child care on the market. Gelbach (2002) estimated the effects of enrolling in public school for a woman's five-year-old on measures of labor supply and public assistance receipt and found that access to free public kindergartens can lead to a significant increase in single mother's labor supply in America.

Policy-driven reforms play a crucial role in encouraging women to participate in formal work activities and can help to reshape female labor force participation. Although there have already been many advances in formulating and implementing these policies, most existing studies focus on the relationship between child care and mother's labor supply when they evaluate the efficiency of child care programs covering the earlies period of childhood. For instance, Baker, Gruber, and Milligan (2008) studied the effects of subsidized childcare in Quebec in the late 1990s on mother's labor supply. They found that the impact on labor supply is highly significant.

However, there is a lack of evidence about the "middle" period in relation to a mother's labor supply. This "middle" period is one interval between early life and adulthood, during which children are exposed to school meal programs during their school years. Yet, much is less known about how these programs affect mother's performance in the job markets. Hence, it is necessary to investigate the effects of school meal programs on mother's labor supply to provide evidence and informed guidance for further policy-making.

Childhood malnutrition remains a primary public concern and has long-term consequences (Alderman, Hoddinott, & Kinsey, 2006). Governments are grappling with solving this problem and many are working to formulate policies to reduce ill-health among children and enhance their nutrition. Many countries provide children with school lunches via education systems at a low cost to improve children's nutrition. Most of these intervention reforms have begun to have effects. For example, according to the Ministry of Finance of People's Republic of China (PRC) (2021), implementation of the school meal program has yielded substantial improvements in the physical well-being and nutritional status of beneficiary students over the years. Specifically, these students' physical fitness pass rate has exhibited a remarkable increase, rising from 70.3% in 2012 to 86.7% in 2021. Moreover, the malnutrition rate has declined from 20.3% in 2012 to a mere 10.2%. Similarly, the rate of anemia also decreased from 19.2% in 2012 to 9.6% in 2021.[3]

China is committed to eradicating extreme poverty and began one school lunch program in 2011. This program aims to provide nutritious meals to children at schools. To evaluate the effectiveness of the school lunch program, my research question is whether there are spillover effects of this school lunch program on mother's labor performance. And if so, whether children being exposed to the school meal program improves mother's labor supply.

According to Dunlop's (2008) *Shark's Fin and Sichuan Pepper*, "Yet Chinese food was something different. ... The sheer variety of the food was dazzling" (Prologue. Page 7). Due to the complex diversity of ingredients different from other countries, moms in China's society usually play an important role in parenting and dedicate considerable time and efforts to food preparation for their children. Hence, if children are provided with meals at schools, more mothers

[3] Ministry of Finance of People's Republic of China (PRC). "*The Ministry of Finance issued 26.034 billion yuan to support the improvement of rural students' nutritional status*" 2021-09-30. Link: https://www.gov.cn/xinwen/2021-09/30/content_5640573.htm

might have more time to work in the job market and do not need to prepare food for their children.

This paper exploits China's Student Nutrition Improvement Program (SNIP) launched in 2011 to estimate the effects on mothers with young children, covering six-year elementary schools and three-year junior schools. To further accomplish this analysis, I have to figure out the factors that determine the adoption of SNIP in different counties. First, the central government chose 699 pilot poor counties in 2011. After the introduction of SNIP, 699 pilot counties listed by the central government had to implement SNIP in 2011. On the other hand, other counties were given greater autonomy in deciding whether to introduce this nutrition-related reform in the following years conditional on their socioeconomic characteristics and status. Hence, the degree of poverty within a region serves as one of the determinants. Second, the pilot counties receive financial support from the central government. In contrast, other counties rely on support from local government expenditure. Even some counties may not have been classified as impoverished, but if they have generous public spending, they are more likely to start the school meal program in response to the central government's call.

In the main analysis, I exploit the difference-in-differences (DID) strategy to estimate the effect on mother's working hours per week and employment status (work or not work) using data from the 2010-2018 waves of China Family Panel Studies (CFPS). The school meal program targets China's compulsory education, which includes six years of primary school and three years of junior high school. The total lasts nine years. Most children start their primary school at the age of six. Consequently, children aged between six and fifteen years old at the implementation of the program can be exposed to the school program principally. Additionally, children aged between sixteen and eighteen years old attend high schools and rely on families, similar to other age groups, but they do not join the school program. Individuals aged 18 years and above are excluded from the sample, as they tend to attain a level of independence from their parents and are

not likely to be comparable to other groups. Therefore, in the sample, I include mothers below 55 years with children aged 6—18 years.

This study contributes to several strands of the literature. First, much of research has studied the effects of government policies in the earliest phase of life whether during prenatal or postnatal periods. In terms of the effects of these policies on children, for example, Araujo, Carrillo, and Sampaio (2021) presented evidence that when mothers in Tanzania participated in an iodine supplementation program during pregnancy, their children are more likely to have more schooling years and higher income in adulthood. Barham, Macours, and Maluccio (2013) and Field, Robles, and Torero (2009) provided experimental evidence that children exposed to a 1000-day program in Nicaragua experience better cognitive developments. Effects of policy-driven programs on mothers are also well-established. (Fitzpatrick, 2010) investigated the effects of universal prekindergarten programs, which provide free preschool to all age-eligible children in the United States. She concluded that preschool enrollment has little effect on the labor supply of most women. Additionally, public childcare has been shown to be an essential early-intervention project. Different countries have different childcare subsidy policies, but the main aim is to reconcile work with care for the mothers of young children and increase their performance in the labor markets. Bauernschuster and Schlotter (2015) yielded positive effects of public child care on maternal employment in response to a marked increase in kindergarten attendance. Bettendorf, Jongen, and Muller (2015) found that child care subsidies can improve maternal working hours per week. However, there is limited evidence about the later phases of childhood and adolescence. Government-sponsored school meal programs focus on this “middle” period, and a substantial proportion of children can be exposed to these programs through the education system at a low cost (Lundborg et al., 2022). This paper examines the relationship between China’s nutritional program and mother’s labor supply.

China's meal program aims to provide qualified nutritious diets, targeting students from rural regions.

Second, this paper adds new evidence on the spillover effects of school meal programs. I am only aware of a few studies that examine the spillover effects of nutrition provided. Wang and Cheng (2022) showed that the implementation of one school meal program can significantly increase household investment in children's education, especially in-school education expenditure, which provides evidence about nutrition-related interventions on the allocation of financial resources. Third, almost every country has implemented school meal programs (Drake et al., 2017). The evaluation of these programs has attracted considerable interest among scholars. Less is known about how these programs affect in developing countries. This study relates to the literature on intergenerational effects of school meal programs—improved nutrition among children and mother's labor supply in the developing country, China in this case.

Launching this kind of program is pricy in terms of government spending. For example, Ralston, Newman, Clauson, Guthrie, and Buzby (2008) pointed out that governments face trade-offs between costs and returns. Therefore, evaluating programs is essential for policymakers.

The remainder of this paper is structured as follows. Section 2 describes recent studies about what children experienced shapes their future outcomes and the effects of policy-intervention programs on children and mothers. Section 3 introduces the SNIP institutional background and how it rolls out. Section 4 describes information about reform timings and the data. Section 5 presents the strategy design. Section 6 shows the empirical results. Section 7 conducts a series of robustness checks. Section 8 sums up the conclusions.

2. Literature Review

In this part, I will sort two strands of literature. One is how children's health/nutrition in the early and "middle" period of life course affects future outcomes, including the effects of negative shocks that children suffer and some intervention programs' evaluation. The second one is the effects of policy-driven programs on mother's labor supply.

First, it is believed that early health impacts every aspect of life and leads to future outcomes, including performance at schools, earning in the job markets, etc. Negative shocks include famine and severe weather. For example, Scholte, van den Berg, and Lindeboom (2015) explored the Dutch Hunger Winter famine and found that it has long-run negative effects of malnutrition in utero, labor market outcomes and hospitalization later in life. Rosales-Rueda (2018) showed empirical evidence about negative weather shocks and found that children are shorter than those who do not experience severe floods.

A large body of evidence shows that early-life interventions improve children's outcomes throughout the life course (Douglas Almond, Currie, & Duque, 2018). First, the nine months in utero are one of the most critical periods in a person's life, shaping future abilities and health trajectories (D. Almond & Currie, 2011). This is called the fetal origins hypothesis proposed by (Barker, 1990). It claimed that the intrauterine environment of the fetus has particular metabolic characteristics, which can lead to future disease. For example, von Hinke Kessler Scholder, Wehby, Lewis, and Zuccolo (2014) found that babies exposed to alcohol in utero have a negative relationship with child academic achievement. Bharadwaj, Gibson, Zivin, and Neilson (2017) estimated utero exposed to pollution can cause a decrease in test scores for children. Additionally, some countries unveiled reforms to eradicate disease and provide mothers with information about nutrition in parenting. For instance, Mexico introduced a malaria eradication program to improve children's health. Venkataramani (2012) evaluated this program and found that although children exposed to this program

can perform better at schools, this can not improve years of schooling. Linnemayr and Alderman (2011) explored one nutrition intervention program, targeting mothers with children aged less than five years old. This program provided mothers with nutritional knowledge about growth promotion and how to feed and supplement children micronutrients. However, they did not find this program has a strong effect. Conti, Heckman, and Pinto (2016) examined one program in the US that provided mothers with children aged 3-5 guidance of parenting skills, including a health care and nutritional part. They found that participants display good health and healthy behavior.

Additionally, child care program is one of the important intervention programs, targeting children aged below five. Since 2005, how human capital accumulation responds to the early childhood environment has sparked heated discussions in the field of economics (Currie & Almond, 2011). Havnes and Mogstad (2015) analyzed the effects of the child care programs in Norway and found differential effects across income of the family. Specifically, children in the lower class can benefit from this program and can make more money when they grow up, but those in the middle- and upper-class even experienced a loss in earnings. Havnes and Mogstad (2011) found that access to child care or preschool in Norway can have positive long-term effects on children's educational attainment and labor market participation. Bharadwaj, Løken, and Neilson (2013) compared health intervention program of Chile and Norway that aimed to provide low-weight neonates and infants with advanced health care at the hospitals and found that extra medical health care can lead to lower mortality rates and better educational attainment. They also explained that this result remains between countries. However, Andrew et al. (2019) examined the government's intervention in preschools in Colombia and found that preschools with significant extra funding hired more teaching assistants but did not improve child development.

Moreover, a number of studies examine the effects of nutrition provision in schools on children, but the effects are not conclusive. Especially when it comes

to short-term effects, research is almost well-established. Most studies show that school meal programs are beneficial for improving health outcomes. Specifically, Liu, Zhao, and Chen (2019) exploited a randomized controlled trial involving 6044 fourth and fifth graders in rural northwestern China and found that better nutrition can lead to better mental health. Neumann, Murphy, Gewa, Grillenberger, and Bwibo (2007) showed that one randomized controlled trial providing meat program conducted in Kenyan schools can increase in physical activity for children. Gundersen et al. (2012) used nonparametric partial identification methods to find out that exposure to free and reduced-price lunches in America improves the health outcomes of children. Nonetheless, Millimet, Tchernis, & Husain (2010) and Schanzenbach (2009) found that the school lunch program can lead to overweight. Leos-Urbel, Schwartz, Weinstein, and Corcoran (2013) exploited the breakfast program in New York and showed that it can only increase a little on academic outcomes.

Additionally, children exposed to the school meal program can lead to an increase in educational attainment. Anderson, Gallagher, and Ramirez Ritchie (2018) studied the sample that all children from public schools in Califia who were offered high quality of school meals can obtain high scores of state tests. Frisvold (2015) found that the availability of the breakfast program increases students' achievement in the USA. However, some studies show school meal programs have limited effects on student performance. For example, Imberman and Kugler (2014) discovered that the breakfast program in the USA does not have effects on test scores for children. McEwan (2013) found there are no effects of the program on school performance. Campbell, Nayga, Park, and Silva (2011) examined the school meals program in the US and found that it does not improve the dietary quality, including vitamin and mineral intakes. Norway is one of the earliest countries to start the school meal program. Illøkken, Øverby, Johannessen, and Vik (2021) exploited a free school meal program in Norway and suggested that no significant effects on children in many aspects, including behavioral

issues, self-efficacy and so on. They explained that they obtain inconsistent results compared with previous studies because of methodological issues, and they can not control for some things going on during the school year.

There are also few studies that analyze the long-term effects of school meal programs. Hinrichs (2010) estimated the National School Lunch Program implemented in United States. He found that the program has positive effects on health and makes participants obtain higher educational achievement. Bütikofer, Mølland, and Salvanes (2018) provided valid evidence that a free school breakfast program in Norway is beneficial. It improves education and earnings. Lundborg et al. (2022) studied a free lunch program in Sweden that all pupils can benefit from. They showed that the program affects positively on lifetime income, educational attainment and health. Fang and Zhu (2022) are the first to examine the long-term effects of the Student Nutrition Improvement Program in China. They found that the program has no effects on urban residents but students in rural areas can improve cognitive skills and educational outcomes. My article differs in that I estimate intergenerational effects to study how mother's labor supply is affected in labor markets.

Second, in the earlier phase of life, one strand of literature studies the relationship between neonatal and early childhood health care and the labor supply of mothers. The effects are mixed. Bharadwaj et al. (2013) made use of detailed administrative data to estimate whether providing infants extra medical care at birth can affect mortality rates and educational outcomes in the future. The empirical evidence showed that those children performed better in the schools, and there is a lower mortality rate. Besides, whether the mother's labor-supply response to child care costs differs with children's age has attracted researchers' attention. Ribar (1995) found that the lower the price is, the less family would pay for child care that can negatively employment. However, some papers find child care does not have significant effects on mother's labor supply. Since the reforms started in the mid-1990s, publicly subsidized child care programs have decreased,

and private care centers have increased. Li (2017) analyzed the data after this reform and found that kindergartens and paid nannies do not have effects on female labor supply, and grandparents' care do.

Besides, child development can affect mother's labor supply. For instance, Frijters, Johnston, Shah, and Shields (2009) found that poor child development can decrease females labor force participation. Berlinski and Galiani (2007) exploited a large-scale construction initiative aimed at establishing pre-primary school facilities in Argentina to estimate the effect on maternal employment. They found that this program implicitly provides childcare subsidy and increase maternal employment.

3. The China's School Lunch Reform

3.1 Background

To fight childhood malnutrition in poverty-stricken areas, some Chinese non-profit institutions launched some small-scale school meal programs (Fang & Zhu, 2022). However, it is not enough to solve malnutrition problems relying on these philanthropic groups. Hence, to comprehensively improve students' nutrient intake to improve health in rural areas and promote health equality, the Chinese government launched the SNIP in 2011. This program is a large-scale nutritional intervention program guided by the central government. It targets nine-year compulsory education students, and also plays an important role in poverty relief. The central government initially implemented the policy at 699 pilot counties, and encouraged local governments individually to expand more pilot areas based their own economic characteristics and government expenditure. These 699 pilot counties are given priority to start this program in 2011 and are granted funding to establish canteens and purchase by the central government[4]. Most of these pilot

[4] Ministry of Education of the People's Republic of China. "*China's Student Nutrition Improvement Program*" 2012-09-03. Link: http://www.moe.gov.cn/jyb_xwfb/moe_2082/s6236/s6811/201209/t20120903_141502.html

counties were in extreme poverty and are located in the western part of China when it launched the reform. However, some provinces including Shanghai, Zhejiang and etc introduced the nutritional intervention program in response to the central government's call although they have relatively high GDP. Yet even at these relatively rich provinces, they also mainly provide students in poverty or disadvantaged children. Besides, in terms of the expense of the lunch program implementation, if counties are on the pilots list unveiled by the central government, they are granted funding from the annual central government expenditure. Otherwise, the expense is supported by the local government expenditure.

Next, I will discuss how this reform was implemented detailedly. Governments subsidize schools to prepare lunches. The daily subsidy was three yuan (≈ 0.44 dollars) per student and rose to four yuan (≈ 0.58 dollars) in 2014 and now five yuan (≈ 0.73 dollars). When schools prepare for meals, they have to base on standard nutritional requirements, which could ensure that students take in nutritious meals. A typical lunch might include 150g of rice, 250g of spinach and 50g of meat, or could be modified to include other types of vegetables, milk, eggs and other cereals. The lunch includes nutrients such as high-quality proteins, essential minerals, and vitamins (Fang & Zhu, 2022). Before the school meal program initiative, students had to bring cold food from home to school because of long distance traveling, and even in some less-developed areas, students just can have meals twice per day. However, now they can have a healthy diet at schools and prevent malnutrition problems, which is helpful for their health and future outcomes.

Additionally, the central government also provides fiscal funding for schools to build canteens that serve meals. After canteens are built, schools generally recruit professional chefs and staff with the knowledge of how to make nutritionally balanced meals according to local customs. They also get relevant training to improve the quality of meals provided. Meanwhile, given that delivery

of school feeding often involves multiple administrative sectors, common policy frameworks and cross-sectoral coordination are required to achieve maximum benefit. Several local authorities, including county education bureaus and health commissions and so on, take responsibility of supervision and help make sure that the ingredients and raw materials for meals are fresh, and there are no hygienic problems about canteens and the process of cooking.

This meal program has been initiated for more than ten years. By the end of 2021, 350 million students benefit from this program according to the Ministry of Education[5]. As already mention in the introduction, physical health rate for rural areas students rose from 70.3% in 2012 to 86.7% in 2021[6], narrowing the gap to five percentage points compared to the average national health rate.

3.2 Rollout of the reform

This part discusses and analyses the reform timings associated with the school meal program in China, taking into account the economic indicators and financial support. This reform is guided by the Chinese central government, and the final reform timing of every county is determined by local governments according to local socioeconomic conditions. Hence, different counties might have various reform timings. First, one of the goals of this school meal program is to reduce inequality and alleviate poverty. Poverty can determine whether the counties started the SNIP earlier. According to the National Bureau of Statistics, China is administratively divided into four parts based on economic status.[7] Many

[5] People's Daily (People's Republic of China newspaper). "*Student Nutrition Improvement Program benefits 350 million rural students*". 2022-10-09. Link: https://www.gov.cn/xinwen/2022-10/09/content_5716750.htm

[6] Ministry of Finance. "*The Ministry of Finance issued 26.034 billion yuan to support the improvement of rural students' nutritional status*" 2021-09-30. Link: https://www.gov.cn/xinwen/2021-09/30/content_5640573.htm

[7] National Bureau of Statistics of China. "*Solutions to divide East, West, Central and Northeast regions*". 2011-06-13. Link: http://www.stats.gov.cn/zt_18555/zthd/sjtjr/dejtjkfr/tjkp/202302/t20230216_1909741.htm
Eastern region includes 10 provinces (municipalities): Beijing, Tianjin, Hebei, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong and Hainan.

economic and human development indicators are lower in the western region, compared to the eastern region. The Panel A of Table 1 shows the average GDP across four regional parts in the five years of pretreatment year (2011), which indicates that the western parts are always lower than the middle part, eastern and northeastern parts; the northeastern part lower than middle part and eastern parts; middle part lower than the eastern part whether in every year. This means that western part performs worse than the other three parts in economics. Therefore, most counties in the west started this school meal program earlier than those located in other parts. Second, government expenditure is an important factor that influences the adoption of the school meal program in different counties. For poor pilot counties, the program was funded by the central government initially. Other counties also can initiate this school meal program according to their economic characteristics. The only difference is their financial sources, which are from the central government or the local. Therefore, even though the central government did not support some provinces and they had generous government expenditure, they still could implement the program. The Panel B of Table 1 shows the average of government expenditure in the eastern part is higher than the other three parts. That could explain why some rich provinces like Zhejiang and Shanghai also launched the program very early.

Table 1
Average GDP and government expenditure of eastern, middle, northeastern and western parts

Variable	2006	2007	2008	2009	2010
Panel A GDP				Unit: 100 million yuan	
East	12919.76	15402.97	18041.66	19667.44	23203.07
Middle	7246.76	8828.51	10673.42	11762.93	14351.56
Northeast	6597.15	7851.00	9469.68	10359.41	12497.82

Central region includes 6 provinces: Shanxi, Anhui, Jiangxi, Henan, Hubei and Hunan.
Western region includes 12 provinces (autonomous regions, municipalities): Inner Mongolia, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, Tibet, Shaanxi, Gansu, Qinghai, Ningxia and Xinjiang.
Northeastern region includes 3 provinces: Liaoning, Jilin, Heilongjiang.

West	3362.14	4098.54	5037.31	5581.12	6784.04
Panel B Government Expenditure				Unit:10 thousand yuan	
East	1359.10	1694.99	2073.76	2495.15	3018.22
Middle	1017.31	1283.96	1644.89	2078.85	2510.38
Northeast	1036.54	1278.44	1625.29	2013.11	2412.11
West	635.57	820.86	1147.14	1465.01	1783.63

Since the adoption of year for every county is not random, I need to further explore which factors can affect it. To analyze further on the timing of the rollout since 2011, I use data on county characteristics for the years before the program started, taken from the county, municipal and provincial statistical yearbooks. In the Table 2, I regress year of adoption on GDP per capita, government expenditure in 2010 (one year before the program implementation) at the county level, and geographical indicators. The variables measuring GDP are intended to roughly capture the poor extent. Poorer areas are more likely to be listed by the central government and started the school meal program earlier, which aimed to reduce inequality between rural and urban areas. The geographical indicators categorize provinces into four different parts of China and are intended to roughly capture the differences across areas.

Column (1) shows that per capita GDP, one of the predictors, has a significant relationship with the year of adoption. The coefficient is negative, which means places with lower GDP per capita started the school meal program earlier compared to other places. Column (2) adds the indicators capturing the government expenditure to the regression. The coefficients are not significant, but the R-square of the regression is very low, at 0.03. There might be other variables influencing reform timings that have not been accounted for in the regression. Therefore, I add the geographical indicators to the regression to address this concern. The result is shown in the column (3). The baseline group is places located in the western part of China. The coefficients show that counties in the western region introduced the reform significantly earlier than the other three parts. Additionally, the coefficient for government expenditure is significant at the

5% level, indicating that government expenditure played a role in influencing the reform timings. All correspond to the trends about how the governments implemented.

Table 2
Relationship between adoption of year and county pretreatment characteristics

	(1)	(2)	(3)
GDP per capita	-0.0710**	-0.0010	-0.0183
	(0.0343)	(0.0756)	(0.0621)
Log (government expenditure)		-0.4106	-0.8382**
		(0.3889)	(0.4088)
Northeast			6.9033***
			(0.3957)
Middle			1.2964*
			(0.7698)
East			2.4356***
			(0.7988)
Constants	2013.2524***	2017.9867***	2021.8070***
	(0.3605)	(4.5477)	(4.6744)
N	73	71	71
R-squared	0.02	0.03	0.44

Notes: Columns 1–3 show estimates of the relationship between counties characteristics in 2010 and year of adoption of the school lunch program. All explanatory variables are measured in 2010. See text for details. Robust standard errors shown in parentheses. Significance levels: *** $p<0.01$, ** $p<0.05$, * $p<0.1$

The results show that the timing of the reform is mainly related to GDP per capita, government expenditure and geography. Therefore, in the methodological part, I also control county characteristics in the equation to ensure that the estimates are valid.

4. Data

4.1 Statistical Yearbooks

At first, I undertook an extensive data collection process about the economic characteristics of counties from the National Statistical Yearbooks between 2006 and 2010 to show the key differences at the macroeconomics level among eastern, middle, northeastern and western regions of China. These economic characteristics cover GDP and government expenditure related to whether counties started the school meal program earlier. This data information presents the overall picture of China's basic socioeconomic status across regions. Of the 23 provinces and 5 autonomous regions excluding 2 special administrative regions, China's western part performs worse in GDP than the other three parts in economic development and has less government expenditure.

Additionally, in the specification methodology, I control GDP per capita and government expenditure of every county because there are some economic disparities to affect labor markets. All of these variables are collected from local statistical yearbooks.

4.2 Reform timings

The important variable is the adoption year of the school meal program across counties. To obtain this information, I rely on official implementation announcements of every county issued by the government on their official websites, and reform timings are mostly extracted from those announcements. There are approximately dozens of these websites, which are publicly available. In terms of implementation timings that have not yet been made public by governments, I also contacted local education authorities to confirm and ensure the accuracy of our data. In the dataset, the CFPS covered 162 counties, and 84 counties adopted the SNIP program (shown in Figure 2) by 2021[8]. Figure 2 shows

[8] Due to data confidentiality, I can not specify names of every county and draw one implementation map.

the most treated counties started implementing the SNIP program in 2012 and then some counties gradually joined this school meal program. Of these 84 treated counties, 37 counties are located in the west, 34 in the east; 13 in the middle part of China. The number of adopted counties between the west and the east is similar because some rich areas in the east, such as Zhejiang Province and Shanghai, still implemented the program and they have generous public expending. Concisely, in these rich areas, the school meals are still only provided with poor family or migrants from rural areas instead of rich families. In the figure 2, the vertical axis refers to the number of counties that adopted SNIP in a particular year, and the horizontal axis indicates the implementation year. Every pilot county is not chosen randomly. The central government prioritize poorer regions, and then they launched the program earlier.

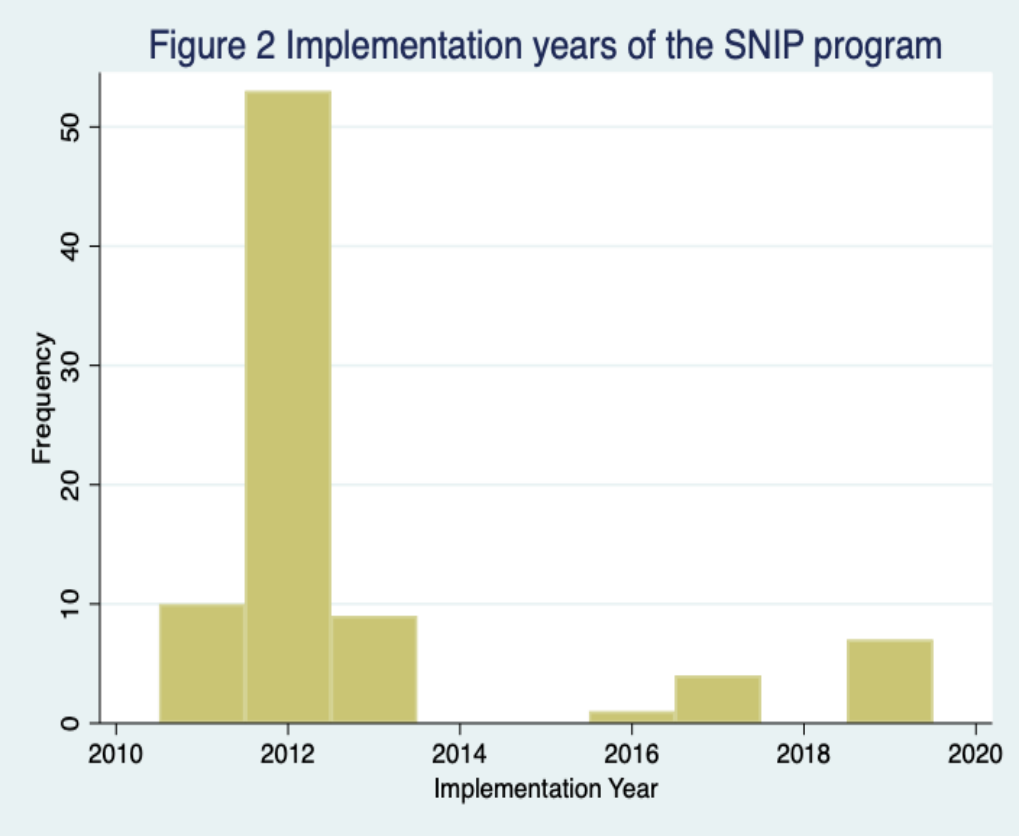

Figure 2 Reform timings

Source: Official implementation announcements from governments official websites

4.3 China Family Panel Studies (CFPS)

To examine the spillover effects of the SNIP program on mother's labor supply, I rely primarily on the CFPS. It, launched by Peking University, is an ongoing, nearly nationwide, comprehensive, longitudinal social survey. It starts from 2010 and has a follow-up interview every two years. The team surveyed in 25 provinces with a sample size of 8438 households. CFPS collects comprehensive information on household and individual economic, demographic, and social characteristics, and individual nutrition intake and health status in the surveyed provinces. The cross-sectional response rate in each wave is approximately 81–84 percent at the individual level. The CFPS collects data on all genetic family members whether they are at home or have left home for study, work, marriage, or other reasons. For those family members who are hard to reach for face-to-face interviews, the CFPS carries out remote interviews whenever possible. If remote interviews can not work, or some members can not be contacted by any means, they will be represented by one of the persons in the household. Thus, the sample attrition rate among migrants is not large (Xie & Hu, 2014). Over the years, the CFPS has successfully conducted multiple waves of panel surveys and provided an extensive longitudinal dataset capturing changes and developments within households over time. To date, the paper uses five waves of panel surveys conducted in the years 2010, 2012, 2014, 2016, and 2018, which allowing for an analysis of the effects of the school meal program on mother's labor supply.

I connect every county's reform timing data to individual data from CFPS to obtain aggregate data information. In the analysis, I use mother's number of hours worked per week or employment status as outcome variables to measure their labor supply. The key independent variable is a dummy variable, indicating whether the county adopts the school meal program in the staggered DID regression or whether the youngest child are exposed to the SNIP program in

cohort DID estimation. Specifically, if the value of the dummy variable equals one, that means that survey year is bigger than implementation year or when the SNIP was adopted in the county, the youngest child is below 16 years old.

5 Empirical methodology

5.1 Staggered DID approach

5.1.1 Sample selection

In the main analysis, I use the five waves to estimate the effects of SNIP on mother's labor supply, covering from 2010 to 2018. The final data limits mothers under 55 years old with children aged between 6 and 18 years old. This selection criterion is based on the retirement age for females in China, which is generally 55 years old. When females are above this age, they are more likely to withdraw from the job market and not be considered part of the labor force. Therefore, I exclude mothers aged over 55. In terms of children chosen, I include children aged between 6 and 18 years, considering that these age groups are exposed to the school meal program or might live at home even though they are not eligible for the program when studying at senior high schools.

Table 3 shows the summary statistics of the staggered DID sample. These characteristics mainly follow the strand of literature and research setting. The average mother's age is around 40 years old, and the schooling years are around 7 years. In terms of the log of weekly working hours, the mean is 3.6. Regarding the "siblings" variable, although China introduced the one-child policy in 1979, this policy was gradually abolished from 2013. However, the school meal program started to launch in 2011 and there is an overlapping period. Additionally, I consider most implemented counties are located in poor areas, especially in some minority areas. One-child policy does not apply to these areas and they generally have one more child. In my dataset, CFPS collected data from some counties that are poor and full of minorities. Therefore, I decide to control for "siblings" in the empirical equation.

Table 3
Summary statistics for staggered DID sample

Variables	Obs	Mean	SD	Min	Max
Log(weekly working hours)	5131	3.678	0.759	-2.303	5.124
Mother's schooling years	5131	7.251	4.483	0	22
Mother's age	5131	39.679	5.665	22	55
Spouse's age	5131	41.491	5.935	23	80
Spouse's schooling years	5131	8.502	3.869	0	19
Family size	5131	4.554	1.541	1	21
Family income	5131	65740.316	106864.06	0	3300000
Children's gender	5131	0.619	0.486	0	1
Children's age	5131	11.898	3.769	6	18
Siblings	5131	0.792	0.83	0	8
GDP per capita	5131	4.706	4.935	0.316	36.875
Log(government expenditure)	5131	12.5	0.948	10.185	16.385

Notes: The table shows summary statistics for the staggered DID sample at the individual and county level. See text for details.

5.1.2 Regression equation

Given that the school lunch program has been introduced gradually from 2011 in different counties, I use 2010-2018 waves and apply a staggered difference-in-differences (DID) strategy to evaluate the effects of exposure to the SNIP on mother's labor supply. This method estimates the effects of a reform by comparing the change in outcomes of the treatment group before and after the reform, using the change in outcomes of a control group to control for common time effects. My treatment group consists of mothers with children influenced by

the school meal program. The key identifying assumption of this DID methodology is that the treatment and control group follow the same employment trends in the absence of the treatment. In other words, the differences between mothers with children exposed to the school meal program and those with children not exposed to the program would be constant over time in the absence of the SNIP reform. The program is implemented gradually in treated counties, so I use event history specifications to test parallel trends assumption, allowing leads and lags around the reform to have different coefficients.

Meanwhile, besides controlling variables at the individual level, I also control economic indicators at the county level, including GDP per capita and government expenditure in order to avoid obtaining the spurious estimates. I compare mother's weekly working hours with children exposed to the SNIP to those with children who do not experience the SNIP. Following previous studies, I regress the following equation on individual characteristics (X_i) and economic indicators at the county level (Γ_c):

$$Y_{ict} = \beta_0 + \beta_1 Treat_{ct} + \beta_2 X_i + \beta_3 \Gamma_{ct} + u_c + \lambda_t + \epsilon_{ict} \qquad (1)$$

where i, t and c denote individual, survey year and county, respectively. I use the mother's number of hours worked per week or employment status to measure mother's labor supply. *Treat* is a dummy variable, denoting whether the county implements the school meal program by the time of the survey. u_c are county fixed effects, which absorb all time-invariant county-level characteristics. λ_t are survey year fixed effects.

5.2 Cohort DID approach

As an alternative empirical strategy, I use data of 2018 wave and apply a cohort DID strategy. In this method specification, I change the treatment group to evaluate the effects of children's exposure to the SNIP on mother's labor supply so that the results can be more robust. Specifically, this strategy differs slightly

from the traditional DID but has been widely adopted in previous studies (Yi Chen, Fan, Gu, & Zhou, 2020; Y. Chen & Zhou, 2007; Cheng & Zhang 2011; Duflo, 2001; Fang & Zhu, 2022). This DID method builds on two sources of variation. First, treated counties did not implement the SNIP at the same time, and they gradually joined the program. Therefore, this way to implement can lead to variations across reform timings. Second, within the same county, children from different cohorts were exposed differently because that depends on whether their schooling years and the SNIP overlapped simultaneously. The validity of this DID estimate also relies on the parallel trend assumption. Specifically, mother's employment trends with different cohorts would be similar over time in the absence of the SNIP reform. I make the following assumption: without the school meal program, the changes in average outcomes among different cohorts within counties that implemented the reform would have been the same as the changes for those residing in the same counties but who are not exposed to the reform.

Now I turn to sample selection, and it is slightly different from the sample of the staggered DID. China's compulsory education comprises six years of primary schooling followed by three years of junior high school. Most children start their primary school at the age of six. Therefore, when the SNIP was implemented in the county, children under 16 years old were affected by the school meal program. Therefore, I restrict the sample to the treatment group that covers mothers under 55 years old with the youngest child aged between 6—15 years old when the reform is implemented. As a control group, I use mothers with the youngest child aged between 16—18 years old. This control group is chosen because children aged 16—18 years old typically attend senior high schools and might live at home but not be exposed to SNIP. I compare weekly working hours or employment status for those mothers with a youngest child with early childhood exposure to the SNIP in their county to those born earlier (and therefore without childhood exposure to the school meal program). Summary statistics are shown in Table 4. The averages of all values are similar to the staggered DID sample —mother's

age, around 40 years old; the schooling years, around 7 years and the log of weekly working hours, 3.6.

Table 4
Summary statistics (CFPS 2018)

Variables	Obs	Mean	SD	Min	Max
Log(weekly working hours)	799	3.621	0.83	-2.303	5.124
Mother's schooling years	799	7.035	4.575	0	19
Mother's age	799	40.303	6.033	23	55
Spouse's age	799	42.319	6.049	23	65
Spouse's schooling years	799	8.378	3.952	0	19
Family size	799	4.821	1.6	1	21
Family income	799	90782.875	110532.37	0	1409800
Children's gender	799	0.607	0.489	0	1
Children's age	799	11.658	3.741	6	18
Siblings	799	0.927	0.741	0	5
GDP per capita	799	4.246	4.691	0.68	36.875
Log(government expenditure)	799	12.826	0.903	11.274	16.385

Notes: The table shows summary statistics for the cohort DID sample at the individual and county level. See text for details.

Following previous studies, I regress the following equation on individual characteristics (X_i):

$$Y_{igc} = \beta_0 + \beta_1 Exposure_{ic} + \beta_2 X_i + \Gamma_c + u_g + \lambda_c + \epsilon_{igc} \quad (2)$$

where $i, g$and $c$denote individual, cohort and county, respectively. As in the previous staggered DID analysis, I still use mother's number of hours worked per

week to measure mother's labor supply. *Exposure* is a measure of early exposure to the SNIP. It is a dummy variable, indicating that an individual was not more than 15 years old when the SNIP was adopted in the county. Γ_c covers a range of economic variables at the county level in 2018. λ_c are municipality fixed effects, which absorb all time-invariant city-level characteristics. u_g are cohort fixed effects, which absorb unobservable cohort heterogeneous effects.

6 Results

6.1 Results from a staggered difference-in-differences framework

Providing lunches at school may alleviate the need for mothers to prepare lunches at home for their children. Consequently, mothers can dedicate more time to the job market. Table 5 shows estimates of one staggered DID about how the school meal program affects mother's weekly working hours in the job market. I gradually add municipality and survey year fixed effects. The column (1) does not control any fixed effects, which might bias my estimates downward. The coefficient is positive but not significant, but it still corresponds to economic intuition. The magnitude of coefficients of column (3) and column (4) remains similar except for controlling municipality fixed effects in the column (4). Both coefficients are around 0.90. Specifically, in the column (3), I control for year fixed effects and the result shows children exposed to SNIP can lead to a 9.4% increase in their mother's working hours at the 5% significance level. In the column (4), I add fixed effects at the municipal level to capture more unobservable factors compared to column (3). The result shows that the relationship between weekly working hours and exposure to the school meal program is positive and statistically significant. Children exposed to SNIP can increase by 9.2% in their mother's working hours at the 5% significance level.

Table 5
Staggered DID estimates for mother's working hours per week

	(1)	(2)	(3)	(4)
Treat	0.030	0.006	0.094**	0.092**
	(0.038)	(0.041)	(0.040)	(0.040)
Mother's schooling years	0.006	0.008**	0.006	0.007*
	(0.004)	(0.004)	(0.004)	(0.004)
Mother's age	-0.021***	-0.009**	-0.019***	-0.009**
	(0.005)	(0.004)	(0.005)	(0.004)
Spouse's age	0.003	-0.003	0.005	-0.001
	(0.004)	(0.003)	(0.004)	(0.003)
Spouse's schooling years	0.000	0.001	-0.001	0.000
	(0.004)	(0.004)	(0.004)	(0.004)
Family size	-0.012	-0.001	-0.008	0.001
	(0.010)	(0.009)	(0.010)	(0.009)
Family income	0.000**	0.000**	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Children's gender	0.003	0.014	0.007	0.012
	(0.023)	(0.022)	(0.022)	(0.022)
Siblings	0.016***	0.009**	0.011**	0.007*
	(0.005)	(0.004)	(0.005)	(0.004)
Children's age	0.007	0.008	0.008	0.008
	(0.024)	(0.026)	(0.023)	(0.025)
GDP per capita	0.009**	0.003	0.005	0.004
	(0.004)	(0.003)	(0.004)	(0.003)
Log(government expenditure)	-0.053*	-0.124***	-0.018	0.032
	(0.030)	(0.030)	(0.025)	(0.022)
Constants	4.814***	5.516***	4.213***	3.473***
	(0.392)	(0.377)	(0.338)	(0.312)
Survey year FE	No	No	Yes	Yes
Municipality FE	No	Yes	No	Yes

N	5131	5131	5131	5131
R-squared	0.021	0.099	0.052	0.122

Notes: Standard errors are clustered at the county level and given in parentheses. Significant levels: ***p¿0.01, **p¿0.05, * p¿0.1.

In order to attain valid DID coefficients, it is necessary to satisfy the parallel trends assumption. Specifically, the differences between treatment and control groups would be similar over time in the absence of the SNIP reform. A common concern is that the DID estimates might confound the dynamic effects of the SNIP program with pre-existing differences in time trends across treated and untreated counties. I adopt a fully flexible event-analysis model to tackle this issue. The equation takes the following form:

$$Y_{i,t} = \beta_0 + \sum_{k=-4}^{s=6} D_{i,t}^{m} \beta_m + \square_1 X_{i,t} + \square_2 \Gamma_{ct} + \square_i + \lambda_t + \epsilon_{i,t} \qquad (3)$$

where $D_{i,t}^{m}$ is a dummy variable that refers to mothers with children exposed to the program when the reform is implemented. I replaced the year gap before the implementation of the SNIP reform more than four years to four when I analyzed the data, and more than six years after the treatment to six years. This allows me to capture the dynamic effects of the program on mother's labor supply over time. The remaining variables are defined in Equation (1). The omitted baseline group is mothers with children residing in untreated counties. Figure 3 plots the estimated coefficients β_m from Equation (2) as well as the 95% confidence interval. The variable on the horizontal axis is the year gap relative to the adoption of year. I do not observe any clear trends of the estimated exposure effects for the mothers except the coefficient of 4 years before the treatment. It is slightly significant. Overall, the estimated differences between non-exposed group and the baseline group are small and statistically not significantly different from zero.

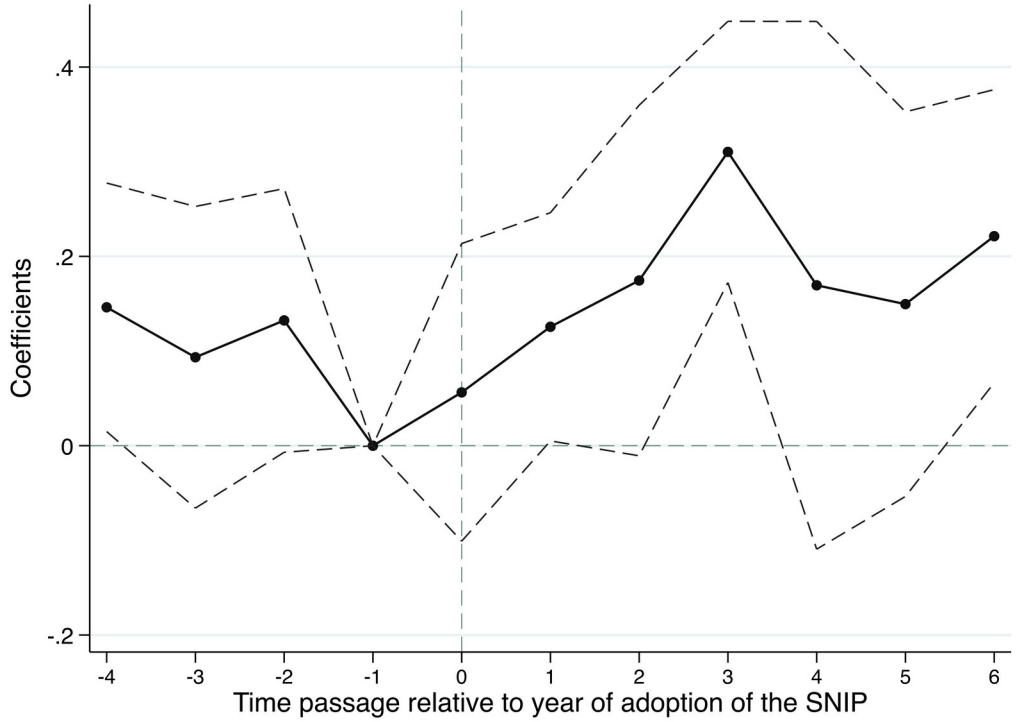

Figure 3
Event analysis for staggered DID estimates

In the following analysis, I examine the employment status of mothers as the outcome variable and run regressions based on Equation (3). The results are shown in the Table 6, where I also gradually add municipality and survey year fixed effects, similar to the previous analysis in the Table 5. All the coefficients of columns (1)-(4) are positive but not statistically significant, indicating that children exposed to the school meal program do not affect mother's employment status.

Table 6
Staggered DID estimates for mother's employment status

	(1)	(2)	(3)	(4)
Treat	0.022	0.027	0.021	0.020

	(0.018)	(0.032)	(0.018)	(0.033)
Mother's schooling years	-0.001	0.001	-0.001	0.001
	(0.002)	(0.002)	(0.002)	(0.002)
Mother's age	0.005***	0.004**	0.005***	0.004**
	(0.002)	(0.002)	(0.002)	(0.002)
Spouse's age	-0.005***	-0.005**	-0.006***	-0.005***
	(0.002)	(0.002)	(0.002)	(0.002)
Spouse's schooling years	0.002	0.001	0.002	0.001
	(0.002)	(0.002)	(0.002)	(0.002)
Family size	-0.000	-0.004	-0.000	-0.004
	(0.004)	(0.003)	(0.003)	(0.003)
Family income	0.000	0.000*	0.000	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)
Children's gender	0.016	0.006	0.015	0.006
	(0.010)	(0.009)	(0.010)	(0.009)
Siblings	0.002	0.003	0.002	0.003*
	(0.002)	(0.002)	(0.002)	(0.002)
Children's age	0.012	0.017**	0.012	0.018**
	(0.011)	(0.008)	(0.011)	(0.009)
GDP per capita	-0.001	0.002	-0.001	0.002
	(0.002)	(0.002)	(0.002)	(0.002)
Log(government expenditure)	-0.004	-0.011	-0.007	-0.020
	(0.014)	(0.013)	(0.014)	(0.017)
Constants	0.882***	0.956***	0.929***	1.083***
	(0.189)	(0.168)	(0.196)	(0.230)
Survey year FE	No	No	Yes	Yes
Municipality FE	No	Yes	No	Yes
N	7073	7073	7073	7073
R-squared	0.007	0.086	0.008	0.087

Notes: Standard errors are clustered at the county level and given in parentheses. Significant levels: ***p¿0.01, **p¿0.05, * p¿0.1.

In conclusion, the results indicate that children exposed to the school meal program can lead to an increase of approximately 9% in their mother's working hours at the significance 5% level. However, the program does not have a significant effect on mother's employment status. A plausible explanation for this observation could be that the school meal program enables mothers to allocate less time to food preparation, allowing them not to withdraw from the job market but to work longer in the job market.

6.2 Results from a cohort difference-in-differences framework

Table 7 presents the estimates from the specification (3). I measure early exposure to the SNIP by an indicator for being exposed to the reform below age 16. Columns (1)-(4) show that the introduction of the SNIP significantly improve mother's weekly working hours, regardless of whether cohort fixed effects and municipality fixed effects are controlled for or not. The estimated coefficient in column (1) indicates that for mothers with the youngest child, being exposed to the SNIP in childhood can significantly work longer in the job market when no fixed effects are included in the regression. Compared with column (1), the coefficients of column (2)-(4) are downward. In columns (2)-(4), the regressions are run with only cohort fixed effects, municipality fixed effects or both. The coefficients are 0.638, 0.495 and 0.453, respectively. One possible explanation for this downward is the sample selection issue. Migration during compulsory school age may imply that respondents are assigned to the treatment group even if they should not be and vice versa (Fang & Zhu, 2022). Considering the result in column (4) with capturing more unobserved variables, the estimated coefficient indicates that for an average child, being exposed to the SNIP in childhood increased mother's weekly working hours by 45.3 percent.

Table 7
Cohort estimates for mother's working hours per week

	(1)	(2)	(3)	(4)

Exposure	0.643**	0.638**	0.495*	0.453*
	(0.254)	(0.249)	(0.271)	(0.260)
Mother's schooling years	0.010	0.010	0.010	0.010
	(0.009)	(0.009)	(0.011)	(0.012)
Mother's age	-0.005	-0.005	0.007	0.009
	(0.010)	(0.009)	(0.010)	(0.009)
Spouse's age	0.007	0.008	-0.004	-0.001
	(0.008)	(0.009)	(0.008)	(0.009)
Spouse's schooling years	-0.002	-0.002	0.001	0.001
	(0.010)	(0.010)	(0.010)	(0.011)
Family size	-0.001	-0.003	-0.007	-0.012
	(0.018)	(0.019)	(0.016)	(0.018)
Family income	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Children's gender	0.044	0.051	0.036	0.045
	(0.061)	(0.062)	(0.062)	(0.063)
Siblings	-0.071	-0.068	-0.073	-0.078
	(0.058)	(0.060)	(0.062)	(0.064)
GDP per capita	0.007	0.007	0.002	0.001
	(0.008)	(0.008)	(0.003)	(0.003)
Log(government expenditure)	-0.024	-0.021	-0.015	-0.007
	(0.056)	(0.057)	(0.041)	(0.043)
Constants	3.174***	3.097***	3.213***	3.007***
	(0.723)	(0.765)	(0.578)	(0.640)
Cohort FE	No	Yes	No	Yes
Municipality FE	No	No	Yes	Yes
N	799	799	799	799
R-squared	0.032	0.038	0.157	0.163

Notes: Standard errors are clustered at the county level and given in parentheses. Significant levels: ***p¿0.01, **p¿0.05, * p¿0.1.

For the cohort DID, the validity of the estimates still relies on the parallel trends assumption. In the empirical strategy, I make an assumption that different cohorts would be similar over time in the absence of the SNIP reform. The pre-trends can be examined by the following equation:

$$Y_{igc} = \beta_0 + \sum_{k=6}^{17} Exposure_{agek} \beta_k + \beta_2 X_i + u_g + \lambda_c + \epsilon_{igc} \qquad (4)$$

where $Exposure_{agek}$ is a dummy variable that refers to the youngest child's age was k years old when the reform is implemented. Other variables are defined as same as in Equation (2). This specification allows us to examine the relationship between age at initial rollout and future outcomes in a nonparametric way. The omitted baseline group is mothers with the youngest child aged more than 17 years old at the implementation of the SNIP, because this group generally has graduated from high schools and go to universities. Therefore, they do not live at home and constrain mother's working hours. Figure 3 plots the estimated coefficients β_k from Equation (4) as well as the 95% confidence interval. The variable on the horizontal axis is the age of the youngest child when the reform was adopted in the county. The graph illustrates the inverse of a typical event study graph, as the treatment (exposure to the SNIP) increases when moving from the right side (treated in later life) to the left side (treated in early life). Therefore, the estimated coefficient β_k tells us the difference in the mother's weekly working hours of the group exposed to the SNIP reform at age k relative to the baseline group.

I learn two important facts from the fully flexible estimates. First, I do not observe any clear trends in the estimated exposure effects for the cohorts aged above 16. These cohorts had already completed nine-year compulsory education when the counties introduced the reform. Therefore, they could not benefit from the school meal program. Second, Figure 4 shows that the effects are statistically significant when children aged between 6 years old and 11 years old. The effects are aligned with the results of the identification strategy that mothers with

children exposed to the school program can increase their working hours per week. However, the coefficients are not significant since the children aged above 11 years old despite their exposure to the school meal program. The estimated differences between this exposed and the baseline group are not significantly different from zero. There are two plausible explanations for this observation. First, most treated counties are characterized as economically disadvantaged areas. Children's homes are distant from junior high schools. At the age of 12, students generally start their junior high schools. They are more likely to live in dormitories instead of distant homes. Therefore, mothers with children aged above 12 are not significantly affected by the school meal program since they do not need to prepare meals when their children live in dormitories. Second, children aged 12 and 15 years old were exposed to the school meal program for less than three years. Considering the policy has lagged effects, by the time this program started making effects on children, those children already are not eligible for this program. Hence, we can see the coefficients for children aged between 12 and 15 at the implementation of the SNIP are not significant.

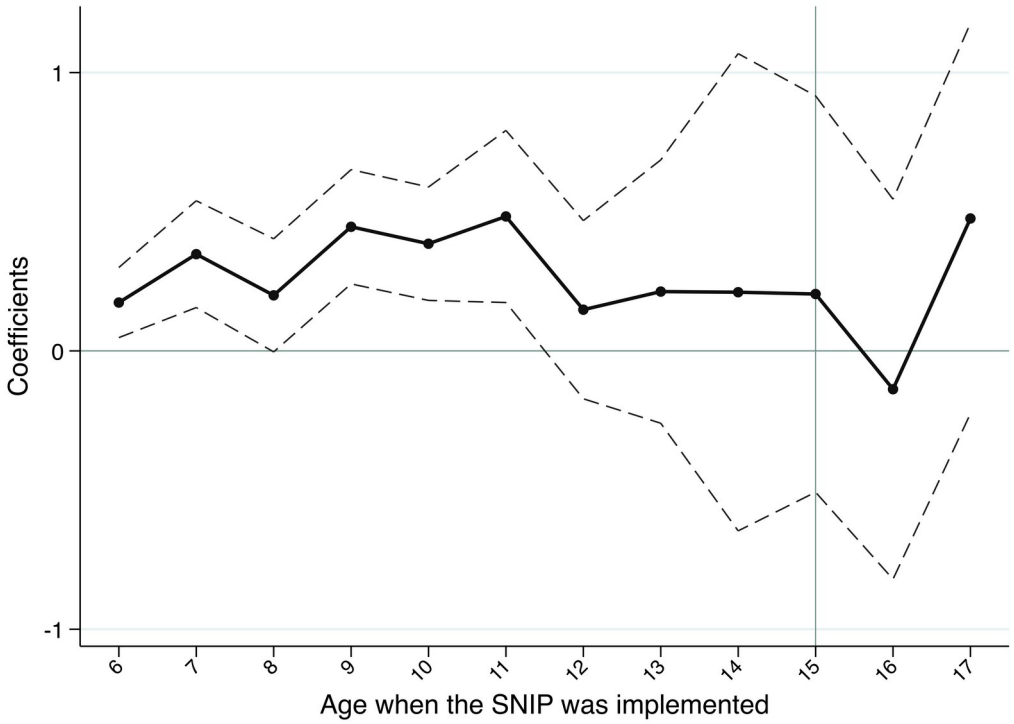

Figure 4
Event analysis for cohort DID estimates

Following the same logic as the staggered DID estimates, here I also examine how the school meal program affects the employment status of mothers based on Equation (4). The results are shown in Table 8. The results are consistent with Table 5 obtained through the staggered DID estimation. All the coefficients of columns (1)-(4) are positive but not statistically significant, indicating that children exposed to the school meal program do not affect mother's employment status. Overall, these findings provide evidence that the school meal program mainly influences mother's weekly working hours rather than their employment status.

Table 8
Cohort estimates for mother's employment status

	(1)	(2)	(3)	(4)
Exposure	0.042	0.052	0.047	0.056
	(0.087)	(0.092)	(0.092)	(0.104)
Mother's schooling years	-0.000	-0.000	0.000	0.001
	(0.004)	(0.003)	(0.003)	(0.003)
Mother's age	0.002	0.002	0.002	0.001
	(0.003)	(0.003)	(0.003)	(0.003)
Spouse's age	-0.001	-0.002	-0.002	-0.002
	(0.003)	(0.004)	(0.004)	(0.004)
Spouse's schooling years	0.000	0.000	0.000	0.000
	(0.004)	(0.004)	(0.004)	(0.004)
Family size	-0.007	-0.006	-0.010	-0.009
	(0.010)	(0.010)	(0.008)	(0.008)
Family income	0.000**	0.000**	0.000**	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)
Children's gender	-0.017	-0.019	-0.032	-0.033*
	(0.018)	(0.019)	(0.020)	(0.020)
Siblings	0.022	0.023	0.027	0.030
	(0.018)	(0.018)	(0.018)	(0.019)
GDP per capita	0.003	0.003	0.004**	0.005**
	(0.003)	(0.003)	(0.002)	(0.002)
Log(government expenditure)	-0.001	-0.004	0.007	0.006
	(0.019)	(0.020)	(0.025)	(0.029)
Constants	0.821***	0.897***	0.735**	0.808*
	(0.272)	(0.283)	(0.364)	(0.426)
Cohort FE	No	Yes	No	Yes
Municipality FE	No	No	Yes	Yes
N	942	942	942	942
R-squared	0.009	0.016	0.163	0.172

Notes: Standard errors are clustered at the county level and given in parentheses. Significant levels: ***p¿0.01, **p¿0.05, * p¿0.1.

7 Robustness checks

In this section, I only use the staggered DID sample to perform a range of robustness checks to further strengthen the validity and reliability of my findings since the number of observations for staggered DID is bigger than the one of cohort DID. First, I will exclude Beijing, Tianjin and Shandong Province from the analysis. These regions have their own lunch meals program and do not participate in the SNIP. Therefore, as a robustness test, I exclude these three districts to run the regression. Second, I examine whether there are heterogeneous effects across subpopulations. i) Previous studies show that the effects of child care programs vary among children's age groups and the number of children. Therefore, by the same logic, I look for differential effects by age and the number of child. ii) Policy-makers at the time were particularly concerned about the nutritional intake of poor students in the rural areas. However, from a policy perspective, an interesting question is also whether the benefits of the school lunch program extend universally across different demographic groups. Therefore, I take into account two family conditions—family income and family socioeconomic status. iii) Finally, regional differences can shape the effects of the school lunch program on mothers' labor supply. Therefore, I also classify the sample into different groups based on urban and rural locations or geographical regions. Overall, the main results remain robust and consistent.

Table 9 shows results after excluding Beijing, Tianjin and Shandong Provinces. As in the main analysis, the regressions are run without any fixed effects, gradually adding municipality or survey year fixed effects and both. Columns (3)-(4) show that when children are exposed to the school meal program, mothers are inclined to increase their working hours by around 8%-9%. This result is aligned with the staggered estimates and the magnitude of effects is also approximately 9%.

Table 9

Effects on working hours per week: excluding three provinces

	(1)	(2)	(3)	(4)
Treat	0.030	0.001	0.094**	0.085**
	(0.038)	(0.041)	(0.042)	(0.041)
Mother's schooling years	0.006	0.007*	0.005	0.006
	(0.004)	(0.004)	(0.004)	(0.004)
Mother's age	-0.022***	-0.009**	-0.019***	-0.009**
	(0.006)	(0.005)	(0.005)	(0.004)
Spouse's age	0.003	-0.003	0.005	-0.001
	(0.004)	(0.004)	(0.004)	(0.004)
Spouse's schooling years	-0.000	0.001	-0.002	0.000
	(0.004)	(0.004)	(0.004)	(0.004)
Family size	-0.010	-0.000	-0.007	0.001
	(0.010)	(0.009)	(0.010)	(0.009)
Family income	0.000**	0.000*	0.000***	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
Children's gender	0.004	0.014	0.009	0.014
	(0.023)	(0.023)	(0.022)	(0.022)
Siblings	0.018***	0.010**	0.013***	0.008**
	(0.005)	(0.004)	(0.005)	(0.004)
Children's age	0.006	0.006	0.008	0.006
	(0.024)	(0.026)	(0.023)	(0.026)
GDP per capita	0.009**	0.004	0.005	0.005*
	(0.004)	(0.003)	(0.004)	(0.003)
Log(government expenditure)	-0.049	-0.116***	-0.017	0.031
	(0.031)	(0.030)	(0.026)	(0.023)
Constants	4.750***	5.399***	4.198***	3.475***
	(0.401)	(0.379)	(0.349)	(0.323)
Survey year FE	No	No	Yes	Yes
Municipality FE	No	Yes	No	Yes
N	4889	4889	4889	4889
R-squared	0.021	0.100	0.052	0.122

Notes: Standard errors are clustered at the county level and given in parentheses. Significant levels: ***p¿0.01, **p¿0.05, * p¿0.1.

I next examine a range of treatment heterogeneity across children's age groups, household conditions and regions. In order to comprehensively examine the program's impact on mothers' labor supply, I conduct further analyses about the effects for subgroups of women based on the age of their children. I divide the sample into three subgroups: i) mothers with children aged 6-12 years who attend elementary schools and exposed to the SNIP; ii) mothers with children aged 13-15 years who attend junior high schools and also eligible for the SNIP. iii) mothers with children aged 16-18 years old and not exposed. I carry on this by estimating Equation (1) for each subsample, thereby allowing differences in coefficients for all covariates between subgroups. Results are reported for these groups in Table 10. In the columns (1) and (2), I find that the effect on mothers with children age 6 -12 years is higher than for the other age group. Specifically, mothers are more influenced by the school meal program around 9.7 percent when their children age 6-12 years. The estimate is significant compared to the other age group at the 5% significance level. In the columns (2)-(3), the coefficients are a little smaller than the column (1)'s and not statistically significant. One possible explanation is that since older children are less likely to need their mother's care, mothers' weekly working hours are not affected whether their children are exposed to the school meal program or not.

Table 10
Effects on working hours per week: subgroup of children

	(1)	(2)	(3)
	6-12 years	13-15 years	16-18 years
Treat	0.097**	0.076	0.089
	(0.049)	(0.087)	(0.107)

Mother's schooling years	0.008	0.009	0.003
	(0.005)	(0.006)	(0.007)
Mother's age	-0.008	-0.017*	-0.006
	(0.006)	(0.009)	(0.009)
Spouse's age	-0.000	0.006	-0.003
	(0.004)	(0.006)	(0.007)
Spouse's schooling years	0.002	-0.009	0.008
	(0.006)	(0.007)	(0.008)
Family size	0.003	-0.008	-0.034
	(0.011)	(0.020)	(0.022)
Family income	0.000***	0.000	0.000
	(0.000)	(0.000)	(0.000)
Children's gender	-0.024	0.050	0.058
	(0.032)	(0.048)	(0.048)
Siblings	0.029	-0.043	0.049
	(0.037)	(0.048)	(0.041)
GDP per capita	0.007*	0.000	0.006
	(0.004)	(0.005)	(0.007)
Log(government expenditure)	0.063**	-0.039	-0.021
	(0.032)	(0.063)	(0.082)
Constants	2.991***	4.667***	4.250***
	(0.424)	(0.897)	(1.081)
Survey year FE	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes
N	2813	1164	1145
R-squared	0.134	0.184	0.228

Notes: Standard errors are clustered at the county level and given in parentheses. Significant levels: ***p¿0.01, **p¿0.05, * p¿0.1.

There is a negative relationship between the number of children and mothers' labor supply (Wu, 2022). Following this finding, it is necessary to examine whether mothers in non-nuclear families can potentially obtain greater benefits

from the school meal program. Therefore, I then evaluate the heterogeneous effects of the school meal program across different numbers of children in one family. The sample is categorized into two subgroups based on whether there is at least one sibling. I generate one dummy variable, which equals to one when there is at least one sibling and zero otherwise. The results are displayed in Table 11. Column (1) shows the estimates for mothers with only one child. This finding is statistically insignificant. Column (2) shows at least two children in a family can lead to a significant 10.4% increase in their mothers weekly working hours. The results are in line with expectations, suggesting that the program can alleviate the female housework burden (Lundborg et al., 2022).

Table 11
Effects on working hours per week: subgroup of the number of children

	(1)	(2)
	One	Over one
Treat	0.059	0.104**
	(0.051)	(0.053)
Mothers' schooling years	0.006	0.010**
	(0.006)	(0.005)
Mothers' age	-0.011*	-0.006
	(0.006)	(0.005)
Spouse's age	0.002	-0.004
	(0.006)	(0.005)
Spouse's schooling years	-0.006	0.004
	(0.005)	(0.006)
Family size	0.014	-0.006
	(0.013)	(0.013)
Family income	0.000	0.000**
	(0.000)	(0.000)
Children's gender	-0.018	0.025
	(0.039)	(0.031)
Siblings	0.011	0.003

	(0.007)	(0.004)
GDP per capita	0.004	0.002
	(0.003)	(0.006)
Log(government expenditure)	0.039	0.060
	(0.028)	(0.044)
Constants	3.362***	3.139***
	(0.412)	(0.579)
Survey year FE	Yes	Yes
Municipality FE	Yes	Yes
N	2011	3112
R-squared	0.140	0.157

Notes: Standard errors are clustered at the county level and given in parentheses. Significant levels: ***p¿0.01, **p¿0.05, * p¿0.1.

I next conduct heterogeneity in the effect of the program by household income. To achieve this, I classify the sample into four groups based on the percentile of family income, namely 25%, 50%, 75%. Table 12 show the effect of the school meal exposure on mothers' weekly working hours by household income quantiles to present any variations in the program's impact across different income groups. Column (1) shows that mothers of the children in the lowest quartile of the household income distribution experienced the most significant gains from the program. The coefficient is positive and statistically significant at the 5% level, and the program can lead mothers' weekly working hours to increase by 30.3%. Additionally, the estimates from columns (2)–(4) show that mothers from the other quartiles of the household income distribution also benefited from the reform, but the relationship is not significant. These findings emphasize that the program is the most beneficial to economically vulnerable families, which is consistent with the results of one child care program's analysis by (Britto et al., 2017).

Table 12
Effects on working hours per week: subgroup of family income quantiles

	(1)	(2)	(3)	(4)
	25%	50%	75%	100%
Treat	0.303**	0.034	0.010	0.090
	(0.128)	(0.095)	(0.083)	(0.101)
Mothers' schooling years	0.011	0.021**	0.000	-0.009
	(0.009)	(0.009)	(0.006)	(0.006)
Mothers' age	-0.007	-0.015***	-0.011	0.002
	(0.008)	(0.006)	(0.009)	(0.009)
Spouse's age	0.000	0.005	0.001	-0.007
	(0.005)	(0.006)	(0.008)	(0.007)
Spouse's schooling years	0.012	-0.007	0.007	-0.010
	(0.009)	(0.009)	(0.006)	(0.007)
Family size	0.005	-0.015	-0.055**	0.015
	(0.017)	(0.024)	(0.026)	(0.018)
Family income	0.000*	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Children's gender	-0.045	0.015	0.035	0.016
	(0.048)	(0.054)	(0.043)	(0.033)
Siblings	0.006	0.006	0.001	0.005
	(0.009)	(0.007)	(0.009)	(0.007)
Children's age	-0.025	0.010	0.054	-0.020
	(0.041)	(0.047)	(0.051)	(0.062)
GDP per capita	-0.045*	0.009	0.006	0.002
	(0.024)	(0.014)	(0.005)	(0.004)
Log (government expenditure)	-0.020	0.178**	0.081*	-0.028
	(0.113)	(0.080)	(0.049)	(0.036)
Constants	3.806***	1.547	3.082***	4.430***
	(1.358)	(1.000)	(0.671)	(0.506)

Survey year FE	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes
N	1129	1429	1437	1110
R-squared	0.198	0.186	0.169	0.180

Notes: Standard errors are clustered at the county level and given in parentheses. Significant levels: ***p¿0.01, **p¿0.05, * p¿0.1.

I then evaluate the heterogeneous effects of the school meal program across different socioeconomic statuses. A family's socioeconomic status is usually proxied by the father's educational level (Fang & Zhu, 2022). I divide the regressions into two distinct groups based on whether fathers received at least a middle school education, equivalent to nine or more years of schooling. The results are presented in Table 13. Column (1) shows the estimates for mothers in a family with less-educated fathers. This finding is in line with expectations, suggesting that the school meal program has a bigger impact on mothers' labor supply in families facing economic disadvantages. Specifically, children raised in the low socioeconomic status family can lead to a significant 11.1% increase in their mothers weekly working hours. However, the coefficient for mothers with highly socioeconomic status is insignificant in the column (2). Overall, the results align with the analysis based on family income quantiles, showing that mothers at the rungs of social ladder can work more per week.

Table 13
Effects on working hours per week: subgroup of socioeconomic status

	(1)	(2)
	Low	High
Treat	0.111**	0.099
	(0.051)	(0.074)
Mothers' schooling years	0.011**	-0.004
	(0.004)	(0.006)
Mothers' age	-0.010**	-0.000

	(0.005)	(0.008)
Spouse's age	-0.002	0.006
	(0.004)	(0.007)
Spouse's schooling years	0.005	0.007
	(0.006)	(0.012)
Family size	-0.007	0.011
	(0.012)	(0.013)
Family income	0.000***	0.000
	(0.000)	(0.000)
Children's gender	-0.005	0.085*
	(0.026)	(0.045)
Siblings	0.009**	-0.005
	(0.004)	(0.007)
Children's age	0.023	-0.064
	(0.026)	(0.062)
GDP per capita	0.002	0.007*
	(0.005)	(0.004)
Log (government expenditure)	0.105***	-0.041
	(0.036)	(0.029)
Constants	2.583***	3.877***
	(0.465)	(0.459)
Survey year FE	Yes	Yes
Municipality FE	Yes	Yes
N	3835	1289
R-squared	0.153	0.156

Notes: Standard errors are clustered at the county level and given in parentheses. Significant levels: ***p¿0.01, **p¿0.05, * p¿0.1.

I conduct a heterogenous analysis that examines the effects separately for urban and rural areas. Urban residents shared educational and healthcare resources with rural residents in the county but were not eligible for the SNIP. Hence, the assumption is supposed to be that the adoption of the school meal program has no

impact on urban families who shared a common socioeconomic environment but were not eligible for the program. Results are shown in the Table 14. Column (1) restricts the sample in the urban regions. The estimated treatment effects are statistically not significantly different from zero. This corresponds to the program's initial design. Column (2) examines the rural subgroup, where mothers' working hours increase significantly by 12.5 percent at the 5% significance level when children are exposed to the school meal program. The result is consistent with the one based on family income quantiles and proves that this policy's goal that provides protection for the vulnerable and reduce inequality between urban and rural areas. Fang and Zhu (2022) also found that effects of the SNIP are not observed in urban residents who experienced similar socioeconomic changes in the same county.

Table 14
Effects on working hours per week: subgroup of urban and rural areas

	(1) Urban	(2) Rural
Treat	0.070	0.125**
	(0.049)	(0.062)
Mothers' schooling years	0.000	0.005
	(0.006)	(0.005)
Mothers' age	-0.011**	-0.009
	(0.005)	(0.006)
Spouse's age	0.001	-0.000
	(0.004)	(0.005)
Spouse's schooling years	0.002	-0.002
	(0.006)	(0.006)
Family size	-0.006	0.004
	(0.015)	(0.013)
Family income	0.000*	0.000*
	(0.000)	(0.000)

Children's gender	0.094***	-0.036
	(0.032)	(0.032)
Siblings	0.008	0.004
	(0.006)	(0.005)
Children's age	0.013	0.009
	(0.050)	(0.025)
GDP per capita	0.002	0.002
	(0.002)	(0.009)
Log(government expenditure)	0.038	0.014
	(0.034)	(0.047)
Constants	3.465***	3.660***
	(0.485)	(0.616)
Survey year FE	Yes	Yes
Municipality FE	Yes	Yes
N	2239	2847
R-squared	0.105	0.185

Notes: Standard errors are clustered at the county level and given in parentheses. Significant levels: ***p¿0.01, **p¿0.05, * p¿0.1.

Finally, Table 15 shows the estimated effects of the school meal program on mothers' labor supply across different regions. However, one subgroup in the northeastern region is not reported in the results. Due to data limitations, the available data only covers by 2018, while the school meal program in this region began in 2019. Therefore, all treat variables for this subgroup are equal to zero, and the coefficient of *"treat"* is omitted in the regression because of collinearity. Therefore, I do not report this northeastern subgroup. The column (1) and column (3) show that the school meal program has significant effects on mothers with children exposed to this program in the job market in the western and eastern region. Specifically, the children exposed to the program in the western region can lead to an approximately 14.0% increase in their mothers' weekly working hours,

while a comparable effect of around 11.8% is obtained for the eastern region. These results are consistent with the earlier findings when subgroups based on family income quantiles and socioeconomic status were analyzed. Disadvantaged families can benefit more from this program. Furthermore, these results also correspond to the policy's goal, which mainly targets poverty-stricken areas.

Table 15
Effects on working hours per week: subgroup of regions

	(1) West	(2) Middle	(3) East
Treat	0.140*	0.023	0.118**
	(0.075)	(0.113)	(0.051)
Mothers' schooling years	-0.007	0.025***	0.000
	(0.004)	(0.008)	(0.006)
Mothers' age	-0.000	-0.026**	0.001
	(0.006)	(0.010)	(0.007)
Spouse's age	0.002	0.004	-0.005
	(0.004)	(0.008)	(0.008)
Spouse's schooling years	0.006	-0.002	-0.000
	(0.006)	(0.007)	(0.009)
Family size	0.009	0.009	-0.012
	(0.014)	(0.020)	(0.017)
Family income	0.000	0.000**	0.000
	(0.000)	(0.000)	(0.000)
Children's gender	-0.002	0.075	0.035
	(0.038)	(0.045)	(0.037)
Siblings	0.004	0.014*	-0.004
	(0.006)	(0.007)	(0.005)
Children's age	-0.001	-0.022	0.010
	(0.033)	(0.064)	(0.036)
GDP per capita	-0.002	0.016*	0.004

	(0.008)	(0.009)	(0.003)
Log(government expenditure)	0.044	0.032	0.005
	(0.043)	(0.069)	(0.028)
Constants	2.949***	3.506***	3.838***
	(0.525)	(0.890)	(0.418)
Survey year FE	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes
N	1663	1419	1601
R-squared	0.074	0.177	0.099

Notes: Standard errors are clustered at the county level and given in parentheses. Significant levels: ***p¿0.01, **p¿0.05, * p¿0.1.

8 Conclusions

This paper provides causal evidence that the introduction of a school lunch program in China has a significant positive effect on the working hours of mothers when their children are exposed to the school lunch program. The school lunch program was initiated in primary schools and junior high schools, which aimed to provide nutritious and free meals to students starting from 2011. I use demographic data at the individual level and the rollout information of the program across different counties, and I employ a staggered and cohort difference-in-differences specification to estimate the effects of the school meal program on mothers' labor supply. A number of robustness checks support this result, conditional on controlling survey year or cohort fixed effects and municipality fixed effects.

My results show substantial economic benefits arising from the school lunch program, leading to an increase in working hours per week approximately 9%-14% for those mothers with children exposed to this school meal program. However, this program does not have effects on mothers' employment status, indicating that it can not determine whether mothers enter the job market or not.

Additionally, mothers with children from disadvantaged families benefit from this program more than other upper-class families and can work more hours in the job markets, suggesting that the program reduced socioeconomic inequalities to some extent.

Overall, my results emphasize the importance of childhood conditions and contribute to the literature that analyses the effect of interventions and circumstances at different phases of childhood. A growing number of studies show that policies that improve conditions early in life for children can have long-term gains, but we know less about the spillover effects of policies implemented during an individual's school years on mothers' labor supply. In contrast to early-life child care programs, school-based policies can reach a large share of children at a relatively low cost, and are therefore of particular interest. My findings show that a universal program that provides school-aged children with nutritious meals can have effects on mothers' labor supply. This paper also has policy implications in China, which has had low female labor force participation rate since the 1990s and also for children's nutritional programs across countries.

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