Health Insurance and the Rise of Women: Evidence from the New Cooperative Medical Scheme *

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This Version: July 21, 2024

Abstract

Females are traditionally viewed as the primary providers of informal parental care in China, especially in rural areas. We investigate whether health insurance coverage in rural China, the New Cooperative Medical Scheme (NCMS), can unleash more female labor force participation by reducing the burden of informal parental care. Employing a heterogeneity-robust difference-in-differences estimation, we find that the NCMS has a significant positive impact on female labor supply, primarily in non-farm occupations. In contrast, we observe no significant changes in male labor supply. We explore the mechanism by showing that the NCMS significantly decreases both the provision and demand for parental care by females. Our findings illuminate the importance of public health insurance in developing countries, highlighting its potential to stimulate labor supply, mitigate gender disparities in the labor market, and empower women with more bargaining power within households.

Keywords: informal parental care, public health insurance, labor supply, gender disparity

*I thank Xuan Zhang, Zihan Hu, and Seonghoon Kim for their supervision. Any remaining errors are my own.

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1 Introduction

Previous studies have found that population aging decreases growth in GDP per capita due to slower growth in labor productivity and employment per capita (Maestas, Mullen and Powell, 2023). As the challenge of population aging intensifies, China, with the world's largest elderly population, faces enormous pressure in providing adequate elderly care.[1] Although professional elderly care services have been gradually increasing in recent years, many elderly people still rely on family members, especially daughters and daughters-in-law, for daily care. Consequently, the impacts of aging may extend beyond the elderly and affect younger generations' employment as well.

In the context of limited market and public insurance provisions, the Chinese government implemented a heavily subsidized voluntary insurance program in 2003, the New Cooperative Medical Scheme (NCMS), in rural China. The program provided comprehensive coverage for hospital expenditures to rural households, improved elderly people's health status both mentally and physically, and at its peak, saved more than one million lives annually (Gruber, Lin and Yi, 2023). In this paper, we exploit the staggered implementation of NCMS to explore whether the public health insurance could increase younger generations' labor supply, especially females', by reducing the burden of informal parental care.

The NCMS is the successor of the old Cooperative Medical Scheme (old CMS) from the 1950s, which was based on the People's Commune System (Yip, Wang and Hsiao, 2008; Dong, 2009). Enrolled commune workers obtained free and timely access to primary health care (Dong, 2009). However, the old CMS virtually disappeared following the collapse of the People's Commune System in the early 1980s. Consequently, the majority of rural residents remained uninsured during the 1990s. To solve the problem of limited health insurance among the rural population, the Chinese government launched the NCMS in 2003. Within eight years of its introduction, it was covering over 800 million people, making it the largest insurance program in the history of the modern world (Gruber, Lin and Yi, 2023).

The main analysis employs a generalized difference-in-differences (DD) method which compares individuals whose communities are exposed to the NCMS to those whose communities are not yet exposed to the NCMS. Nevertheless, the NCMS rollout

[1] In 2015, 95.6% of the elderly had family members as their main caregivers (China Research Center on Aging, 2015). Details can be found at http://www.crca.cn/index.php/19-life/27-2015.html.

is staggered. Recent studies have found that in staggered DD design, two-way fixed effect estimates could be biased if the treatment effect varies across groups and over time (Goodman-Bacon, 2021; De Chaisemartin and d'Haultfoeuille, 2023). Thus, we employ a heterogeneity-robust DD estimation DID_{total} proposed by De Chaisemartin and d'Haultfoeuille (2024) to present our main results.

Overall, we find a positive and statistically significant impact of NCMS on aggregate labor force participation: the implementation of NCMS increases the aggregate labor force participation by 29.11 percentage points, which is 33.1 percent of the labor force participation rates before the NCMS adoption. However, we do not find a significant effect on daily work hours, though there is a 0.63 h increase.

We then investigate how the NCMS effect differs by gender to provide evidence on the mechanism of informal care. The results show that female labor force participation and daily work hours increase by 62.3 percent and 49.9 percent of the baseline level, respectively. In contrast, we do not find significant changes in males' labor supply. The event-study results show that estimates are consistent with the parallel trends assumption. The gender difference results provide baseline support for our mechanism that public health insurance unleashes the labor supply of women who are the primary undertakers of parental informal care.

Next, we investigate a related question: what types of jobs did these women take? Our results show that NCMS increases female labor force participation in nonfarm-related occupations but has a negligible effect on participation in farm-related work. Similar results are found for daily work hours. In summary, the results indicate that the NCMS increases the labor supply of the risk-averse group (females) in high-risk work (nonfarm-related occupations), which is consistent with the findings of Wang, Wu and Yuan (2024).

The mechanism analysis suggests that parental care need and provision by females decrease substantially. The event-study results show that there are decreasing dynamic effects for all parental care measures. These trends are consistent with the dynamic effects on female labor force participation, which further proves the reduced parental care as the mechanism of the increased female labor supply. Since we do not have the parental care information for males due to data constraints, we explore how the NCMS affects engagement in household chores by gender to provide suggestive evidence on the mechanism for gender-specific labor market effects. We find opposing effects for males and females, with males doing more household chores but decreasing engagement for

females. The results highlight the importance of public health insurance in empowering women with more bargaining power by releasing them into the labor market.

This paper contributes to the literature on informal care and labor supply. Focusing on developed countries, most of the current literature finds negative effects of informal caregiving on labor force participation and work hours (Lilly, Laporte and Coyte, 2010; Van Houtven, Coe and Skira, 2013; Crespo and Mira, 2014; Schmitz and Westphal, 2017; Korfhage and Fischer-Weckemann, 2024; Maestas, Messel and Truskinovsky, 2024).[2] Notably, in the context of Germany, Schmitz and Westphal (2017) find persistent negative effects of informal care provision on the probability of working full-time. Using U.S. data, Van Houtven, Coe and Skira (2013) find that caregiving increases the probability of women being retired by 2.3 to 2.4 percentage points and decreases female work by 3 to 10 hours per week. However, the effects on labor market outcomes remain unknown if informal care is reduced exogenously. This paper finds that the implementation of the NCMS in rural China significantly reduced the need for informal parental care, which in turn unleashes more women to enter the non-agricultural labor market.

This paper also contributes to a large strand of literature studying the impact of public health insurance expansion on labor market outcomes. A large body of literature focuses on developed countries with pre-existing employer-sponsored health insurance (Borjas, 2003; Hamersma and Kim, 2009; Heim and Lurie, 2015; Garthwaite, Gross and Notowidigdo, 2014). With the pre-existence of employer-sponsored health insurance, they find that the public health insurance decreases labor supply and increases job mobility.[3] For developing countries, most of the public health insurance programs are implemented with some specific conditions, such as the Universal Coverage Health Scheme (UCS) in Thailand (Wagstaff and Manachotphong, 2012), the Seguro Popular programme in Mexico (Aterido, Hallward-Driemeier and Pagés, 2011; Bosch and Campos-Vazquez, 2014), the Regimen Subsidiado (SR) in Colombia (Camacho, Conover and Hoyos, 2014), and the Health Care Fund for the Poor in Vietnam (Lê et al., 2019).

Our paper differs from others in the following ways. First, before the implementation

[2]There are a few relevant papers focusing on China. For instance, Wen and Huang (2024) find that parental health shocks (the initial hospitalisation of either adult children's parents or parents-in-law) have long-term negative effects on female's labor supply. From the perspective of bargaining power, Huang et al. (2021) show that the family elderly care activities have an obstacle effect on married women's participation in employment.

[3]In such contexts, individuals trade off between public health insurance and employer-sponsored health insurance. After the adoption of public health insurance, individuals do not have to work for health insurance (weakening the employment lock effect).

of NCMS, there was almost no health insurance for rural residents. Thus, there is no other competing health insurance. Second, different from health insurance in other developing countries, NCMS is a universal coverage for all rural residents with voluntary participation. Third, the NCMS is the largest insurance program in the history of the modern world (Gruber, Lin and Yi, 2023).

Finally, this paper adds to a broader body of studies about the impacts of NCMS across various dimensions. Most of the literature focuses on health-related outcomes, though with mixed results. Some papers find very limited impact on health status (Lei and Lin, 2009; Chen, Shi and Zhuang, 2019) and mortality (Chen and Jin, 2012). However, improvements in elderly activities of daily living and cognitive function are found by Cheng et al. (2015), despite finding no significant effect on self-assessed general health status. Employing a more credible empirical strategy, Gruber, Lin and Yi (2023) find a significant decline in aggregate mortality and an increase in life expectancy, with improvements in a variety of other health measures, ranging from self-reported health to activities of daily living.

There are a growing number of papers studying the effect on other factors beyond health, such as human capital investment (Liu, 2016), pharmaceutical innovation (Zhang and Nie, 2021), and children's future education (Huang and Liu, 2023). As for labor market outcomes, focusing on labor mobility, Shi (2020) and Wang et al. (2022) find a residence lock-in effect: the insurance discourages rural residents from working outside their registered areas of residence.[4] Bai, Zhang and Liu (2021) discover an increase in labor supply time and rate by improving individual health status. Employing a simple difference-in-differences method, a positive effect on agricultural work hours and off-farm labor force participation is found by Shen et al. (2017), though with only one post-NCMS period. On the contrary, Liu and Burge (2024), using an instrumental variable approach, find that NCMS coverage reduced aggregate labor supply by disincentivizing individuals' need to cover catastrophic medical costs. Since the implementation of NCMS is staggered, the estimates in two-way fixed effects DD (TWFEDD) could be biased when average treatment effects vary over time (Goodman-Bacon, 2021), which could be a reason for the mixed effects of NCMS on labor supply in previous papers. Employing the heterogeneity-robust DD estimator by De Chaisemartin and d'Haultfoeuille (2024), this

[4]The NCMS offers health insurance only to people with rural household registration, and they can benefit from the NCMS only when visiting the hospitals near their registered location in the household registration system (Shi, 2020).

paper finds a significant positive impact on female labor force participation, primarily in non-farm occupations, which is consistent with the findings in Shen et al. (2017) and Liu et al. (2019).

This paper is closely related to Wang, Wu and Yuan (2024), who investigate the NCMS and rural entrepreneurship. They find that the introduction of health insurance led to a substantial increase in rural households' engagement in entrepreneurship, in both extensive and intensive margins. The insurance empowers rural households to engage in more profitable income opportunities that were previously deemed too risky, significantly boosting their involvement in entrepreneurial ventures. In our study, we find a significant gender-specific labor market effect, with a significant increase only in female labor force participation and work hours. We provide another mechanism, informal elderly care, to explain the increased labor supply. Additionally, our results on household chores highlight the importance of public insurance in empowering women with more bargaining power within the household.

The rest of the paper is organized as follows: Section 2 provides some background on the development of NCMS; Section 3 describes the data sources used in the analysis and presents summary statistics; Section 4 discusses the empirical strategy; Section 5 presents the results; Section 6 explores the mechanisms; Section 7 concludes.

2 Background

The CMS was first established in rural China in the 1950s (Yip, Wang and Hsiao, 2008). It experienced dramatic development in its early years and covered up to more than 90% of rural residents from the early 1950s to the economic reform in 1979 (Burns and Liu, 2017). The traditional system not only resolved the issue of funding healthcare for rural people, but it also significantly improved the general quality of health in rural areas (Dong, 2009). However, as China transformed from a central-planned economy to a market-oriented economy in the early 1980s, the CMS began to collapse with the dissolved collective economy. Consequently, the CMS coverage of rural residents declined sharply from nearly universal to almost zero in the 1990s (Blumenthal and Hsiao, 2015). In 1998, only 9.5% of the Chinese population was covered by a public health system, and this figure dropped to 7% one year later (Milcent, 2018).

In the absence of a healthcare system, rural residents became more vulnerable to

health risks. The high cost of healthcare deterred many families from obtaining necessary healthcare (Milcent, 2018). To solve the problem of the lack of health insurance among rural residents, the Chinese government launched the NCMS in 2003. The program was rolled out progressively and was operated at the county level, leading to different counties within the same city being treated in different years. Under broad guidelines issued by the central government, at least two to three pilot counties were selected in each province in the first year, and more counties were gradually included, aiming to achieve full coverage by 2010 (Gruber, Lin and Yi, 2023).

Generally, the program focuses on inpatient care, the largest source of healthcare spending risk, and provides a catastrophic insurance coverage design (Yip, Wang and Hsiao, 2008). It mainly reimburses large expenses so as to ease the economic burden resulting from catastrophic disease and alleviate illness-caused poverty. Many services, particularly outpatient care, are not covered; deductibles are high, ceilings are low, and co-insurance rates are high (Milcent, 2018). But as time went by, the NCMS benefits became more generous, with the coinsurance rate falling to 10%–30% (Burns and Liu, 2017).

The NCMS only targeted rural residents (those who hold agricultural Hukou). But the program would also be offered in urban districts and county-level cities that include rural residents (Milcent, 2018). The participation is voluntary but must be at the household level. However, due to the modest premiums, intense government subsidies, and strong government mobilization ability, participation rates were as high as 75% in the first three years after initiation and increased to 96% in 2010 (Gruber, Lin and Yi, 2023).

However, some papers point out that NCMS pilot counties were not randomly selected (Milcent, 2018; Wang and Yang, 2021; Gruber, Lin and Yi, 2023). A complex set of criteria, including local interest and capacity, level of economic development, and the status of the delivery system, were considered (Milcent, 2018). The NCMS was first implemented in those counties with larger rural population shares and stronger economies. We incorporate such endogenous rollout in our identification strategy following (Wang, Wu and Yuan, 2024).

3 Data

To explore the labor market effect of NCMS, we rely on the China Health and Nutrition Survey (CHNS), which is a longitudinal survey using a multistage, random cluster process to draw a sample of about 7,200 households with over 30,000 individuals in 15 provinces and municipal cities that vary substantially in geography, economic development, public resources, and health indicators.[5] To define the treatment variable, we utilize the confidential CHNS community survey, the community-level rollout of the NCMS following Lei and Lin (2009). We employ two waves before the introduction (i.e., waves 1997 and 2000), two waves spanning the expansion phase (i.e., waves 2004 and 2006), and two waves for full coverage (i.e., waves 2009 and 2011).[6] While the CHNS asked the government officials of each community whether the Cooperative Medical Scheme (old CMS) had been implemented in their community, it did not distinguish between the old CMS and NCMS. However, knowing that the pilot implementation of the NCMS started in 2003, it is clear that those communities that began the CMS before 2003 were implementing the old CMS. Therefore, we defined those CMS plans that started to operate in or after 2003 as the NCMS. And we drop those communities which implemented old CMS before 2003 to make our identification more reliable.[7] We restrict the sample to rural residents (with rural hukou) who are not at school and not disabled, with age between 16 and 59. Our final sample is an unbalanced panel comprising 13,505 observations, representing 3,840 individuals from 1,641 households across 90 communities.

In our main analysis, the key dependent variables are individual's labor force participation (LFP) status and their average daily work hours.[8] Specifically, we define LFP as a binary variable indicating whether the respondent is working in the survey year. The average daily work hours are directly obtained from the survey question. Following Liu and Burge (2024), if the reported average daily work hours exceed 13h, we recode work hours to 13h to ease the concern that some respondents may conceptualize 'work' in a non-traditional manner. The CHNS also asked respondents about their average daily work hours spending on farm-related work and small household commercial business

[5] More details can be found in their official website: https://www.cpc.unc.edu/projects/china.

[6] We excludes the data prior to 1997, as the CHNS community survey only began inquiring about cooperative medical insurance from that year onward.

[7] From a total of 311 communities, we exclude 66 communities (approximately 21.2%) that were implementing the old CMS.

[8] If the individual is not working, we assign his or her work hours as zero.

during the year before the survey year.[9] Therefore, for the missing values of average daily work hours, we impute from last year's maximum average daily work hours spending on farm-related work and small household commercial business.

We classify occupation types into farm work and nonfarm work based on the survey question.[10] For respondents who did not answer the occupation type question, we define their occupation as farm work if they are currently working and answered the question about last year's farm-related work. Similarly, we define their occupation as nonfarm work if they are currently working and reported engaging in small handicraft or small commercial household business last year.

To explore the mechanism, we conduct the analysis based on the following survey questions regarding parental care activities: (1) whether the respondent's parents or parents-in-law need to be taken care of (the need for other people's help in daily life and shopping); (2) whether the respondent help parents or parents-in-law with daily life and shopping last week; (3) how much time did the respondent spend taking care of the parents or parents-in-law (in hours) [11]; However, these parental-care are only asked to all women under age 52 who are married, widowed, or divorced. Therefore, we utilize the household-chores-related questions which is asked to both males and females in order to provide suggestive evidence on gender specific labor market effect.[12]

Table 1 summarizes the labor market outcomes, individual and household characteristics, and parental care measures for our baseline sample. The first two columns present the statistics for the overall sample. The average labor market participation rate and daily work hours are 85% and 3.066 h, respectively. There are more individuals engaging in farm work, and they tend to work longer hours in this sector. On average, individuals have 6.6 years of education, with an average age of 40.8 years. Meanwhile, 86.3% of individuals are married and 37.1% of them are household heads.

[9]Farm-related work includes home gardening, collective farm or household farm work, raising livestock or poultry, collective or household fishing. Small household commercial business includes carpentry, shoe repair, housekeeping/child care service, tailoring, hairdressing, electrical appliance repair, restaurant, store, family child care, family hotel, family clinic, etc.

[10]Based on the occupation type question, we define farm workers as farmers, fishermen, hunters, or those engaged in home gardening, collective/household farm work, raising livestock or poultry, or collective/household fishing. Nonfarm workers include professional/technical workers, office staff, skilled workers (foremen, group leaders, craftsmen), non-skilled workers (ordinary laborers, loggers), army officers, police officers, ordinary soldiers, policemen, drivers, service workers (housekeepers, cooks, waiters, doorkeepers, hairdressers, salespersons, launderers, child care workers), athletes, actors, and musicians.

[11]If the respondent did not take care of his/her parents or parents-in-law, we set this variable as zero.

[12]The survey asked both males and females about their household chore activities in the previous week, including buying food, preparing and cooking meals, washing and ironing clothes, and cleaning the house.

TABLE 1: SUMMARY STATISTICS BY GENDER

	All		Male		Female	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Labor market outcomes						
Work status (= 1 if working)	0.850	0.357	0.912	0.283	0.789	0.408
- farm work (= 1 if doing farm work)	0.662	0.473	0.654	0.476	0.670	0.470
- nonfarm work (= 1 if doing nonfarm work)	0.187	0.390	0.258	0.438	0.119	0.323
Average daily work hours	3.055	3.056	3.581	3.043	2.545	2.981
- farm work	1.945	2.609	2.075	2.655	1.819	2.556
- nonfarm work	1.111	2.618	1.506	2.909	0.726	2.234
Individual & household characteristics						
Education years	6.613	3.364	7.639	2.817	5.615	3.548
Age	40.804	10.958	40.118	11.255	41.471	10.619
Married or not	0.863	0.344	0.823	0.381	0.901	0.299
Divorced or not	0.006	0.074	0.009	0.096	0.002	0.044
Widowed or not	0.025	0.156	0.015	0.123	0.034	0.182
Separated or not	0.002	0.046	0.003	0.055	0.001	0.036
Household head	0.371	0.483	0.690	0.463	0.060	0.238
Household size	4.287	1.463	4.276	1.452	4.298	1.474
Home activity	0.378	0.485	0.081	0.272	0.626	0.484
Parental care measures						
Parental (parents-in-law) care needs	0.126	0.332	.	.	0.126	0.332
Care parents (parents-in-law) last week	0.058	0.233	.	.	0.058	0.233
Parental care hours last week	0.925	7.552	.	.	0.925	7.552
Observations	13,505		6,656		6,849	

When splitting the sample by gender, we observe that females have lower labor force participation rates and fewer work hours compared to males. This gender gap is more pronounced in nonfarm work. The middle panel reveals that females have fewer years of education and are less likely to be household heads than males. Conversely, there is a higher probability of engaging in home activities for females. Regarding parental care, 12.6% of parents (or parents-in-law) of females require assistance with daily life activities and shopping. Furthermore, 5.8% of females reported caring for their parents (or parents-in-law) in the week before interview.

4 Empirical strategy

To evaluate the causal effects of public health insurance on individual's labor supply, we leverage the staggered rollout of NCMS across rural areas in China. We adopt a generalized difference-in-differences (DD) strategy by estimating the following equation:

$$Y_{i,c,t} = \beta_0 + \beta_1 NCMS_{c,t} + X'_{i,h,t}\beta_2 + \gamma_i + \gamma_{p,t} + \gamma_{t_c^0} \times t + \epsilon_{i,c,t} \tag{1}$$

where $Y_{i,c,t}$ is a labor market outcome such as an indicator of labor force participation or daily work hours for individual i of community c in year t. $NCMS_{c,t}$ is an indicator

that takes the value of 1 if community c implemented the NCMS in year t. $X'_{i,h,t}$ is a set of time varying individual- and household-level characteristics, which includes individual's age and squared age, marital status, household size, and an indicator for household head. We control for individual fixed effects γ_i and province-by-year fixed effects $\gamma_{p,t}$ which account for any fixed differences across individuals or general time patterns at the province level. Standard errors are clustered at the community level.

As Wang and Yang (2021) document, about 90% of the China's experiments (including NCMS) exhibit positive sample selection in terms of a locality's economic development. And more agricultural and higher-income counties were the first to adopt the program (Gruber, Lin and Yi, 2023). It is likely that residents in these counties were facing unparalleled labor market conditions before the program began. Therefore, to account for the nonrandom timing of NCMS adoption, we additionally controlled for NCMS adoption timing trends ($\gamma_{t_c^0} \times t$) to allow communities across different rollout waves to have different pre-existing trends following Wang, Wu and Yuan (2024).

In this setup, we compare the before-after change in labor supply between individuals in communities where the NCMS was implemented and those in communities not yet covered by the program between the two periods. The key identifying assumption is that the timing of NCMS implementation is not systematically related to with-in community unobserved factors affecting individual's labor supply conditional on controls in equation (1). Any systematic pre-adoption differences across communities affecting the timing of NCMS implementation and labor at the same time may bias the point estimates. Therefore, we estimate an event-study to test the parallel trends assumption:

$$Y_{i,c,t} = \beta_0 + \sum_{k \neq -1} \delta_k \mathbb{1}\{K_{c,t} = k\} + X'_{i,h,t}\beta_2 + \gamma_i + \gamma_{p,t} + \gamma_{t_c^0} \times t + \epsilon_{i,c,t} \tag{2}$$

where $K_{c,t} = t - s_c$ denotes the "relative period" and s_c is the year when community c implemented the NCMS. We take the year immediately before the launch of NCMS ($t - s_c = -1$) as the reference period and calculated the coefficients for all other years relative to the reference period.

Despite the parallel trends assumption assures the casual inference, the average treatment effect (ATE) can still be susceptible to be biased because of the heterogeneous treatment effect. Recent study has found that in staggered DD design, TWFEDD estimators are unbiased for an ATE: (i) if parallel trends hold, and (ii) if the treatment effect

should be constant, between group and over time (Goodman-Bacon, 2021; De Chaisemartin and d'Haultfoeuille, 2023; De Chaisemartin and d'Haultfoeuille, 2024; Callaway and Sant'Anna, 2021; Borusyak, Jaravel and Spiess, 2024; Sun and Abraham, 2021). As shown by Goodman-Bacon (2021), the TWFEDD estimator is a weighted average of all possible 2×2 DD estimators that compare timing groups with each other.[13] If treatment effects are heterogeneous across groups or time, the TWFE estimator does not deliver consistent estimates.

To address such bias, we adopt a recently developed heterogeneity-robust DD estimator DID_{total} by De Chaisemartin and d'Haultfoeuille (2024) throughout the whole analysis. The robust estimator compares the outcome evolution of newly-treated group (switcher) and groups whose treatment has not changed yet (nonswitcher). By overcoming the forbidden comparison (early-treated group as the treatment group of later-treated group), the robust estimator delivers consistent estimates even in the presence of heterogeneous treatment effects across groups or time.

5 Results

5.1 Baseline results

Table 2 reports estimates of β_1 in equation (1) on labor force participation (coloum 1-3) and daily work hours (column 4-6). We present the results of the DID_{total} estimation in panel B and compare them with the TWFE estimation in panel A. For each panel, column 1 (column 4) presents the the simplest specification controlling for the individual fixed effects and province-by-year fixed effects. In column 2 and 3 (column 5 and 6), we incrementally add individual and household covariates, and NCMS adoption timing trends.

In panel A, the point estimates remain generally stable across specifications, albeit with statistically insignificant results. Panel B, however, presents a stark contrast in the DID_{total} results for labor force participation compared to panel A, showing an opposite effect and a larger magnitude. Considering that the heterogeneous treatment effect may cause such a difference, we conduct the Bacon decomposition proposed by Goodman-Bacon (2021). Appendix Figures A.1 and A.2 demonstrate that the effects of NCMS on labor force participation and work hours are primarily driven by comparisons between

[13] Timing groups are groups of units treated at different points in time.

TABLE 2: THE EFFECT OF NCMS ON LABOR SUPPLY

	LFP			Work Hours		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: TWFE OLS						
NCMS	-0.0115	-0.0124	-0.0116	0.6150*	0.5928	0.5796
	(0.0399)	(0.0400)	(0.0404)	(0.3634)	(0.3606)	(0.3497)
Observations	13,215	13,215	13,215	13,215	13,215	13,215
R^2	0.464	0.470	0.470	0.475	0.480	0.480
Panel B: de Chaisemartin and D'Haultfoeuille's (2024)						
DID_{total}	0.4920***	0.4737***	0.2911***	0.0915	0.1546	0.6325
	(0.1153)	(0.1133)	(0.0790)	(0.4711)	(0.4772)	(0.4341)
Mean outcome	0.850	0.850	0.850	3.055	3.055	3.055
Individual FEs	✓	✓	✓	✓	✓	✓
Province × year FEs	✓	✓	✓	✓	✓	✓
Controls		✓	✓		✓	✓
NCMS adoption timing trend			✓			✓

Notes: Panel A presents the coefficients with OLS TWFE model. Panel B presents estimators by De Chaisemartin and d'Haultfoeuille (2024). DID_{total} is the average total effect per unit of treatment, where "total effect" refers to the sum of the effects of a treatment increment, at the time when it takes place and at later periods. Standard errors in parentheses are clustered at the community level.

timing groups (individuals in early-treated communities and those in late-treated communities). Hence, the discrepancies between panels A and B are most likely attributable to the heterogeneity of treatment effects. Consequently, we focus on the DID_{total} estimation in the subsequent analyses presented in this paper.

Panel B of Table 2 presents the results of the DID_{total} estimation, where DID_{total} is the estimated average total effect per unit of NCMS treatment at the time when NCMS takes place till all later periods. With the DID_{total} estimation, the inclusion of individual and household controls only slightly changes the estimation. However, the inclusion of NCMS adoption timing trend changes the estimation from 0.4737 in column 2 to 0.2911 in column 3 of panel B. This suggests that the NCMS adoption time is endogenous in our setting. Thus, we add NCMS adoption timing trend in our preferred specification. According to the results in column 3, the implementation of NCMS increases aggregate labor force participation by 29.11 percentage points. As the average labor force participation rate is 87.8 percent before the NCMS adoption in our sample, the NCMS effect on labor force participation is about 33.1 percent of the baseline rate (29.1/87.8 = 33.1 percent). However, through column 4-6, we do not find significant results on daily work hours, though with a 0.63 h increase in our preferred specification (column 6).[14]

[14]Event-study results are presented in Appendix Figure A.3

5.2 Effects by gender

The summary statistics reveal a notable gender disparity in labor supply, with lower labor force participation rates and fewer work hours for women compared to men. Furthermore, women are typically the primary providers of informal care for their parents or parents-in-law. If the NCMS reduced the need for informal care, as previously discussed, the female group would likely be more affected by the NCMS in terms of labor supply. Therefore, we investigate how the NCMS effect differs by gender to provide evidence on the mechanism of informal care.

Table 3 presents the DID_{total} estimation by gender based on De Chaisemartin and d'Haultfoeuille (2024). The results in column 3 show that after experiencing the NCMS implementation, the female labor force participation rate increases by 51.7 percentage points on average, which is statistically significant at the 1% level. The effect is about 62.3 percent of the female baseline rate (83.0 percent). Although there is no significant effect on the aggregate work hours, in column 6, we observe that female daily work hours increase by 1.22 h on average, which is about 49.9 percent of the female baseline rate (2.44 h). In contrast, we do not find significant changes in males' labor force participation rate and daily work hours.

Overall, the adoption of NCMS leads to an increase in female labor force participation and work hours. However, males' labor supply does not respond to the NCMS. The gender difference results in Table 3 provide baseline support for our mechanism that public health insurance unleashes the labor supply of women who are the primary undertakers of parental informal care.

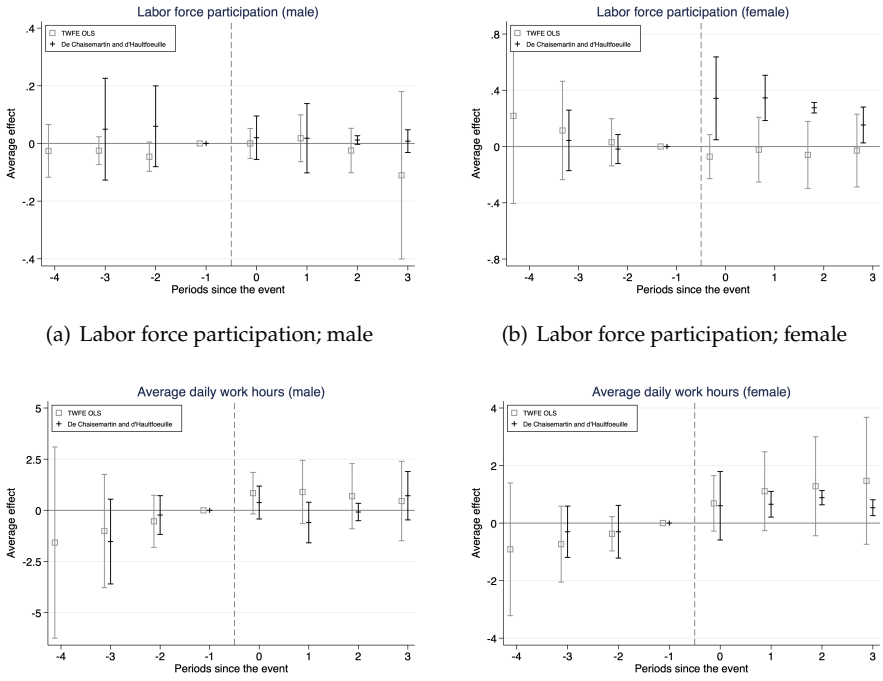
Table 3: The Effect of NCMS on Labor Supply by Gender

	LFP			Work hours		
	(1) All	(2) Male	(3) Female	(4) All	(5) Male	(6) Female
DID_{total}	0.2911***	0.0292	0.5170***	0.6325	-0.1863	1.2188***
	(0.0790)	(0.0543)	(0.1315)	(0.4341)	(0.5264)	(0.4329)
Mean outcome	0.850	0.912	0.789	3.055	3.581	2.545
Individual FEs	✓	✓	✓	✓	✓	✓
Province × year FEs	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓
NCMS adoption timing trend	✓	✓	✓	✓	✓	✓

Notes: Panel A presents the coefficients with OLS TWFE model. Panel B presents estimators by De Chaisemartin and d'Haultfoeuille (2024). DID_{total} is the average total effect per unit of treatment, where "total effect" refers to the sum of the effects of a treatment increment, at the time when it takes place and at later periods. Standard errors in parentheses are clustered at the community level.

Figure 1 presents the event-study figure and shows that the estimates are consistent

with the parallel trends assumption: independent of the estimator used, prior to the implementation of NCMS, the labor force participation rates and daily work hours of individuals in the NCMS communities are similar to those in non-NCMS communities, and the difference is small and statistically insignificant. Additionally, the post-treatment estimates show a slightly decreasing trend in the effect on female labor force participation. The decreasing trend may reflect that as the need for elderly care has been decreased by the NCMS, there are fewer parents or parents-in-law needing care in the longer period; hence, there are fewer unleashed female labor forces in later periods.[15] Despite this, the estimated effect of NCMS on female labor force participation remains statistically significant for all periods from the initial implementation of NCMS.



(a) Labor force participation; male

(b) Labor force participation; female

(c) Daily work hours; male

(d) Daily work hours; female

FIGURE 1: EVENT STUDIES: THE EFFECTS OF NCMS ON LABOR SUPPLY

Notes: The figures show the event-study estimates and 95% confidence intervals of the effects of NCMS on labor force participation and daily work hours by gender. Two estimators are used: a dynamic version of the TWFE model, equation (2), estimated using OLS (in gray with square markers), and the DID_{total} estimator from De Chaisemartin and d'Haultfoeuille (2024) (in black with cross markers). For the estimators by De Chaisemartin and d'Haultfoeuille (2024), the maximum number of preperiods that can be estimated in our sample is only two. Standard errors are clustered at the community level.

[15] In Section 6, a similar decreasing trend in the effect of NCMS on parental care need can be observed, which demonstrates parental care as the mechanism of the increased female labor supply.

5.3 Effects by occupation type

Having observed an increase in female labor supply in response to the NCMS, a related question arises: what types of jobs did these women take? To investigate this question, we classify occupations into farm-related and nonfarm-related occupation. As Table 1 shows, the gender gap in labor supply is larger in nonfarm work, with lower labor force participation rates and fewer work hours for females. Consequently, we explore whether the NCMS could narrow this gender gap in nonfarm work labor supply.

TABLE 4: THE EFFECTS OF NCMS ON LABOR FORCE PARTICIPATION IN FARM AND NONFARM OCCUPATION

	LFP (farm)		LFP (nonfarm)	
	(1) Male	(2) Female	(3) Male	(4) Female
DID_{total}	0.0569	-0.0302	-0.0200	0.1024***
	(0.0534)	(0.0665)	(0.0856)	(0.0347)
Mean outcome	0.654	0.670	0.258	0.119
Controls	✓	✓	✓	✓
Individual FEs	✓	✓	✓	✓
Province × year FEs	✓	✓	✓	✓
NCMS adoption timing trend	✓	✓	✓	✓

Notes: Panel A presents the coefficients with OLS TWFE model. Panel B presents estimators by De Chaisemartin and d'Haultfoeuille (2024). DID_{total} is the average total effect per unit of treatment, where "total effect" refers to the sum of the effects of a treatment increment, at the time when it takes place and at later periods. Standard errors in parentheses are clustered at the community level.

Tables 4 and 5 report the gender-specific labor supply responses in farm-related and nonfarm-related occupations. In Table 4, we find that female labor force participation in nonfarm-related occupations increases by 10.24 percentage points. In contrast, NCMS has a negligible effect on participation in farm-related work. The results indicate that more females begin participating in nonfarm-related work while not abandoning farm-related work. We find a similar pattern for daily work hours in Table 5. There is a 0.4293 h increase in average daily work hours for females in nonfarm work. We also observe an increase in farm-related work for females, though it is only statistically significant at the 1% level. Additionally, we find that males increase their work hours in farm work. The increase in male work hours in farm work may be explained by the reduced parental care need. Males spend more time on jobs with more security but relatively low wage levels (farm work) after the parental care needs are reduced. Also, they do not have to take the risk of income instability to seek higher wages (nonfarm work) after having the eligibility for public insurance.

Overall, the increased female labor supply is mostly driven by nonfarm-related work.

Women are usually more risk-averse than men Croson and Gneezy (2009). Our results indicate that the NCMS increases the labor supply of the risk-averse group, females, in high-risk work, nonfarm-related occupations. This finding is consistent with Wang, Wu and Yuan (2024), who find that the NCMS increases households' engagement in entrepreneurship (high-risk work).

TABLE 5: THE EFFECTS OF NCMS ON WORK HOURS IN FARM AND NONFARM OCCUPATION

	Work hours (farm)		Work hours (nonfarm)	
	(1) Male	(2) Female	(3) Male	(4) Female
DID_{total}	0.6212**	0.7895*	-0.8075	0.4293***
	(0.2914)	(0.4120)	(0.5984)	(0.1309)
Mean outcome	2.075	1.819	1.506	0.726
Controls	✓	✓	✓	✓
Individual FEs	✓	✓	✓	✓
Province × year FEs	✓	✓	✓	✓
NCMS adoption timing trend	✓	✓	✓	✓

Notes: Panel A presents the coefficients with OLS TWFE model. Panel B presents estimators by De Chaisemartin and d'Haultfoeuille (2024). DID_{total} is the average total effect per unit of treatment, where "total effect" refers to the sum of the effects of a treatment increment, at the time when it takes place and at later periods. Standard errors in parentheses are clustered at the community level.

6 Mechanism

The previous sections have shown that NCMS increases female labor force participation and work hours but has very limited impact on males. This section explores the mechanisms behind these effects. From the previous discussion, our hypothesis is that the NCMS unleashed female labor supply by reducing parental care needs. Therefore, we empirically test whether there is a decrease in parental care provided by females. Due to data limitations, we do not know the parental care measures for males. Hence, we test how the NCMS shapes the engagement for household chores for both males and females to provide suggestive evidence for our mechanism.

6.1 Effects on parental care by females

Many studies have found that informal parental care has a negative effect on female labor supply Wen and Huang (2024); Huang et al. (2021). However, there is very limited evidence on whether reduced parental care could unleash more female labor force participation. We utilize the NCMS as an exogenous shock to parental care and explore

responses in parental care needs and provision. We exploit three parental care measures from the survey questions (see Section 3). Our dependent variables are: (1) an indicator of whether parents or parents-in-law need care; (2) an indicator of whether the respondent actually cared for his or her parents or parents-in-law last week; (3) parental care hours last week. Since these questions are only asked of married women under 52 years of age, we do not have parental care measures for males.

Table 6: Substitution Effect: The Reduced Informal Parental Care

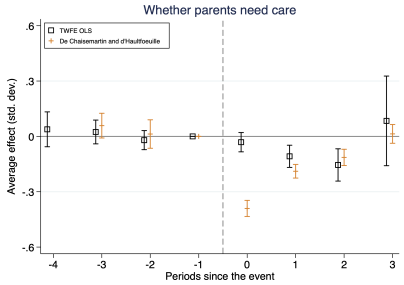
	Parental care needs	Care parents	Parental care hours	Home activity	
	(1)	(2)	(3)	(4)	(5)
	Female	Female	Female	Male	Female
DID_{total}	-0.2016***	-0.1824***	-4.6572***	0.0185	-0.1272***
	(0.0324)	(0.0473)	(1.1622)	(0.0283)	(0.0394)
Mean outcome	0.126	0.058	0.925	0.081	0.626
Controls	✓	✓	✓	✓	✓
Individual FEs	✓	✓	✓	✓	✓
Province × year FEs	✓	✓	✓	✓	✓
NCMS adoption timing trend	✓	✓	✓	✓	✓

Notes: Panel A presents the coefficients with OLS TWFE model. Panel B presents estimators by De Chaisemartin and d'Haultfoeuille (2024). DID_{total} is the average total effect per unit of treatment, where "total effect" refers to the sum of the effects of a treatment increment, at the time when it takes place and at later periods. Standard errors in parentheses are clustered at the community level.

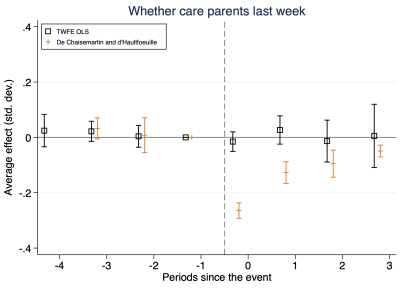
Columns 1-3 of Table 6 present the DID_{total} estimation of the effects on parental care measures for females based on our preferred specification. We find consistent decreases in all parental care measures. From the parents' side, after the implementation of NCMS, fewer parents need to be taken care of in their daily lives. On the side of care provision, fewer females help their parents or parents-in-law with daily life, and there is also a sizeable decrease in parental care hours.

Figure 2 provides the event-study figures for the results on three parental care measures. The pre-treatment estimates using De Chaisemartin and d'Haultfoeuille (2024) are small and statistically insignificant through panels (a) to (c). An interesting feature is that the post-treatment estimates show a decreasing trend in all three panels. Such trends are consistent with those in panel (b) of Figure 1, indicating that as the effect on parental care diminishes in longer periods, the prompting effect on female labor force participation also becomes smaller. These consistent patterns further prove the reduced parental care as the mechanism of the increased female labor supply.

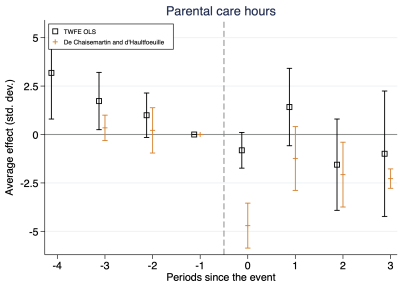
To further validate the mechanism, we include these parental care measures as controls in our outcome models. The results are shown in Table 7. Panels A and B present the results for female labor force participation and work hours. We report the baseline results in column 1. Through columns 2 to 4, we control for each parental care measure, and in column 5, we add all three parental care measures as controls.



(a) Parental care need



(b) Actually caring parents



(c) Parental care hours

FIGURE 2: EVENT STUDIES: EFFECTS OF NCMS ON PARENTAL CARE

Notes: The figures show the event-study estimates and 95% confidence intervals of the effects of NCMS on (a) parental care need, (b) indicator for caring parents last week; (c) parental care hours. Two estimators are used: a dynamic version of the TWFE model, equation (2), estimated using OLS (in black with square markers), and the DID_{total} estimator from De Chaisemartin and d'Haultfoeuille (2024) (in orange with cross markers). For the estimators by De Chaisemartin and d'Haultfoeuille (2024), the maximum number of preperiods that can be estimated in our sample is only two. Standard errors are clustered at the community level.

In panel A, the coefficient on female labor force participation decreases by around 1/3 to 1/2 of the baseline level through columns 2 to 5. In panel B, there is a slight decrease in the magnitude of the effect on female work hours if we add a single parental care measure. In column 5, however, the effect becomes insignificant if we include all parental care measures as controls. Therefore, this provides suggestive evidence for the mechanism of reduced parental care in explaining the increased female labor supply.

6.2 Effects on household chores engagement

The CHNS only asks questions about parental care to women under age 52 who are married, widowed, or divorced. Thus, we do not have parental care information for males. However, the CHNS asked questions about household chores to both males and females. If the NCMS unleashed more women into the labor market by reducing parental care, females may spend less time on household chores. To shed light on our mechanism for gender-specific labor market effects, we explore how the NCMS affects the

Table 7: Adding More Controls

	Female				
	(1)	(2)	(3)	(4)	(5)
Panel A: female LFP					
DID_{total}	0.5170***	0.3499***	0.2374***	0.3662***	0.3377***
	(0.1315)	(0.0861)	(0.0736)	(0.0879)	(0.0856)
Mean outcome	0.789	0.789	0.789	0.789	0.789
Panel B: female work hours					
DID_{total}	1.2188***	1.1437***	1.1314***	1.1317***	0.5612
	(0.4329)	(0.4024)	(0.4064)	(0.4094)	(0.5511)
Mean outcome	2.545	2.545	2.545	2.545	2.545
Baseline controls	✓	✓	✓	✓	✓
Individual FEs	✓	✓	✓	✓	✓
Province × year FEs	✓	✓	✓	✓	✓
NCMS adoption timing trend	✓	✓	✓	✓	✓
Parental care needs		✓			✓
Care parents			✓		✓
Parental care hours				✓	✓

Notes: Panel A presents the coefficients with OLS TWFE model. Panel B presents estimators by De Chaisemartin and d'Haultfoeuille (2024). DID_{total} is the average total effect per unit of treatment, where "total effect" refers to the sum of the effects of a treatment increment, at the time when it takes place and at later periods. Standard errors in parentheses are clustered at the community level.

engagement in household chores by gender. The dependent variable is an indicator of whether he or she did the following household chores last week: buying food, preparing and cooking meals, washing and ironing clothes, and cleaning the house.

The last two columns in Table 6 present the results on household chores engagement for males and females. We do not find significant changes in males' engagement in household chores. However, there is a 12.72 percentage point decrease in female engagement. Appendix Figure A.4 shows the event-study results for males and females on household chores. Since there is one significant pre-treatment estimate (for period -2) for males, the explanation for the male results should be interpreted with caution.

We further explore the effect on different types of household chores. The results are reported in Table 8. In panel A, we find that more males begin engaging in household chores of buying food and washing and ironing clothes after the NCMS adoption. In panel B, however, we find an opposite effect for females, with a decrease in the probability of washing and ironing clothes and cleaning house. The opposing effects for males and females indicate that the NCMS released more women into the labor market, which empowers them with more bargaining power within the household.

TABLE 8: EFFECTS OF NCMS ON HOME ACTIVITIES BY GENDER

	Buy food (1)	Cook food (2)	Wash and iron (3)	Clean house (4)
Panel A: male				
DID_{total}	0.2992***	0.0473	0.1396***	-0.1265*
	(0.0607)	(0.0360)	(0.0518)	(0.0768)
Mean outcome	0.441	0.253	0.151	0.233
Panel B: female				
DID_{total}	-0.0563	-0.0011	-0.0412**	-0.1226**
	(0.0379)	(0.0221)	(0.0191)	(0.0505)
Mean outcome	0.697	0.895	0.907	0.881
Controls	✓	✓	✓	✓
Individual FEs	✓	✓	✓	✓
Province × year FEs	✓	✓	✓	✓
NCMS adoption timing trend	✓	✓	✓	✓

Notes: Panel A presents the coefficients with OLS TWFE model. Panel B presents estimators by De Chaisemartin and d'Haultfoeuille (2024). DID_{total} is the average total effect per unit of treatment, where "total effect" refers to the sum of the effects of a treatment increment, at the time when it takes place and at later periods. Standard errors in parentheses are clustered at the community level.

7 Conclusion

Population aging, as a critical global demographic trend, is faced by many developed and developing countries in the world. China, with the world's largest elderly population, is under great pressure to provide adequate elderly care. In rural areas, this challenge is particularly acute, as many elderly individuals heavily rely on female family members, especially daughters and daughters-in-law, for their daily care needs. Consequently, this reliance on women for eldercare significantly constrains female labor force participation. To address these challenges, China implemented the NCMS in 2003, which is the largest insurance program in modern history. This paper provides empirical evidence about the gender-specific labor market effect of the NCMS in a difference-in-differences framework.

Using CHNS data with a heterogeneity-robust DD estimation, our results suggest that NCMS, on average, increases the labor force participation by 62.3 percent and daily work hours by 49.9 percent for females. The estimated effects for males, on the other hand, are not statistically significant. Additional results reveal that the increase in female labor supply is driven by nonfarm-related work. The analysis of potential mechanisms shows a significant effect of NCMS on parental care need and provision by females. The decreasing dynamic effects for all parental care measures are consistent with those for female labor force participation, which further proves reduced parental care as the mechanism of the increased female labor supply. We also provide suggestive evidence on

household chores to shed light on gender differences in labor supply. We find opposing effects for males and females, with males doing more household chores but females showing decreased engagement. We suggest that women are empowered with more bargaining power after they are released from parental care and enter the labor market.

From a broader perspective, our findings highlight the importance of public health insurance in alleviating the pressure of population aging on the labor market for other developing countries. Our gender-specific results also highlight the implications of health insurance in mitigating gender disparities in the labor market and empowering women with more bargaining power within households.

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Appendix

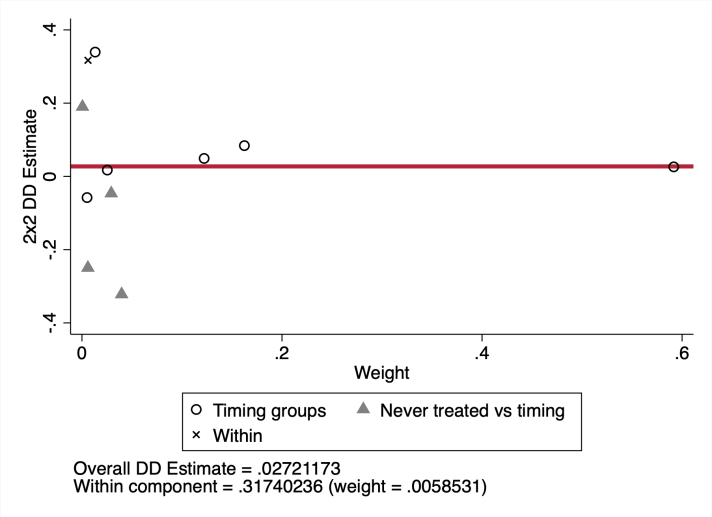


FIGURE A.1: GOODMAN-BACON DECOMPOSITION: NCMS ON LABOR FORCE PARTICIPATION (FULL SAMPLE)

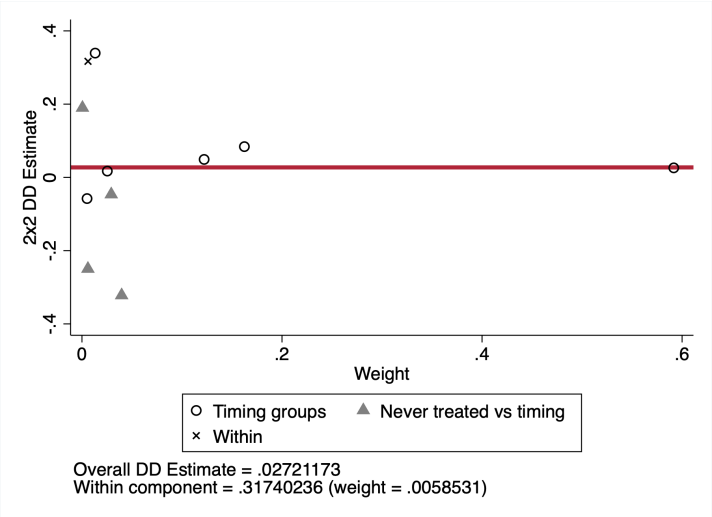
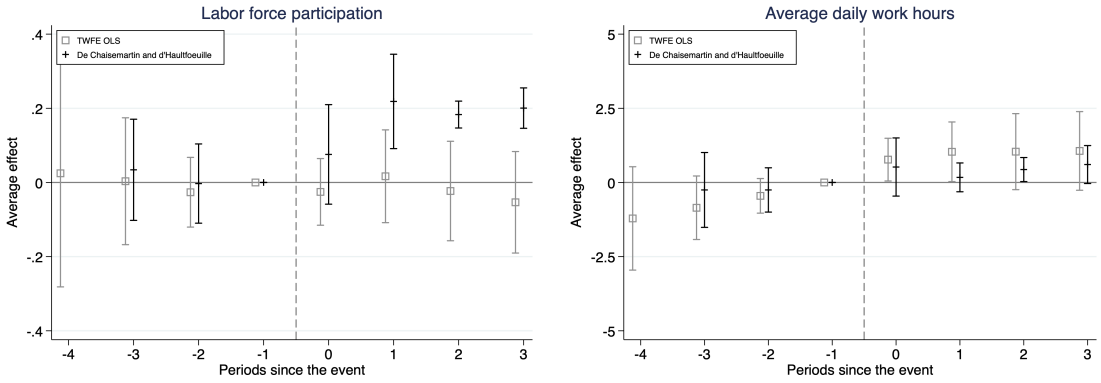


FIGURE A.2: GOODMAN-BACON DECOMPOSITION: NCMS ON WORK HOURS (FULL SAMPLE)



(a) Labor force participation (b) Work hours

FIGURE A.3: EVENT STUDIES: NCMS ON LABOR SUPPLY

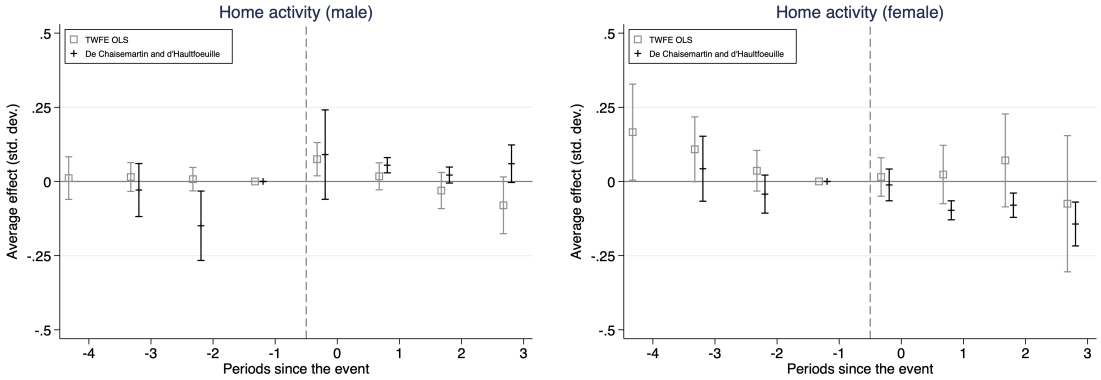


FIGURE A.4: EVENT STUDIES: NCMS ON HOME ACTIVITY