Locked out? China's Health Insurance Scheme and Internal Migration

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Abstract

Providing health insurance with certain geographical restrictions may lead to possible misallocations in the labour market by hindering migration. this paper tests whether the new rural health insurance introduced in 2003, the New Cooperative Medical Scheme (NCMS), had unintended and negative effects on rural-to-urban migration mobility in China. The NCMS only offers health insurance to people with rural household registration, and they can only benefit from the NCMS when visiting the hospitals near their registered location in the household registration system. Utilising a new dataset collected from provincial yearbooks in China, the results from the event-study approach show that the NCMS does not reduce the percentage of rural residents who are rural-to-urban migrants and working outside their home counties at the county level but has negative effects on its growth rate. Using the China Health and Nutrition Survey (CHNS), my instrumental variable (IV) results find that being enrolled in the NCMS decreases the probability of being a migrant at the individual level. The IV is a time-variant dummy indicating the counties that have relative early NCMS implementations. In addition, I use the CHNS to construct a county-level dataset and replicate the county-level results. Together, the results suggest that the NCMS gradually locks the rural labour force into rural areas and further hinders geographical job mobility in China.

Keywords: Health Insurance, Immigrant Workers, Public Policy

JEL codes: I13, I18, J61, J68

1 Introduction

Providing basic health care services to every citizen is one of the important responsibilities of the central government in China (Wang, 2009). In 2003, the central government initiated a new rural health insurance scheme to replace the old policy, which was largely ineffective, to cover the health needs of the rural population. This scheme, the New Co-operative Medical Scheme (NCMS), provides coverage for catastrophic illnesses among the rural population and aims to prevent "poverty caused by illness".[1] However, the policy has a major geographical restriction on the reimbursement rate for medical expenses. The reimbursement rates for medical expenses vary depending on the administrative regions of the hospitals visited. Rural residents are eligible for high reimbursement rates only when they visit hospitals in the same administrative regions as their residence place registered in the household registration system in China.[2]

How might this policy restriction on health insurance distort the migrant labour market in China? This paper finds that the implementation of the NCMS has a negative effect on the number of rural residents who are rural-to-urban migrants and work in urban areas away from their hometowns. However, from a first glance at the general statistics, the trend seems to be the opposite. During the implementation period of the NCMS (from 2003 to 2008), the number of migrants increased dramatically due to China's rapid urbanisation process, and there were increasing income differences between rural and urban areas. The great temptation to work in urban areas might alleviate the proposed negative effects of the NCMS. Despite the rapid economic development of urban areas in China before 2008, the social security system for rural-to-urban migrants was greatly underdeveloped. More than 70% of migrants were still not enrolled in health or work injury insurance within employment-based health insurance in the urban areas in 2012 (NBS, 2012; Giles et al., 2013). Rural-to-urban migrants are particularly vulnerable to health problems that might hinder their earning ability (Barber and Yao, 2010). Providing health insurance in rural areas fulfils rural-to-urban migrants' need for the social safety net. But the geographical restriction brought by the health insurance might potentially encourage these migrants to stay close to their hometown, which is usually their residence place in the household registration system, to benefit from high reimbursement rates.

This paper studies the unintended consequences of the implementation of the NCMS on the rural-to-urban migrant labour market in China. Similar effects of health insurance schemes on labour market distortions have been noted in the U.S. context at the individual level. Gruber and Madrian (1993) discuss the "job-lock" effect of employer-sponsored health insurance portability; other papers examine the effects of health insurance, mainly Medicare, on retirement decisions (Gruber and Madrian 1995; Fairlie

[1] Source for NCMS information: http://www.gov.cn/gongbao/content/2002/content_61818.htm (Content in Chinese), the State Council of the P.R.C.

[2] The system of household registration includes information such as whether the person is a rural or urban resident, birthplace, age, gender and other basic personal information (Chan, 2009).

et al., 2016). Results from the U.S. show that health insurance affects job-related decisions at the individual level. However, none of the studies in the U.S. investigates the effect of health insurance on geographical job mobility. This paper also contributes to the literature on welfare-induced migration. Borjas (1999) found that immigrant welfare recipients are more likely to end up in high-benefit states in the U.S. Others have also contributed to the literature by providing empirical evidence for similar conclusions (Blank, 1988; Gelbach, 2004; McKinnish, 2005; McKinnish, 2007; Giorgi and Pellizzari, 2009), but mostly in developed countries. Munshi and Rosenzweig (2016) conducted a study on migration in India; their structural model estimates whether the improvement of formal insurance on migrations, such as government safety nets and private credit will double the migration rate. However, whether health insurance schemes have similar effects on the labour markets in developing countries, especially in China, is still an under-studied topic in the literature. To date, there has been almost no discussion of possible labour-market distortions caused by the NCMS in China. Qin and Zheng (2011) mentioned this issue, but the results are limited to an individual-level dataset with a restricted period and an identification strategy that not fully identify possible individual endogeneities. My paper provides both robust individual and county-level evidence with clearer identification strategies and longer time-span to fill this missing piece in the literature, with the new datasets collected from various statistical yearbooks and newspapers.

I provide new county-level evidence of the effects of the implementation of the NCMS on the rural-to-urban migration labour market in China. By collecting raw data of the rural-to-urban migrants for each county for 13 years from five provincial statistical yearbooks and the county implementation date of the NCMS from the newspapers, I use an event-study approach to test whether the gradual roll-out of the NCMS decreases the percentage of rural-to-urban migrants from different counties. Rural-to-urban migrants from a county are the county's rural residents who are working in urban areas outside their home county. I call this percentage of rural-to-urban migrants at county-level the 'migration propensity'. The results show that, although the NCMS implementation does not decrease the migration propensity at the county-level, it has a lagged effect on the corresponding growth rate of the migration propensity, usually taking into effect after the first year of the NCMS implementation.

As the results from the county-level data with limited geographical coverage might suffer from misreporting, I use a survey dataset, the China Nutrition and Health Survey (CHNS), to conduct an individual-level analysis. In this analysis, I examine the effects of individual NCMS enrolment on the probability of one being a rural-to-urban migrant. The instrumental variable method is my identification strategy to tackle the possible endogeneities between individual-level health insurance enrolment and migration decision. I use the difference in the timing when different counties become the "pilot" county as an IV for the individual level enrolment. The results show that

individual enrolment in the health scheme decreases the probability of one being a rural-to-urban migrant. I also utilise the CHNS to construct a county-level data, and the results from the constructed county dataset provide supporting evidence for the results from the self-collected county dataset.

The paper seeks to fill the gaps in the current literature by studying the distortionary effect of the NCMS on rural-to-urban migration in China. It is an important topic because the studied migrant group with potential distorted migration behaviour is one of the main labour forces contributing to China's recent development. The first contribution of this paper is that the new health insurance scheme in China might affect people's choices in the labour market on a larger scale compared to the effects of health insurance in the U.S (Gruber and Madrian 1995; Fairlie et al., 2016). The results imply that the unintended consequences of health insurance policies for labour markets in developing countries might be greater than what has been discussed in the literature on developed countries. Secondly, the paper contributes to the existing literature by documenting the aggregated change in migration behaviour caused by health insurance, while most of the papers studying the effects of health insurance focus on individual-level evidence. Another contribution is the new county-level dataset that I collected from provincial statistical yearbooks and used for the county-level analysis.

The remainder is organised as follows. Section 2 provides background on different types of health insurance, especially the NCMS, and rural-to-urban migrants in China. Section 3 mainly focuses on the county-level data, and Section 4 discusses the individual-level evidence. Policy implication and conclusions are in Section 5.

2 Background

To understand why the rural-to-urban migration labour market could be possibly distorted by the geographical restriction of the NCMS, I first need to provide some background on the NCMS, other health insurance policies implemented, and also rural-to-urban migrants in China.

2.1 New Cooperative Medical Scheme and other health insurance schemes

The Cooperative Medical Scheme (CMS) was the health insurance before the implementation of the New Cooperative Medical Scheme (NCMS) since the 1950s, and its coverage was considerably low just before 2003 (Wagstaff et al., 2009). According to Wagstaff and his colleagues, there were many efforts, from local areas to the central government, to improve or even to resuscitate the CMS, yet the improvement on individual health nor the decrease in out-of-pocket medical expenses in rural areas in China was quite insignificant.

The NCMS was designed to cover the health expenditure on the illnesses of rural residents and aimed to avoid possible "poverty caused by catastrophic illness" in rural areas (Yi et al., 2009). The scheme was launched in some counties first in 2003, then gradually rolled out until all counties in China had implemented the NCMS by 2008. For each year from 2003, each provincial government chose different counties within the province as "pilot areas".[3] Once a county became a pilot area, the local government would continuously provide the NCMS to rural residents in the county from then on. I regard the pilot counties as treated counties on and after their first year of this policy implementation throughout this paper. The treated counties increased year by year from 2003.[4] Figure 3.1 presents the number of counties that first become pilot counties in different years.

It is called a "cooperative" medical scheme because there are different parties involved in the financing of the NCMS. Governments at various administrative levels, the central government, provincial government, county-level government, and local (village/township-level) government, are all involved in the implementation of the NCMS in rural areas, and so are the individual participants. The county-level governments are the main operators and designers of the NCMS, and the local government has "some discretion over the level of financing of the program, and the associated benefit package" (Wagstaff et al., 2009). The provincial and county governments are in charge of setting the detailed NCMS implementation, while the central government only provides guidelines (Wagstaff et al., 2009). Individual participants pay a relatively small fixed part of the contribution, and the central or provincial government provides subsidies for the NCMS. The scheme only provides higher reimbursements for medical expenses for a person seeking medical services in his or her township health centres and county-level hospitals (Wagstaff et al., 2009). This geographical restriction on the level of reimbursement rate across different administrative regions is mainly due to the financial structure of the NCMS. Because county-level and local governments are the main operators in the financing of the NCMS, the reimbursement rate is lower if rural residents visit their local hospitals than higher administrative-level hospitals (i.e. prefecture-city or provincial level hospitals) and/or hospitals in places where are administratively different from the rural residents' household registration location.

The NCMS provides not only reimbursements for catastrophic and chronic diseases, but also for inpatient and outpatient services, making the NCMS important for the young rural generation as well as the elderly. The NCMS offers different reimbursement services for various types of service utilised. For any inpatient services, it provides reimbursements for each inpatient treatment within-county, but there is a cap on the amount that can be reimbursed per year. The highest rate is around 80% to 90%, but the rate varies across counties and especially provinces. Some provinces allow a

[3]The selection of "pilot areas" is discussed in Section 3.

[4]Figure A.1 shows the gradual expansion of the "pilot" counties from 2003 to 2008 in the five provinces used in the county-level dataset.

fixed subsidy to each person per year for all outpatient services consumed in a year, and others provide different reimbursement rates depending on the hospitals visited. These subsidies are in addition to the coverage for outpatient services for chronic diseases. For outpatient services and medicines for chronic diseases, the NCMS provides reimbursements depending on the type of disease. The inpatient or outpatient services reimbursement level commonly decreases to around 30-40% if the patients attend hospitals outside their county but within the same provinces.[5] The health expenditure coverage for the NCMS varies slightly across counties but is mostly based on the provincial standard. The reimbursement level has been increasing since its early implementation. According to Wagstaff et al. (2009), hospitals above the county level only consist of 26% of the number of reimbursement episodes per NCMS member. The reimbursements for inter-province out/inpatient visits were not common until 2013. The information implies rural residents are more likely to visit their local hospitals to benefit from the NCMS.

Apart from the NCMS, there are two other main health schemes in China, Urban Resident Health Care Insurance and Urban Employee Health Care Insurance, up to the final period of the NCMS implementation (Yu, 2015). Each of these three schemes provides health insurance coverage for different groups of residents in China. The NCMS mainly benefits rural residents and a small percentage of rural migrants that work close to their home address according to their household registration. Urban Resident Health Care Insurance covers residents with urban *hukou* but only those who are not employed, such as young students and senior residents. Urban Employee Health Care Insurance covers people who are employed in companies that offer this insurance in urban areas, regardless of their household registration status. The summary of the coverage is in Table 3.1.

Combining all three insurance schemes, it shows that most of the rural-to-urban migrants are theoretically covered by the NCMS, yet it is difficult for them to directly benefit from the scheme.[6] Given their low-income level, it is not likely that they will buy commercial health insurance.[7] If rural-to-urban migrants want to enrol in the scheme and benefit from the NCMS, they are likely to go back to the residence place in their household registration, so this scheme might count as an incentive for them to return to or to stay in rural areas, rather than working in urban areas and

[5]Different counties have their regulations on the NCMS, but there are usually some common settings in these different regulations. Patients have the highest reimbursement rate when visiting village-level NCMS-designated hospitals (above 90%), and get a relatively high reimbursement rate of around (70-80%) when visiting county-level designated hospitals. If patients want to visit provincial-level designated hospitals, they usually get around 40% for the reimbursement rate. The process of getting reimbursements is also troublesome after visiting designated hospitals at their province-level. Some counties require an official transfer document from the county or village-level hospitals if patients want to visit the provincial level hospital. The regulation from Qidong (a county in Jiangsu) is in http://www.qidongnews.com/html/2015-11/20151104063042.htm.

[6]Thorough discussion in Section 2.2.

[7]The market for commercial health insurance was very limited during the implementation period of the NCMS.

cannot commute frequently between their workplaces and hometowns. This is one of the main reasons why there might be potential negative effects of the NCMS on the rural-to-urban migration labour market. There is some health insurance coverage for rural-to-urban migrants in big cities such as Beijing, Shanghai, Guangdong, and Shenzhen, but these schemes are not compulsory for the employers hiring the migrants and were not well implemented before 2010 (Barber and Yao, 2010).

2.2 Rural migrants and the *hukou* system

The different coverages of the different insurance schemes in China imply that rural-to-urban migrants are difficult to benefit directly from any of these schemes. One of the possible reasons that inferred from the previous descriptions is the household registration system (*hukou*) in China. *Hukou* is the individual level record in the system of household registration. It includes information such as whether a person is a rural or urban resident, birthplace, age, gender and other basic personal information (Chan, 2009). The classification of rural or urban residency is very difficult for rural residents to change. This geographical mismatch between where one's hukou is registered and where one is working and living potentially prevents a sizeable number of people in rural areas from benefiting from other urban health insurance schemes and also the NCMS, which most of the inter-province or even inter-county rural-to-urban migrants should be able to utilise.

Rural-to-urban migrants consist of three types. The first type (Type 1) is intra-county rural-to-urban migrants. They work in urban areas of the county in which they reside and comprise some 20% of the total migrants (NBS report, 2012).[8] It is easy for the intra-county rural migrants to commute between their *hukou* residence and their workplace, so they can still benefit from local welfare schemes such as the NCMS. The second type (Type 2) consists of the rural-to-urban migrants who are the focus of this paper. They have rural *hukou*, but they work and live in urban areas far from their hometowns.[9] They are usually enrolled in low-skilled labour sectors such as construction and manufacturing in urban areas. In these sectors, employers are usually less likely to provide insurance coverage during the roll-out period of the NCMS. Working in big cities makes it difficult for them to participate in local welfare schemes, and their rural *hukou*s prevent them from enrolling in welfare schemes in urban areas that were designed for urban *hukou* residents. The third type (Type 3) of rural-to-urban migrants are similar to Type 2, but Type 3 migrants have higher education levels and are mostly employed by companies that provide welfare benefits in urban areas. The NCMS implementations in rural areas do not affect Type 3 migrants because these migrants' social insurance is already provided by their employers in urban areas. Type

[8] All information about migrants in Section 2.1 are from this report and similar reports from other years.

[9] This category of migrants is non-seasonal because of the long distance between their workplace and their hometown. It is expensive and difficult for them to go back in the harvest season.

3 migrants are more likely to be classified as rural-to-urban employees rather than rural-to-urban migrants.

According to the Report of Chinese Migrants in 2012, there are 208 million rural-to-urban migrants working outside their hometown, and 83% of them still cannot benefit directly from any health insurance scheme (NBS report, 2012). 94% of rural migrants do not have a college degree, and 80% of them do not even have a high school diploma. Moreover, around 75% of them are not employed by companies providing welfare benefits in urban areas (NBS, 2012). Giles et al. (2013) found that no more than 20% of rural-to-urban migrants are covered by employment-based insurance. The rural-to-urban migrants have much less health insurance coverage compared to urban residents, rural residents who are not working outside their hometowns, and rural-to-urban employees. Despite the group's young average age (around 30), this group of migrants is vulnerable to serious health problems including lower immunization rates, higher rates of infectious diseases, and maternal mortality (Barber and Yao, 2010). The occupational health risks that migrants face are higher than for those with higher socioeconomic status and/or "white collar" jobs (Herd et al., 2010). Rural-to-urban migrants usually have relatively poor health because their workloads are higher while their incomes are comparatively lower than others (Chen et al., 2014). They can easily be dragged below the poverty line if they fall ill and cannot afford health expenditures for illness because of the difficulty of enrolling in most of the health insurance schemes available in urban or rural areas.

There was a decrease in the number of rural-to-urban migrants and also in the growth of rural-to-urban migration in 2009 due to the 2008 financial crisis; however, the number of migrants returning to their hometowns (return migrants) was relatively low compared to the total migration population. According to Xiwen Chen, one of the officials in the Rural Working Leading Group from the central government, there were about 20 million return migrants in 2009 due to the financial crisis.[10] The total number of inter-county rural migrants was 145.33 million, and the total number of rural migrants was 229.78 million (NBS, 2009). These return migrants account for less than 10% of the total migrants and 14% of the inter-county migrants. The total number of migrants actually increased by 1.9% in 2009, and the total number of inter-county migrants increased by 3.5% (NBS, 2009). From the different growth rates for total migrants and inter-county migrants, it seems that the financial crisis affected intra-county migrants more compared to the inter-county group. The corresponding growth rates for the total migrants and the inter-county migrants were 6% and 5.4% in 2010, 3.4% and 4.4% in 2011, and 3.0% and 3.9% in 2012 (NBS, 2009-2012). The different growth rates of the total migrants and the inter-county migrants indicates that the financial crisis might only have had one-year negative effects on the increase of rural migrants, especially the inter-county ones. The return migrants represent a

[10]Website: http://theory.people.com.cn/GB/49154/49369/8738602.html, contents in Chinese.

relatively small percentage in terms of the total number of rural-to-urban migrants. These growth rates also indicate the trend of increasing rural-to-urban migrants might not be concave, which helps the later interpretation of my empirical results.

The county-level data in the government report does not identify the new migrants and the return migrants. According to the Longitudinal Survey on Rural-Urban Migration in China (RUMiC),[11] there were 522 new migrants who had just migrated to cities in 2008, compared to 407 new migrants in 2007.[12] The trend of an increasing number of new migrants is evident in Figure 3.2. I might not be able to eliminate all impacts of the 2008 financial crisis on the number of migrants, but as the evidence from the RUMiC shows, the effects might not be large enough to affect my main results in an extensive way, at least in 2008 and 2009. However, given that the RUMiC is limited to the 2008 and 2009 sample, I cannot say more about what might have happened for the rural-to-urban migrants after 2009. The financial crisis might have had lagged effects on rural-to-urban migrants, but interpreting this information together with the figures of the growth rates from the NBS migration report, it seems that 2009 should be the year that the financial crisis had the largest effect on rural-to-urban migrants,[13] which the year fixed-effect could capture the crisis in the results.

3 Evidence from the county-level data

The theoretical mechanism behind the negative effects of the NCMS is a simple compensating differential model by Gruber (2000) based on Rosen's model in 1986. A modified form of the Gruber model applied to the rural-to-urban migration context is in Appendix A.1. The migration decision under the compensating differential model is very simple. For those who have already migrated, if the NCMS were to narrow the urban-rural income gap after decreasing the medical expenses in rural areas, then the number of migrants who want to move back to their hometown would increase. For people who reside currently in rural areas, the number of people who want to become rural-to-urban migrants would also decrease. So if the NCMS were more generous, then there would be fewer rural residents who are rural-to-urban migrants. The important condition for these changes is that the implementation of the NCMS does not affect the probability of people getting sick, which is likely to be true in short run. I provide two sets of empirical evidence for the effects of the NCMS implementation on the number

[11] RUMiC consists of three parts: the Urban Household Survey, the Rural Household Survey and the Migrant Household Survey. It was initiated by a group of researchers at the Australian National University, the University of Queensland and Beijing Normal University and was supported by the Institute for the Study of Labor (IZA), which provided the Scientific Use Files. The financial support for RUMiC was obtained from the Australian Research Council, the Australian Agency for International Development (AusAID), the Ford Foundation, IZA and the Chinese Foundation of Social Sciences.

[12] RUMiC only contains two waves, one in 2008 and one in 2009. In the 2009 data, it cannot capture all the new migrants who migrated in 2009 in the sample, so I use the number of new migrants up to the year 2008 in the 2009 dataset.

[13] The effect of the financial crisis on the counties with the NCMS implementation close to 2008 is discussed in Appendix A.4.2.

of rural residents who become rural-to-urban migrants in two different perspectives: the county-level results and the individual level results. I focus on the county-level results in this section first, using the county-level data collected from provincial statistical yearbooks. The results provide insight into the extent to which rural-to-urban migrants respond at an aggregate-level to a policy change that was not designed to affect the labour market in China.

3.1 County-level dataset and main variables

To examine the effects of the NCMS on the percentage of rural residents who are rural-to-urban migrants working outside their county at the county level, I obtained the corresponding data from different provincial statistical yearbooks and compiled a novel self-collected dataset. The dataset consists of county-level data from 1998 to 2011. Only five provinces, Jiangsu, Gansu, Ningxia, Hubei and Shanxi, provide data on the number of rural-to-urban migrants at the county-level in their provincial yearbooks or provincial rural yearbooks. These provinces are important for economic and also migration-related activities in China. Gansu, Hubei and Shanxi are in the top-ten list of migrant-exporting provinces (Chan, 2013),[14] and Jiangsu is the province with the second largest GDP in China.[15]

The main variables collected are the total number of the rural population and the total number of the rural labour force who are rural-to-urban migrants and working outside their county at the county level. I call the percentage of rural residents who are rural-to-urban migrants in urban areas the migration propensity, which is the number of rural residents who are rural-to-urban migrants divided by the total rural population. Because the data collected is at the county-level, this sample only consists of inter-county rural-to-urban migrants, and 85% of the migrants are aged between 16-45 (NBS, 2009). The intra-county rural-to-urban migrants are counted as being in the labour force in other sectors (manufacturing or service etc.) within the total county labour force. For all provincial yearbooks, in most years, I also collected GDP, disposable income per capita for rural residents, total irrigated farmland, and the total number of the rural labour force at the county-level. The format of the provincial statistical yearbooks is not completely consistent over a long period, thus in certain years, for one or two provinces, the total number of migrants in rural areas is missing. Some imputations based on the dataset are needed to fill in the missing values.[16]

Another important variable is the starting year of the implementation of the NCMS for different counties. To get the date of the initial implementation of the NCMS for each county, I extracted the information from various county/prefecture/province-level

[14] In the list, Chongqing needs to be included in Sichuan province because it is more a city than a province in terms of the land area.

[15] Source: http://www.economist.com/content/chinese_equivalents

[16] The detailed information about imputation methods is in Appendix A.2. The estimations depend on different provincial statistical yearbooks.

newspapers and government documents, and I formed a dataset for 178 counties from 2003 to 2008. Suburban areas that under prefecture-level cities were excluded from the regressions. Suburban areas are classified administratively as counties, but in practice, they are more similar to the urban areas in prefecture-level cities rather than counties that are far from prefecture-level cities. Rural-to-urban migrants from these suburban areas usually work in the urban area close to their *hukou* residence place, so it is easier for them to benefit from the NCMS than migrants from other counties. The migrants in rural areas in this county-level dataset are inter-county or inter-province migrants. As they cannot easily benefit from the NCMS due to the commuting difficulties, this is the group on which the NCMS might exert negative effects.

3.2 Empirical methods and results

The implementation of the NCMS was gradually rolled-out in different counties in different years from 2003 to 2008. Compared to the common difference-in-differences method, it is more reasonable to use the event study approach to identify the yearly effects of the NCMS implementation. The NCMS might take years to come into effect, but in the basic difference-in-differences method, the results only represent the aggregate average effect from the year of implementation onwards. Also, given the number of "pilot" counties changes over time, the time-varying DID method is criticised by de Chaisemartin and D'Haultfoeuille (2018) for mixing the DIDs in different periods.

To observe the basic results of the NCMS's yearly impacts on the migration propensity for different counties, the regression equation using the event study approach is

$$\begin{aligned} prop(migrants)_{i,t} =& \alpha + \sum_{n=-4}^{4} \beta_n \mathbf{I}[FirstNCMS_{i,t} = n] + X'_{i,t}\theta + \sum_{k} \gamma_k \times \mathbf{I}[k = t] \\ & \times \sum_{l} \rho_l \times \mathbf{I}[l = p] + year_t + \mu_i \times year_t + \upsilon_t + \varepsilon_{i,t}, \end{aligned} \tag{1}$$

where i is the index for county and t stands for time. $prop(migrants)_{i,t}$ is the propensity of rural residents from county i working outside their home county (county i) at year t, which is the migration propensity. It is used to analyse the aggregate level of rural-to-urban migration from a county. The definition for this variable is the number of rural-to-urban migrants from a county divided by the total rural population in the county. $\mathbf{I}[FirstNCMS_{i,t} = n]$ is a dummy variable and equals 1 for the n^{th} years before or after the initial implementation of the NCMS for each county i at year t. υ_t is the year fixed effect. $year_t$ is the linear year trend and $\mu_i \times year_t$ is the county fixed effect times the linear year trend. $\mathbf{I}[k = t]$ represents the year dummies from 1998-2011, and $\mathbf{I}[l = p]$ indicates the province (p) dummies for five provinces in total. The fixed-effect error term $\varepsilon_{i,t}$ is clustered at the county level.[17] $X_{i,t}$ are the control variables, which

[17]The choice of the cluster-level in the regressions is based on the discussion of the cluster-level by

include GDP per capita, disposable income per capita for rural residents, irrigated farmland per capita, and total rural labour force for each county at each year.[18]

The results are shown in the first and the second column of Table 3.2, and the plot for the coefficients is the left graph in Figure 3.3. The regression results are similar with or without controls. After controlling for county fixed-effects, year trend fixed-effects, year times province fixed-effects, and other county-level control variables, each of the coefficients β_n represent the yearly effects of n^{th} year before or after implementing the NCMS. For the results from the event study approach to identify the yearly effects of the NCMS implementation, one key assumptions for the results to be valid is the parallel-trend assumption, which means prior to the NCMS implementation, the differences between "pilot" counties and other counties should be small and insignificant.

The trend assumption for the period before the implementation of the NCMS is not violated according to the results in Table 3.2 and Figure 3.3. The β_n for $-4 \leq n \leq -1$ are insignificant and close to zero. The coefficients representing the years after the implementation of the NCMS are still insignificant but the magnitudes are larger than those before implementation. However, it is still difficult to draw any conclusion about the effects of the new insurance policy here. The effects of the first and the second year of the initial NCMS implementation are even positive. I find no strong evidence of the NCMS having negative effects on the migration propensity at the county-level.

One explanation for not finding the expected negative effects of the NCMS implementation on the $prop(migrants)_{i,t}$ could be the economic background during the period examined in the data, which is from 1998 to 2011. During this period, China experienced rapid development and urbanisation. The urban-to-rural income ratio from 1998 increased from 2.5 to 3 and has been stagnating at a high level since 2007 (Sicular, 2013). Due to the income differences, there was a large increase in rural-urban migration during this time (Shi, 2008). It is reasonable to believe that the NCMS might not have strong effects on the propensity of rural migrants for each county directly, but it might be able to slow its growing trend. To test this effect, I change the dependent variables from $prop(migrants)_{i,t}$ to the growth rate of the migration propensity in a county, $growthrate_{i,t}$, so the regression becomes:

Abadie et al. (2017). They suggest that when using fixed-effects regressions, the cluster-level should be adjusted to the level of corresponding policy treatments. The NCMS policy is implemented at the county level. It would be suitable to use the cluster at the county-level in all fixed-effects regressions in this paper.The results under different cluster-levels are presented in Table A.1. When the error term is just robust but not clustered, the results are similar to the results in Table 3.2. When the error term is clustered at the prefecture-level, the significance level dropped and only the effect of the NCMS implementation on $growthrate_{i,t}$ after the fourth year of its implementation is significant at 90%. The results are insignificant when the error term is clustered at the province-level. However, since I am only able to collect 5 provinces for the county-level dataset, it might be too few clusters used when choosing the province as the cluster-level. Also, within a province or even a prefecture city, the differences between different counties are quite large in terms of GDP, population, and especially the NCMS implementation. It is reasonable to use the county level as the cluster-level of my stander errors in the regressions, together with the argument by Abadie et al. (2017).

[18]Results for the correlation between controls and the implementation dates of the NCMS are in Appendix A.4.3 Table A.6. The detailed explanations are also in Appendix A.4.3.

$$growthrate_{i,t} = \alpha + \sum_{n=-4}^{4} \beta_n \mathbf{I}[FirstNCMS_{i,t} = n] + X'_{i,t}\theta + \sum_{k} \gamma_k \times \mathbf{I}[k = t] \times \sum_{l} \rho_l \times \mathbf{I}[l = p] + year_t + \mu_i \times year_t + \upsilon_t + \varepsilon_{i,t}, \quad (2)$$

The results are presented in the third and fourth columns of Table 3.2. The regression results are similar with or without controls. The graph on the right in Figure 3.3 plots the coefficients from Equation (2).

I observe significant negative effects of the NCMS for the 1st, 3rd and 4th year after its initial implementation, shown in Table 3.2. These results indicate that the NCMS slows down the growing trend of rural-urban migration in most of the years following implementation. No immediate effects from the NCMS might because the NCMS takes time to come into effect. The rural residents who are working in urban areas may require time to quit their jobs and settle in their hometowns if they want to benefit from the NCMS. The implementation of the NCMS could unintentionally decrease the growth rate of migrants by as much as 1.43% on average in the first year after the initial implementation. The effect counts around 40% of the growth rate for the number of inter-county migrants, which was 3.5% in 2004.[19] The third-year effect of the NCMS is the largest amongst the yearly effects. It decreases the growth rate of the migration propensity by 1.65%. If an average county implemented the NCMS in 2006, then the counterfactual growth rate without the NCMS implementation for the rural-to-urban migrant in 2009 should be 5.15%, which is almost 1.5 times of the actual growth rate. This figure is based on the assumption that there is no impact from the financial crisis in 2008, and also the 2009's growth rate is 3.5% (NBS, 2009).

One possible explanation for the growth rate of the migration propensity is the possible diminishing growth rate of the rural-to-urban migrants. To address this concern, I control for the county fixed effect times a linear year trend in all the regressions in this paper. Apart from the empirical method, the statistical figures about the growth rate from 2009-2011 stated in Section 2.2 shows that the growth rate is around 3%. There is no general decreasing trend for the growth rate of the migrant in the period examined. A report from Asian Development Bank also shows the increasing trend of the migration share of the total population is not diminishing.[20] These statistics might also help to alleviate the concern of the possible diminishing growth rate of the rural-to-urban migrants that might be driven the results.

Generalising the results to the whole country, and, given the actual number of inter-county migrants in 2008 was 140.41 million (NBS, 2012), if the NCMS decreased

[19] https://clb.org.hk/schi/content/%E4%B8%AD%E5%9B%BD%E5%86%9C%E6%B0%91%E5%B7%A5%E9%97%AE%E9%A2%98%E7%A0%94%E7%A9%B6%E6%80%BB%E6%8A%A5%E5%91%8A. Content in Chinese

[20] Lu and Xia (2016). Migration in the Peoples Republic of China. https://www.adb.org/sites/default/files/publication/191876/adbi-wp593.pdf

the growth rate in 2009 by 1.65%, this would mean that 2.31 million rural residents were affected by the NCMS.[21] This number is calculated based on the number of rural residents who are already rural-to-urban migrants, which does not include potential rural-to-urban migrants, so the actual size of the affected population could be larger. It is a relatively small compared to the total migrant size in China, but this decrement in the migrants in just one year would be more than two-thirds of the total labour force of Singapore, Hong Kong or Massachusetts.[22], not to mention the migrants-to-be who might be affected. However, many restrictive assumptions need to be born in mind when interpreting the generalised effect.

The takeaway from the results is that the implementation of the NCMS has a negative second-order effect on the number of the rural-to-urban migrants. The robustness checks for different numbers of years before and/or after the implementation of the NCMS are presented in Appendix A.4.1. The results from these checks show significant negative effects for different numbers of leads and lags on the growth rate of the migration propensity. These results also suggest that the NCMS has a long-term lagged effect on migration rather than an immediate effect. When interpreting the results, I need to consider the increasing generosity of the NCMS since the early years of its implementation. The increase in the NCMS generosity level would amplify the negative effects of the implementation. However, counties set the reimbursement rates based on the guidelines provided by the provincial governments (Wagstaff et al., 2009). The year times province fixed effects that I controlled for in the regression would help to address this concern. Apart from this, the interpretation of the results and the conclusions also rely on a set of identification assumptions for the event study approach.

Checking the identification assumptions

The first and the most important assumption in the event study approach is that the NCMS implementation is not determined by the outcome variable. The NCMS was emphasised mainly as a welfare benefit for rural residents rather than the central government targeting the rural migrants (Yi et al., 2009). From a policy point of view, implementing the NCMS and the rural-to-urban migrants from different counties should be exogenous. In addition, the plots of coefficients in Figure 3.3 both support this assumption: the migration propensity and its growth rate do not vary much before the implementation of the NCMS. To further confirm this assumption, I conduct a classic placebo-test on the implementation of the NCMS. I assume hypothetically that the NCMS initial implementation starts two years early than the actual starting date for each county. I run Equations (1) and (2) with the same specification and the hypothetical early NCMS implementation date, and the results are in the first two

[21] Assume all counties implemented the NCMS in 2006.

[22] Sources: http://www.censtatd.gov.hk/hkstat/sub/so30.jsp (HKG), http://stats.mom.gov.sg/Pages/Labour-Force-In-Singapore-2013.aspx (SGP) and http://www.bls.gov/news.release/laus.t03.htm (USA).

columns of Table A.2. The results show that, for the migration propensity and its growth rate, the hypothetical early NCMS implementation does have effects at least until the third year of the implementation, which are consistent with the results when running the actual NCMS implementation timing in Table 3.2. The results from this placebo test make the assumption of the migration propensity and its growth rate do not vary much before the implementation of the NCMS as a valid one.[23]

Another key assumption for the results to hold is that the timing of the NCMS implementation also needs to be exogenously assigned to each county in theory. However, the detailed official requirements for the timing of the implementation of the NCMS in each county were not publicly revealed. Some news reports discussed the requirements for being a "pilot" county, yet the requirements were quite vague, and there is no detailed information on the timing of the implementation.[24] The main concern arising from the vague requirements is that the timing of the first implementation of the NCMS was related to GDP per capita or other characteristics that are controlled at the county level. For example, counties with higher GDP per capita might have implemented the NCMS earlier than counties with lower GDP per capita. Also, GDP per capita and other controls might lower the migration propensity and/or its growth, which might affect the interpretation of the results.

To check whether GDP per capita and other controls correlate with the timing of the counties' initial NCMS implementation. I first classify counties into two groups based on the date of the NCMS implementation: an early-treated group and a late-treated group. The early-treated group includes counties that implemented the NCMS in 2003, 2004 and 2005, and the late-treated group includes those counties that implemented it after 2005. I test the correlations between GDP per capita, rural residents' income per capita, the number of the total rural labour force, and whether a county is in the early treated group. The results are in Table A.6 in the Appendix, and the correlations between whether a county is in the early-treated group and different controls at the county level are insignificant. However, there are other unobservables that might affect the interpretation of the result in the same way as the GDP per capita and other controls. It would have been desirable to have the information related to medical and health services provided in the rural areas at county-level. I could have used the information as an instrument for the timing of the NCMS implementation. However, not all statistical yearbooks offer this information from five provinces. This possible

[23] I also run the event-study regressions only for Guangdong province, which implemented an early version of the NCMS in 1999 (Zheng, 2011).The implementation of the NCMS in 2003 in Guangdong province was merely a name change from the previous health insurance system. So if there were no actual NCMS implementation in Guangdong, then the advertising of the NCMS would be unlikely to have affected the migration propensity. The details of this placebo test are in Appendix A.3, and the results are in the last two columns of Table A.2. The large coefficients and stander errors might be due to the sample size limitation.

[24] Website: http://www.jxsrwsj.gov.cn/Article/ShowArticle.asp?ArticleID=174 (The content is in Chinese). The requirements are such that the county has sufficient ability to manage health care resources or the county needs to have sufficient subsidies to help the implementation of the NCMS, but they did not define what "sufficient" is in their requirements.

selection bias should be borne in mind when interpreting the results.

In the event study approach, I show that the coefficients for the years before the NCMS implementation are insignificant and have smaller magnitudes than the yearly effects after the implementation. However, it would be reassuring if the difference between the average of the $prop(migrant)$ and $growthrate$ for the early-treated counties and late-treated counties are small or insignificant. In Figure 3.4, I show the average of the $prop(migrant)$ and $growthrate$ for early-treated and late-treated counties for three periods: before the NCMS implementation (1998-2003), during the roll-out of the NCMS (2003-2008), after roll-out of the NCMS (2009-2011). The figure shows the $prop(migrant)$ for early and late-treated counties are similar before and even during the NCMS implementation. For the growth rate of $prop(migrant)$, it seems like the late-treated group has a higher average for the period before and during the NCMS implementation. However, the differences seem not large enough given the 95% confidence intervals for the early-treated and late-treated groups. The figure shows for the growth rate of $prop(migrant)$ after roll-out of the NCMS, the early-treated counties have a higher average than the late-treated counties, which could explain the results of early-treated counties with insignificant NCMS impacts in Table A.7. The statistics for pre-NCMS implementation period and the period during the NCMS roll-out seems to be consistent with the pre-event results from the main regressions.

Apart from testing the validity of the identifying assumptions, during the time period examined in this section, there might have been other reforms in China that might also have affected the percentage of rural-to-urban migrants from counties. Large-scale agricultural reforms could be one of these. For example, the central government officially abolished the agricultural tax on January 1st, 2006.[25] This reform was nationwide, so the abolition of agricultural taxation was implemented provincially from 2004 to 2006 (Chen, 2017). Another change that might have affected the results could be the change in provincial leaders. From 1998 to 2011, the provincial leaders changed at least five times. Different provincial leaders also affects policy implementations in their provinces differently, depending on the closeness of their relationship with the central government (Chung, 1995). The year times province fixed effect and the year fixed effect controlled in the regressions could capture the tax reform effect and hopefully captures other provincial level changes.

However, there are two other flaws in the county-level dataset that might have weakened the credibility of the results: under-reporting on the number of migrants at the county level and limited provincial coverage of the dataset. Regarding the first weakness, a county's government has an incentive to under-report the number of migrants in order to "look good" in comparison to other counties in provincial statistical yearbooks (Cai, 2014). According to Koch-Weser (2013), the under-reporting might also be due to unregistered migrants. The second problem is that the dataset only

[25] Website: http://news.xinhuanet.com/politics/2009-10/13/content_12220598.htm

covers 5 out of 32 provinces in China. I have to bear these two main flaws of the county-level dataset, as well as the possible selection bias and the fact that the county-level data cannot track return migrants, in mind when interpreting the results. Using individual-level datasets collected by non-governmental research organisations helps avoid the under-reporting problem. Therefore, I use the individual-level data to verify the county-level results and also try to analyse the question from a micro perspective.

4 Evidence from the China Health and Nutrition Survey

Because the interpretation of the county-level data results might suffer from the mis-reporting problem and the geographical limitation, I use an individual level dataset, the China Health and Nutrition Survey (CHNS), to verify the effect of the NCMS implementation on rural-to-urban migrants from a micro-perspective. The CHNS is a comprehensive survey panel dataset covering information regarding income, healthcare, medical expenditure, health insurance and other aspects. This unbalanced longitudinal dataset contains comprehensive information about households from nine different provinces from 1989-2011.[26] Hence, the CHNS can be treated as a comprehensive representation of national data compared to the county-level data. Data are collected through questionnaires filled out by households, and one household representative answers the questionnaire for all the household members.[27] The data are at the individual level. I utilise the dataset in two ways. First, I use the individual-level data provided by the CHNS to examine the effect of being enrolled in the NCMS on the probability of an individual being a migrant, providing supporting evidence for the effect of the NCMS on rural-urban migrants at the individual level. The second method of utilising the CHNS is to construct a new county-level dataset. The corresponding results provide new county-level results, which add more credibility to the macro-level evidence.

4.1 Individual level evidence

When generating the individual-level evidence, I want to test whether being enrolled in the NCMS makes individuals less likely to be inter-county rural-to-urban migrants. The outcome variable indicates whether an individual is seeking jobs somewhere else and has not been home for a certain period (labelled here as *migrant*), and the key independent variable shows whether an individual is covered by the NCMS (labelled here as *haveNCMS*). I use a sample that contains individuals with rural *hukou* only, for it to be consistent with the data used in Section 3. The CHNS does not show whether

[26] Liaoning, Heilongjiang, Jiangsu, Shandong, Henan, Hubei, Hunan, Guangxi, and Guizhou. Guangdong is not included in this dataset. There are nine waves: 1989, 1991, 1993, 1997, 2000, 2004, 2006, 2009, 2011 and, recently 2015. The coverage map for CHNS is shown in Figure A.4.

[27] In survey wave on or before 2000 and for some questions on and after the wave 2004.

an individual is an inter-county migrant. It only provides information on whether an individual is now a migrant and how long this individual has been away from home. To identify the inter-county rural-to-urban migrant, I set the variable migrant equal to 1 if individuals are seeking jobs somewhere else and have been away from their hometown for more than six months. In the wave 1989, 1991, and 1993, there was no information about the migration behaviours in the data, so I only use 6 waves of the CHNS from 1997 to 2011 (1997, 2000, 2004, 2006, 2009, and 2011) to match the time period covered by the county-level results. It is still difficult to identify whether a person is a return migrant in the CHNS, just like the county-level data.

Using the difference-in-differences method with panel data, the possible unobservable time-invariant individual effects were eliminated from the individual fixed-effect. For the time-variant variables, the wave (corresponding to year) times province fixed-effect also helps to control for the trends partially. The regression for the individual-level result is:

$$\begin{aligned} migrant_{d,t} =& \alpha + \beta haveNCMS_{d,t} + X'_{d,t}\theta + \sum_{k} \gamma_k \times \mathbf{I}[k = t] \\ & \times \sum_{l} \rho_l \times \mathbf{I}[l = p] + \mu_d + \upsilon_t + \varepsilon_{d,t}, \end{aligned} \tag{3}$$

where d is the index for individuals and t stands for time. μ_d is the individual fixed-effect and υ_t is the wave fixed-effect. $\mathbf{I}[k = t]$ represents the six wave dummies from 1998-2011, and $\mathbf{I}[l = p]$ is the province (p) dummies for 9 provinces in total. $migrant_{d,t}$ equals 1 if an individual has a rural *hukou*, is aged between 16 and 45,[28] is seeking a job somewhere else, and has been away from home for more than half a year in wave t. $X_{d,t}$ is an array of the demographic variables including deflated household income per capita, age, marital status, occupation, and highest education level, and also county-level average household income. All individuals in the sample have rural *hukou*. The error term $\varepsilon_{d,t}$ is robust. $haveNCMS_{d,t}$ equals 1 if an individual d covered by the NCMS in wave t. The OLS results are presented in Panel A in Table 3.3.

At the individual level, enrolment of the NCMS is voluntary (Wagstaff et al., 2009). So, there are endogeneities between $haveNCMS_{d,t}$, $migrant_{d,t}$, the controls, and possible unobservable variables, even after controlling for the individual fixed effects. For example, individual health affects decisions on both whether or not to become a rural-to-urban migrant and the NCMS enrolment. In addition to the difference-in-differences method, I partially adopt Lei and Lin's (2009) method and use a variable related to the county-level NCMS enrolment as the instrumental variable for the individual-level enrolment. Lei and Lin argue that it is difficult for the individual-level factors to affect the county-level implementation of the NCMS, which indicates the county-level policies are plausibly exogenous to individual-level controls and unobservable demographic

[28] which is the main age range for rural-to-urban migrants (NBS, 2012)

variables. Also, the county-level NCMS implementation is strongly correlated with the individual-level NCMS enrolment. Most of the counties implemented the NCMS cover for more than 50% of the population even during the first year of the NCMS implementation (Wagstaff et al., 2009).

However, the county-level NCMS implementation might still affect the individual decision to be a rural-to-urban migrant. Hence, I modify the county-level NCMS implementation variable to a variable indicating whether the county is an early pilot county for the NCMS. Whether the county is an early pilot county affects the residents' decision to be a rural-to-urban migrant in a relatively smaller way. The average county-level NCMS implementation's effects on the individual level decisions are alleviated by using the differences between the early-treated and the late-treated counties as the IV. Also, in Section 3, I show that, before the implementation of the NCMS, the early-treated counties and the late-treated counties had a similar pre-trend in terms of the percentage of rural-urban migrants at the county level. The early-treated counties usually have higher NCMS coverage for their population than the late-treated counties given their early implementation dates and advertising, which makes it correlates with the individual level NCMS enrolment.

To identify which counties are the early-treated counties, I need the percentage of NCMS coverage for different counties. An ideal scenario would be if I knew the detailed county names so that I can extract the exact start date of the first implementation of the NCMS in different counties. However, the CHNS does not provide the name of counties that were surveyed in the data, so I cannot match the counties in the CHNS with the information collected in the county-level dataset for the corresponding implementation date. Each county is classified as belonging to one of two groups, the early-treated group or the late-treated group. Those counties where there are sudden increases in the number of people enrolled in the NCMS in the 2004 or 2006 wave are classified as the early-treated group.[29] This is because only the 2004 and 2006 waves of the CHNS are close to the starting date of the initial implementation of the NCMS. In 2004, only a few counties were included in the first and the second round pilot, so, likely, only a small number of counties in the CHNS 2004 wave implemented the NCMS. The year 2006 can be regarded as a suitable date to ensure that at least some of these counties in the CHNS are included in the early-treated group.

I create a dummy variable *earlycounty* which sets to 1 for all individuals from early-treated counties for the waves on and after 2006, and 0 for other individuals and waves. This time-variant IV is similar to the idea of the difference-in-differences IV, which further alleviates the concern of the county-level implementation affecting the individual migration decisions. Also, the results from Section 3 shows that the

[29]In rare cases, if a county had less than 10 people in 2000/2004 and had at least a 50% increase in 2004/2006, then I counted this as a sudden increase and treated this county as an early-treatment county. The detailed number of counties that had a sudden increase in NCMS coverage for each year are presented in Appendix Table A.8.

parallel-trend exist before the NCMS implementation for the early and the late-treated county, which helps the validity assumption of my resembling difference-in-differences IV. The insignificant effect of the NCMS implementation on the migration propensity in Section 3 might imply the early-treated county implementation do not directly affect the probability of one being a rural-to-urban migrant. Yet, there might be some second-order correlations that I need to bear in mind when interpreting the results.

Using this new instrumental variable in the regression, I test whether individual enrolment in the NCMS affects individuals' choice to be a rural-urban migrant. The IV results are reported in Panel B in Table 3.3, after controlling for individual demographics, and the wave times province fixed effects. The result is negative and significant for $haveNCMS_{d,t}$. The effects of the NCMS on individual choices test the stock of migrants. This means that, on average, being enrolled in the NCMS reduces the probability of one being a migrant by 5.9%. The first-stage results for $earlycounty_{d,t}$ are reported in Table A.9, and the coefficients are positive and significant with large F-statistics. The IV results show that being enrolled in the NCMS has negative effects on the probability of one being a rural-urban migrant.

If I generalise this individual-level effect to a county-level effect, it corresponds to the negative effects of the NCMS implementation on the percentage of rural-urban migrants at the county-level. The individual-level results show that the effects of the NCMS implementation are larger than the county-level evidence, which only shows that the NCMS implementations have second-order negative effects on the migration propensity. One of the possible explanations for the difference between the individual-level and county-level results is the misreporting problem. The under-reporting problems in the county-level dataset would give me a lower-bound of the effect of the NCMS implementation on the migration propensity. The possible endogeneity from the timing of the county-level implementation can be another possible reason that drives the larger effect of the NCMS implementation found in the individual-level results than in the county-level results. Although the difference-in-differences IV alleviates the effects of the county-level NCMS implementation on the individual-level migration decisions, there are still possibilities that these effects are difficult to be completely ruled out. I should bear this in mind when interpreting the results in this section.

The different effects of individual NCMS enrolment by gender are also presented in the second and the third column of Table 3.3 for the OLS and the IV results. The different effects of the NCMS enrolment on the choice to be rural-to-urban migrants at the individual level could be driven by a specific gender group. The gender of the rural-to-urban migrants could have two different impacts on insurance enrolment. First, according to the literature, women are more risk-averse than men (Borghan et al., 2009), so the strong insurance preference of female migrants might camouflage the fact that healthy male migrants do not want to be enrolled in the insurance scheme. Second, male rural-to-urban migrants are more likely to join the workforce in poorly

regulated sectors, such as private mining, construction, and manufacturing firms (NBS, 2009). The actual accident injury rate and the occupational injuries of males are higher than that of the female migrants. So female migrants are more under-insured than male migrants because of their lower occupational risk (Mou et al., 2013), and this makes male migrants more likely to respond to the new health insurance in rural areas. The results for different gender in Table 3.3 show that the effects of the NCMS on males and females are both negative and insignificant, which implies the effects of the NCMS enrolment are not driven by one specific gender group, yet the male group has lager coefficients compared to the female group.

There is also an age difference in terms of the enrolment of the NCMS. Theoretically, young migrants are less likely to be enrolled in health insurance than old migrants. I divide the total sample into two different age groups: young migrants aged between 16 to 29, and old migrants aged between 30 to 45. I run Equation (3) on two different subgroups, and the results are in the last two columns of Table 3.3. The results show that the effects of the NCMS implementation are larger on young migrants than old migrants, yet both effects are insignificant. The results can be possibly interpreted as young migrants might on average have less saving than old migrants. They also understand the idea and the function of the insurance, especially health insurance, better than the old migrants. So, the results do not support the argument that the effect of the NCMS enrolment is driven by the old-migrant group.

In the description of the mechanism, the reason why the NCMS decreases the migration propensity or its growth rate is that the NCMS reduces medical expenditure. It is also necessary to test whether the NCMS reduces healthcare expenditure in the individual-level dataset. However, the quality of the information on medical expenditures is not very good in the CHNS. Hence, I provide the evidence proving the mechanism by quoting the results of the impact of the NCMS implementation on out-of-pocket expenditures from previous literature. There are many papers in the literature on the reduction in out-of-pocket expenditures by the NCMS. Sun et al. (2009) find that the NCMS decreases the out-of-pocket payments and significantly decreases the number of households below the poverty line after catastrophic illnesses, and they draw a similar conclusion in their paper in 2010 (Sun et al., 2010). In Wagstaff et al. (2009) review of the NCMS, they show that the NCMS increases the outpatient and inpatient utilisation and reduces the cost of deliveries.

4.1.1 Attrition bias

The difference-in-differences method tracks individual behaviours over time, so the attrition of the sample in the CHNS might affect the results. The argument is as follows. The sample attrition could be partly driven by the people who became rural-to-urban migrants and moved to urban areas with their whole family members during the period of the survey. With people leaving the sample and the data's focus on

people remaining in the sample, the attrition bias amplifies the negative effects of the NCMS implementation. I test the attrition bias by regressing the probability of one not being present for the next wave $t+1$ on the implementation of the NCMS, with the same demographic variables controlled as in Equation (3) in the current wave t (Zhang, 2012). If people enrol in the NCMS, they are then less likely to become rural-to-urban migrants and have a lower possibility of leaving their place of residence. The probability of people leaving the sample should decrease through the implementation of the NCMS if there is an attrition bias affecting the results. The results are in Panel A in Table 3.4. From the insignificant coefficients and quite low R^2, the results indicate the effects of the attrition bias might be small in the CHNS, and the context of rural-to-urban migration and the NCMS implementation.

I also simply examine the effect of the NCMS on those individuals who remained in the dataset from 1997 to 2011. The number of individuals drops from 5,769 to 2,539, so less than half of the sample remained. I apply the same regressions in this reduced sample, and the results are in Panel B in Table 3.4. A comparison of the results in Panel B in Table 3.3 and Table 3.4 shows similar conclusions. For other attrition biases, the fixed effect approach helps to alleviate potential biases associated with demographic factors (Ziliak and Kniesner, 1998). These two methods are naive ways of dealing with the attrition bias problem; I cannot eliminate other possible attrition biases.

4.2 County-level evidence

In addition to the individual-level evidence provided by the CHNS, I construct a county-level CHNS dataset and provide supporting county-level evidence from this data source other than the yearbook dataset. The county-level CHNS dataset has a limited sample with 36 counties only. Using the individual-level variable migrant, I created a variable measuring the total number of eligible rural-to-urban migrants working in other places in different counties.[30] Dividing the total number of eligible rural-urban migrants by the total sample population for different counties, I obtain the migration propensity for each county, and again I use $prop(migrants)_{i,t}$ to indicate the migration propensity, as in Section 3. I also generate corresponding growth rate, $growthrate_{i,t}$. The constructed average income per capita, irrigated farmland per capita, total rural-labour force, and average education level for each county similarly matched the control variables included in Equation (1) in Section 3.

Due to the data limitation, the CHNS county-level data only include 36 counties for the years 1997, 2000, 2004, 2006, 2009, and 2011. A difference-in-differences county-level regression is used to conduct the county-level CHNS analysis. The detailed information of the name for the counties is not available in the CHNS, so I cannot obtain specific NCMS implementation dates for the counties. So I cannot use

[30]Eligible migrants mean those migrants included in the sample for regression 3 who are aged between 16-45 and are away from their households for more than 6 months.

the event study approach in this part. I continue to use $earlycounty_i$ used as the IV for the individual-level results, which equals 1 if a county i is in the early-treated group and is covered by the NCMS at wave t, and 0 otherwise. The key variable $earlycounty_i$ is in a simple fixed-effect difference-in-differences regression to conduct the analysis. The regression for examining the impact of the NCMS implementation on the migrant propensity at the county-level is:

$$\begin{aligned} prop(migrants)_{i,t} =& \alpha + \beta earlycounty_{i,t} + X'_{i,t}\theta + \sum_k \gamma_k \times \mathbf{I}[k=t] \\ & \times \sum_l \rho_l \times \mathbf{I}[l=p] + year_t + \mu_i \times year_t + \upsilon_t + \varepsilon_{i,t}, \end{aligned} \tag{4}$$

where i is the index for county and t stands for wave. $prop(migrants)_{i,t}$ is the propensity of rural residents in county i working outside their home county (county i) at wave t. $year_t$ is the linear wave trend and $\mu_i \times year_t$ is the county-fixed effect times the linear wave trend. υ_t is the wave fixed effect. $\mathbf{I}[k=t]$ represents the six wave dummies from 1997-2011, and $\mathbf{I}[k=p]$ is the province (p) dummies (nice provinces in total). The fixed-effect error term $\varepsilon_{i,t}$ is clustered at the county level. $X_{i,t}$ are the control variables: the constructed average income per capita, irrigated farmland per capita, total rural-labour force, and the average education level at the county-level. To examine the impact of the NCMS on the growth rate of the migration propensity for each county, the regression is:

$$\begin{aligned} growthrate_{i,t} =& \alpha + \beta earlycounty_{i,t} + X'_{i,t}\theta + \sum_k \gamma_k \times \mathbf{I}[k=t] \\ & \times \sum_l \rho_l \times \mathbf{I}[l=p] + year_t + \mu_i \times year_t + \upsilon_t + \varepsilon_{i,t}. \end{aligned} \tag{5}$$

All other variables have the same meaning as in Equation (4). Again, the identifying assumption for the difference-in-differences method is that the migration propensity and its growth rate for the early-treated counties and the late-treated counties show similar trends before the NCMS implementation. The assumption is likely to be valid as discussed in the previous sections, and the results in Section 3 also show a parallel trend using a county-level dataset with larger sample size.

The results of the two regressions are reported in Table 3.5. It shows that the NCMS implementation does not have a significant negative effect on the migration propensity but has a marginally significant negative impact on its growth rate. The negative effect on the growth rate could enhance the hypothesis that the NCMS implementation has negative effects on the number of rural residents who are rural-to-urban migrants at the county level, although through a second-order effect. This aggregate-level result from CHNS also implies that it is reasonable to believe that the county-level results

from the dataset collected from the yearbooks are more likely to be valid. However, the magnitude of the coefficient for $earlycounty_{i,t}$ is around 0.9%, which is smaller than most of the yearly effects of the NCMS initial implementation in Table 3.2. However, these two results are generated using different econometric methods, and the results from the CHNS county-level are not as well identified as the results in Section 3. I cannot conclude the exact effects of the NCMS implementation on the growth rate of the migration propensity, but it is plausible that there is a negative effect on the growth rate of the migration propensity.

5 Conclusions

Providing health insurance coverage for residents improves social welfare states, yet the restrictions imposed by health insurance schemes might create unintended misallocations in the labour market. This paper finds that implementing a new health insurance scheme with geographical limitations on the entitled reimbursement rates has negative effects on the rural-to-urban migration labour market from both the county-level and the individual-level analysis. The county-level results show that the NCMS implementation has negative and lagged effects on the growth rate of the migration propensity at the county level, while the individual-level results find a larger effect for NCMS: it decreases the migration propensity directly. It is difficult to draw a precise conclusion on the exact effect of the NCMS on the rural-to-urban migration labour market from the individual and the county-level results, but both results suggest that the NCMS implementation is likely to hinder the job mobility of rural-to-urban migrants in China.

There are a few limitations of the analysis that affect the interpretation of the results. First, both of the datasets used are not comprehensive. Only twelve of China's 23 provinces are covered, and there are missing entries in the self-collected county dataset and the CHNS, due to the long-time span covered. Second, the measurement error problems in both datasets are almost unavoidable when using survey data and yearbook data. Third, the magnitude difference between the county-level and the individual-level NCMS results may be due to the data availability. However, both results support possible negative effects of the NCMS on rural-to-urban migration, which makes the misreporting and the low-coverage less of a problem to some extent. The problems caused by the data availability have not been fully eliminated, and this still needs to be borne in mind when interpreting the results. If there were a more complete and larger dataset for migrant information in China, this would permit a structural analysis of individual willingness to pay for the NCMS in rural areas and also the propensity-score matching method to have better identified empirical results.

Given the large population in China, even a small change in the growth rate of the migration propensity can affect millions of people's labour market behaviours. The NCMS was implemented to meet the welfare needs of rural residents and provide

universal health insurance coverage for them in China. But, NCMS's restriction on the reimbursement rate due to its financing method creates unexpected adverse effects on rural residents who are rural-to-urban migrants. After the roll-out of the NCMS, this cheap manual labour is still in high demand in urban areas, while the pool of workers is shrinking. If the NCMS continues to tether migrants and potential migrants to their birthplace, it might hinder the speed of China's urbanisation process.[31] It would be optimal if the government provided a specific health insurance scheme for rural-to-urban migrants in urban areas. From 2010 onwards, the government has made the enrolment of rural-to-urban migrants in Urban Resident Health Care Insurance easier for rural-to-urban migrants.[32] The government further merged the NCMS and the Urban Resident Insurance Scheme from 2016, making it easier for rural residents to claim their expenses and get a higher reimbursement rate if they visit hospitals outside their town or village (Pan et al., 2016). These are practical policies for the government to provide more comprehensive health insurance for rural-to-urban migrants and should be encouraged to improve the consolidation of these two health insurance schemes. But it still requires collaborations between different administrative-level governments, and it might be challenging in practice due to the way that the NCMS is financed. Many papers evaluating this integration, yet the results are mixed (Shan et al., 2018; Xu et al., 2018), and little research focuses on the rural-to-urban migrants.

From the above description of the constraints on the NCMS, it is clear that the *hukou* system is one of the main factors preventing rural-to-urban migrants from participating in the health insurance programme provided in urban areas. If the *hukou* system were abolished, and urban and rural people had an identical household registration type, the geographical limitations of the NCSM would have smaller negative effects on individual migration decisions. Without the *hukou*, migrants could be enrolled in any type of health insurance schemes in China. The central government in China is trying to abolish, or at least relax, the restrictions of *hukou*.[33] However, it is difficult for the government to do this quickly because the design of many existing policies is based on the *hukou* system, and the urban-rural differences in China are quite large. It is easier for the central government to introduce a health insurance scheme only for rural-to-urban migrants and to use the new scheme to address the immediate health care needs of this large group of migrants. Apart from the health insurance policy, it would also be more relevant if the government in future could set policies that were not based on the *hukou* system given the large migrant population in China.

[31] News articles are reporting the difficulties of hiring rural-to-urban migrants in 2012. http://jingji.cntv.cn/20120206/116278.shtml

[32] Source: http://www.sz.gov.cn/sbjjblj/zcfggfxwj/sbzy/201311/t20131130_2258714.htm (in Chinese).

[33] Source: https://www.scmp.com/news/china/politics/article/2187689/could-be-end-chinas-notorious-household-registration-system

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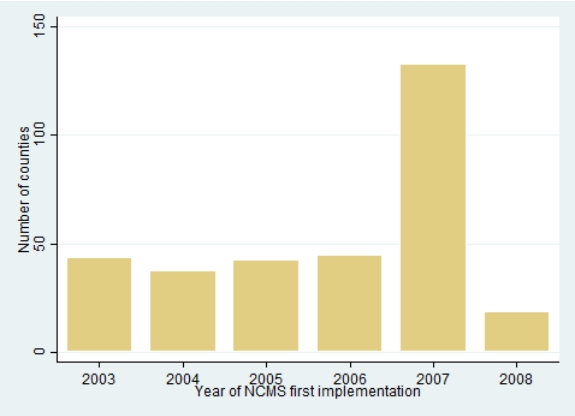
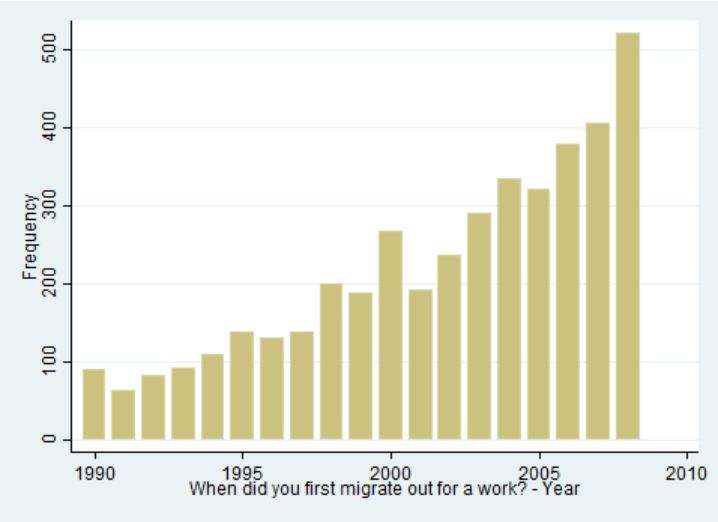
Figure 3.1: The distribution of "pilot" counties: 2003-2008



Note: This distribution is based only on data collected from provincial statistical yearbooks. y-axis is the number of new pilot counties for each year. x-axis is the year of the NCMS initial implementation. The figure only includes counties from the five provinces covered in this paper. There is also one county starting in 2002 and one county starting in 2009.

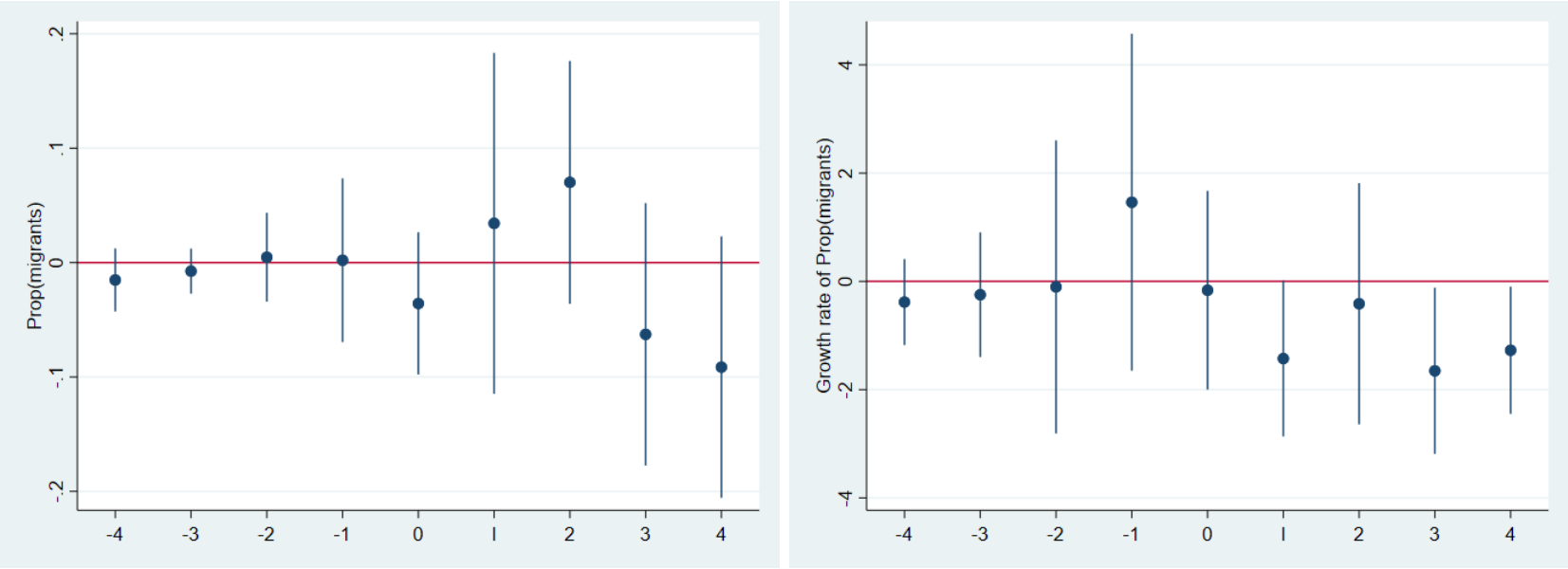
6 Figures and Tables

Figure 3.2: The number of new migrants (1990 to 2008, RUMiC)



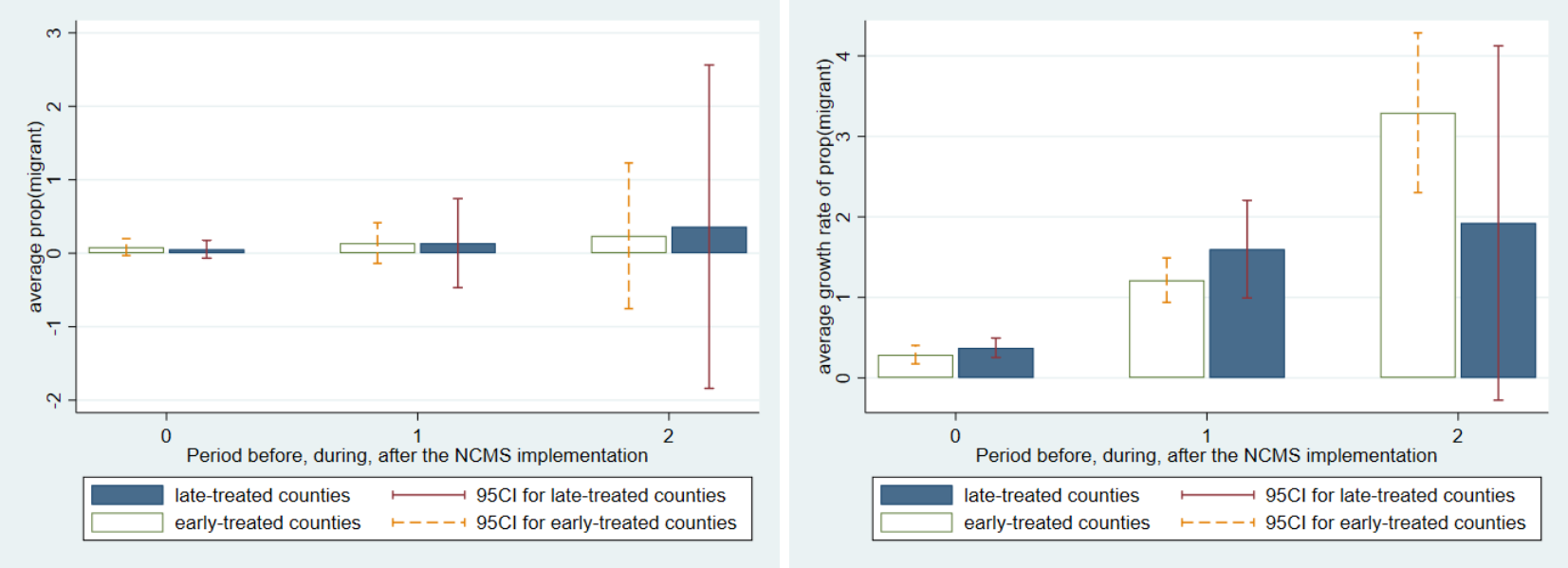
Note: The number of new migrants is the number of people who first migrates out as a rural-to-urban migrant. y-axis is the number of new migrants. x-axis is the year that respondents answered for the question When did you first migrate out for work. The time span similar to the datasets used in this paper, I only show the number of new migrants from 1990 to 2008.

Figure 3.3: The yearly effects of $FirstNCMS$ on $prop(migrants)_{i,t}$ and $growthrate_{i,t}$



Note: The graph is a coefficient plot for Table 3.3. The confidence intervals are 95% confidence interval. y-axis is the effect of NCMS initial implementation on the migration propensity (left graph) and its growth rate (right). x-axis indicates the event time t. $t = 0$ means the year that a county first starts to implement the NCMS.

Figure 3.4: Overview of the average migration propensity and its growth rate



Note: The left one is the graph for the migration propensity and the right one is the graph for its growth rate. y-axis is the average migration propensity and its growth rate respectively. x-axis is the different time frame before, during and after the NCMS implementation. 0 represents years before the NCMS implementation, 1 is the period during the NCMS roll-out, and 2 is the years after roll-out of the NCMS implementation. The navy bar represents the late-treated group and the white bar is the early-treated group.

Table 3.1: Different health insurance schemes and their coverage in China

Group	Heath insurance coverage
Urban residents	URHI
Urban employees	UEHI
Rural-to-urban employees	UEHI
Rural residents	NCMS
Intra-county migrants	NCMS
Rural-to-urban migrants	**NCSM, difficult to benefit**

Table 3.2: The event study results on $prop(migrants)_{i,t}$ and $growthrate_{i,t}$

VARIABLES	$prop(migrants)_{i,t}$		$growthrate_{i,t}$	
Event time				
-4	-0.0161	-0.0152	-0.400	-0.383
	(0.0138)	(0.0139)	(0.400)	(0.403)
-3	-0.00747	-0.00752	-0.230	-0.247
	(0.00945)	(0.00998)	(0.592)	(0.584)
-2	0.00517	0.00465	-0.0829	-0.102
	(0.0196)	(0.0197)	(1.375)	(1.371)
-1	0.00162	0.00203	1.474	1.461
	(0.0361)	(0.0363)	(1.574)	(1.577)
0	-0.0356	-0.0358	-0.156	-0.164
	(0.0315)	(0.0315)	(0.932)	(0.931)
1	0.0331	0.0343	-1.453**	-1.426*
	(0.0757)	(0.0755)	(0.729)	(0.730)
2	0.0696	0.0701	-0.464	-0.413
	(0.0544)	(0.0538)	(1.119)	(1.129)
3	-0.0615	-0.0627	-1.724**	-1.653**
	(0.0554)	(0.0581)	(0.777)	(0.778)
4	-0.0900	-0.0914	-1.282**	-1.272**
	(0.0578)	(0.0579)	(0.591)	(0.596)
year × province FE	Yes	Yes	Yes	Yes
year trend	Yes	Yes	Yes	Yes
county FE × year trend	Yes	Yes	Yes	Yes
controls	No	Yes	No	Yes
Observations	1,813	1,813	1,812	1,812
R-squared	0.236	0.237	0.158	0.158
Number of county	178	178	178	178
Autocorrelation test	0.0183	0.0183	0.5583	0.5583

Note: Robust standard errors in parentheses.* significant at 10%; ** significant at 5%; *** significant at 1%. The stand errors are clustered at county-level. $prop(migrants)_{i,t}$ is the migration propensity for each county i at time t and $growthrate_{i,t}$ is the corresponding growth rate. Key regressor *Event time* equals 0 indicates the first year a county starting to implement NCMS. The control variables include GDP per capita, disposable income per capita for rural residents, irrigated farmland per capita, and total rural labour force for each county at each year.

Table 3.3: The effect of the NCMS enrolment on one's decision to be a migrant

VARIABLES	$migrant_{d,t}$				
Panel A: OLS					
	Total	Male	Female	Young	Old
haveNCMS	0.001	-0.003	0.006	-0.0131	0.005
	(0.005)	(0.008)	(0.006)	(0.0238)	(0.004)
Observations	12,092	6,255	5,837	4,151	7,941
Number of individuals	5,769	2,844	2,925	2,895	3,750
R-squared	0.052	0.017	0.008	0.042	0.004
Panel B: IV					
	Total	Male	Female	Young	Old
haveNCMS	-0.060**	-0.077	-0.035	-0.101	-0.0125
	(0.027)	(0.047)	(0.027)	(0.106)	(0.025)
Observations	12,092	6,255	5,837	4,151	7,941
Number of individuals	5,769	2,844	2,925	2,895	3,750
R-squared	0.068	0.013	0.005	0.047	0.004
individual FE	Yes	Yes	Yes	Yes	Yes
county control	Yes	Yes	Yes	Yes	Yes
year FE	Yes	Yes	Yes	Yes	Yes
year × province FE	Yes	Yes	Yes	Yes	Yes
controls	Yes	Yes	Yes	Yes	Yes

Note: Robust standard errors in parentheses.* significant at 10%; ** significant at 5%; *** significant at 1%. The stand errors are clustered at county-level. $migrant_{d,t}$ is a dummy variable equals 1 if individual d is a migrant and 0 otherwise. Key regressor $haveNCMS$ is the individual decision variable of NCMS participation. This table also shows the effect of $haveNCMS$ by gender and age. Males and females are nearly equally sampled in the dataset. Young migrants age from 16 to 29 and old migrants age from 30 to 45. The instrumental variable for $haveNCMS$ is $earlycounty$, which sets to 1 for all individuals from early-treated counties for the waves 2006, 2009 and 2011 and 0 for other individuals and waves. The control variables are deflated household income per capita, age, marital status, occupation, and highest education level, and also county-level average household income.

Table 3.4: Attrition bias check and attrition-bias-free CHNS data

Panel A: attrition bias check

	$pr(attrition)_{d,t}$				
VARIABLES	Total	Male	Female	Young	Old
haveNCMS	-0.030	-0.020	-0.042	-0.040	0.002
	(0.050)	(0.080)	(0.061)	(0.096)	(0.062)
Observations	12,092	6,255	5,837	4,151	7,941
Number of individuals	5,769	2,844	2,925	2,895	3,750
R-squared	0.0004	0.0002	0.0000	0.0000	0.0000

Panel B: attrition-bias-free sample

	$migrant_{d,t}$: IV				
VARIABLES	Total	Male	Female	Young	Old
haveNCMS	-0.064**	-0.080	-0.040	-0.111	-0.009
	(0.017)	(0.050)	(0.035)	(0.133)	(0.026)
Observations	6,419	3,644	2,775	2,099	4,320
Number of individuals	2,539	1,132	1,494	1,272	1,755
R-squared	0.101	0.006	0.035	0.003	0.005
individual FE	Yes	Yes	Yes	Yes	Yes
county FE	Yes	Yes	Yes	Yes	Yes
year × province FE	Yes	Yes	Yes	Yes	Yes
controls	Yes	Yes	Yes	Yes	Yes

Note: Robust standard errors in parentheses.* significant at 10%; ** significant at 5%; *** significant at 1%. The stand errors are clustered at county-level. Key variable $haveNCMS$ is the individual decision variable of NCMS participation. In Panel A, outcome variable $pr(attrition)_{d,t}$ is the probability of respondents leaving the sample in year $t+1$. In Panel B, outcome variable $migrant_{d,t}$ is a dummy variable equals 1 if individual d is a migrant and 0 otherwise. This table also shows the effect of $haveNCMS$ by gender and age. Males and females are nearly equally sampled in the dataset. Young migrants age from 16 to 29 and old migrants age from 30 to 45. The control variables are deflated household income per capita, age, marital status, occupation, and highest education level, and county-level average household income. The instrumental variable for $haveNCMS$ is *earlycounty*, which sets to 1 for all individuals from early-treated counties for the waves 2006, 2009 and 2011 and 0 for other individuals and waves. In this attrition-bias-free CHNS dataset, the sample size drops from around 5,769 to 2,539 observations.

Table 3.5: Results from the county-level CHNS data

VARIABLES	$prop(migrants)_{i,t}$	$growthrate_{i,t}$
$earlycounty_{i,t}$	-0.009	-0.902*
	(0.011)	(0.446)
county FE × year trend	Yes	Yes
year trend	Yes	Yes
year × province FE	Yes	Yes
control	Yes	Yes
Observations	212	172
Number of counties	36	36
R-squared	0.026	0.0512

Note: Robust standard errors in parentheses.* significant at 10%; ** significant at 5%; *** significant at 1%. The stand errors are clustered at county-level. $prop(migrants)_{i,t}$ is the county-level migration propensity and $growthrate_{i,t}$ is the growth rate of the migration propensity. The control variable is the average household income per capita adjusted by CPI for each county. *earlycounty* is the county-level decision variable of NCMS participation. There are only 36 counties in this sample because of CHNS data limitations. The number of observations drops in the third column because for the growth rate of the migration propensity, it loses one-year of data due to the calculation.

Appendix

A.1 NCMS coverage and the compensating differential model

Todaros (1969) and Harris and Todaros (1971) migration models focus on market equilibria in rural and urban labour markets. Most general equilibrium models place more emphasis on the importance of the unemployment rate in the urban labour market. However, my analysis focuses on partial equilibrium: whether these rural migrants want to come back to, or stay in, their hometown because of the NCMS, given the fact that they can find a job in urban areas. The migrants are usually guaranteed at least one job option in rural areas, which is farming. Gruber (2000) uses a model of compensating differential based on Rosen (1986) when analysing health insurance coverage and job mobility. A modified form of the Gruber model is applied to the rural-to-urban migration context.

Focusing on individuals in rural areas, an individual i has preferences over the net income in urban areas M_{iu}, or in rural areas M_{ir}, and the consumption-related job indicator, D_i. So the utility function for a rural-to-urban migrant in urban areas is

$$U_{iu} = U(M_{iu},\, D_i),$$

and in rural areas is

$$U_{ir} = U(M_{ir},\, D_i);$$

M_{ir} and M_{iu} can take positive or negative values. D_i is a binary indicator for the individual's job type, $D_i = 1$ (jobs in urban areas), and $D_i = 0$ (jobs in rural areas). The utility function is quasi-concave in M_i.

The net income earned in urban or rural areas equals wages for the job in urban or rural areas respectively, W_{iu} or W_{ir}, minus health care expenditure, C_i:

$$M_{iu} = W_{iu} - C_{iu},$$

and

$$M_{ir} = W_{ir} - C_{ir}.$$

For simplicity, we assume for now that health care expenses are the same in both urban and rural areas. So $C_i = C_{iu} = C_{ir}$. This assumption will be changed after introducing the NCMS into the model.

Wages in urban areas are usually higher than rural wages. The compensating variation (Z) is the difference between M_{iu} and M_{ir} when the individual is indifferent between working in rural or urban areas, $U(M^*_{iu},\, 1) = U(M^*_{ir},\, 0)$, and

$$Z = M^*_{iu} - M^*_{ir}.$$

The wage difference for an individual, $\triangle W_i$, in urban and rural areas is $W_{iu} - W_{ir}$ assuming identical urban and rural health care expenses, then

$$\triangle M_i = M_{iu} - M_{ir} = \triangle W_i,$$

where $\triangle M_i$ is the urban-rural income difference for individual i. The choice to work in urban areas can be summarised as

$$D_i = 0 \quad \text{if} \quad Z > \triangle M_i; \qquad D_i = 1 \quad \text{if} \quad Z \leq \triangle M.$$

I use $F(Z)$ for the cumulative distribution function of Z and $f(Z)$ for the associated probability density function. Aggregating from the individual level to the county level, the fraction of the rural population who work in urban areas is

$$N_{D=1} = \int_0^{\triangle M} f(z)dz = F(\triangle M) = P(Z \leq \triangle M), \tag{6}$$

and the fraction of the rural population who remain in rural areas is

$$N_{D=0} = \int_{\triangle M}^{\infty} f(z)dz = 1 - F(\triangle M) = 1 - P(Z \leq \triangle M), \tag{7}$$

assuming that demand in both urban and rural labour markets is exogenous. The demand for rural migrant workers in urban areas, especially during the period of NCMS implementation, grew fast (Shi, 2008). It is reasonable to assume that the labour markets in cities were large enough that the changes in numbers of migrants in each county did not affect the urban labour market. From Equation (6), if $\triangle W$ decreases, the fraction of the rural population who work in urban areas decreases.

If a rural migrant joins the NCMS, he/she can get reimbursements, B_i, from health care expenses generated when visiting hospitals or clinics in his/her own county. The rural-urban income difference for this migrant after joining the NCMS becomes:

$$\triangle M_i^{'} = \triangle W_i + B_i = M_{iu} - M_{ir} + B_i.$$

As the income difference decreases, the NCMS implementation should lead to a decrease in the fraction of rural residents who work in urban areas according to Equation (6).

At the beginning of this section, I assumed $C_i = C_{iu} = C_{ir}$. However, in reality, urban health care expenses are usually higher than rural expenses (Chen et al., 2014). This further reduces the income difference:

$$\triangle M_i^{''} = W_{iu} - C_{iu} - W_{ir} + C_{ir} + B_i < \triangle M_i^{'},$$

where $C_{iu} > C_{ir}$. It decreases the fraction of rural-urban migrants in the total rural population compared to the case where health care expenses are the same in both rural and urban areas. The simple model here shows how health insurance affects migration behaviours through changes in income differences.

A.2 Data imputation

Missing data for a specific year During the long time span of the data collected from provincial yearbooks or provincial rural yearbooks, there are missing entries for the key variables for different years and different provinces. I needed to impute the missing entries based on the information available. For example, if, for the year 2000, the total number of migrants in rural areas was missing, but I had data for this variable and the total labour force and other sectors' labour force for 1999 and 2001, I would use the 1999 to 2001 data's growth rate of the total labour force and other sectors' labour force to calculate 2000's data. These imputed missing years are the year 2007 for Hubei, the year 2011 for Ningxia and the years 2005, 2007, 2011 for Shanxi.

Missing data on the exact number of migrants If, in the yearbooks, there was no data for the total number of migrants in rural areas, but they provided all other sectors' labour force data, I approximated the total number of migrants in rural areas using the total number of labour force in rural areas minus the total number of all other labour forces. The imputed province is Jiangsu. Other provinces all have the rural-to-urban migrant data from provincial yearbooks or provincial rural yearbooks.

A.3 Placebo test

Guangdong province has had an early version of the NCMS since 1999 (Zheng, 2011). The early version in Guangdong operated in a similar way to the NCMS before 2003. In 2003 and 2004, the province redistributed documents in its counties about the implementation of the NCMS, and the NCMS replaced its early version in 2003 and 2004. Compared to other provinces, Guangdong was a highly-treated group around 2003. The NCMS implementation should not have effects on the county level migration propensity trend showing up just right after 2003, nor on its growth rate. Although Guangdong province is one of the provinces that receive a lot of migrants from other provinces and has a lot of intra-province migrants, the inter-province migrants also account for around 40% of the total migrants in Guangdong. After factoring out the suburban or urban areas in Guangdong, other under-developed rural areas in counties should behave similarly to other counties in other provinces in terms of rural-to-urban migrants if they experienced the same NCMS implementation timeline.

The same regression equations (1) and (2) for $prop(migrants)_{i,t}$ and $growthrate_{i,t}$ are applied to the Guangdong data. The date of NCMS implementation is the time

that the NCMS replaced its early version. All variables have the same definitions as before. The results are in Table A.2. The regression results for $prop(migrants)_{i,t}$ and $growthrate_{i,t}$ show that there is no negative and significant effect of NCMS on migration trends on or after 2003. For $growthrate_{i,t}$, the effects for the third and fourth year after the NCMS implementation are even positive.

The increasing trends in rural-to-urban migration might be due to the fact that Guangdong province allows rural-to-urban migrants and rural residents to visit hospitals in Guangzhou and get their reimbursements in their hometown.[34] Therefore, many inter-county but intra-province migrants in Guangdong province are no longer "locked" by the NCMS. Hence, intra-province rural-to-urban migration in Guangdong might be positively affected after the implementation of the NCMS. Also, Guangdong is one of the provinces that receive a large number of rural-to-urban migrants. The provincial government has more incentives to implement policies that are beneficial for migrants to maintain social stability in urban areas in Guangdong.

A.4 Robustness Checks

A.4.1 Different lengths of leads and lags

The regression results in Table 3.2 can be valid only for four years before and after the first implementation of the NCMS. In this section, I tried different numbers of years before and after the NCMS first implementation. The results for three, five, and seven years before and after the implementation are shown in Table A.3 and A.4. I also present the results with four lags only and four leads only in Table A.5. The results are consistent with the main regression with four leads and lags: NCMS implementations have lagged negative effects on the growth rate of migration in a county. These results show that the main results are robust in terms of the number of years before and after the implementation used.

A.4.2 Comparison between the early-treated group and the late-treated groups

To further check whether all of the negative effects of the NCMS were fully driven by the early-treated group, I run the same regressions separately on the early-treated group and the late-treated group and compared the results. Table A.7 shows the results for these two groups. The main dependent variable is the migration propensity and its growth rate at the county level.

The results surprisingly show that the late-treated group contributes more to the significant negative effects in the whole sample. This implies that the NCMS has more effects on the late-treated group after controlling for year trends, county fixed effects, and their interactions. However, this might lead to another possibility, which is that

[34] Website: http://www.gd.gov.cn/gdgk/gdyw/200711/t20071128_35482.htm (In Chinese)

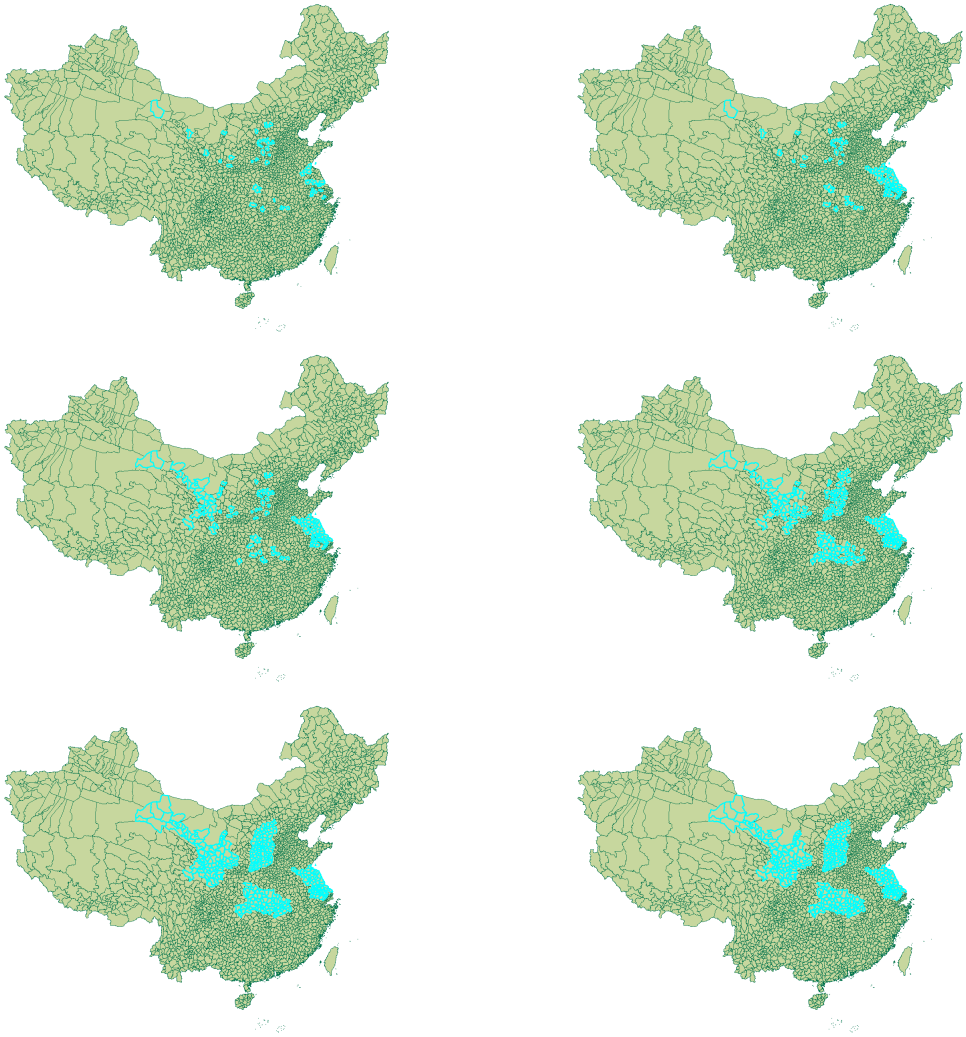
the financial crisis in 2008 caused the decrease in rural-to-urban migrations rather than the implementation of the NCMS. After controlling for the year and the year times province fixed effects, the concern might be less worrying in the context. Also, the financial crisis had effects on both the early-treated and late-treated groups, yet the results do not reflect this for the 4th-year lag after the NCMS implementation for the early-treated group. I also ran regressions with 7 years before and after the NCMS implementation for both groups, which show the negative effects of the NCMS still show up after the fifth and seventh year of the initial NCMS implementation.

A.4.3 Possible determiners of the NCMS implementation date

The results for the regression analysing the correlations between county GDP per capita, the migration propensity, rural income per capita, total rural labour force, and the NCMS implementation dates are presented in Table A.6. The results show that none of the controls or the migration propensity is significantly correlated with whether counties are selected as early "pilot" counties. The results might help to relieve worries about the selection of the "pilot counties" depending on the outcome and the controls.

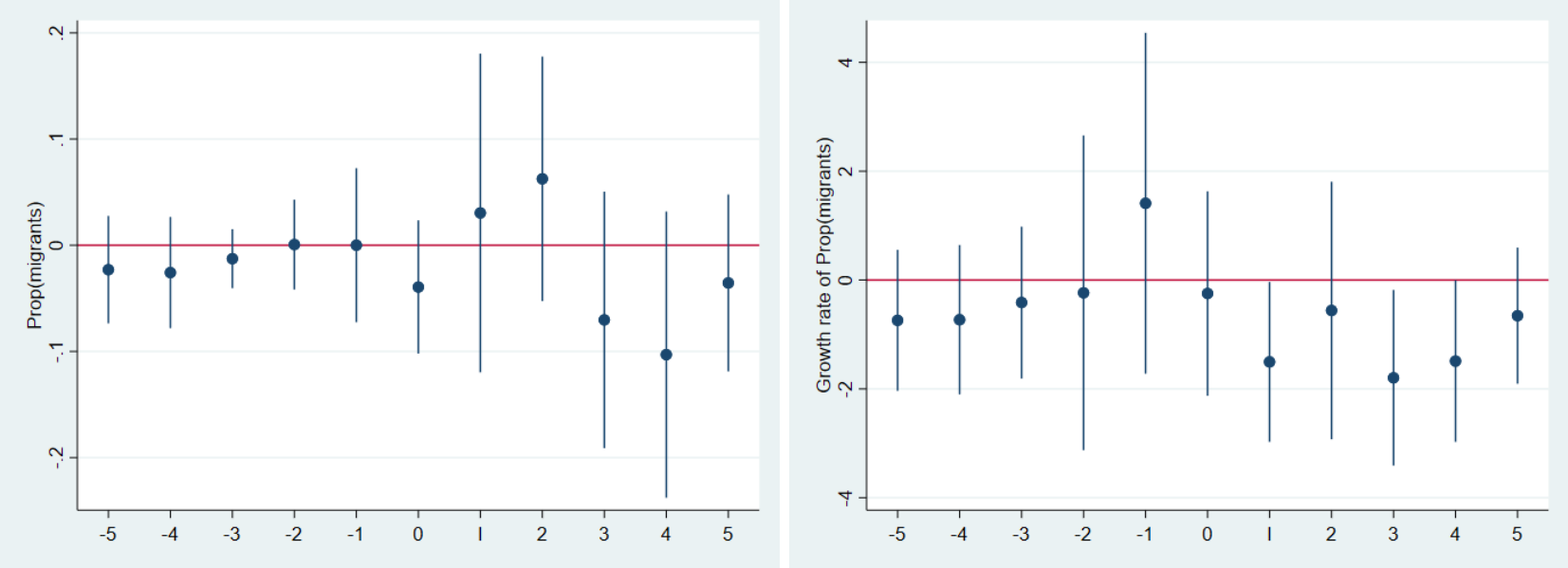
A.5 Figures and Tables

Figure A.1: NCMS coverage from 2003 to 2008



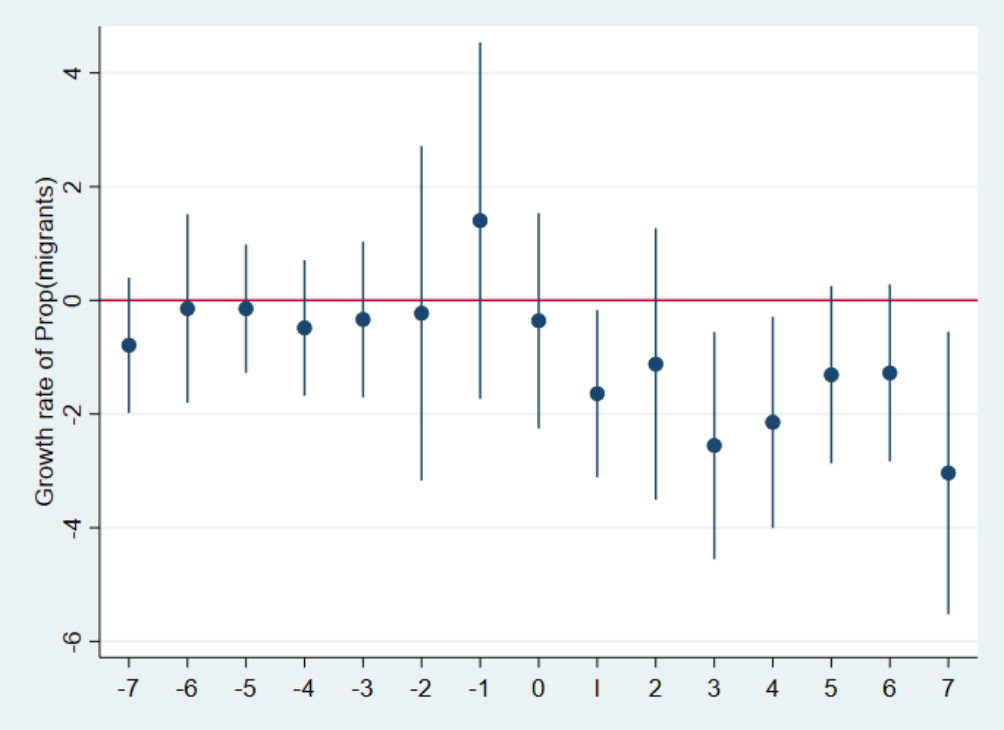
Note: The distribution of counties for different implementation years. Only five provinces are shown in this figure and it indicates the gradual expansion of NCMS in the five provinces from 2003 to 2008.

Figure A.2: Coefficients plot for the effects of $FirstNCMS$ on $prop(migrants)_{i,t}$ and $growthrate_{i,t}$: Five leads and lags



Note: The graph is a coefficient plot for the third and fourth column of Table A.3. The confidence intervals are 95% confidence interval. y-axis is the effect of the NCMS implementation on the migration propensity (left graph) and its growth rate (right). x-axis indicates the event time t. $t = 0$ means the year that a county first starts to implement the NCMS.

Figure A.3: Coefficients plot for the effects of $FirstNCMS$ on $growthrate_{i,t}$: Seven leads and lags



Note: The graph is a coefficient plot for $growthrate_{i,t}$ coefficients in Table A.4. The confidence intervals are 95% confidence interval. y-axis is the effect of the NCMS implementation on the growth rate of the the migration propensity. x-axis indicates the event time t. $t = 0$ means the year that a county first starts to implement the NCMS.

Figure A.4: Map of survey regions in the CHARLS

Note: The map is taken from the CHNS website. It shows the geographical coverage of CHNS. Website: https://www.cpc.unc.edu/projects/china.

Table A.1: The event study results with different s.e. clusters

cluster	robust s.e.		prefecture-level		province-level	
VARIABLES	$prop(migrants)_{i,t}$	$growthrate_{i,t}$	$prop(migrants)_{i,t}$	$growthrate_{i,t}$	$prop(migrants)_{i,t}$	$growthrate_{i,t}$
Event time						
-4	-0.0152	-0.383	-0.0152	-0.383	-0.0152	-0.383**
	(0.0271)	(0.541)	(0.0141)	(0.447)	(0.0144)	(0.0744)
-3	-0.00752	-0.247	-0.00752	-0.247	-0.00752	-0.247
	(0.0252)	(0.632)	(0.00717)	(0.561)	(0.0113)	(0.117)
-2	0.00465	-0.102	0.00465	-0.102	0.00465	-0.102
	(0.0255)	(1.278)	(0.0105)	(1.514)	(0.00585)	(0.551)
-1	0.00203	1.461	0.00203	1.461	0.00203	1.461
	(0.0328)	(1.428)	(0.0353)	(1.531)	(0.00291)	(0.543)
0	-0.0358	-0.164	-0.0358	-0.164	-0.0358	-0.164
	(0.0317)	(0.857)	(0.0521)	(0.729)	(0.0520)	(0.200)
1	0.0343	-1.426*	0.0343	-1.426	0.0343	-1.426
	(0.0724)	(0.758)	(0.0415)	(0.898)	(0.0281)	(1.681)
2	0.0701	-0.413	0.0701	-0.413	0.0701	-0.413
	(0.0524)	(1.084)	(0.0865)	(0.622)	(0.0760)	(0.430)
3	-0.0627	-1.653**	-0.0627	-1.653	-0.0627	-1.653
	(0.0551)	(0.781)	(0.0404)	(1.158)	(0.0652)	(1.445)
4	-0.0914*	-1.272**	-0.0914	-1.272*	-0.0914	-1.272
	(0.0547)	(0.632)	(0.0864)	(0.688)	(0.104)	(1.212)
year × province FE	Yes	Yes	Yes	Yes	Yes	Yes
year trend	Yes	Yes	Yes	Yes	Yes	Yes
county FE × year trend	Yes	Yes	Yes	Yes	Yes	Yes
controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,813	1,812	1,813	1,812	1,813	1,812
R-squared	0.237	0.158	0.237	0.158	0.237	0.158
Number of county	178	178	178	178	178	178

Note: Robust standard errors in parentheses.* significant at 10%; ** significant at 5%; *** significant at 1%. The stand errors are clustered at robust, clustered at prefecture city-level, and clustered at province-level perspectively. $prop(migrants)_{i,t}$ is the migration propensity for each county i at time t and $growthrate_{i,t}$ is the corresponding growth rate. Key regressor *Event time* equals 0 indicates the first year a county starting to implement NCMS. The control variables include GDP per capita, disposable income per capita for rural residents, irrigated farmland per capita, and total rural labour force for each county at each year.

Table A.2: The placebo tests for the effects of the NCMS

	simulated early NCMS implementation		Guangdong province only	
VARIABLES	$prop(migrants)_{i,t}$	$growthrate_{i,t}$	$prop(migrants)_{i,t}$	$growthrate_{i,t}$
Event time				
-4	0.0230	-0.295	1.821	1.379
	(0.0478)	(0.819)	(3.144)	(4.658)
-3	-0.0158	-0.795	2.925	5.604
	(0.0358)	(0.817)	(4.671)	(6.617)
-2	-0.0276	-0.600	3.730	8.063
	(0.0219)	(0.594)	(5.826)	(8.336)
-1	-0.00914	-0.302	4.482	10.06
	(0.0139)	(0.678)	(6.864)	(10.02)
0	0.00673	-0.107	5.520	12.36
	(0.0230)	(1.450)	(8.111)	(12.18)
1	0.0111	1.638	6.704	9.943
	(0.0362)	(1.590)	(9.943)	(15.27)
2	-0.0189	0.185	9.104	11.06
	(0.0269)	(0.937)	(12.19)	(17.72)
3	0.0473	-1.171*	27.35	46.98**
	(0.0766)	(0.701)	(17.40)	(22.47)
4	0.0945	0.159	13.40***	21.93**
	(0.0593)	(1.162)	(5.060)	(9.103)
county FE × year trend	Yes	Yes	Yes	Yes
year × province FE	Yes	Yes	-	-
year trend	Yes	Yes	Yes	Yes
controls	Yes	Yes	Yes	Yes
Observations	1,813	1,812	475	474
R-squared	0.234	0.157	0.269	0.180
Number of counties	178	178	47	48

Note: Robust standard errors in parentheses.* significant at 10%; ** significant at 5%; *** significant at 1%. The stand errors are clustered at county-level. $prop(migrants)_{i,t}$ is the migration propensity for each county i at time t and $growthrate_{i,t}$ is the corresponding growth rate. Key regressor *Event time* equals 0 indicates the first year a county starting to implement NCMS. The control variables include GDP per capita, disposable income per capita for rural residents, irrigated farmland per capita, and total rural labour force for each county at each year. The first and the second column table is only run on counties in Guangdong. The third and fourth column are the results for the placebo test for hypothetical early NCMS implementation.

Table A.3: The effects of $FirstNCMS$ on $prop(migrants)_{i,t}$ and $growthrate_{i,t}$: with different lengths of leads and lags

VARIABLES	$prop(migrants)_{i,t}$	$growthrate_{i,t}$	$prop(migrants)_{i,t}$	$growthrate_{i,t}$
Event time				
-5	-	-	-0.0230	-0.740
	-	-	(0.0256)	(0.656)
-4	-	-	-0.0257	-0.730
	-	-	(0.0266)	(0.695)
-3	-6.57e-05	-0.0853	-0.0126	-0.413
	(0.00739)	(0.460)	(0.0141)	(0.707)
-2	0.0103	-0.00235	0.000620	-0.234
	(0.0189)	(1.318)	(0.0214)	(1.465)
-1	0.0101	1.582	3.06e-05	1.410
	(0.0349)	(1.556)	(0.0367)	(1.587)
0	-0.0214	0.0492	-0.0394	-0.247
	(0.0288)	(0.886)	(0.0318)	(0.952)
1	0.0453	-1.266*	0.0304	-1.504**
	(0.0775)	(0.722)	(0.0760)	(0.744)
2	0.0860	-0.188	0.0626	-0.560
	(0.0529)	(1.091)	(0.0583)	(1.199)
3	-0.0299	-1.192*	-0.0703	-1.797**
	(0.0514)	(0.693)	(0.0612)	(0.818)
4	-	-	-0.103	-1.489**
	-	-	(0.0683)	(0.752)
5	-	-	-0.0355	-0.656
	-	-	(0.0422)	(0.633)
year × province FE	Yes	Yes	Yes	Yes
year trend	Yes	Yes	Yes	Yes
county FE × year trend	Yes	Yes	Yes	Yes
controls	Yes	Yes	Yes	Yes
Observations	1,813	1,812	1,813	1,812
R-squared	0.234	0.157	0.237	0.159
Number of county	178	178	178	178

Note: Robust standard errors in parentheses.* significant at 10%; ** significant at 5%; *** significant at 1%. The stand errors are clustered at county-level. $prop(migrants)_{i,t}$ is the migration propensity for each county i at time t and $growthrate_{i,t}$ is the corresponding growth rate. Key regressor *Event time* equals 0 indicates the first year a county starting to implement NCMS. The control variables include GDP per capita, disposable income per capita for rural residents, irrigated farmland per capita, and total rural labour force for each county at each year.

Table A.4: The effects of $FirstNCMS$ on $prop(migrants)_{i,t}$ and $growthrate_{i,t}$: Seven leads and lags

VARIABLES	$prop(migrants)_{i,t}$	$growthrate_{i,t}$		$prop(migrants)_{i,t}$	$growthrate_{i,t}$
Event time			*Event time*		
-7	0.022	-0.789	1	0.0222	-1.640**
	(0.0357)	(0.572)		(0.0771)	(0.746)
-6	0.0319	-0.145	2	0.0297	-1.122
	(0.0502)	(0.841)		(0.0634)	(1.210)
-5	-0.0147	-0.146	3	-0.114	-2.553***
	(0.0328)	(0.572)		(0.0812)	(1.012)
-4	-0.0207	-0.485	4	-0.141*	-2.146**
	(0.0243)	(0.604)		(0.0849)	(0.941)
-3	-0.00970	-0.337	5	-0.0746	-1.309*
	(0.0140)	(0.694)		(0.0591)	(0.790)
-2	0.00464	-0.228	6	-0.0779	-1.277
	(0.0226)	(1.490)		(0.0589)	(0.788)
-1	9.74e-05	1.402	7	-0.173*	-3.035**
	(0.0368)	(1.589)		(0.0901)	(1.259)
0	-0.0462	-0.360			
	(0.0330)	(0.961)			
year × province FE	Yes	Yes		Yes	Yes
year trend	Yes	Yes		Yes	Yes
county FE × year trend	Yes	Yes		Yes	Yes
controls	Yes	Yes		Yes	Yes
constant	0.499	4.528		0.499	4.528
R-squared	0.241	0.161		0.241	0.161
Observations	1,813	1,812		1,813	1,812
Number of counties	178	178		178	178

Note: Robust standard errors in parentheses.* significant at 10%; ** significant at 5%; *** significant at 1%. The stand errors are clustered at county-level. $prop(migrants)_{i,t}$ is the migration propensity for each county i at time t and $growthrate_{i,t}$ is the corresponding growth rate. Key regressor *Event time* equals 0 indicates the first year a county starting to implement NCMS. The control variables include GDP per capita, disposable income per capita for rural residents, irrigated farmland per capita, and total rural labour force for each county at each year.

Table A.5: The effects of $FirstNCMS$ on $prop(migrants)_{i,t}$ and $growthrate_{i,t}$: Four leads only and four lags only

	4 years before		4 years after		
VARIABLES	$prop(migrants)_{i,t}$	$growthrate_{i,t}$		$prop(migrants)_{i,t}$	$growthrate_{i,t}$
Event time			*Event time*		
-4	-0.0180	-0.257	0	-0.0350	-0.300
	(0.0167)	(0.388)		(0.0303)	(0.723)
-3	-0.0104	-0.105	1	0.0343	-1.552*
	(0.0119)	(0.556)		(0.0773)	(0.836)
-2	-0.00215	0.0679	2	0.0698	-0.506
	(0.0199)	(1.316)		(0.0531)	(1.070)
-1	0.00255	1.761	3	-0.0629	-1.778**
	(0.0386)	(1.612)		(0.0581)	(0.801)
0	-0.0310	0.382	4	-0.0916	-1.378**
	(0.0311)	(0.985)		(0.0570)	(0.569)
year × province FE	Yes	Yes		Yes	Yes
year trend	Yes	Yes		Yes	Yes
county FE × year trend	Yes	Yes		Yes	Yes
controls	Yes	Yes		Yes	Yes
R-squared	0.230	0.155		0.237	0.157
Observations	1,813	1,812		1,813	1,812
Number of counties	178	178		178	178

Note: Robust standard errors in parentheses.* significant at 10%; ** significant at 5%; *** significant at 1%. The stand errors are clustered at county-level. $prop(migrants)_{i,t}$ is the migration propensity for each county i at time t and $growthrate_{i,t}$ is the corresponding growth rate. Key regressor *Event time* equals 0 indicates the first year a county starting to implement NCMS. The control variables include GDP per capita, disposable income per capita for rural residents, irrigated farmland per capita, and total rural labour force for each county at each year.

Table A.6: The correlations between NCMS implementation and possible determiners

VARIABLES	prop(migrants)	GDP per capita	ln(rural income)	rural labour
early-treated	2.555	-0.400	3.571	204,148
	(28.88)	(0.0.427)	(3.950)	(655,553)
year × province FE	Yes	Yes	Yes	Yes
year trend	Yes	Yes	Yes	Yes
county FE × year trend	Yes	Yes	Yes	Yes
controls	Yes	Yes	Yes	Yes
Observations	1,813	1,813	1,813	1,813
Number of counties	178	178	178	178
R-squared	0.229	0.761	0.869	0.893

Note: Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. The stand errors are clustered at county-level. *earlycounty* indicates if a county is in the early-treated group. The early-treated group includes counties that had NCMS implementation in 2003, 2004 and 2005 and the late-treated group includes those counties with the implementation after 2005. The four outcome variables are the migration propensity, GDP per capita, *log* of the rural income per capita, and the total number of the rural labour force.

Table A.7: The effects of the NCMS on the early-treated and late-treated group

	early-treated		late-treated	
VARIABLES	$prop(migrant)_{i,t}$	$growthrate_{i,t}$	$prop(migrant)_{i,t}$	$growthrate_{i,t}$
Event time				
-4	-0.00187	-0.303	-0.00318	-0.0750
	(0.00667)	(0.234)	(0.0294)	(1.500)
3	-0.00253	-0.235	-0.0110	-0.136
	(0.00740)	(0.152)	(0.0466)	(2.541)
2	-0.00444	-0.137	-0.0213	-1.028
	(0.00694)	(0.0843)	(0.0618)	(3.982)
1	0.0722*	0.360	-0.0367	1.967
	(0.0420)	(0.365)	(0.0589)	(2.688)
0	0.00426	-0.0376	-0.0789	-0.374
	(0.0125)	(0.0848)	(0.0533)	(1.480)
1	0.0151	-0.177	0.0516	-1.850*
	(0.0200)	(0.274)	(0.125)	(0.951)
2	0.00829	-0.0411	0.137*	0.0446
	(0.00737)	(0.0817)	(0.0809)	(1.219)
3	0.00988	-0.0379	-0.0687	-2.894*
	(0.00789)	(0.0846)	(0.121)	(1.664)
4	0.00884	-0.0416	-0.0563	-1.707**
	(0.00744)	(0.116)	(0.0688)	(0.854)
year × province FE	Yes	Yes	Yes	Yes
year trend	Yes	Yes	Yes	Yes
county FE × year trend	Yes	Yes	Yes	Yes
controls	Yes	Yes	Yes	Yes
Observations	848	848	965	964
R-squared	0.289	0.272	0.244	0.161
Number of county	69	69	109	109

Note: Robust standard errors in parentheses.* significant at 10%; ** significant at 5%; *** significant at 1%. The stand errors are clustered at county-level. $prop(migrants)_{i,t}$ is the migration propensity for each county i at time t and $growthrate_{i,t}$ is the corresponding growth rate. Key regressor *Event time* equals 0 indicates the first year a county starting to implement NCMS. The control variables include GDP per capita, disposable income per capita for rural residents, irrigated farmland per capita, and total rural labour force for each county at each year. The early-treated group includes counties that implemented the NCMS in 2003, 2004 and 2005, and the late-treated group includes those counties with the implementation after 2005.

Table A.8: Number of counties implimented the NCMS in the CHNS dataset overtime

	CHNS wave			
	2000	2004	2006	2009
Number of pilot counties	0	7	24	36
New pilot counties	0	7	17	12
Total number of counties	36	36	36	36

Table A.9: The first stage for the early county NCMS implementation IV

VARIABLES	$haveNCMS_{d,t}$				
	Total	Male	Female	Young	Old
earlycounty	0.278***	0.237***	0.336***	0.350***	0.291***
	(0.020)	(0.027)	(0.029)	(0.060)	(0.026)
individual FE	Yes	Yes	Yes	Yes	Yes
county control	Yes	Yes	Yes	Yes	Yes
year FE	Yes	Yes	Yes	Yes	Yes
year × province FE	Yes	Yes	Yes	Yes	Yes
controls	Yes	Yes	Yes	Yes	Yes
Observations	12,092	6,255	5,837	4,151	7,941
Number of individuals	5,769	2,844	2,925	2,895	3,750
R-squared	0.002	0.003	0.115	0.283	0.027
F-statistic	226.09	141.63	104.12	21.76	141.53

Note: Robust standard errors in parentheses.* significant at 10%; ** significant at 5%; *** significant at 1%. The stand errors are clustered at county-level. Key regressor $haveNCMS$ in the main regression is the individual decision variable of NCMS participation is the main outcome variable here. This table also shows the effect of $haveNCMS$ by gender and age. Males and females are nearly equally sampled in the dataset. Young migrants age from 16 to 29 and old migrants age from 30 to 45. The instrumental variable *earlycounty* is the key regressor, which sets to 1 for all individuals from early-treated counties for the waves 2006, 2009 and 2011 and 0 for other individuals and waves. The control variables are deflated household income per capita, age, marital status, occupation, and highest education level, and also county-level average household income. F-statistic is larger than 10.