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The effect of Hukou registration policy on rural-to-urban migrants' health

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The effect of Hukou registration policy on rural-to-urban migrants' health

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Abstract: Access to social services in China is connected to a system of household registration (Hukou system) determined by place of origin with difficult geographical transferability. As a consequence, a vast majority of rural-to-urban migrants do not have access to public health services in urban areas. This paper examines if restrictions on healthcare provisions—that are due to restrictions on migration and Hukou registration—are linked to poorer health for rural-to-urban migrants compared with non-migrant urban residents. We use data from two waves of the Longitudinal Survey on Rural Urban Migration in China that provide data on self-reported health and objectively measured health indicators – blood pressure and grip strength. Results indicate that even after accounting for migrant's characteristics that have known impacts on health, such as income, education, sex, marital status, and being underweight, the effect of the Hukou restriction policy is large, significantly negative, and acts as a key predictor of why rural-to-urban migrants' health deteriorates, especially during the early years since migration.

Keywords: internal migration, Hukou registration system, health outcomes, longitudinal data analysis

JEL classification: C33, F22, I15, I18, J18

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1 Introduction

In 1958, Chinese authorities began implementing the household registration system, commonly known as Hukou. The Hukou card—which *de facto* acts as an internal passport—allows the central and local government to implement a classification system sorted by geographical determinants. The system was put in place to control residency, access to benefits, and to restrict labour mobility. Each citizen (or household) is classified by origin into an urban or rural hukou which gives those households access to social benefits—working rights, education, healthcare, or social security—in their place of residence but limits access to those outside of their hukou registration area. As a result, Chinese urban residents have access to better social benefits and education than rural citizens which allows urban residents to apply for better and higher paying jobs than those available in rural areas. Changing hukou registration from rural to urban is only accessible to the most privileged, either because those migrants start working for the government, or are highly educated (Chan and Buckingham, 2008). Borjas (1987) seminal paper shows that differences in income are significantly related to the economic and political conditions in the migrants' original location. In the case of China, Ge and Tech (2017) estimate that rural migrant workers have fewer characteristics associated with higher earnings than urban workers. Their monthly earnings are approximately 70 per cent of urban workers even though they work for longer hours.[1]

Despite these limitations, rural Chinese citizens migrate to urban cities to work due to the hardship of rural conditions and the increase of demand for labour in urban areas since China became a member of the WTO in 2001. Due to the nature of undocumented migration, it is difficult to estimate the exact number of migrants, but estimations reveal the migrant population to be above 220 million (Wang et al. 2010). The National Bureau of Statistics in China estimates that there are more than 160 million rural-to-urban workers and that more than 260 million Chinese citizens live in locations that do not correspond with their hukou registration card. These figures suggest migrants comprise approximately 16 per cent of the total Chinese population (Shi and Kennedy, 2016).

This phenomenon of mass internal migration, combined with the hukou policy, have important effects on labour mobility, worker earnings, education, productivity, and public health policy. Mou et al. (2015) find a strong correlation between the risk of getting infectious diseases and migration in China. The relationship is driven by unsafe working environments, deteriorated living conditions with lack of hygienic or overcrowded spaces, low income, and lack of information. China has tried to increase rural residents' access to healthcare through the New Rural Cooperative Medical Scheme (RCMS). RCMS insurance, however, only allows access for rural hukou holders to receive healthcare in their registered rural areas (Liu and Rao, 2006). Latest studies show that increased participation in RCMS leads to increased utilization of preventive care, but does not improve health status (Lei and Lin, 2009). Shaokang et al. (2002) indicate that economic growth might actually be widening the health gap as healthcare providers are more likely to demand insurance or out-of-pocket payments than in the past. While this change impacts poor, urban residents as well, migrants are less likely than most urban residents to have health insurance or have the means to pay high out-of-pocket costs. The combination of the discriminatory hukou system and a lack of healthcare access certainly creates obstacles for migrant workers to obtain healthcare in urban Chinese cities.

[1] Our data indicate that on average a rural to urban migrant has received 9 years of education compared to the 12 years of average schooling for the urban worker.

Gong et al. (2012) find that China's urbanization can be linked to substantial health risks including air pollution, occupational and traffic hazards, and changes in occupational activities or social structures that promote illnesses such as neuropsychiatric disorders, cardiovascular disease, and other non-communicable chronic diseases. Additionally, healthcare delivery faces many challenges in highly populated urban areas which increases the likelihood of spreading infections. Lu and Qin (2014) demonstrate that migrant workers are likely to be healthier than their rural neighbours who choose not to migrate as unhealthy or infirm workers aren't as able to travel far distances nor are likely to be productive workers. Most recent studies suggest that migrants are likely to be reasonably healthy at the point of migration, but are more likely to experience adverse healthcare events than their native-born urban neighbours (Chen, 2011; Lu and Qin, 2014; and Wallace and Kulu, 2014).[2] Without access to healthcare in urban areas, some migrants that become ill might decide to travel home to their rural village for treatment. However, Zheng and Lian (2005) find that the majority of sick or injured migrants choose to forego healthcare and to remain in urban areas. Therefore, due to the increased risk of workplace accidents, increased participation in high-risk behaviours and lack of access to healthcare, migrant workers face many challenges to remain healthy.[3]

China has been subject to the largest rural-to-urban migration movement in the world, which poses significant challenges for social integration and health policy. However, there is a lack of proper analysis about the impact of urban living and laborious work on migrants' actual health outcomes or indicators of health risk, especially regarding their hukou status. In this paper, we estimate an ordered logit model based on self-reported health status to analyse if there exists a significant differential impact on health outcomes between rural-to-urban migrants and urban citizens. We compared these results with those from estimations on the effect of rural hukou on objectively measured health indicators. We use the longitudinal survey on rural urban migration in China provided by the Institute for the Study of Labour (IZA).[4] The survey contains two waves, 2008 and 2009, and it is divided in three sections: the urban household survey, the rural household survey and the migrant household survey. Previous studies have focused on migrant's self-reported health outcomes which introduces estimation bias.[5] In this study, however, we use two measures of health indicators reported in 2008 and 2009 surveys, including blood pressure and grip strength, to study these questions: i) does lack of access to health services due to hukou have a significant impact on health status? ii) is there any differential effect when using objectively measured health outcomes? and iii) are health outcomes conditioned on years passed since migration, marital status, or pre-determined conditions/habits?

Our results indicate that the lack of access to health services due to the hukou registration system has a negative effect on health outcomes. Results are robust to the inclusion of control variables as years of education, income, sex, and marital status. When controlling for the number of years

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[2] According to Zheng and Lian (2005) rural migrants have higher propensity to experience workplace accidents because migrants have a propensity to work in more dangerous conditions. Their study stated that 83 per cent of workplaces surveyed were deemed to have unsafe factors and 60 per cent lacked of any safety measures.

[3] Migrant workers are also more likely to engage in high-risk behaviours, including unprotected sex and sex with high-risk partners (Pan et al. 2013; Dai et al. 2015).

[4] The Longitudinal Survey on Rural Urban Migration in China (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 the Beijing Normal University and was supported by the Institute for the Study of Labour (IZA), which provides 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.

[5] Migrants have a higher likelihood than urban workers of answering positively to questions related with health outcomes to avoid negative discrimination.

since migration, the negative impact diminishes. Rural-to-urban migrants with significant urban experience have access to better paying jobs and have more-developed social networks. These factors allow them to either access informal healthcare sector or to pay for medical expenses. In this context, local governments are currently considering the benefits and costs of extending health coverage to migrant workers—at least for preventative or primary care visits—and have put in place pilot programs in major cities. Nevertheless, there are increasing concerns over the scope of the pilot programs and if they can really target the special set of health risks that migrant populations face.

The rest of the paper is organized as follows: Section 2 includes a brief background of the hukou registration system and focuses on the relationship of rural-to-urban migration on health. Section 3 offers a descriptive analysis of the data and describe the empirical strategy. The results are described in section 4 and section 5 offers conclusions and policy recommendations.

2 Literature review

For the first time in history—since 2012—the urban population in China has surpassed the rural population. Official census figures show that the number of migrants increased from 144 million in 2000 to 294 million in 2015. Song and Liang (2016) analyse the new patterns of internal migration in China to show that there are significant economic benefits as emigrants' family members received remittances which increase their economic profiles. However, while overall economic development in China has had positive effects on Chinese citizens' conditions in terms of lower mortality rates, infant mortality, and improvements in life expectancy, it has also created large inequalities between migrants and non-migrants. Those are mainly driven by the migrants' lack of access to social services.[6]

In 2009, China designed a healthcare reform that was intended to address these health access inequalities. Specific goals include: i) to provide wide basic health coverage for urban workers (which would be mandatory) and to allow voluntary enrolment for urban residents without jobs (including students, elderly or disabled); ii) a voluntary cooperative medical system for rural citizens; and iii) to provide wide healthcare coverage to vulnerable and low-income population groups. The reform left the rural-to-urban migrant population outside of the provision of public healthcare. As a consequence, social disparities across migrant and non-migrant workers have been widening. Several major cities have tried to introduce policy reforms to address the health challenges confronted by this phenomenon. Since 2006, Beijing is offering primary care health services and free healthcare to the children of migrant workers in community centres. There is also a pilot program that covers major cities in 29 provinces with the aim to provide migrant workers with primary health services and health education.[7]

Nevertheless, the pilot program's implementation is facing numerous obstacles as many migrants don't use the services due to lack of knowledge, tight work schedules and self-medication habits (Peng et al. 2010 and Gong et al. 2012). This is not an uncommon behaviour among migrants in different countries. Larchanché (2012) finds that in France stigmatization and other social factors limit healthcare access for undocumented immigrants even when there is a government-provided

[6] Chan and Zhang (1999) state that the hukou registration system in China was designed to serve the state and to exert social control and control over the population's mobility.

[7] Beijing, Chengdu, Shanghai and Shenzhen are among the cities where the pilot programs are being implemented. Local authorities have designed the programs, so they differ across locations in terms of deductibles, co-payments, and type of coverage.

right to healthcare services. Davidovitch et al. (2013) establish that utilization of healthcare for legal immigrants in Israel, a country with universal healthcare access, is significantly lower for foreign immigrants than native-born Israelis.[8] Healthcare access for foreign immigrants who don't participate in the labour market is legally often limited or heavily restricted in many other countries as well, for example in the US or in Europe to non-European citizens. Hansen and Donohoe (2003) evaluate health consequences from workplace hazards for migrant farmworkers in the United States and determine that migrant workers are significantly more likely to underreport medical conditions and have poor access to health treatment.

Studies about national migration on health outcomes are scarce. Bollini and Siem (1995) use health data for immigrants and migrant workers in Western European countries and find that non-native-born residents were less likely to receive competent healthcare following a workplace accident or injury. This is particularly troubling because migrant workers are much more likely to work in dangerous jobs (Hesketh et al. 2008). Miranda et al. (2011) analyse cardiovascular risk factors for nearly 1,000 people in Peru and their findings suggest that rural-to-urban migration is detrimental to cardiovascular health.[9] The study concludes that many common explanations for health outcomes, such as age, socioeconomic status, gender, and body mass index, do not seem to explain much of the difference in cardiovascular health indicators between migrants and urban populations. Nauman et al. (2015) examine differences in health in rural-to-urban migrants in Thailand. The study finds that migrants who are now settled in urban areas are physically healthier than returning migrants and rural residents. After accounting for socioeconomic effects, *a priori* physical health remains positively correlated with migration, but after several years since migration occurred the relationship is no longer significant. In the case of Peru's internal migration, unlike in China, citizens are free to move to other regions and have similar access to available services in other locations. Hesketh et al. (2008) collected data from approximately 8,500 individuals in Eastern China and found that only 19 per cent of migrant workers have health insurance, compared with 58 per cent of native-born urban residents. Migrants self-report excellent health, better than both urban and rural workers, but this is likely due to selection bias (Hu et al. 2008). Additionally, Hong et al. (2006) find that migrants view healthcare as too costly and unavailable. This leads many migrants to seek alternatives to high-level medical treatment, such as self-treatment or seeing an unlicensed healthcare provider (Wei et al. 2010 and Peng et al. 2010). Our data analysis confirms this hypothesis.

In our study, we use two proxies for health outcomes – grip strength and blood pressure. Schooling et al. (2011) use grip strength as a measure for muscle mass and concludes that low muscle mass could be a contributing factor for diabetes in adolescents, especially in developing countries like China. Timpka et al. (2014) use hand grip strength as one of three factors to measure muscle strength and find that men with lower muscle strength during adolescence are more likely to die from cardiovascular events during their middle ages. Blood pressure is also a known indicator of risk of mortality (Sun et al. 2008; He et al. 2009; and Diaz et al. 2014).

Due to data restrictions, there is a lack of studies analysing the consequences of migration for migrants' health. Nguyen and White (2007) study the health status of temporary migrants in Viet Nam. They conclude that migrants are most vulnerable to health problems. Before migration begins, Vietnamese migrants are healthier but they report that health deteriorates afterwards. Authors conclude that their health status worsens faster than other groups of urban residents.

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[8] According to Davidovitch et al. (2013), migrant workers underutilize heath care services because of cultural and language barriers, lack of trust in service providers, inability to miss work to receive treatment, and other bureaucratic barriers.

[9] Around 600 of these are migrants, while the remaining 400 are nearly evenly split between rural and urban residents.

Goldman et al. (2014) focus on Mexico-US immigration. They demonstrate that non-migrants are less likely to experience changes in health compared with migrants. They find that Mexican immigrants experience a decline in health compared with non-migrants. They conclude that either the migration process or the hardships of post-migration in the early years detrimentally affect the health of Mexicans immigrants in the US. Our own results are in line with those of Goldman et al. (2014) for rural-to-urban migrants in China.

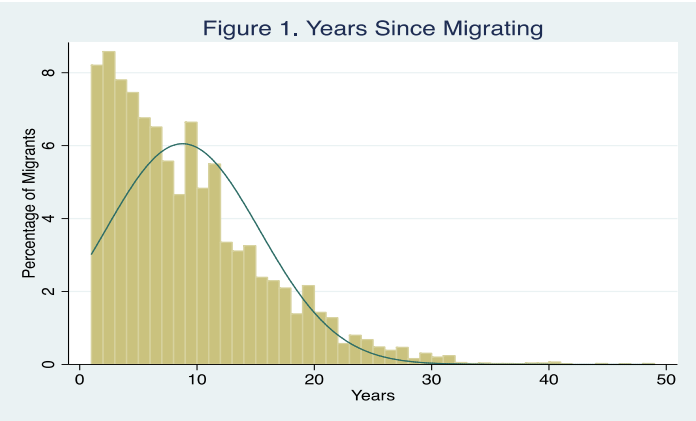
3 Data and empirical strategy

3.1 Data and summary statistics

In this paper, we use survey data reported in the *Longitudinal Survey on Rural Urban Migration in China (RUMiC)* available through the Institute for the Study of Labour (IZA). The survey collects data for 71,074 individuals (29,556 urban persons; 32,171 rural persons; and 9,347 migrants) in 2008 and 2009. The survey defines a migrant as a person who has a rural hukou but lives in an urban area. The survey follows individuals over two waves, however, attrition is high in the migrant household survey (approximately 58 per cent). Akguc et al. (2013) argue that the large attrition is due to the reallocation of migrants in other geographical areas during the economic recession and that many of the migrants returned to their places of origin. The 2009 wave of the migrant household survey adds new members of the families previously interviewed in 2008 and a new random sample of migrants. The RUMiC survey contains data on socioeconomic indicators, such as education, income, ethnicity, and hukou registration. Available data includes the highest level of education completed, years of formal education, and grades earned before leaving school. Separate data is reported for educational participation and attainment for children, including school location for every child. This is especially relevant for migrant workers because the children of migrants are only eligible for government education where their hukou is registered. Data on income is distinguished for all sources, including incomes from other jobs, and their expected wages if they were to remain in their home village.

Figure 1 shows the number of years since first migration for rural-to-urban migrants. The average years since migration is about 8.5 years. The average education level of migrants has also improved. In China, while nine years of schooling is compulsory, migrant workers in our sample reach an average of 9.5 years. Urban workers, in contrast, attend school for an average of more than 12 years in school.

Figure 1: Years since migrating



Source: Authors' elaboration based on RUMiC survey.

Table 1 summarizes socio-economic characteristics of urban and migrant workers. We use all the data available for males and females between the ages of 16 and 65 years old to minimize selection bias from age group which affects health in distinctive ways. Average income is much higher for urban-born workers, earning over 60 per cent more than their migrant neighbours. Some of the individuals surveyed do not receive income because they are employed as housekeepers without pay. Only 3 per cent of migrant workers have legal authorization to live in their urban city (almost 95 per cent of migrants have a rural Hukou).

We observe that the majority of urban workers are employed in the public sector (more than 54 per cent). However, the large majority of migrants work in low-skill jobs (77 per cent). Migrants are more likely to report being in excellent health and miss about half as many days of work as their urban peers (Tables 1 and 2). The average age of migrants has been increasing since the 1980s and according to the latest data -2009- is about 32 years. About 56 per cent of migrants are male. In terms of location preferences, migrants prefer to migrate to the central or eastern areas where more large cities are located. Only about 18 per cent of the individuals surveyed have migrated to the west.

Table 1. Descriptive Statistics by Residence Status

	Migrant	Urban
Married %	62.3	76.0
Male %	56.1	48.7
Smoker %	27.1	21.4
Age	32.0	40.2
Cigarettes Per Day	3.7	3.0
Monthly Income	1,620.5	2,615.7
Years of Education	9.3	11.7
Height (cm)	165.6	165.9
Weight (kg)	61.2	62.2
Systolic Blood Pressure	119.1	118.4
Diastolic Blood Pressure	75.8	76.9
Right Grip Strength	37.3	31.9
Left Grip Strength	36.2	35.1
Urban Hukou %	3.0	94.3
Rural Hukou %	94.9	4.1
Excellent Health Rating %	30.8	12.7
Good Health Rating %	48.6	53.4
Average Health Rating %	16.6	29.1
Poor Health Rating %	1.8	2.8
Very Poor Health Rating %	0.2	0.5
Self-reported Health Rating (1-5 scale, 5 is best)	1.9	2.2
Days Missed due to Illness or Injury	3.6	6.8
Years Since Migration	8.5	NA
Prior Migrant	NA	NA
Number of observations	8,065	10,732

Source: Authors' own elaboration.

The survey includes detailed data on health insurance status. Possible responses include commercial medical insurance, government health services, employment medical care, family medical insurance, rural cooperative medical coverage, women and children health insurance, immunization insurance, or other. The rural cooperative medical coverage (RCMS) only provides care where a person's hukou is registered, so migrants are unable to obtain coverage through RCMS in an urban city. Therefore, when calculating if migrants have health insurance coverage, respondents that indicate they only have RCMS will be considered to be without health insurance coverage. While over 50 per cent of migrant workers report having insurance through the rural cooperative medical coverage, this coverage is worthless where they live. Essentially, over 90 per cent of migrant workers lack health insurance coverage near their home. RUMiC also includes data on health indicators and outcomes. Measurable characteristics are detailed in the survey. These include weight (kilograms), height (centimetres), dominant handedness, blood pressure, and grip strength. To reduce measurement error for blood pressure screenings, a person's blood pressure is measured three times and the average of all values is reported. For example, blood pressure is measured three times and the systolic pressure from each separate measurement is averaged to determine a person's systolic pressure. Similarly, diastolic pressure is calculated by averaging the diastolic pressure from each separate measurement. Grip strength is measured twice for both hands and the average for each hand is calculated from the two measurements. Instructions to measure blood pressure, grip strength, height, and weight are explicitly provided, so that different people administering a survey will minimize measurement error. Smoking status, and number of cigarettes smoked per day is also included in the survey.

The self-reported health from respondents sets a scale from one (excellent health) to five (very poor health) compared to people of the same age. A person's disability status is included, and specifies if there is (1) no disability, (2) a disability but one that does not impact normal living, or (3) a disability that does impact living standards. Respondents indicate if they were sick or injured in the previous three months and, if so, to list the nature or name of that illness or injury. Importantly, a person's response to illness or injury is listed. It is detailed if a respondent: (1) did nothing; (2) rested, but did not take medicine; (3) took medicine, but did nothing else; (4) went to the doctor at a clinic; or (5) went to the doctor at a hospital. This question is particularly helpful to understand potential differences in medical choices for urban and migrant populations. The data analysis shows that migrants are much more likely to report their health status as 'excellent' than urban-born Chinese residents.

However, when we compared the self-reported health status with measures based on real health indicators, we observe a different picture. Table 2 shows the behaviours of each group after becoming ill or injured: 18.9 per cent of migrants do not take any action when they are ill or injured, 44.1 per cent self-medicate, and they have a higher propensity to use emergency services at hospitals instead of using primary care services.

Table 2. Actions taken when ill or injured by residence status
(percentage)

	Migrant	Urban
Took No Action	18.9	6.5
Rested, but No Medicines	2.3	2.8
Obtained Medicine by themselves	44.1	39.4
Went to Doctor at Medical Office	14.5	8.6
Went to Doctor at Hospital	20.3	42.4
Did not Seek Treatment Because of Costs	0.0	0.4
Other Treatments Sought	0.0	0.0
Number of observations	1,373	2,372

Source: Authors' own elaboration based on RUMiC survey.

Table 3 shows that migrants miss less days of work due to illness or injury than urban-born residents. The lower wages and lack of insurance and social networks prevent them from being able to take unpaid sick leave.

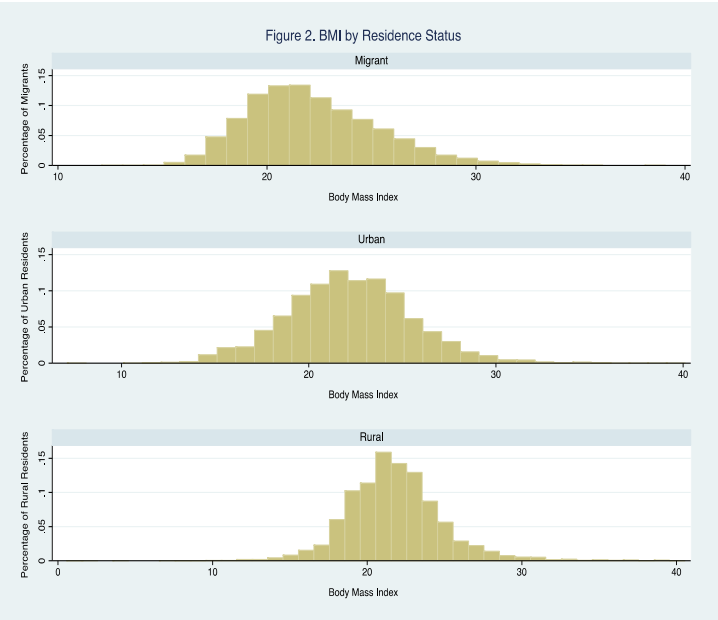
Table 3: Days of work missed due to illness or injury (percentage)

	Migrant	Urban
0	69.7	60.7
1	3.2	3.2
2	6.1	4.1
3	3.4	4.0
4	1.0	1.3
5	2.3	2.5
6-10	7.0	8.7
11-20	3.4	6.0
21-30	1.8	3.6
31-40	0.2	0.5
41-50	0.2	0.4
51-75	0.9	1.1
76-100	1.0	3.9

Source: Authors' own elaboration based on RUMiC survey.

Figure 2 displays the distribution of the body mass index for each group of workers. The body mass index (BMI) is calculated taking a person's weight in kilograms and dividing it by the square of height in meters. High body fat levels are associated with a high level of BMI. According to the World Health Organization (WHO), BMI can be used to screen for weight categories that may lead to health problems. Zhu et al. (2011) used data collected over 10 years for 124,456 participants and they observed a U-shaped association between BMI and mortality. A BMI of 24.0–25.9 for men and women was associated with the lowest mortality rate in China. Figure 2 shows that migrant's BMI distribution is skewed to the left, because they have lower weight than non-migrant individuals; 31 per cent of migrants have a BMI below 24.0, which categorizes them as being underweight and subject to higher health risks.

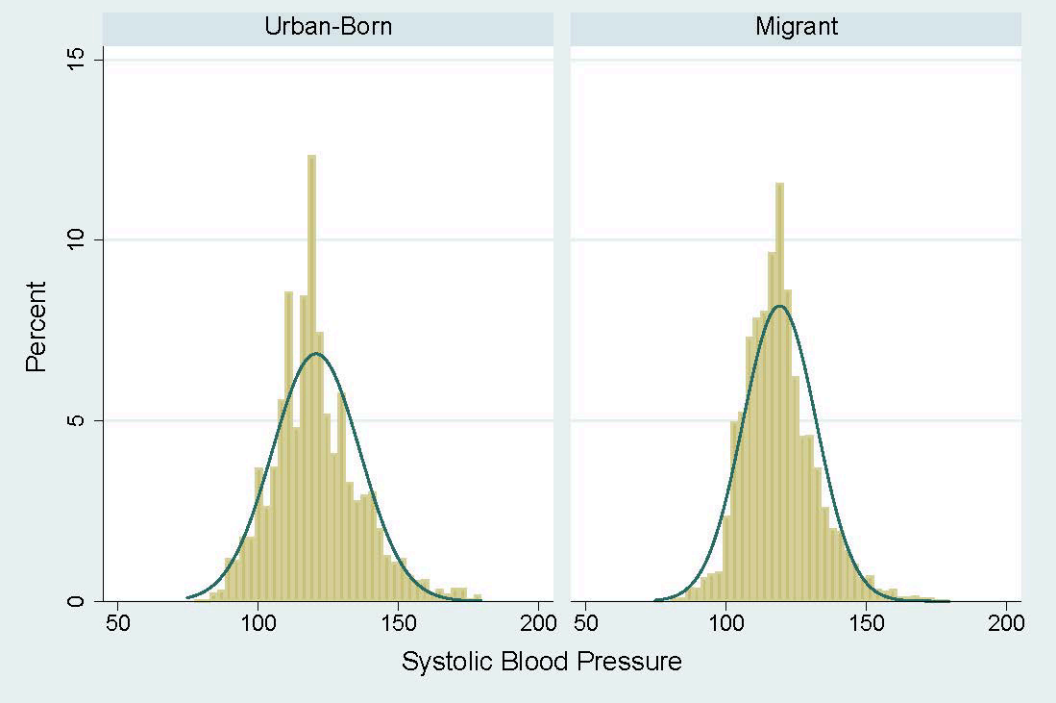
Figure 2. Body mass index by residence status



Source: Authors' own elaboration based on RUMiC survey.

Figure 3 shows the differences in blood pressure for migrants and urban-born residents. We observe, again, a skewed distribution for migrants in line with the results observed for the body mass index. Other health indicators such as grip strength show a similar distribution, with a larger range of variability and high standard deviation. We have also found higher smoking prevalence in migrants, that is, 30 per cent of migrants report to be smokers compared to 20 per cent of urban-born residents.

Figure 3. Blood pressure distribution: urban-born residents vs migrants



Source: Authors' own elaboration based on RUMiC survey.

Given the disparities between the self-reported health status and the observable health indicators, we proceed with the empirical analysis. Our study is the first that uses objective health measures to asses the relationship between access to healthcare and health outcomes in China. This is an empirical question that has been debated from a policy perspective but the difficulty to access data in China has left the debate without proper empirical analysis to support policy initiatives.

3.2 Empirical strategy

In the empirical analysis, we assess if migrants with rural hukou status – and their lack of access to healthcare – has a significant, predictive effect on health perceptions and health indicators than those of urban residents. We pool the data of the urban and migrant household surveys in the 2008 and 2009 waves. Due to the richness of the dataset, we can include a large set of control variables to mitigate the effects of migrants' health selectivity. We estimate an ordered logistic regression analysis as baseline specification to analyse the differential effect of Hukou registration system on self-reported health status of individuals living in urban areas – migrants and non-migrants. The ordered-logit regression model is the appropriate statistical strategy to estimate self-reported health (Min, 2013). The dependent variable (self-reported health status or SRH) is organized in a scale that ranges from 1 to 5. RUMiC supplies data on migrants and non-migrants' health status. Respondents have to choose between 'excellent', 'good', 'average', 'poor' or 'very poor', 1 being the best and 5 the worst. This methodology allows us to identify the strength and to predict future trends on the relationship between lack of access to healthcare due to Hukou

system and health perceptions. The baseline specification is as follows with coefficients estimated by maximum likelihood (Williams, 2006 and Kleinbaum and Klein, 2010):

$$Pr\left(Y_j = i\right) = \Pr(\tau_{i-1} < \beta_1 MHukou_j + \beta_2 Age_j + \beta_3 YearsSinceM_j + \beta_4 Male_j + +\mathrm{X}_j\varphi + \\ + \mathrm{Z}_j\phi + \varepsilon_j \leq \tau_i) \quad (1)$$

Where Y_j states the self-reported health status for all j individuals living in urban areas, migrants and non-migrants. Self-reported health rating is a one to five score, where one is very poor compared to other people of the same age and a five is excellent health.[10] In ordered regression models, the underlying score is estimated as a function of a set of thresholds (or cut-points), together with the independent variables. The thresholds τ_i stands for individual's health status thresholds, so i=1…5 thresholds or categories. 'Excellent' category occurs when $Y_j \leq \tau_0$, as 'good' if $\tau_0 < Y_j < \tau_1$..etc. $MHukou_j$ is a dummy variable that is equal to 1 if the individual is a migrant with rural hukou—no access to public healthcare—and zero otherwise. The equation includes control variables that affect health status, such as age, sex, years of schooling and years since first migration. X_j is a vector of health measures that account for potential differences in health status of the rural-to-urban migrants. We control for weight, by using the body mass index (BMI). We consider that individuals whose BMI is below 24 to be underweight, and whose BMI is over 28 to be obese. Additionally, we also classify individuals according to their systolic and/or diastolic blood pressure. Those individuals whose systolic blood pressure marks are mmHg>140, or in the case of diastolic mmHg>90, are classified as hypertensive (WHO, 2015) and we add if the individual is a smoker. To control for selectivity of migrants we add the vector Z_j that contains socioeconomic indicators, such as years of schooling, income, marital status and origin of migration (west, central, east) as migration decisions also depend on place of origin. The error term is distributed in ordered logit.

Migrants have a high propensity to answer more positively on questions regarding their health status. In the previous section, we compared migrants' answers to those of urban residents being migrant's responses overwhelmingly optimistic (see Table 1). Additionally, using health indicators instead of health status based on perceptions offers alternative specifications to add robustness to the analysis. Next, we redefine the model to use the two health indicators—blood pressure and grip strength—as dependent variables. Objective measurements should inform more accurately on the health status of the individuals than health self-rating. As discussed in the literature review, empirical research establishes that the two measurements are credible predictors of health status (Sun et al. 2008; He et al. 2009; Schooling et al. 2011; Timpka et al. 2014; Diaz et al. 2014; Goldman et al. 2014, and Mainous et al. 2016). Grip strength, as a measure of muscular strength, is a good indicator of current health, while blood pressure is a reliable predictor for current health as well as future cardiovascular diseases and early mortality. We use a simple model with pooled data from the two waves 2008 and 2009:

$$GripStrength_i = \beta_1 MHukou_i + \beta_2 Age_i + \beta_3 YrsSinceM_i + \beta_4 Male_i + \mathrm{K}_i\varphi + \\ + \mathrm{Z}_i\phi + \varepsilon_i \quad (2)$$

[10] The survey question asks: your current state of health (compared to people of the same age as you):
① Excellent ② Good ③ Fairly ④ Poor ⑤ Very poor

$$BloodPressure_i = \beta_1 MHukou_i + \beta_2 Age_i + \beta_3 YrsSinceM_i + \beta_4 Male_i + \mathrm{K}_i\varphi + \\ + \mathrm{Z}_i\phi + \varepsilon_i \quad (3)$$

Equations (2) and (3) include a vector K of health indicators, such as BMI, or being a smoker. Health indicators could also be impacted by the length of time since a person migrated. The direction of the relationship is unknown, but the longer individuals remain in the city, they can create more networks and gather more information about primary care clinics to access healthcare. We add health risk factors variables as well as socioeconomic variables to control for migration bias. The RUMiC only provides data on grip strength and blood pressure for households living in urban areas so that reduces our sample to 7,609 individuals. The ordinary least square analysis using pooled data has limitations and can display biased estimators, we are interested in using the analysis to check correlations as a robustness test by using objectively measured health indicators, as opposed to self-reported health status.

4 Results

Table 4 offers the results for the ordered logistic model based on self-reported health status. One of the advantages of ordinal regressions models is that the interpretation of covariates is similar to those from linear regression models. Additionally, we can obtain the odds ratios from the parameter estimates. Those will allow us to compare the individuals that are in groups greater than the cut-point τ, versus those individuals that are in groups in a lower or equal threshold (τ)

In all estimations, the coefficient of the rural hukou variable that characterizes rural-to-urban migrants with rural hukou, therefore with limited access to health services, is significant at 10 per cent level (at the margin) and exert a negative influence on urban's population health. These are ordered logit regression covariates, so for rural-to-urban migrants to report a better health status is -0.585 less likely than urban individuals in the same category *ceteris paribus* (col. 1). The odds ratios allow us to compare rural-to-urban migrants with urban individuals with access to healthcare. The odd ratio for estimation (1) informs on the probability of reporting excellent or good health versus average or poor health status. Estimation (1) indicates that for migrants with rural hukou, the probability of reporting excellent or good health versus average or poor health is 0.557 times that for urban residents with access to healthcare services *ceteris paribus*.

When we control for years since migration, we observe that the rural hukou covariates are still negative but not highly significant and the size of the coefficients declines (col. 2 and 5). These results indicate that the longer the migrants stay in the cities, the more this favours their knowledge of networks. They also adapt to the environment and it has been empirically demonstrated that their incomes increase which again influences access to healthcare (Ge, 2017).

A 1 per cent increase in income will result in approximately 0.6 per cent increase in the ordered log-odds of being in a better health status (see col. 4 and 5). The odd ratios indicate that a 1 per cent increase in income gives the individuals in a given cut-off group a 1.83-1.86 likelihood of reporting better health status versus average or lower health. One additional year of schooling gives individuals a likelihood between 1.33 and 1.54 to report better health. As expected, being a smoker, underweight, or suffering from hypertension affects health status negatively.

Table 4. Estimation Results for self-reported health status. Ordered Logistic Regression

	Parameter Estimates					Odds Ratios*				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
Rural Hukou	-0.585 c	-0.531 c	-0.627 c	-0.463 c	-0.412 c	0.557	0.588	0.534	0.656	0.629
	(0.310)	(0.266)	(0.281)	(0.211)	(0.212)					
Years since migration	0.410 a	0.329 a			0.304 a	1.522	1.390			1.355
	(0.034)	(0.021)			(0.023)					
Age	-0.261 a	-0.361 a			-0.103 a	0.770	0.770			0.902
	(0.013)	(0.032)			(0.025)					
Male	-0.228 a	-0.125 a			-0.105 a	0.796	0.882			0.900
	(0.051)	(0.035)			(0.014)					
BMI<24.0		-0.010 b	-0.034 b	-0.023 b	-0.023 b		0.990	0.967	0.977	0.977
		(0.006)	(0.018)	(0.012)	(0.011)					
Smoker		-0.362 a	-0.279 a	-0.284 a	-0.336 a		0.696	0.757	0.753	0.715
		(0.044)	(0.034)	(0.048)	(0.053)					
Hypertensive			-0.602 a		-0.501 a			1.826		0.606
			(0.021)		(0.013)					
Years of Schooling				0.433 a	0.292 a				1.542	1.339
				(0.018)	(0.013)					
Income				0.621 a	0.604 a				1.860	1.829
				(0.023)	(0.020)					
Marital Status					0.043 b					1.044
					(0.022)					
Origin West					-0.075 b					0.928
					(0.038)					
_cut1	1.367 a	1.365 a	2.163 a	2.103 a	1.874 a					
	(0.011)	(0.024)	(0.011)	(0.019)	(0.015)					
_cut2	2.026 a	2.0146 a	3.3296 a	3.2866 a	2.9426 a					
	(0.008)	(0.011)	(0.005)	(0.012)	(0.003)					
_cut3	3.036 a	3.047 a	4.2136 a	4.0126 a	3.640 a					
	(0.007)	(0.012)	(0.003)	(0.007)	(0.015)					
_cut4	5.028 a	4.959 a	5.218 a	5.168 a	5.481 a					
	(0.008)	(0.014)	(0.010)	(0.009)	(0.022)					
Number of observations	18797	18797	7609	15344	7609					
LR Chi square	31.45 a	25.12 a	22.93 a	19.35 a	15.5 a					

Notes: Dependent variable: Self-reported health ordered scale: 1 to 5 (1 being 'excellent health').

a, b, c denote parameters significant at 1%, 5% and 10% respectively. Clustered standard error in brackets.

*Odds ratios are the proportional odd ratios for the ordered logit model. They are obtained by exponentiating the ordered logit coefficients $e^{\hat{\beta}}$. It allows to compare individuals that are in groups greater that the cut-point τ with those who are in groups equal or lower than a given cu-point τ. Likelihood Ratio (LR) Chi square tests the model goodness of fit. The null hypothesis states that no association between two variables exist. All p-values<0.1, therefore we can reject the null.

Source: Authors' own elaboration based on RUMiC survey data.

Table 5 displays the results from the effects of rural hukou on objective health outcomes. We use two objective measures as health indicators: grip strength and blood pressure (systolic and diastolic measures). Our results show how lack of access to healthcare due to hukou policy negatively influences health indicators objectively measured. Our results are robust to different specifications

and to the inclusion of socioeconomic control variables and health-related risks factors. The effect is larger in magnitude in the case of blood pressure measures than grip strength, as expected. Individuals suffering from abnormally high blood pressure need regular check-ups and access to medication. The risk of illness for those individuals is also higher. The rest of the control variables have the expected sign and influence. It is worth highlighting that income and human capital are both positively and highly correlated with health. Higher income allows individuals to access healthcare and face out-of-pocket expenditures in case they need to get urgent treatment, also to have access to preventive treatments or better-quality food. In summary, our results show that there are no substantial differences in all different estimated models. Not having access to healthcare affects rural-to-urban migrants' health outcomes in a significant and negative way even when controlling for other risk factors.

Table 5. Impact of rural hukou on health measures

	Dependent Variable: Health Indicators																			
	Grip Strength										Blood Pressure									
	(1)		(2)		(3)		(4)		(5)		(1)		(2)		(3)		(4)		(5)	
Rural Hukou	0.425	a	0.394	a	0.471	a	0.514	a	0.401	a	-0.499	a	-0.486	a	-0.542	a	-0.536	a	-0.604	a
	(0.081)		(0.072)		(0.063)		(0.024)		(0.021)		(0.078)		(0.043)		(0.025)		(0.027)		(0.034)	
Years since Migration	0.434	a	0.398	a	0.427	a			0.488	a	0.321	a	0.213	a	0247.	a			0.368	a
	(0.034)		(0.031)		(0.052)				(0.071)		(0.071)		(0.041)		(0.073)				(0.060)	
Age	-0.341	a	-0.435	a					-0.283	a	-0.216	a	-0.301	a					-0.271	a
	(0.057)		(0.041)						(0.020)		(0.009)		(0.013)						(0.002)	
Male	0.214	a	0.199	a					0.203	a	-0.012	c	-0.003						-0.004	
	(0.051)		(0.043)						(0.033)		(0.007)		(0.003)						(0.004)	
BMI (underweight)			-0.012	b	-0.010	b	-0.021	b	-0.018	b			-0.031	a	-0.058	a	-0.092	a	-0.074	a
			(0.006)		(0.006)		(0.010)		(0.010)				(0.004)		(0.011)		(0.007)		(0.003)	
Smoker			-0.102	b	-0.081	c	-0.103	c	-0.093	b			-0.083	a	-0.095	a	-0.079	a	-0.063	b
			(0.051)		(0.041)		(0.052)		(0.046)				(0.030)		(0.021)		(0.025)		(0.018)	
Schooling							0.228	a	0.121	a							0.313	a	0.213	a
							(0.017)		(0.001)								(0.002)		(0.005)	
Income (log)							0.431	a	0.417	a							0.385	a	0.306	a
							(0.009)		(0.013)								(0.000)		(0.001)	
Marital Status							0.042		0.092								0.013		0.024	
							(0.038)		(0.052)								(0.073)		(0.038)	
Adj-R^2	0.46		0.38		0.46		0.52		0.49		0.35		0.41		0.38		0.32		0.43	
Observations	7609		7609		7609		7609		7609		7609		7609		7609		7609		7609	

Notes: a, b, c denote parameters significant at 1%, 5% and 10% respectively. Include fixed effects by households.

Clustered standard error in brackets.

Source:Authors' own elaboration based on RUMiC survey data.

5 Conclusions and policy recommendations

One intention of hukou registrations is to restrict internal migration. Evidence overwhelmingly shows that internal migration is occurring on a large scale. Despite health risks associated with dangerous work and lack of healthcare, rural Chinese continually decide that the gamble of urban living and work is better than sustenance living in the countryside. These workers are an integral part of China's rapid economic growth and would greatly benefit from healthcare where they live and work.

Our results demonstrate that holding a rural hukou in an urban area is a significant predictor of health outcomes. Our estimations show that health status of migrants is substantially less likely to improve than of non-migrants. This holds true even after controlling for many independent variables, like marriage, smoker status, age, gender, income, or years of education. Having a large population concentrated in urban areas without proper access to healthcare, increases the risk of illness or disease. To have a better idea of the magnitude, official estimates report that, in 2015, Shanghai had approximately 9.8 million migrant workers holding a rural hukou without access to health insurance. Migrants are less likely to have private health insurance coverage in their urban city or to afford copays, and less likely to visit a licensed healthcare provider. Additionally, lack of healthcare access prevents individuals from getting appropriate treatments which worsens migrants' health status and might have spillover effects on non-migrants. Our analysis shows that migrants tend to go to work even when they are sick to avoid losing income.

Lack of healthcare access is associated with multiple costs. It imposes a burden on emergency services and increases the number of nights that migrants are hospitalized. The new pilot programs in place since 2013 provide primary healthcare to migrants in local clinics or community centres. However, these programs are not well-endowed to care for an increasing migrant population, are limited in scope, are very localized in major urban areas and will fail to prevent an epidemic break. The hukou policy reform should address insurance transferability by designing a method to break down some of the institutional barriers. It would allow migrants to use the public urban health system with reimbursements transfers across administrations. One of the main challenges is that the implementation of the hukou reform policy gets decided at the local level and lacks coordination between the different localities. For the first time on record, large cities, as Beijing and Shanghai, are losing migrants due to the latest policies regarding evictions. Some of the migrants return to their rural village to get health treatment. If the trend continues, it will introduce new challenges in which the rural areas, with fewer financial resources, might start facing the increasing burden of providing healthcare to ill returned-migrants.

This paper informs public policy, specifically the necessity to eliminate barriers to health access which are now linked to geography. The Hukou system has failed on that front and instead institutionalized inequality. China's economic growth will still prompt migration flows from rural areas to urban areas to fulfil production in manufacturing and services (driven by domestic demand and international trade). Migration needs will require adjustments in health provisions to accommodate the changing spatial demographics. Could local administrations face the costs of providing healthcare access to migrants by reforming the hukou system? It will require large-scale political reform to abandon the hukou as a tool for social and political control. The alternative, however, is not viable: restricting migrants access to healthcare and other social services will clearly have a substantial negative impact

in the long run, in terms of overall population health status, productivity, and will hinder economic growth.

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