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Shuming Bao
Örn B. Bodvarsson
Jack W. Hou
Yaohui Zhao

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Shuming Bao
University of Michigan

Örn B. Bodvarsson
St. Cloud State University and IZA

Jack W. Hou
California State University, Long Beach

Yaohui Zhao
Beijing University

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IZA

P.O. Box 7240
53072 Bonn
Germany

Phone: +49-228-3894-0
Fax: +49-228-3894-180
E-mail: iza@iza.org

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ABSTRACT

The Regulation of Migration in a Transition Economy: China's Hukou System*

Unlike most countries, China regulates internal migration. Public benefits, access to good quality housing, schools, health care, and attractive employment opportunities are available only to those who have local registration (Hukou). Coincident with the deepening of economic reforms, Hukou has gradually been relaxed since the 1980s, helping to explain an extraordinary surge of migration within China. In this study of interprovincial Chinese migration, we address two questions. First, what is a sensible way of incorporating Hukou into theoretical and empirical models of internal migration? Second, to what extent has Hukou influenced the scale and structure of migration? We incorporate two alternative measures of Hukou into a modified gravity model – the unregistered migrant's: (i) perceived probability of securing Hukou; and (ii) perceived probability of securing employment opportunities available only to those with Hukou. In contrast to previous studies, our model includes a much wider variety of control especially important for the Chinese case. Analyzing the relationship between Hukou and migration using census data for 1985-90, 1995-2000 and 2000-05, we find that migration is very sensitive to Hukou, with the greatest sensitivity occurring during the middle period.

JEL Classification: J61

Keywords: internal migration, Hukou, migrant networks, reforms

Corresponding author:

Örn B. Bodvarsson
Department of Economics
St. Cloud State University
St. Cloud, MN 56301-4498
USA
E-mail: obbodvarsson@stcloudstate.edu

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I. INTRODUCTION

In most countries, internal migration is unregulated. That is not the case in China, which restricts migration through its "Household Registration System," also called "Hukou." Instituted in 1958, Hukou requires every citizen seeking a change in residence to obtain permission from the public security bureau. If one wants to move from a rural to urban area, for example, he (or she) must convert his (or her) local registration status from "agricultural" to "non-agricultural," an approval that is usually very difficult.[1] Likewise, if one wants to move from a small city to a large city, it is also very difficult. Being registered in a large city can bring substantial benefits, e.g. access to permanent jobs (including jobs in the state sector), housing, food, public schooling and health care.[2] Hukou is effectively an internal passport system that makes the process of moving between or within provinces analogous to the process of moving between countries. For researchers interested in the study of how restrictions affect the scale and structure of migration, China is thus a tremendously valuable natural experiment.

We contend that the Chinese case is important for migration researchers worldwide for two reasons. First, consider the fact that despite the high costs of changing one's local registration, there continues to be a very high level of undocumented migration in China.

[1] Historically, it has been very difficult to change one's local citizenship in China and even today, there are considerable barriers to obtaining local registration in an urban area. One way of surmounting these barriers is through education. If a person is able to gain admission to college and complete his degree, then there is a strong chance of being hired into an urban job with local registration. The government has sometimes permitted factories in urban areas to hire permanent workers from rural areas, permitted family members in rural areas to join other members in cities, or permitted migration from rural areas to nearby small cities. Other ways of gaining urban Hukou include military recruitment or having membership in communes whose land is requisitioned for urban purposes. In addition to the costs of overcoming barriers to access, conversion to urban Hukou imposes high opportunity costs. For example, permanently leaving one's village forces a migrant to abandon claims to ownership of land without compensation, land that may have been in the family for decades, as well as to profits of local rural industries.

[2] Until the early 1990s, urban Hukou also entitled a person to "grain rations" – rations of necessities such as grain products and kerosene.

There is a huge "floating population" comprising persons with no local household registration who have concentrated primarily in large coastal cities.[3] The floating population has grown because as China's transition to a market-based economy has intensified, regional income differences (which have favored Eastern coastal cities) have widened. Analogous to the large population of undocumented U.S. immigrants from Mexico and Central America, China's floating population is testimony to the power of spatial differences in income as a motive for migration.[4] It follows that despite the history of central planning in China, traditional Western models of migration, which emphasize the influence of spatial differences in labor markets, should be quite applicable to the Chinese case.

A second reason is that Hukou has undergone an incremental dismantling over the last three decades. The deregulation of migration in China may be broken down into three periods – the 1980s, 1990s and post-2000 period. Up to the late 1980s, anyone wishing to travel within China had to show an official "permission" letter from his/her local government. Beginning in the late 1980s, identity cards replaced permission letters, making it much easier to travel. During the early 1990s, grain rationing coupons were abolished. These coupons had been the means by which people obtained food rations and

[3] The floating population comprises the bulk of the extraordinary surge in internal migration that has taken place since the 1980s. Based on the 1% population sample survey of 1987, for example, it is estimated that over 30 million Chinese relocated either within or between provinces during 1982-87. Using data from the 2000 Chinese Census, researchers have estimated that intra- and interprovincial migration during 1995-2000 totaled over 121 million persons. According to the 2005 Census, the level of migration during 2000-05 is estimated to have risen even further, to nearly 195 million persons. Much of the surge since the mid 1990s has involved rural residents moving to urban areas without obtaining local registration, particularly the metropolitan coastal cities and Beijing. See Seeborg, Jun and Zhu (2000) and Goodkind and West (2002) for a discussion of some of the most important reasons for the emergence of the floating population. In addition, the government's Xibu Da Kaifa ("Go West") policy, enacted in 1999, which encouraged Westward migration, has been a recent contribution to China's migration surge.

[4] For a more detailed history and explanation of the Hukou system, see Chan (1994), Chan and Zhang (1999), Cheng and Selden (1994), Day and Xia (1994), Goldstein (1990), Goldstein and Goldstein (1990), Wang (1997), Davin (1999), and Liang (2001)

they could only be used in the place of residence. In 2001, residency in small towns and townships was opened to all rural workers who were legally employed and had a place to live. At roughly the same time, medium-sized cities and some provincial capitals eliminated ceilings on the number of rural workers who could apply for permanent residence status. Some very large cities such as Shanghai and Beijing concurrently eased restrictions on the in-migration of rural workers.[5] Since census data on migration flows are available going back to the mid-1980s,[6] a test of the effects of deregulation on migration is quite feasible because one can exploit the variation in Hukou restrictions across all three periods. Since the migration research community still knows very little about how exactly changes in restrictions influence migration behavior, the Chinese test case could provide significantly valuable information.

Thanks largely to the 1990, 2000 and 2005 Chinese censuses and the intensification of Western style market reforms, researchers can now study migration patterns in China using Western style models. A small, mostly empirical, literature on the

[5] Coincident with the easing of Hukou restrictions was the introduction of various market-oriented reforms. The first reform was the decollectivization of agriculture (also known as the inception of the *household responsibility system*) in rural areas. The most important aspect of this reform is that it freed workers to choose how they wanted to allocate their labor supplies. This encouraged many workers to leave the agricultural sector and seek employment in other sectors, most notably enterprises in urban areas. The second consisted of a set of market-oriented reforms in the urban areas during the late 1980s. The government, in an effort to attract foreign direct investment, created favorable provisions, e.g. tax concessions and attractive terms for leasing land, to many coastal cities so they could establish economic development areas and high technology development zones. In the 1990s, the government gave special tax and regulatory treatment to certain areas (called "special economic zones"), which generated large amounts of FDI in those areas. These economic reforms had the effect of creating large real income differentials between the Eastern provinces and the rest of China, encouraging Eastward migration. These reforms very likely helped to contribute to the rural-to-urban migration surge beginning in the 1980s. Other reasons include global prosperity, which helped fuel tremendous growth in China's export markets, the growth of migrant networks, and cultural changes making migration more acceptable and appealing.

[6] The first national survey that included questions about migration was the 1987 1% population survey and 1990 was the first year in which the government collected data on migration in the population census. The 1990 census asked questions about both inter- and intra-provincial migration for the period 1985-90 and the 2000 (2005) census included questions about migration during 1995-2000 (2000-05). There have also been a number of household surveys in very specific areas of the country, which have included questions about migration.

determinants of internal migration in China has emerged. Its focus has been to examine the extent to which migration flows are driven by regional differences in labor markets.[7] While most researchers have generally acknowledged the important role of the Hukou system in Chinese migration patterns, no study has attempted to estimate the effects of Hukou on the scale and structure of migration.[8] While there have been various applications of the modified gravity model to studying the determinants of migration flows in China, no study has developed a measure of Hukou and estimated a migration model which includes such a measure.[9]

The study coming closest to examining the effects of Hukou on migration is Poncet (2006). Poncet argued that as deregulation intensified, migration should have become more responsive to economic factors. She estimated a modified gravity model for the 1985-90 and 1990-95 periods, finding that intra- and interprovincial migration rates were

[7] The literature can be conveniently divided into studies utilizing micro-data obtained from special household surveys (see, for example, Liang (2001), Liang and White (1996,1997), Zhao (1997,1999a, 1999b, 2002, 2003) and a few studies utilizing province-level aggregate data provided by the central government (see, for example, Fan (2005), Lin, Wang and Zhao (2004), Poncet (2006) and Bao, Hou and Shi (2006)). We should also point out that in 2002, an entire issue of the journal *Urban Studies* was devoted to empirical papers on China's growing migration and urbanization. We particularly wish to highlight the studies of Chen and Coulson (2002) on the determinants of urban migration, Liang, Chen and Gu (2002) on the effects of rural industrialization on internal migration, Li and Zahniser (2002) on the determinants of temporary rural-to-urban immigration, and the Goodkind and West (2002) study on the floating population.

[8] We should point out that several relatively recent studies examine other effects of Hukou. Au and Henderson (2006) develop a theoretical model and test to demonstrate that Hukou has led to undersized cities (they call this "insufficient agglomeration") and losses in GDP. Whalley and Zhang (2004) use a simulation model to show that in the absence of restrictions on migration, interregional income inequality in China would have been substantially smaller. There is also a study by Wu and Treiman (2004), which seeks to identify those factors which are most important in influencing the odds of converting from rural to urban registration. They find that education and membership in the Chinese Communist Party are the most important sources of influence.

[9] Economists studying migration have generally paid very little attention to the modeling of and testing for the effects of restrictions on migration propensities. Because most countries don't have restrictions on within-country mobility and most internal migration studies have been on those countries, researchers have seen no need to modify their models to account for restrictions. It is surprising, though, that the literature on international migration has generally avoided theoretical or empirical analyses of restrictions, especially since most countries do have immigration restrictions. The only study of international migration we are aware of where a theoretical migration model includes restrictions and where the effects of restrictions on migration rates are estimated is Clark, Hatton and William's (2007) study of U.S. immigration. For a very recent appraisal of the status of theoretical and empirical work on the determinants of migration, see Chapters 2 and 3 in Bodvarsson and Van den Berg (2009).

indeed more responsive to spatial income and unemployment rate differences in the later period. However, Poncet's theoretical and empirical models actually did not include a Hukou variable, nor did her data set include a measure of the intensity of Hukou restrictions. Furthermore, Poncet's coefficient estimates are likely to suffer from omitted variables bias because her regression equations lacked a number of important controls. These include migrant networks, foreign and domestic investments, industry mix, demographic characteristics, climate, and educational attainment. We should emphasize, though, that lack of adequate controls is a problem with most other studies of Chinese migration.

The goal of this study is twofold. First, we seek to estimate the strength of the Hukou system's influence on the scale of migration in China. We accomplish this by developing several alternative measures of Hukou restrictions and incorporating them into a modified gravity model of migration. Using data from the Chinese censuses and other sources, we test this model on the 1985-90, 1995-2000 and 2000-05 migration periods. We perform panel estimation to ascertain the extent to which the sensitivity of migration to Hukou has changed over time. Such an analysis helps us better understand how the structure of migration has changed as deregulation of migration and other market reforms have deepened. Second, we test our hypotheses using a much more comprehensive model of migration than will be found in earlier studies. The Chinese test case is unique because it involves an economy in transition from central planning to a market-based system, where there have been large infusions of FDI and domestic fixed asset investments, considerable social and cultural changes, and tremendous growth in communications and transportation infrastructure. China has also experienced very large

growth in migrant networks, particularly in urban areas. Earlier studies have not adequately included controls for all these factors. Consequently, we believe our test provides the most complete and accurate picture to date of the scale and structure of migration in China.

The remainder of this paper is organized as follows. Below we present a theoretical model of interprovincial migration flows, which includes parameters describing restrictions on internal migration, followed by empirical specifications that include Hukou measures. We then describe our data set, followed by a presentation of the empirical results. The paper concludes with a discussion of the implications of our findings for Western research on migration.

II. A THEORETICAL MODEL OF MIGRATION

Our theoretical model of internal migration incorporates elements of models due to Poncet (2006), Crozet (2004) and Tabuchi and Thisse (2002). For simplicity, we assume just one potential destination. Worker k from province j needs to decide whether to relocate to province i or stay home. Her objective is to choose the location for which the perceived quality of life, adjusting for all relocation costs, is higher. The perceived quality of life in a province is assumed to depend upon earnings opportunities available to the worker, the probability of finding a job, and the availability of various amenities and non-tradeable goods. Amenities and non-tradeable goods may include climate, the availability of ethnic goods and services, the quality of schools and public services, etc. Furthermore, the perceived quality of life will depend upon the size and proximity of the migrant's community of family and friends from the home province.

The migration decision will also depend upon migration costs, which are assumed to vary directly with distance. In the more general case where there are R destination provinces (including j), the migrant's objective function is

$$(1)\Phi_{ji}^{k} = W_{ji}^{k} + \eta_{i}^{k} = \ln[\pi_i Y_i (d_{ij})^{-\psi}] + \eta_i^k \qquad i \in [1, R],$$

where π_i is the probability of securing employment in province i, Y_i is real income in i, d_{ij} is the geographic distance between home and host provinces, and η_i^k is a stochastic term capturing all the other factors influencing the migrant's perceptions of the quality of life available in province i. Migration costs will rise proportionately with distance because as distance rises, typically the physical costs of moving, the costs of acquiring information about labor market opportunities in the province, and the psychic costs of migration will be higher. In our simplified (one-destination case), though, the decision boils down to comparing the two equations below and choosing the option associated with the higher-value equation:

$$(2)\ \Phi_i^k = W_i^k + \eta_i^k = \ln[\pi_i Y_i (d_{ij})^{-\psi}] + \eta_i^k$$

$$(3)\ \Phi_j^k = W_j^k + \eta_j^k = \ln[\pi_j Y_j] + \eta_j^k$$

Since there are no migration costs associated with the "stay home" option (equation (3)), then real income, the probability of securing employment and/or the migrant's perceptions of provincial characteristics in i, must be higher to overcome any explicit or implicit costs of moving there.

The migrant's comparison of the values of equations (2) and (3) is equivalent to her calculating the expected net benefits of migration, $\Phi_i^k - \Phi_j^k$, and choosing to relocate

only if those net benefits are positive. Taking the difference between equations (2) and (3) and then taking logs, the expected net benefits to migration are

$$(4)\ \Phi_i^k - \Phi_j^k = [\ln(\pi_i) - \ln(\pi_j)] + [\ln(Y_i) - \ln(Y_j)] - \psi \ln(d_{ij}) + [\eta_i^k - \eta_j^k].$$

Equation (4) implies that the likelihood of migration will be higher the higher are expected relative income and the relative probability of securing employment in i, the higher is the perceived relative favorability of other characteristics of i, and the lower is distance. These are standard predictions implied by the economic theory of internal migration due originally to Sjaastad (1962) and Greenwood (1969).

In the home province, where the prospective migrant is assumed to have local Hukou, the probability of securing employment depends upon general labor market conditions, which are reflected in the provincial unemployment rate. Specifically, we posit that $\pi_j = g(u_j)$, where u_j is the unemployment rate in the home province. In provinces where labor demand is relatively weak, the unemployment rate will be higher and it will be more difficult for anyone to find employment. With subscripts as derivatives, this implies that $g_1 < 0$.

In the destination province, the unregistered migrant can be hampered in finding a good job by two factors – general labor market conditions and the lack of household registration. Therefore, the probability of securing employment depends upon both the unemployment rate and the likelihood of obtaining Hukou:

$$(5)\ \pi_i = f[u_i, pr\{H_i\}],$$

where u_i is the unemployment rate in province i and $pr\{H_i\}$ is the probability of obtaining Hukou. It is assumed that $f_1 < 0$ and $f_2 > 0$. The reason for $f_2 > 0$ is that if a person lacks local Hukou, she will be shut out of certain parts of the labor market, e.g. jobs in state

enterprises and more high-skill and better-paying jobs. Having local Hukou not only provides one access to coveted jobs, but access to a greater variety of jobs. Even if the migrant doesn't care about securing Hukou, she may view the probability of securing Hukou as an indicator of the openness of the province, e.g. provinces where it is harder to obtain local registration could be provinces that generally impose higher barriers to entry for outsiders. It is also possible that there could be an interaction effect between the unemployment rate and the likelihood of securing local Hukou ($f_{12} \neq 0$). For example, suppose an export boom affecting all industries strengthens labor demand and lowers the unemployment rate. While all workers will experience a higher likelihood of securing employment, those with local Hukou may experience an even bigger increase in the odds of landing a job ($f_{12} < 0$) because they have access to a greater variety of job opportunities.

Incorporating $\pi_j = g(u_j)$ and equation (5) into equation (4), the expected net benefits to migration are now

$$(6)\ \Phi_i^k - \Phi_j^k = [\ln(\pi_i(u_i, \Pr\{H_i\}) - \ln(\pi_j(u_j)] + [\ln(Y_i) - \ln(Y_j)] - \psi \ln(d_{ij}) + [\eta_i^k - \eta_j^k].$$

Equation (6) implies that the probability of migration is higher: (a) the higher is the unemployment rate in the home province; (b) the lower is the unemployment rate in the destination province; and (c) the higher is the perceived probability of obtaining local Hukou in the destination. In the section below, we work with several empirical specifications implied by equation (6).

III. EMPIRICAL SPECIFICATIONS

The theoretical model above implies a double-log empirical specification where the dependent variable is the log of the migration rate ($\ln(M_{ij})$), defined as the number of persons moving from province j to province i as a percentage of all persons moving out of province j.[10] In using this specification for the case of China, we include explanatory variables from an assortment of studies, including Lin, Wang and Zhao (2004), Bao, Hou and Shi (2006) and Poncet (2006). However, our empirical model extends previous research in several other important ways. First, we add controls for the regulation of migration, which is very important for China because of its history of restrictions on migration. Second, we add other measures which are important for the study of the Chinese test case. Furthermore, in contrast to most previous studies of China, ours is a panel study spanning three important periods of migration.

We estimate three specifications implied by the theoretical model. The first is a panel version of a basic specification due originally to Greenwood (1969, 1997) and applied to the Chinese test case by Lin, Wang and Zhao (2004). This specification is described by the following double-log equation for the interprovincial migration rate:

$$(7)\ \mathrm{Ln}(M_{ijt}) = \alpha_0 + \alpha_1 Ln(Y_{jit}) + \alpha_2 D_{ij} + \alpha_3 Ln(\pi_{it}) + \alpha_4 Ln(\pi_{jt}) + \sum_{x=1}^{q} \beta_x Ln(Z_{xt}) + \sum_{t=1}^{T-1} \lambda_t \mathrm{Period}_t + \sum_{p=1}^{Z-1} \theta_p \mathrm{Province}_p + \varepsilon_{ijt},$$

where:

Y_{jit} = the ratio of destination province to origin province income in period t;

D_{ij} = Geographic distance between provinces;

π_{it} (π_{jt}) = the probability of securing employment in the destination (origin) province in period t;

[10] This specification, widely used in the literature, is due originally to Greenwood (1969).

Z_{xt} = other controls for perceived quality of provincial life, in period t;

$Period_t$ = time period during which migration occurred, where there are T periods;

$Province_p$ = origin province fixed effect, where there are Z provinces;

ε_{ijt} = random error term;

and the α, β, λ, and θ parameters are coefficients to be estimated. We hypothesize that $\alpha_1 > 0$, $\alpha_2 < 0$, $\alpha_3 > 0$ and $\alpha_4 < 0$.

The next two empirical specifications are extensions of equation (7). Where they differ is in how Hukou restrictions are measured. Before describing each equation, it is important to note that in China unemployment rates are estimated using data only on locally registered persons, i.e. members of the "floating population" are not part of the sample. Therefore, the official provincial unemployment rate measures unemployment risk for a registered person only. Define u_{it} (u_{jt}) as the reported unemployment rate in the destination (origin) province. It follows that $(1 - u_{it})$ are the odds of securing employment in the destination province when a person is registered there and $(1 - u_{jt})$ are the odds of securing employment in the origin province.

The first equation measures Hukou as the odds of securing local registration in the destination:

$$(8)\ \mathrm{Ln}(M_{ijt}) = \alpha_0 + \alpha_1 Ln(Y_{jit}) + \alpha_2 D_{ij} + \alpha_3 Ln(1-u_{it}) + \alpha_4 Ln(\mathrm{Hukpercent}_{it}) + \alpha_5 Ln(1-u_{jt}) + \sum_{x=1}^{q} \beta_x Ln(Z_{xt}) + \sum_{t=1}^{T-1} [(\lambda_t \mathrm{Period}_t) + \chi_t((\mathrm{Period}_t) Ln(\mathrm{Hukpercent}_{it}))] + \sum_{p=1}^{Z-1} \theta_p \mathrm{Province}_p + \varepsilon_{ijt},$$

where "Hukpercent" is the probability of securing local Hukou. Given available data, we measure Hukpercent as the *lagged relative frequency of registered households*. It is assumed that prospective migrants know the historical relative frequencies of registered households in destination provinces and have adaptive expectations about barriers to

entry. We hypothesize that $\alpha_4 > 0$, implying that when the likelihood of securing Hukou rises, the perceived benefits to migration and the migration rate will rise. The second equation measures Hukou as the joint probability of an unregistered migrant securing a job and Hukou in the destination. This measure equals *one minus the unemployment rate in the destination times the historical relative frequency of registered households:*

$$(9)\ \mathrm{Ln}(\mathrm{M_{ijt}}) = \alpha_0 + \alpha_1 Ln(Y_{jit}) + \alpha_2 D_{ij} + \alpha_3[Ln(1-u_{it})Ln(\mathrm{Hukpercent}_{it})] + \alpha_5 Ln(1-u_{jt}) + \sum_{x=1}^{q}\beta_x Ln(Z_{xt}) + \sum_{t=1}^{T-1}[\lambda_t \mathrm{Period}_t + \chi_t((\mathrm{Period}_t)(Ln(1-u_{it})Ln(\mathrm{Hukpercent}_{it}))] + \sum_{p=1}^{Z-1}\theta_p \mathrm{Province}_p + \varepsilon_{ijt},$$

While one minus the unemployment rate measures the likelihood of a registered migrant securing a job, weighting that likelihood by the likelihood of securing Hukou accounts for the fact that unregistered migrants find it more difficult to secure employment in the destination than those who are registered, all other things equal. It is hypothesized that α_3 in equation (9) is positive.

Another way of looking at the difference between equations (8) and (9) is that in (9), Hukou is relevant to the migrant only if it impacts the odds of securing employment in the destination. In contrast, equation (8) includes a more expansive measure of Hukou, reflecting the notion that the benefit of local Hukou goes beyond getting a good job; Being registered means having access to other kinds of benefits in the destination, e.g. access to public benefits, better quality housing or job security.

The interactions between the time period dummies and the relative frequency of registered households ($(\mathrm{Period_t})(\mathrm{Ln(Hukpercent_{it})})$) describe the time-varying effects of Hukou on the incentive to migrate. If the odds of obtaining local Hukou affect the incentive to migrate differently for different periods, this will be reflected in positive or negative values of the χ_t coefficients in equations (8) and (9). The Hukou system across

China has gradually been relaxed over the last quarter century, with some provinces reducing barriers to local registration more than others. Greater deregulation may, for example, lower the perceived relevance of securing Hukou to the migration decision and cause the migration rate to be less sensitive to the odds of securing Hukou. In that case, λ_t will be negative. On the other hand, if greater ease of transportation and communication reduce migration costs and macroeconomic reforms, combined with growing prosperity, substantially stimulate migration flows, then having local registration may be more important than before. In that case, λ_t will be positive.

The other controls (the x's) included for each period in the empirical specifications are the following (hypothesized signs in parentheses):

(i) log size of the migrant community residing in the destination province that previously migrated from the origin province, as a percent of the destination's population (> 0);

(ii) log ratio of real FDI per capita in the destination province to real FDI per capita in the origin province (>0);

(iii) log ratio of real domestic fixed asset investment (FAI) per capita in the destination province to real domestic FAI in the origin province (>0);

(iv) log percentages of population enrolled in the origin province's universities (< 0) and the destination province's universities (> 0)

(v) log ratio of the share of manufacturing employment in the destination to the share of manufacturing employment in the origin (> 0)

(vi) log ratio of the urban share of the destination province's population to the urban share of the origin province's population (> 0)

(vii) log ratio of the destination province's minority population share to the origin province's minority population share (> 0 or < 0);

(viii) log ratio of mean yearly temperature in the capital city of the destination province to mean yearly temperature in the capital city of the origin province (> 0);

(ix) log share of real origin FAI devoted to transportation infrastructure (< 0);

(ix) interaction of the log of the FDI ratio (item (ii) above) and the log of the FAI ratio (> 0 or < 0);

(x) interaction of the log of real FAI in the origin and real per capita GDP in the origin (> 0);

(xi) interaction of the log of relative past migration flows (item (i) above) and log of distance (> 0).

Below are explanations for hypothesized signs on selected items above:

1. The migration rate is hypothesized to be positively related to both the destination/origin real FDI and FAI ratios. Higher investment, such as new commercial or residential construction in the destination area, will generate higher demand for labor from other provinces, higher wage rates, and thus an increase in "demand-pull" migration. Higher investment in the origin province will diminish the incentive to migrate due to more attractive labor market opportunities there. An interaction term between the real FDI and FAI ratios is included to control for the possibility that higher levels of one investment type may influence the marginal effect of the other investment type on the migration rate. Foreign firms investing in a province tend to compete for the same pool of workers as do domestic firms making fixed-asset investments (which tend to be state and collective enterprises). Suppose, for example, there is higher FDI in the destination province which results in a greater inflow of workers who obtain employment in FDI-financed firms. Now the pool of migrants available for jobs in FAI-financed firms will be lower, implying that the amount of immigration induced by higher FAI will be lower. In that case, the hypothesized coefficient on the interaction term is negative;

2. The ratio of the share of manufacturing employment in the destination province to the origin province's share is included as a control for industrial composition. Manufacturing jobs are generally higher-skilled and higher-paying compared to, for example, jobs in the agricultural sector. Therefore, provinces with relatively larger manufacturing sectors should attract relatively more migrants, all other things equal, especially from provinces that have large agricultural sectors;
3. The ratio of destination urban population share to origin urban population share controls for relative population density in the destination province. Provinces that are relatively more urbanized tend to have different amenities, types of employment opportunities, standards of living, etc., which could influence the rate of immigration. For example, the proportion of skilled positions in more urban provinces is typically higher and may encourage more immigration;
4. Following Bao, Hou and Shi (2006, pp. 335), we include a control for the relative proportion of the destination's population that is minority.[11] We include this variable for several reasons and postulate that its effect on migration could be positive or negative. First, this variable may proxy general political conditions in the province, e.g. provinces with larger minority population shares may have more political divisiveness than other provinces, which may influence immigration rates. Second, as Bao, Hou and Shi (2006) point out, provinces with relatively large minority population shares tend to lack many basic service industries, hence entrepreneurial migrants seeking to start service businesses may find these provinces profitable places to establish businesses. On the other hand, professionals seeking salaried positions

[11] The proportion of a province's population that is minority was computed in the following way: $\text{minority share} = (\frac{\text{total population - Han population}}{\text{total population}}) x 100.$

may be less interested in migrating to provinces with higher minority shares because they may perceive such provinces to have more limited high-skill employment opportunities;

5. The migration rate is hypothesized to be positively related to the level of educational attainment, measured as the proportion of the province enrolled in universities[12] in the destination, because a better-educated labor force often means a distribution of higher quality employment opportunities. However, using the same type of argument, greater educational attainment in the origin is hypothesized to be inversely related to the migration rate;
6. In a province where the share of real FAI allocated to transportation infrastructure rises, e.g. there are greater investments to expand and upgrade railroads, airports and highways, the costs of relocating will fall. We would thus expect to see a higher out-migration rate from the province;
7. The interaction between FAI per capita and real GDP per capita in the origin province is included to account for the possibility that emigration from poorer provinces in response to changes in domestic investment spending may behave differently than emigration from richer provinces. An increase in FAI in the origin province would be expected to reduce out-migration from that province. In poorer provinces, where state-sponsored investment spending is usually much lower to begin with, the marginal productivity of new investment and the resulting increase in labor demand may be much higher. Consequently, the out-migration rate may fall relatively more in poorer provinces than in richer provinces, i.e. the higher is GDP per capita in the origin

[12] A better measure of educational attainment is the percentage of the population that is college-educated, however that sort of data are not available for individual provinces.

province, the lower will be the marginal effect of FAI on the rate of migration from the province. In this case, the hypothesized sign on the interaction term is negative;

8. The interaction between past migration flows and distance incorporates the idea that when the destination and origin provinces are far apart, the marginal value of having friends and family already in the destination will be very high, hence the marginal effect of past migration flows on the incentive to migrate will be very strong. For a long distance move, the migrant will likely be much more reliant on a pre-existing migrant network for information and assistance with relocation, as well as relief from the psychic costs of relocation. In contrast, when the provinces are very close to one another, the destination province will be familiar territory and one is likely to be less reliant on a pre-existing network. Therefore, we hypothesize a positive sign on this interaction.

IV. DISCUSSION OF DATA

Our data are drawn from two major sources. For the 1985-90 and 1995-2000 periods, we expand the data set used by Lin, Wang and Zhao (2004) in their study of interprovincial migration.[13] Their data set is expanded because it doesn't include some provincial measures discussed earlier. Data for 2000-05 plus data for these additional measures are taken from University of Michigan's *China Data Online* website (http://www.chinadataonline.org/), where data on that website are extracted from China's National Bureau of Statistics. The entire data set used in this study consists of 2,425 observations, although 40 observations for which the migration rate was zero were

[13] Note that we replaced Lin, Wang and Zhao's (2004) calculations of the dependent variable with our own calculations. The reason is that there are some inaccuracies in the series used by Lin, Wang and Zhao, which they acknowledged in communications with us.

excluded. There are 790 observations for the 1985-90 period, 765 for 1995-2000 and 790 for 2000-05, for a total of 29 provinces.[14] Each of the 29 provinces was a prospective destination and a point of origin. A major drawback of the 1985-90 subsample is that estimates of the effects of past migration flows on migration rates during that period could not be obtained, owing to the absence of data on migrant flows prior to 1985. However, one can use data on migration flows going back to 1985 when estimating migration rates for 1990 and beyond. Consequently, we produced two sets of estimates: (1) estimates for the full panel with no control for past migration; and (2) estimates for a smaller panel comprising the later two periods only with a control for past migration (1,580 observations).

Tables 1 - 3 show summary statistics for all variables used in our regressions for each of the three migration periods. Starting from the top of each table, we describe the variable, the data source from which the variable is taken, and trends apparent in the data:

(i) Gross interprovincial migration rate. For the 1985-90, 1995-2000 and 2000-05 periods, respectively, migration rates are calculated from samples comprising 1% of the 1990 population census, 0.95% of the 2000 census,[15] and 1% of the 2005 census. In the 1990 (2000, 2005) census, respondents were asked to report on migration activities during

[14] As with Lin, Wang and Zhao (2004), we exclude Tibet because of missing observations and treat Chongqing as part of Sichuan.

[15] As pointed out by Lin, Wang and Zhao (2004), there is a small difference between the 1990 and 2000 censuses with respect to how migration is defined. If a person is observed to change residence *and* to change their household registration (a situation officially called "Hukou migration"), then this movement is officially classified as "migration" in both censuses. If, however, the person is observed to change residence without changing registration ("non-Hukou migration"), then the movement is classified as "migration" only if the migrant has been away from the place of registration for a minimum period of time. In the 2000 census, this period is 6 months, but in the 1990 census it is one year. To account for this change in classification between the two periods, the migration numbers in both periods were standardized by discounting the 2000 numbers by a small amount, approximately 5%. For further details, see Lin, Wang and Zhao (2004, page 593).

1985-90 (1995-2000, 2000-05, respectively). Consequently, migration rates during each decade were calculated for only the second half of each decade. The mean volume of emigration from a province surged from over 355,000 persons during 1985-90 to over 1,075,000 during 1995-2000 and over 2,200,000 during 2000-05.[16] Note that mean provincial population rose by 9.44% between 1990 and 2000 and by 5.86% between 2000 and 2005. For the first two periods, Sichuan province experienced the highest volume of interprovincial emigration (approximately 1,457,000 persons during 1985-90 and 4,375,000 during 1995-2000), while Ningxia province had the lowest (approximately 54,500 persons during 1985-90 and 94,750 during 1995-2000). During 1985-90, the highest interprovincial migration rate was 79.34% (Guangxi to Guangdong) and the lowest was 0.02% (a tie between Jiangxi to Qinghai and Jiangxi to Ningxia). During 1995-2000, the highest reported migration rate was 87.32% (Guangxi to Guangdong) and the lowest was 0.14% (Jiangxi to Qinghai). For 2000-05, the highest in-migration rate was experienced by 36.53% (Guangdong) and the lowest was 0.19% (Qinghai); The highest out-migration rate was 20.54% (Gansu) and the lowest was 0% (Xinjiang);

(ii) *The historical relative frequency of persons with local Hukou*. This is the ratio of the registered population to total (registered + unregistered) population at year's end. For the 1985-90 (1995-2000, 2000-05) period, we use the mean annual proportion of persons with Hukou during 1980-84 (1990-94, 1995-99, respectively). There are two reasons for used the lagged proportion of persons with Hukou. First, this measure is consistent with its theoretical counterpart, the lagged relative frequency of persons with Hukou. Second,

[16] There are likely to be discrepancies in the calculations of these numbers between decades, for the reasons discussed in the preceding footnote.

there is very likely to be two-way causality between the migration rate and the contemporaneous proportion of registered persons in the destination. By using the lagged proportion of persons with Hukou we avoid potential problems with simultaneous equations bias.

Tables 1-3 indicate some very interesting patterns over time with respect to the proportion of registered persons in each province. First, note that despite Hukou undergoing gradual relaxation, the proportion of persons with local Hukou fell from an average of approximately 98% during the early 1980s to an average of approximately 88.5% during the late 1990s. This is probably because the floating population grew faster than the number of registered households. Second, note that the variance of the proportion of persons with Hukou across the provinces rose appreciably over these three decades. The spread between the minimum and maximum percentages during 1980-84 was 4.79%, but soared to 21.04% during 1990-94 and 28.85% during 1995-99. This means that differences across provinces with respect to the ease of obtaining Hukou rose significantly. Some provinces, for example, reduced entry barriers substantially, which would have greatly increased the incentive to migrate to those particular provinces.

(iii) Past migration flows. This is measured as the estimated persons from the origin province that reside in the destination province, as a percentage of the latter's population. An ideal measure of the size of the migrant community is the percentage stock of previous migrants residing in the destination province, measured at the time of migration. Unfortunately, unlike data sets in the USA and many European countries, a migrant stock measure is not available for China. Therefore, we used past *flows*. In our regression

analyses for the 1995-2000 and 2000-05 sub-samples, relative migrant flows during 1985-95 were used to proxy the relative size of the migrant network during each of these two migration periods. For the 1995-2000 period, the proportionate size of the migrant community was calculated by the ratio of total flows from origin to destination during 1985-95 to the destination's population in 2000; For the 2000-05 period, we used 1985-95 flows as a percentage of 2005 population. The basic assumption underlying these calculations is that the stock of previous migrants is proportional to the size of the previous flow of migrants. While not an ideal measure, we are confident that data on flows over a longer (10-year) period should be relatively accurate. Using this approach, the average size of the migrant community in each province during 1995-2000 and 2000-05 was approximately 2.5 million persons;

(iv) Real annual FDI and FAI per capita. For each period, we used mean annual real FDI (FAI) per capita during 1980-84 when regressing 1985-90 migration flows, 1990-94 mean annual real FDI (FAI) per capita when regressing 1995-2000 migration flows and 1995-99 mean real FDI (FAI) per capita when regressing 2000-05 migration flows. We lagged investment spending because it typically takes time for migration to respond to changes in spending on investment projects. Furthermore, since there is very likely to be two-way causality between investment and migration, by regressing migration rates on lagged investments we avoid potential problems with simultaneous equations bias. We adjusted the investment series for cost of living differences between the two decades, as well as across provinces within each decade, using national government measures of provincial CPI and calculating both series at 1985 price levels. For most of the

provinces, FDI numbers were available for each year, but for some there were missing years. For several provinces, no investment data were available for 1980-84, so we used the earliest year available as a proxy for that period. Therefore, our coefficient estimates for the early period may be influenced by measurement error in some parts of the investment series. Note that the FDI series is in USA dollars, whereas the fixed asset investment series is in Chinese Yuan.

Comparing Tables 1-3, there was a dramatic increase in FDI, reflecting a surge in interest by international investors in the Chinese economy. The areas receiving the highest levels of FDI tended to be the main cities in China and those receiving the lowest amounts tended to be rural provinces. Tables 1-3 also indicate that China experienced a dramatic increase in FAI across decades, reflecting a boom in mostly state-sponsored residential and commercial construction. There is great disparity across provinces with respect to the level of construction spending, with the largest cities receiving the most investment and rural provinces the least;

(v) The share of manufacturing employment. Manufacturing is classified in China as a "Secondary" industry in China and construction is one of its components. There is considerable variation across the country with respect to the dominance of manufacturing in the provincial labor market. For all three periods, Shanghai had the highest share of manufacturing employment and Hainan the lowest;

(vi) The share of the province's population that is minority. This is the percentage of population that is not Han. Because data on Han population shares for 1990 are not

available, we used 2000 data to proxy minority population shares for the first two migration periods. For the most recent migration period, we used information on Han population shares from the 2005 census;

(vii) Mean real per capita income. Due to lack of available data for consecutive years during the 1980s and 1990s, income data only for 1989 (1999) were used to measure average annual income for the 1985-90 (1995-2000) periods. For the 2000-05 migration period, though, we use the average of incomes for each year. All income data are adjusted for cost of living differences across provinces and over time using provincial CPI measures;

(viii) Mean level of educational attainment. Educational attainment was measured as the mean annual percentage of the population enrolled in colleges and universities during 1985-90, 1995-2000, and 2000-05. For all three periods, most people in each province were not enrolled in colleges or universities, reflecting substantial barriers to access to post-secondary education in China. However, as reforms deepened and barriers to access fell, the percentage of the population enrolled at colleges and universities rose at an increasing rate, from approximately one-quarter of one percent during 1985-90 to approximately one percent during 2000-05. Note also that the variance of mean annual enrollment percentages across provinces also rose at an increasing rate. This could have contributed to the rising income inequality observed in China.

Data on the remaining variables are from Lin, Wang and Zhao (2004). Please refer to their paper for details on data sources and measurement of these variables.

V. COEFFICIENT ESTIMATES

Tables 4 and 5 provide results from OLS estimation of equations (7), (8) and (9). Table 4 presents results for the full panel, whereas Table 5 presents results for the smaller panel comprising the last two migration periods. The important difference between the two tables is that in Table 4, past migration flows (and the interaction between past migration flows and distance) are not included as explanatory variables.

Our results reveal three broad patterns. First, results in both tables strongly confirm the hypothesis that a strengthening (loosening) of Hukou restrictions will deter (stimulate) migration. What is particularly surprising is the very high degree of sensitivity of migration rates to Hukou restrictions. Second, Table 5 demonstrates that past migration flows are one of the strongest determinants of interprovincial migration rates. Note that in a comparison of Tables 4 and 5, the omission or addition of past migration flows to the regressions will cause some coefficient estimates and goodness of fit to change dramatically. This comes as no surprise, for researchers since Sjaastad (1962) and Greenwood (1969), as well as sociologists, have argued that migrant networks tend to exert strong influences on the scale of migration. Third, our results demonstrate that the "basic specification" (equation (7)) used in earlier studies is clearly an incomplete story about internal migration in China.

We organize the discussion of specific results as follows. We first discuss coefficient estimates for Hukou restrictions. We then discuss the influences of past migration flows and the other controls for provincial characteristics. Before discussing specific results, though, we must emphasize that interpretation of the numerical

coefficients in Tables 4 and 5 requires some care due to the double-log functional form for the regression equations and because some of the independent variables are ratios. Note that each coefficient is a migration elasticity, which is the estimated percentage change in the percentage of persons moving from province j to province i (out of all persons moving from j). Furthermore, some coefficients will be estimates of the percentage change in the migration rate when there is a one percentage change in a ratio. For example, the coefficient on the destination/origin income ratio measures the estimated percentage change in the migration rate when *relative* destination income changes by 1%. Note that all estimated equations in both tables include origin province fixed effects and time period controls, and are also corrected for heteroskedasticity. Finally, as all the tables indicate, data on some percentage variables were multiplied by 100 to allow for greater ease in interpretation of coefficients.

The influence of Hukou

Regardless of which measure is used, Tables 4 and 5 confirm that Hukou restrictions can have a substantial impact on the scale of interprovincial migration. Consider first columns II and III in both tables, where Hukou is measured by the lagged relative frequency of registered households. While column II in Table 4 indicates a positive but insignificant effect of Hukou on the migration rate, once one adds the Hukou x time period interactions, Hukou's effect is very strong and highly significant. Specifically, column III predicts that a one-percentage point increase in the perceived probability of securing Hukou (suppose the odds rise by one unit from 88.5 to 89.5 percentage points, for example) will induce an increase (decrease) in the migration rate of 11.8%. Table 5

reveals similar findings. From column II, for example, a one-point increase (decrease) in the odds of securing Hukou will induce an increase (decrease) in the migration rate of about 8%. Consider now columns IV and V in Tables 4 and 5, where Hukou is measured as the joint probability of an unregistered migrant securing a job and Hukou. From Table 4, when the odds of securing Hukou rise by a percentage point, the migration rate rises between 3.53% and 4.73%. From Table 5, a one percentage point increase in the odds of an unregistered migrant securing a job and Hukou will induce an increase in the migration rate of between 6.5% and 8%.

Tables 4 and 5 also reveal that the sensitivity of migration rates to changes in migration restrictions can vary substantially across periods. In Table 4, the default period is 1995-2000, so the coefficients on the interactions between the period dummies and Hukou (rows 3-4, column III) are estimates of the difference between the elasticity of migration with respect to the odds of securing Hukou in one period relative to the middle period. The migration elasticity is 23.89% lower in 1985-90 than in 1995-2000, but only 9% lower in 2000-05 than in 1995-2000. The sensitivity of migration rates to Hukou rose between the 1980s and 1990s and fell between the 1990s and 2000s, but the fall between the later two periods was less. Thus, measured over the three decades, migration on balance is more sensitive to Hukou now than back in the 1980s. This suggests that as the comprehensive economic reforms deepened and Hukou underwent incremental reform, migration become more sensitive to Hukou. The same pattern emerges in column V, rows 6-7. When the narrower measure of Hukou is used, migration is less sensitive to Hukou in the early and later periods compared to the middle period, but the diminution in sensitivity is much less in the latest period. In Table 5, the default period is 2000-05.

According to column III, row 3, the elasticity of migration with respect to the odds of securing Hukou was nearly 22% higher in 2000-05 than in 1995-2000. According to column V, row 5, the elasticity with respect to the odds of an unregistered migrant securing a job and Hukou was approximately 5% higher in 2000-05.

Table 6 pulls together the coefficients from Table 4 and shows results of t tests on differences in the time period x Hukou interactions across periods. Note that the default period is 1995-2000. The number in the last column to the right in row 3 is the estimated difference between: (A) the change in the migration elasticity (with respect to the odds of securing Hukou) from 1985-90 to 1995-2000; and (B) the change in that elasticity from 1995-2000 to 2000-05. While the elasticity was lower in the first and third periods compared to the second period, it is lower than the middle period by 14.8% in 2000-05. Note that the estimated difference between (i) the 1985-90 and 1995-2000 difference in the elasticity; and (ii) the 2000-05 and 1995-2000 difference in the elasticity is significant at 1%. The number in the last column to the right in row 4 shows the same type of information for the migration elasticity with respect to the joint odds of an unregistered migrant securing a job and local registration. While that elasticity was lower in the first and third periods, it was lower by 8% less in the the third period, a result significant at 1%.

The results in Table 6 suggest that there is an inverse U-shaped relationship between the elasticity of migration with respect to Hukou restrictions and time. Between the 1980s and 1990s, migration's sensitivity to Hukou apparently rose, which we believe is a result of the deepening of economic reforms and deregulation of migration. Following the arrival of the new millennium, sensitivity fell, perhaps because the above-normal returns

to migration had by then dissipated for most prospective migrants.[17] However, the sensitivity of migration to Hukou was still higher in the 2000s compared to the 1980s, consistent with our general hypothesis that China's move towards a market-based system heightened incentives to migrate.

The influence of migrant networks

Table 5 illustrates the strong and robust effects of migrant networks on the scale of interprovincial migration. Across different specifications, the elasticity of migration with respect to past migration flows varies between approximately 0.5% and 0.75%. For example, according to column V, a one-point increase in past migration flows (as a percentage of current population in the destination) is estimated to cause the migration rate to rise by approximately 0.75%. Note that we find no evidence of an interaction between past migration flows and distance. Of equal importance is what we learn from column VI, which indicates the effects on coefficient estimates and goodness of fit when past migration flows are omitted from the regression equation. We find that some coefficients on remaining variables change dramatically and the adjusted R-squared falls from approximately 75% to 60%. These results illustrate that failure to control for migrant networks will very likely lead to omitted variables bias.

The influence of provincial controls not included in previous studies

The results in columns II- V in Tables 4 and 5 illustrate that coefficient estimates from earlier studies may suffer from omitted variables bias because some important provincial controls are excluded. Turning first to column III in Table 4, we find that the migration

[17] We thank T.N. Srinivasan for pointing this out to us.

rate is positively related to relative FDI in the destination; A one-percent increase in the ratio of destination to origin FDI generates an approximately 0.06% increase in the migration rate. While relative FAI appears to have no effect, the migration rate is positively related to the interaction of the two investments. The positive interaction term implies that an increase in relative FDI boosts the sensitivity of migration to relative FAI. Note also the positive and significant interaction between per capita GDP and FAI per capita. This implies that in less prosperous provinces, domestically-financed investment has a smaller effect on migration than in more prosperous provinces. Column V in Table 4 shows the same sorts of results.

In Table 5, some of our provincial controls exert important effects on the migration rate. According to column III, the migration rate is negatively related to the relative destination share of manufacturing employment, the relative destination share of minority population, the relative amount of fixed investment in the destination, the investment interaction and the share of fixed asset investment comprising transportation infrastructure in the origin province. As with the full sample, the migration rate and relative FDI in the destination are positively related, although the effect is smaller than in the full panel. The coefficient for relative fixed asset investment in the destination is contrary to what is hypothesized, but note from column VI that when past migration flows are omitted, the coefficient on this investment ratio becomes positive and significant. We found this to be true for different permutations of the migration equation when past migration flows were excluded. Further investigation confirmed the reason for the negative coefficients on the FAI term in columns III and V -- unexplained multicollinearity between past migration flows and FAI.

VI. CONCLUDING REMARKS

We view this study as making two important contributions to the literature. First, very little is known in the general immigration literature about the effects of immigration restrictions on the scale and structure of migration. Due to lack of theoretical work and lack of data in many countries, or vast differences in the types and qualities of available data across countries, there are no studies addressing questions such as: (i) How elastic are migration rates with respect to a change in quantitative restrictions; (ii) Does migration become more or less sensitive to restrictions as they ease over time; and (iii) Do restrictions influence the effects of other determinants on migration? In response to this void, we have extended the neoclassical model of internal migration to include the effects of restrictions. We seized upon a very convenient natural experiment – China – a country with an internal passport system that has been undergoing incremental deregulation. For a cross-section study of the effects of immigration restrictions, China is a beautiful case of "borders within a border," allowing a researcher to test for the effects of restrictions across spatial units without having to use different data sets for different countries or having to control for country-specific influences such as type of political system, labor market structure, regulations, and educational system. Furthermore, China offers the researcher the opportunity to study the effects of restrictions in a transition economy, one that has been experiencing dramatic changes in the structure of its markets.

What we learn from our examination of the Chinese test case is that migration can be significantly responsive to a loosening of restrictions. We find that even a modest reduction in restrictions can greatly strengthen the incentive to migrate. We find strong

evidence that the sensitivity of migration to Hukou restrictions has on balance risen over the last 30 years, with the greatest increase occurring during the 1990s. We also find that adding migration restrictions to an empirical specification can influence considerably the effects that other determinants of migration have on migration. Therefore, restrictions change not only the scale of migration, but its *structure*. This inspires a question for future research: Are these results for post-reform China generalizable to an international study?

Our second contribution is to further clarify what drives migration in post-reform China. We see our study as generating two specific benefits in this regard. First, we show that Hukou's influence can be substantial, implying that if the goal of deregulation is to encourage more labor mobility, then further deregulation is clearly warranted. Second, the empirical literature on Chinese migration is still very small, comprising studies that estimate relatively parsimonious equations of migration rates. Most of these studies lack controls for migrant communities in the destination, indicators of a spatial unit's economic and demographic structures, FDI and domestic investments, export market dependency, and other influences. We add migrant networks, FDI and domestic fixed asset investments, industry and ethnic mix, climate, origin fixed effects, and more, to the modified gravity model of Chinese migration. These controls often contribute significantly to accounting for migration patterns across spatial units and time, hence failure to include them can result in substantial omitted variables bias. Finally, ours is the first comprehensive panel study of migration in China.

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TABLE 1
Summary Statistics for 1985-90 period
765 observations

Variable	Mean	Standard Deviation	Maximum	Minimum
Migration rate x 100[i]	3.775%	6.982%	79.336%	0.018%
Mean annual percentage of households with *Hukou* status during 1980-84 x 100	98.40%	1.412%	99.73%	94.94%
Real Mean Annual FDI Per Capita during 1980-84[ii]	$US 1.544	$US 5.947	$US 31.75	$US 0.0038
Real Mean Annual Fixed Asset Investment (FAI) Per Capita during 1980-84[ii]	163.77 Yuan	132.84 Yuan	518.71 Yuan	40.888 Yuan
Percentage of provincial FAI attributable to transportation infrastructure x 100	3.67%	1.85%	8.82%	1.07%
Railway distance between capital cities	1,630.76 Kilometers	1.87 Kilometers	6,313.21 Kilometers	137 Kilometers
Real annual per capita income[iii]	510.95 Yuan	183.11 Yuan	1084.5 Yuan	340.53 Yuan
Percentage of population enrolled in universities x 100	0.2499%	0.2649%	1.3%	0.08%
Unemployment rate x 100	1.178%	0.705%	4.11%	0.28%
Manufacturing share of employment x 100	23.44%	12.10%	59.3%	9.47%
Urban share of population x 100	31.03%	16.17%	73.44%	14.87%
Mean yearly temperature	14.113 C	5.176 C	24.517 C	4.608 C
Minority population share	12.28%	16.06%	59.43%	0.31%

[i] In the 1990 Census, a migrant is defined as someone who has moved from other towns or townships and has lived in this place for more than one year but less than five years.
[ii] Computed using average annual CPI for 1980-84
[iii] Computed using income and average annual CPI for 1989 only

TABLE 2
Summary Statistics for 1995-2000 period
790 observations

Variable	Mean	Standard Deviation	Maximum	Minimum
Migration rate x 100[i]	3.589%	7.230%	87.317%	0.014%
Mean annual percentage of households with *Hukou* status during 1990-94 x 100	90.38%	5.443%	96.01%	74.97%
Past migration flows during 1985-95	2,498,500	6,854,100	89,320,000	10,000
Real Mean Annual FDI Per Capita during 1990-94[ii]	$US 16.14	$US 24.25	$US 92.73	$US 0.58
Real Mean Annual Fixed Asset Investment (FAI) Per Capita during 1990-94[ii]	871.66 Yuan	717.63 Yuan	3393.2 Yuan	229.7 Yuan
Percentage of provincial FAI attributable to transportation infrastructure x 100	5.48%	2.04%	11.07%	2.81%
Real annual per capita income[iii]	1,069 Yuan	442.2 Yuan	2,451.5 Yuan	605.26 Yuan
Percentage of population enrolled in universities x 100	0.3769%	0.3329%	1.7%	0.13%
Unemployment rate x 100	4.40%	2.41%	9.64%	1.36%
Manufacturing share of employment x 100	22.83%	9.82%	49.25%	9.17%
Mean yearly temperature	14.113C	5.176C	24.517C	4.608C
Urban share of population x 100	40.20%	18.56%	90.67%	18.63%
Minority population share x 100	12.28%	16.06%	59.43%	0.31%

[i] In the 2000 Census, a migrant is defined as someone who has moved from other towns or townships and has lived in this place for more than one year but less than five years.
[ii] Computed using average annual CPI for 1990-94
[iii] Computed using income and average annual CPI for 1999 only

TABLE 3
Summary Statistics for 2000-05 period
790 observations

Variable	Mean	Standard Deviation	Maximum	Minimum
Migration rate x 100[i]	3.655%	7.387%	87.32%	0.01%
Mean annual percentage of households with *Hukou* status during 1995-99 x 100	88.57%	6.726%	95.85%	67%
Real Mean Annual FDI Per Capita during 1995-99[ii]	$US 44.64	$US 66.57	$US 253.05	$US 1.15
Real Mean Annual Fixed Asset Investment (FAI) Per Capita during 1995-99[ii]	2,452.8 Yuan	2,441.5 Yuan	12,705 Yuan	646.5 Yuan
Percentage of provincial FAI attributable to transportation infrastructure x 100	9.2%	3.06%	17.19%	3.98%
Real annual per capita income[iii]	5,122.3 Yuan	2,632.7 Yuan	13,484 Yuan	2,614.6 Yuan
Percentage of population enrolled in universities x 100	0.9985%	0.5985%	3.06%	0.4%
Unemployment rate x 100	3.14%	1.50%	7.17%	1.21%
Manufacturing share of employment x 100	22.83%	9.82%	49.25%	9.17%
Mean yearly temperature	14.27C	5.24C	25.1C	4.70C
Urban share of population x 100	40.20%	18.56%	90.67%	18.63%
Minority population share x 100	12.83%	16.47%	60.13%	0.31%

[i] In the 2005 Census, a migrant is defined as someone who has moved from other towns or townships and has lived in this place for more than one year but less than five years.
[ii] Computed using average annual CPI for 1995-99
[iii] Computed using average annual income and average annual CPI for 2000-05

TABLE 4
OLS Results for Full Sample (1985-90, 1995-2000 and 2000-05 migration periods)
Dependent variable = log gross interprovincial migration rate
(Standard Errors in Parentheses; ** denotes significant at 1%, * significant at 5%)

REGRESSOR	I	II	III	IV	V
Log (odds of obtaining Hukou in destination x 100) (Measure A)		1.505 (1.209)	11.836** (2.933)		
A x early dummy			-23.89** (4.29)		
A x late dummy			-9.097** (2.629)		
Log (odds of migrant securing a job with Hukou x 100) (Measure B)				3.531** (0.949)	4.729** (1.239)
B x early dummy					-9.848** (3.181)
B x late dummy					-1.964** (1.092)
Log distance	-1.306** (0.)	-1.325** (0.04)	-1.341** (0.041)	-1.333** (0.04)	-1.339** (0.041)
Log (destination/origin income ratio)	1.889** (0.09)	1.866** (0.130)	1.902** (0.130)	1.940** (0.124)	1.914** (0.126)
Log (university enrollment in origin x 100)	-0.348** (0.137)	-0.272 (0.161)	-0.275* (0.161)	-0.283 (0.162)	-0.286* (0.162)
Log (university enrollment in destination x 100)	-0.193** (0.05)	-0.258** (0.059)	-0.290** (0.062)	-0.257** (0.06)	-0.265** (0.059)
Log (1-unemployment rate in origin)	-5.984** (2.066)	-4.426** (2.10)	-4.404** (2.085)	-4.675** (2.098)	-4.485** (2.095)
Log (1-unemployment rate in destination)	5.644** (1.49)	6.623** (1.582)	2.866* (1.686)		
Log (ratio of destination to origin urban population shares)	-0.148 (0.102)	-0.175 (0.104)	-0.240** (0.106)	-0.246** (0.99)	-0.244** (0.102)

Log (ratio of destination to origin temperatures)	0.471** (0.062)	0.330** (0.071)	0.342** (0.071)	0.348** (0.07)	0.347** (0.071)
Log (ratio of destination to origin manufacturing employment shares)		-0.095 (0.1)	-0.081 (0.09)	-0.107 (0.1)	-0.077 (0.1)
Log(ratio of destination to origin minority population shares)		-0.011 (0.02)	-0.011 (0.017)	-0.012 (0.17)	-0.014 (0.018)
Log (ratio of destination to origin per capita FAI)		0.030 (0.05)	0.059 (0.048)	0.036 (0.046)	0.026 (0.046)
Log (ratio of destination to origin per capita FDI)		0.066** (0.018)	0.058** (0.048)	0.061** (0.018)	0.056** (0.018)
Log FAI ratio x Log FDI ratio		0.017** (0.005)	0.019** (0.006)	0.017** (0.005)	0.016** (0.005)
Log(transportation share of fixed asset investment in origin x 100)		-0.053 (0.09)	-0.065 (0.088)	-0.069 (0.88)	-0.068 (0.088)
Log (origin per capita GDP) x Log (origin per capita FAI)		0.029** (0.01)	0.031** (0.01)	0.03** (0.01)	0.029** (0.01)
Early period dummy	-0.121 (0.171)	0.367 (0.26)	0.367 (0.26)	0.522* (0.248)	0.272 (0.266)
Late period dummy	-0.490** (0.185)	0.051 (0.233)	0.065 (0.236)	0.131 (0.231)	0.05 (0.245)
Constant	9.95** (0.405)	-8.50 (13.74)	8.473** (0.65)	-2.616 (13.44)	8.535** (0.643)
Adjusted R-squared	0.5499	0.5558	0.5608	0.5551	0.557
SSE	2476.5	2435.6	2406.5	2440.9	2429.6
Sample size	2,385	2,385	2,385	2,385	2,385

TABLE 5
OLS Results for later two periods
Dependent variable = log gross interprovincial migration rate
(Standard Errors in Parentheses; ** denotes significant at 1%, * significant at 5%)

REGRESSOR	I	II	III	IV	V	VI
Log (odds of obtaining Hukou x 100) (Measure A)		7.975** (1.24)	6.932** (1.138)			
A x middle dummy			21.88** (2.18)			
Log (odds of migrant securing job in destination with Hukou x 100) (Measure B)				8.00** (1.16)	6.536** (1.094)	9.625** (1.466)
B x middle dummy					5.18** (0.954)	3.274** (1.155)
Log relative size of migrant network	0.499** (0.021)	0.670** (0.134)	0.746** (0.131)	0.670** (0.134)	0.692** (0.133)	
Log distance	-0.53** (0.047)	-0.48** (0.103)	-0.51** (0.01)	-0.48** (0.103)	-0.48** (0.101)	-1.28** (0.05)
Log distance x Log network		-0.014 (0.018)		-0.014 (0.018)	-0.016 (0.017)	
Log (ratio of destination to origin incomes)	1.251** (0.085)	1.503** (0.117)	1.390** (0.116)	1.505** (0.114)	1.370** (0.113)	2.08** (0.148)
Log education in origin	-0.48** (0.225)	-0.50** (0.220)	-0.48** (0.214)	-0.50** (0.220)	-0.47** (0.218)	-0.59** (0.285)
Log education in destination	-0.016 (0.06)	0.058 (0.66)	-0.08 (0.068)	0.058 (0.06)	0.051 (0.062)	0.137 (0.085)
Log (1 – unemployment rate in origin)	1.356 (3.14)	2.854 (3.02)	3.083 (2.96)	2.841 (3.01)	3.625 (3.00)	-1.441 (3.61)
Log (1 – unemployment rate in destination)	7.618** (1.838)	8.071** (1.99)	2.771 (1.939)			
Log (ratio of destination to origin urban shares)	-0.33** (0.097)	-0.02 (0.1)	0.018 (0.098)	-0.02 (0.09)	0.090 (0.092)	0.088 (0.123)

Log (ratio of destination to origin temperatures)	0.674** (0.068)	0.620** (0.07)	0.686** (0.070)	0.620** (0.071)	0.613** (0.071)	0.484** (0.088)
Log (ratio of destination to origin manufacturing employment shares)		-0.244** (0.091)	-0.200* (0.090)	-0.244** (0.091)	-0.214** (0.09)	-0.366** (0.115)
Log (ratio of destination to origin minority population shares)		-0.058** (0.018)	-0.068** (0.018)	-0.058** (0.018)	-0.056** (0.018)	0.026 (0.021)
Log (ratio of destination to origin real per capita FAI)		-0.293** (0.052)	-0.260** (0.050)	-0.292** (0.05)	-0.311** (0.049)	0.186** (0.074)
Log (ratio of destination to origin real per capita FDI)		0.082** (0.03)	0.104** (0.03)	0.082** (0.028)	0.109** (0.028)	0.009 (0.037)
Log FAI ratio x Log FDI ratio		-0.018** (0.004)	-0.011** (0.004)	-0.018** (0.004)	-0.016** (0.004)	0.025** (0.008)
Log (transportation share of fixed asset investment in origin x 100)		-0.214 (0.123)	-0.211* (0.120)	-0.214 (0.123)	-0.207* (0.122)	-0.237 (0.158)
Log (origin per capita GDP) x Log (origin per capita FAI)		-0.013 (0.013)	-0.012 (0.013)	-0.013 (0.013)	-0.015 (0.013)	0.01 (0.016)
Middle period dummy	-0.405 (0.107)	-0.590 (0.345)	-0.549 (0.338)	-0.592 (0.343)	-0.262 (0.343)	-0.036 (0.04)
Constant	7.849** (0.354)	-78.98** (18.12)	8.027** (1.071)	-78.73** (17.1)	8.09** (1.09)	9.532** (1.16)
Adjusted R-squared	0.737	0.7591	0.7716	0.7593	0.7633	0.606
SSE	910	813.84	785.11	828.62	814.26	1375
Sample size	1,580	1,580	1,580	1,580	1,580	1,580

TABLE 6
Variation in Estimated Marginal Effect of Hukou across periods[1/]
(Standard Errors in Parentheses; ** denotes significant at 1%, * significant at 5%)

	1985-90 (A)	2000-05 (B)	(A) – (B)
Marginal effect relative to 1995-2000 period of:			
Log (odds of securing Hukou x 100)	-23.89** (4.294)	-9.097** (2.629)	-14.80** (3.45)
Log (odds of a migrant securing a job with Hukou x 100)	-9.85** (3.18)	-1.964* (1.09)	-7.885** (3.20)

[1/]Coefficients are taken from estimates of equations (III) and (V) in Table 4