Labor Market Integration, Entrepreneur Sorting, and Regional Inequality*

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[Preliminary and incomplete. Please do not circulate.]

Abstract

This paper studies the impact of increased labor market integration on entrepreneurs' migration decisions and firms' performance in China over the past three decades. We employ a spatial general equilibrium framework that incorporates salient features of the Chinese migration restriction system to illustrate the mechanism by which worker and firm locations respond together to heterogeneous changes in labor mobility restrictions. We compile a novel dataset of the universe of prefectural-level Hukou reforms between 1995 and 2019. We then use this exogenous change in labor mobility costs, together with data on city-to-city labor migration flows and data on 90 million firms, to identify the effect of labor mobility restriction reduction on the regional redistribution of economic activities. We show that skill-biased relaxation of mobility restriction attracts high-skill labor and migrant entrepreneurs, at the cost of crowding out local entrepreneurs. In contrast, non-restrictive hukou relaxation spurs overall economic activities through abundant labor supply, firm agglomeration, and, more importantly, the co-movement of labor and entrepreneur.

Keywords: Sorting, Internal Migration, Migrant Entrepreneurs, Local Entrepreneurs

JEL Codes: D22, D24, J61, R12 .

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1 Introduction

China's recent rapid productivity growth has been accompanied by an uneven redistribution of entrepreneurial activities across space. Figure 1a presents the growing trend of migrant entrepreneurs across cities/provinces.[1] The growing number of migrant entrepreneurs is accompanied by a regional redistribution of economic activities from small cities to large cities. As shown in Figure 1b, the majority of entrepreneur migration is driven by the flow to larger cities. This trend is evident across a wide range of manufacturing and service sectors, from small to large size firms. The increasing flow of entrepreneurs to large to cities, on one hand, is driven by agglomeration forces (Gaubert, 2018; Kleinman, 2022) and plays an essential role in firm growth (Behrens, Duranton, and Robert-Nicoud, 2014; Fajgelbaum et al., 2019; Amornsiripanitch et al., 2021); on the other hand, may contribute to enlarging regional disparity Lindenlaub, Oh, and Peters (2022).

In accompanied with the rising share of migrant entrepreneurs, Chinese has witnessed a substantial change in internal labor mobility over the past three decades. The internal migrant population grew from 21 million in 1990 to 253 million in 2015 (Zhao, Liu, and Zhang, 2018). The literature has studied the role of labor demand and changes in internal migration restrictions in driving laborers' location choice (Bryan and Morten, 2019; Beerli et al., 2021; Tombe and Zhu, 2019*a*). By contrast, much less is known about the interaction of the labor market and the entrepreneur market, and to be more specific, the role of labor market mobility (and its frictions) for entrepreneurs' migration decisions, firm sorting, and, furthermore, regional inequality across space. In this paper, we aim to fill this gap by utilizing the plausibly exogenous changes in local Hukou restrictions to study its effect on the entrepreneurs' location choices and firms' performances. The changes in labor market mobility restrictions allows us to focus on the labor supply channel of entrepreneurship.

[Figure 1 about here]

The gradually liberalized labor market stemming from the successive reforms of China's unique system of local worker registration, the Hukou, provides a perfect ground for studying this question.[2] More importantly, the relaxation of Hukou restrictions is characterized not only by its wide coverage, but also by the prevalent regional heterogeneity in timings and

[1] More than 50% of entrepreneurs enter the market outside their hometown cities, and more than 30% are outside their hometown provinces.

[2] Prior to 1990, China's largely centrally planned economy severely restricted labor mobility: Individuals were only allowed to work in the prefecture and sector where they were registered. After about 1990, cities began to relax those restrictions in a staggered way, creating variation in Hukou-based migration frictions across time and space. We use the term city to denote the main urban areas of each prefecture-level administrative unit.

policy details. Some cities almost completely opened up their Hukou restrictions or only imposed some minimal restrictions on the conditions for a local Hukou; some cities only opened up for individuals with certain education degrees or skill certificates or individuals with business investment passing a certain threshold; and some others remained highly restrictive in their Hukou policies. The *heterogeneous* relaxation of labor mobility restriction generates wide implications for laborers with different skills, and, furthermore, for entrepreneurs and firms of different types, especially when taking into account the regional linkages of the labor market and the entrepreneur market. For example, policies favoring high-skill labor may benefit firms with high-skill intensity and attract entrepreneurs into the city, while at the same time crowd out firms in the low-skill intensity industries, thus changing the composition but not necessarily the volume of firms in the local economy. On the other hand, policies that relax overall labor mobility restrictions attract not only high-skill labor but also low-skill labor, and the complementarity of the two boost local entrepreneurial market to a greater extent. In this paper, we focus on the heterogeneous effect of different types of Hukou policies on labor market and investigate how the effects pass on to the entrepreneur market.

We compile a novel policy dataset of *all* migration-related policy changes across *all* cities between 1990 and 2019, and *all* conditions within those reforms leading to a worker-type-specifc change in migration restrictions— each serves as a sufficient condition for migrants who permanently reside in the city to apply for a local Hukou. We classify Hukou policies into skill-biased and non-restrictive. We define a policy with certain requirements on education, skills, investment as skill-biased category and that with no specific requirement as non-restrictive category. We combine this comprehensive policy dataset with rich micro-level data, including labor skill-type-specific migration flows from 4 waves of population census, the universe of firm registration and performance combined with the entrepreneurs' information, and a large-scale firm tax survey with detailed performance measures. The firm's registration data universally track all 90 million firms owned by 50 million entrepreneurs. For each entrepreneur, we observe his/her location of birth, historical location, and current location, which allows us to fully picture their migration history. The firm's inspection data systematically records the performance of these 90 million firms, including assets, sales, profits, etc. Last, the administrative tax survey data contains detailed information on the firms' income, expenditure, tax, TFP, profitability, R&D expenditure, etc. Leveraging on these rich policy variations and detailed micro-level data, we aim to answer three central questions: 1) to what extent did migration increase as a result of unprecedented labor market integration? And 2) what did the largest migration wave in modern history mean for the entrepreneurial market, specifically for migrant entrepreneurs and local entrepreneurs, separately? Moreover, 3) to what extent were productivity growth itself and regional disparity

a function of unprecedented labor market integration and better worker-firm matches across space?

We first document two motivational facts by exploiting a Difference-in-Difference regression on the number of firms (of migrant entrepreneurs and of local entrepreneurs): 1) Skill-biased policies attract migrant entrepreneurs, but crowd out local entrepreneurs; 2) Non-restrictive Hukou policies spur overall entrepreneurial activities. We further examine labor mobility and firm performance to investigate the channels of such firm dynamics, and find that 3) Low-skill workers only respond to non-restrictive Hukou policies, measured by the number of migrant labors to the destination city; and 4) High-skill labors respond to both skill-biased and non-restrictive policies; 5) Low-type firms are hurt by skill-biased Hukou policies measured by the number of firms and their performance, and benefit from non-restrictive Hukou policies; 6) High-type firms benefit even more from non-restrictive Hukou policies, compared with low-type firms. We also find new evidence suggesting that the unequal relaxation of Hukou policy indeed contributes to greater regional inequality. To be specific, 7) Younger entrepreneurs from relatively poorer regions are more responsive to the relaxation of Hukou policy in relatively richer regions and thus then are more inclined to migrate to the richer destinations.

To illustrate the mechanism, we build a model in which workers have idiosyncratic location-specific preference, and in which locations differ in firm's overall productivity. This setup allows for both sorting and agglomeration effects for firms and workers. Into this framework we incorporate the salient features of Chinese mobility constraints prior to the Hukou reform. In this spatial equilibrium, each city is endowed with two types of workers (low skill v.s. high skill) and firms (low type v.s. high type). Households choose a city location where maximizes their indirect utility — a function of wage and mobility cost. Selective migration therefore also affects the composition of worker types and skills in each city. This leads to general equilibrium effects on a city's wage structure due to downward-sloping labor demand, and substitutability of worker types in production. And a fixed mass of firms in each sector decide in which city to locate to maximize the profit given labor cost and agglomeration effect. We then use this structural framework to quantify the sorting of labor in response to the heterogeneous reduction in mobility cost, and firms' sort with labor, that would result from removing movement costs and/or equalizing amenity differentials.

In a series of quantitative exercises using our calibrated model, we evaluate how the measured cost changes affect the migration flow workers (of high-skilled and low-skilled) and entrepreneurs (of high-type and low-type). We find that the policy increases overall welfare, though it strengthens inequality across regions. If we implement a skilled-biased policy reform by reducing the migration cost by 50% in the largest 20 cities of China, the welfare of overall cities, relaxing cities, and unchanged cities would increase by 2.56%, 17%,

and 2.52%, respectively. If we reduce the average migration cost by 50% by implementing the unrestricted Hukou reform policy, the aggregate welfare across all regions would increase by 19.30%, while the welfare of relaxing cities and unchanged cities would increase by 108.88% and -4.27%, respectively. In this exercise, a skill-biased policy reform would change the wage of high-skilled workers (low-skilled workers) in the relaxing cities and non-relaxing cities by -7.02% (3.89%) and 4.56% (-2.25%). While a non-restricted policy reform would change the wage of low-skilled workers (high-skilled workers) in the relaxing cities and non-relaxing cities by -0.84% (-3.73%) and -0.77% (4.12%). These results show that migration barriers have significant effects on the aggregate welfare, distributional effects, and regional disparity in China.

Our paper contributes to existing works in three ways. First, we bridge the gap between the two strands of literature on firm and labor sorting. In the first strand of literature on firm sorting, Behrens, Duranton, and Robert-Nicoud (2014) study the spatial sorting of entrepreneurs who produce non-tradable intermediates. Gaubert (2018); Fajgelbaum et al. (2019); Kleinman (2022) extend the framework to accommodate for U.S. state tax system, perfectly tradable goods and trade costs, and spatial expansion of firms, respectively. The second strand of literature including Eeckhout, Pinheiro, and Schmidheiny (2014); Bryan and Morten (2018); Davis and Dingel (2020) has focused on the spatial sorting of workers who have different skill level. Moretti (2013) shows that workers of different skills sort into different cities and that taking account of those sorting patterns is key to understanding welfare inequality between groups. Diamond (2016) investigates productivity and amenity spillovers within and between groups as an underlying mechanism for this divergence. Combing these two strands of literature under the context of China, our paper adds to them by incorporating salient features of the Chinese migration restriction system to illustrate the mechanism by which worker and firm locations simultaneously respond to reductions in labor mobility restrictions.

Second, we build on the recent literature incorporating migration frictions into quantitative spatial equilibrium models based on the framework of Rosen (2009) and Roback (1982) and quantitative trade models pioneered by Eaton and Kortum (2002) (see, for instance, Redding (2012)). A key challenge in this literature is the estimation of migration elasticities, and early papers mostly rely on cross-sectional moments such as the dispersion of wages (Ahlfeldt et al., 2015) or the correlation of wages with migration flows Bryan and Morten (2018). More recently, Morten and Oliveira (2018) and Allen, Dobbin, and Morten (2018) use quasi-exogenous variation over time from high-way construction and border walls respectively, to identify migration elasticities from migration responses to migration cost shocks over time.

Following this later strand of the literature, we develop new estimates to identify the

parameters of the model by taking the advantage of multiple disaggregate administrative datasets in longer time series over past 30 decades. Rather than using infrastructure changes as in the earlier literature, we use policy-induced migration cost shocks for identification. These are likely much larger in magnitude. Moreover, in contrast to infrastructure changes or temperature shock, Hukou policies discriminate by type of workers (skilled v.s. unskilled). Earlier studies calibrate from cross-sectional moment, thus counterfactual relies on model structure. Our paper can, to some extent, estimate more accurate parameters from the micro data directly, relying much less on calibration.

Third, this paper is, to the best of our knowledge, the first to study the distributional effect of Hukou policies on entrepreneurial activity and its contributions to growth and inequality. Several papers have documented that the Hukou system of local registration is particularly important in preventing worker sorting across space in China (Tombe and Zhu, 2019*b*; Imbert et al., 2022). Ngai, Pissarides, and Wang (2018), for instance, show that the Hukou leads to over-employment in agriculture and slows urbanization and industrialization and Bosker, Deichmann, and Roberts (2018) argue that reductions in migration frictions due to the Hukou reforms are orders of magnitude more important than the building of China's highway network. Using a city-level dataset on Hukou reforms and a difference-in-differences strategy for 2000 and 2005, Fan (2019) estimates that 2/3 of migration costs in China are due to the Hukou system, and Hukou reforms increase aggregate welfare by 10% and significantly reduce regional inequality. We contribute to this literature by studying the heterogeneous effects of Hukou policy on migrant entrepreneurs and local entrepreneurs.

The remainder of the paper is structured as follows: Section 2 describes the context and characteristics of our newly collected dataset on worker-type-specific Hukou reforms (of low and of high skill). Section 3 describes our data and empirical strategy, and Section 4 presents our reduced-form results of Hukou reform on migration, firms, and entrepreneurs. Section 6 build a quantitative general equilibrium model and describes how we use our reduced form estimates to identify key parameters in the model. Section 7 concludes.

2 Institutional Background

China has seen a large increase in internal migration in recent years. Between 1990 and 2015, its internal migrant population grew from 21mio to 253mio (Zhao, Liu, and Zhang, 2018). Both in terms of absolute numbers and growth rates, the extent of this migration wave is unprecedented in modern history.

The literature identifies two main causes: First, migration costs fell. Second, productivity differentials between locations increased due to China opening up to trade, particularly between coastal cities and the interior. According to the best available estimates, the first

mechanism is at least an order of magnitude more important. Using their calibrated spatial equilibrium model, Tombe and Zhu (2019*b*), for instance, find that international trade increased migrant stocks by only 2.5% whereas the reduction in migration costs raised the intra- and inter-provincial migrant population by 15 and 81% respectively. These estimates, however, rely strongly on the validity and functional form assumptions of their spatial model. Moreover, they remain agnostic on the exact nature of migration cost changes. Although China was expanding its highway and high-speed rail network over the period, the effects of infrastructure improvements are likely dwarfed by changes to internal migration policy - most importantly, the Hukou (Bosker, Deichmann, and Roberts, 2018).

During the period between 1982 and 2003, the labor market was not well functioning, which restricted the mobility of migrant workers from prefecture to prefecture due to the Hukou system. Introduced in 1958, the Hukou is a system of local registration that severely restricts labor mobility in China, particularly rural farming labor mobility. Before 1978, workers were prohibited from working outside their region/registration category. Since then, the restrictions have been relaxed in incremental steps, with reforms being introduced gradually across different cities. The three waves of Hukou liberalization, as well as the roll-out of a non-Hukou temporary residence system we consider in this paper, provide significant spatial and temporal variation in policy-based migration costs for farm labor.

The first wave, the 'Blue Stamp Hukou', was rolled out between 1984 and 1998 and allowed entrepreneurs who made significant investments, white-collar workers, and farmers who had been displaced by government purchases of their land to acquire urban Hukou. Between 1997 and 2001, the second wave allowed migrants who permanently resided in selected (mostly smaller) cities to apply for local Hukou. The third wave extended these regulations to 123 larger cities from 2002 to 2014. In parallel to relaxing Hukou restrictions, some cities introduced temporary residence permits between 1984 and 2000. These allow rural workers to legally reside in the cities but bar them from access to many public services available to urban residents, including schooling, health insurance, social security, and the right to purchase a house. Between 2004 and 2010, some cities strengthened the permit system to allow for permanent residence (Chow, 2015). These staggered timings of reforms at the prefecture level provide exogenous shocks to the cost of internal migration and increase market integration.

The plethora of overlapping systems and policies governing internal migration over the period illustrates that there is no longer such a thing as *The Hukou System*. Rather, beginning in 1970 and even more so after about 1995, Chinese cities enjoyed substantial freedom in customizing their immigration policies to their needs. As we will show, they made use of that freedom to create a range idiosyncratic policies, targeting a variety of dimensions affecting migration costs, and many different skill level of migrants.

While the literature has studied certain aspects of this process, we are, to the best of our knowledge, the first to collect a comprehensive dataset on *all* worker-type-specific policies affecting internal migration costs after 1990[3]. For each reform, we obtain information of the type of policy, the target group (origin, demographics, employment and financial condition) to which the policy applies, and the scope and strength of the migration cost relaxation / tightening (see appendix A for more details on policy data construction).

3 Data and Empirical Strategy

We combine several data sets to investigate the effect of the reduction of labor mobility restrictions in China in the past several decades on the evolution and redistribution of entrepreneurship across regions, to examine the mechanism by which labor market friction affect the entrepreneurial market, and to quantify its welfare implications and contributions to regional disparity.

3.1 Entrepreneur and Firm Data

Our first data set is the firm registration database released by the State Administration for Industry and Commerce (SAIC). This data set covers the universe of *all* registered firms—over 200 million in total—established in China since 1949. It contains information on the firm's year of establishment, exit date (if applicable), 4-digit industry classification code, the name, hometown, and age of its legal representative, registered capital, investment history, initial main shareholders and their shares, and records of any subsequent changes in the main shareholders, etc.

It is noteworthy that our data has two major advantages over the commonly used business registration data in the literature for other countries. First, the registry data provide comprehensive ownership information on all firms ever established in China, and our registry data contains unique identifiers for the main shareholders and legal representatives of each firm at the time of establishment, which enables us to track the entrepreneurial history of the entrepreneurs. From the unique entrepreneur identifier, we are also able to extract information on his/her hometown (measured at 6-digit county administrative code level) and birth year. Based on the universe of firms in our analysis, we define an entrepreneur as the legal representative of a firm at the time of the firm's establishment or when it was later acquired by the entrepreneur.[4]

[3] Tian (2019) similarly collects city-level migration related reforms between 1995 - 2007. However, she abstracts from the worker-type-specific nature of those reforms, and focuses on showing that those reforms were endogenously driven by labor demand shocks due to international trade

[4] Our results are robust to the alternative definition of entrepreneur in which an entrepreneur is defined

Second, in order to examine firms' performance in more detail, we further combine the registration data with the administrative enterprise income tax records from the Chinese State Administration of Tax (SAT) for the years 2008-2015. The SAT is the counterpart of the IRS in China and is in charge of tax collection and auditing and it keeps its own firm-level records of tax payments as well as other financial statement information used in tax-related calculations. The advantages of the tax data are, first, that it is representative with wide coverage, and second, it has detailed historical information on a wide spectrum of tax-related information about the firms, including their total production, sales, inputs, employment, etc. This allows us to examine the firms' performance in a longer time horizon and in more dimensions. Since it is an administrative data set, it is not subject to the potential measurement-error problem of self-reported tax inspection data. As such, we also use this data set to cross-validate our findings from the SAIC inspection data.

Our third and final data set is compiled from the Chinese Statistical Yearbooks 1990-2005, from which we obtain information on the provinces' industrial structure, employment structure, wage, etc.

3.2 Hukou Policy Data

We collect information on the local prefecture-level implementation of the first wave of Hukou reform that was passed at the national level from several different sources. We first collect all migration-related policies using a two-tiered keyword search across multiple platforms to build our policy dataset. In combination with the name / administrative ID of each administrative unit (provinces and prefectures), the keywords we use are:
1. First tier: Rural-urban, urbanized population, Hukou, household registration, living permit, temporary residence, settled down.
2. Second tier: Rural-urban population, Rural-urban residents, migrant workers, migration, registration management, registration reform, registration change, points-based the application system for household registration, abolition of rural and agricultural Hukou.

The primary sources of government regulation documents are from Beidafabao (PKlaw),[5] various governance discussion papers and official government websites, government gazettes, repositories of laws and regulations, as well as documents provided by relevant administrative units. We also complement these sources by directly searching above the keywords through the search engine and historical news. For each document, we digitize 1) when, 2) for whom, and 3) migrating from where.

as the largest shareholder of a company.

[5]The website is www.pkulaw.com.

3.3 Migration Flow Data

We construct individual-level bilateral migra- tion flows from micro-data from four population censuses between 2000 - 2015. We have a 10% random sample of the 2010 census (10% of the population) and a 20% sample from the 2005 mini census that sampled 1% of the population (0.2% of the population). For 2010, we obtain a 2% sample of the 10% of the population that was asked detailed origin questions (0.2% of the population). We have a 10% sample of the the 2015 mini census that sampled 10% of the population (0.1% of the population).

For our main specification, we follow the previous literature (e.g. Clement Imbert and Zylberberg (2019) and Tombe and Zhu (2019)) in constructing migration flows based on migrants' original Hukou location and current residence. An important caveat for this methodology is that, for each individual, we only observe when they left their place of original Hukou. We do not observe if migrants move multiple times over the last 5 year period (e.g. because of step migration to another location) or if they return to their place of Hukou. This problem gets more severe in years further away from the census year: For example, our migrant flows in 1996 are based only on people who migrated in 1996 and resided for at least 4 years at their destination where we observe them in the 2000 census, while flows for 1999 are based on anyone staying at least 2 years. Migration flows in different years, therefore, differ not only by the actual migration rate, but also by the average duration migrants decide to stay at the destination. See 2 for how we disentangle those channels empirically. We also observe the province of residence 1 and 5 years ago for 2000 - 2010, and the actual date and origin prefecture of the last migration episode in the last 5 years in 2000 and 2015. In future work, we aim to use this information to shed more light on temporary and step migration.

3.4 Empirical Strategy

We are interested in the effect of the relaxation of Hukou policy and reduction of migration friction on the following outcomes: first, whether this reform has induced an inflow of entrepreneurs in cities that relaxed Hukou restrictions; second, whether this reform has changed the entrepreneurs' composition, especially their skill composition; third, whether the reform has affected the *distribution* of economic activities across regions, and furthermore the pattern of regional inequality; and finally, in exploring the channels, whether the reform has affected the inter-city flow of labor and the performance of firms, especially firms of different industries.

A key novelty about our dataset and identification strategy is that we not only look at city level relaxations overall, but collect and consider the group-specific nature of reforms: In fact, conditionality is the norm rather than the exception: 93% of all Hukou reforms

are conditional on at least one worker characteristic. And the conditions by which cities select workers vary widely. For instance, 16% of all conditional Hukou reforms condition on migrants' origin. Often, migrants with rural Hukou within the same prefecture are preferred over migrants from elsewhere. Similarly, 34% of reforms target migrants by demographics (relationship to local residents, sex, age and education). Consistent with labor demand shocks driving policy reforms, 46% of relaxations condition on migrants' employment situation, including their job title, occupation, or sector of work. 23% condition on residence situation (renting / owning property) or duration, and 19% on financial situation such as whether the migrant owns a business, or paid a certain amount of taxes. Note that many conditions appear in combination. For example, a city may grant local Hukou to college-educated males under the age of 45. Important for our empirical exercise, 71% of the conditions are partially, and 42% fully observable in the census micro-data we use to construct bilateral migration flows by group.

Our baseline specification employs a simple difference-in-difference (DID) method to analyze the *heterogeneous* impact of the relaxation of labor market mobility constraints on the number, composition, distribution, and performance of entrepreneurs in China. Our identification strategy relies on the heterogeneity across cities in the exogenous change in Hukou policies. The DID specification compares cities with no change in Hukou policy versus the ones that relaxed their Hukou restrictions, before versus after the reform. In our empirical analysis, we look at three sets of outcome variables: the number of new entrepreneurs, their performance, and labor market outcomes. The number of new entrepreneurs and labor flows are measured at the city level, while the performance variables are measured at the firm level.

In the city-level regressions, the baseline regression equation is specified as follows:

$$Y_{ct} = \beta_0 + \beta_1 HukouReform_{ct} + \gamma_c + \eta_t + \delta_{ct} + \epsilon_{ct}, \tag{1}$$

where c and t respectively index the city and the year. Y_{ct} represents the number of new firm registrations or new entrepreneurs in city c in year t. We examine both the number of new firms and the number of new entrepreneurs to ensure that the relaxation of Hukou policies not only spurs the creation of new firms but also induces more entrepreneurial entry. We further break down the entrepreneurs into migrant entrepreneurs whose hometown is not the city (or province) where the firm was established, and local entrepreneurs, to examine its compositional change. $HukouReform_{ct}$ is a dummy variable that takes the value 1 for the city-year cells that have implemented a Hukou policy relaxation. Specifically, we examine the effect of three kinds of Hukou relaxation policy: 1) Gerenal Hukou policy: any kinds of Hukou restriction relaxation; 2) Skill-biased Hukou policy: a Hukou restriction relaxation with skill related requirements, such as education, skill certificate, employment, business

investment, etc.; 3) Non-restrictive Hukou policy: a Hukou restriction relaxation with no specific requirement or only minimal requirement such as 6 months of social security payment, etc. We compare the effects of different types of Hukou relaxation policies on the set of labor market and entrepreneurial market outcomes. γ_c, η_t, and δ_{ct} are province and year fixed effects, and city-specific time trends, respectively; and ϵ_{ct} is the error term. The standard errors are clustered at the city level. β_1 is the main coefficient of interest. It captures the additional effect on the number of new entrepreneurs in the market due to the relaxation of the Hukou restriction and the increased inter-city labor mobility.

As the relaxation of Hukou restrictions may facilitate the inter-city flow of entrepreneurs and induce a regional re-distribution of entrepreneurial activities, it is thus interesting to further examine the distributional effect of the relaxation of Hukou restriction on regional inequality and the pattern of firm sorting. Thus, we turn to the more granular firm-level data and examine the heterogeneous response to Hukou relaxation by the entrepreneurs' characteristics. The regression equation is specified as follows:

$$Mig_{ijct} = \beta_0 + \beta_1 HukouReform_{ct} + \beta_2 HukouReform_{ct} D_{jt} + \beta_3 X_{it} + \gamma_j + \delta_t + \epsilon_{ijct} \quad (2)$$

where Mig_{ijct} is a dummy variables that takes the value 1 if firm i is established by a migrant entrepreneur j in city c in year t, D_{jt} represents entrepreneur j's characteristics, which is one of the following: the entrepreneurs' previous firm location GDP per capita, the entrepreneurs' hometown city GDP per capita, the entrepreneurs' age, the entrepreneurs' previous firm performance, and the firms' registration cities' GDP per capita. It is worth noting that when D_{jt} is the entrepreneurs' previous firms' characteristic, we only leverage on the "mover" sample— entrepreneurs who have established multiple firms in multiple cities.

To further understand the channels through which Hukou policy change may affect entrepreneurial activities, we employ the tax survey data and examine the firms' performance in the same difference-in-difference framework as above. The regression specification is:

$$Y_{ijct} = \beta_0 + \beta_1 HukouReform_{ct} + \beta_2 X_{ijct} + \gamma_j + \delta_t + \epsilon_{ijct} \quad (3)$$

where the outcome variable Y_{ijct} measures the performance of firm i established by entrepreneur j in city c in year t. Specifically, we measure a firm's performance with its employment, wage, profit, revenue, value-added, TFP, R&D expenditure, etc. All other variables are defined as in eq. (2). The standard errors are clustered at the city-by-year level. It is worth noting that all firm-level regressions focus on the firms whose largest shareholder is an individual (rather than a firm or legal entity) as the object of our study is entrepreneur.

Lastly, firms with different production technology may respond to different policy shocks

differently and thus result in a change in the composition of entrepreneurs and firms in the market on the intensive margin. To further investigate the heterogeneous effect on firms with different production technologies, we interact the treatment dummy with the firms' skill intensity (denoted as $Skill_{it}$). Skill intensity is measured at the 4-digit industry level following (Belo et al., 2017). Skill intensity is defined as the percentage of workers in that industry that work on occupations that require a high level of training and preparation, that is, are high-skill workers. We then use the industry correspondence[6] to map the industry-level skill intensity to Chinese firm data. The regression specification is thus:

$$Y_{ijct} = \beta_0 + \beta_1 HukouReform_{ct} + \beta_2 HukouReform_{ct} \cdot Skill_{it} + \beta_3 X_{ijct} + \gamma_j + \delta_t + \epsilon_{ijct} \quad (4)$$

4 Results

In this section, we provide reduced form evidence on the heterogeneous effect of Hukou reform on the number, composition, and intercity flow of entrepreneurs.

4.1 Baseline results

Table 1 reports the results from estimating Equation (1). Column (1) reports the regression result using generally-defined Hukou reform as the treatment variable— i.e. treatment variable turns on as long as the city has relaxed its Hukou restriction, no matter with any requirement or not. It shows that the coefficient for the interaction term is positive but statistically insignificant, suggesting that, overall, a general Hukou reform does not have a significant effect on the number of new entrepreneurs. Column (2) reports the regression result examining the effect of skill-biased Hukou reform on entrepreneurship, and the effect is statistically insignificant either— and if there were to be any effect, it is a negative effect. Column (3) reports the regression result examining the effect of non-restrictive Hukou reform on entrepreneurship, and the coefficient for the interaction term is positive and statistically significant, suggesting that the non-restrictive Hukou reform— the reform that allows anyone who works and live in the city to get registered for a local Hukou without any bias— on average results in a yearly increase of new entrepreneurs by 6% after the reform.

[Table 1 about here]

Table 2 - Table 4 present a further breakdown of the results by the entrepreneurs' identity— whether the entrepreneur is a "migrant entrepreneur" who establish the firm outside his/her hometown city or a local entrepreneur who establish the firm in his/her

[6] available at https://www.census.gov/naics/reference_files_tools/2022_NAICS_Manual.pdf

hometown city. Table 2 present the DID estimation results for the general Hukou policy breaking down the result in column (1) of Table 1. We examine both the number of new firms and the number of new entrepreneurs to ensure that our results are not purely driven by the expansion of existing entrepreneurs. Columns (1) and (2) present the results for the number of newly registered firms, and columns (3) and (4) present the results for the number of newly-entered entrepreneurs. The results suggest that Hukou relaxation policies attract more migrant entrepreneurs from other cities, but have no statistically significant effect on the number of local firms or local entrepreneurs. On average, Hukou reform leads to a yearly increase of migrant entrepreneurs by 8% after the reform.

[Table 2 about here]

Table 3 and Table 4 report the breakdown results using skill-biased Hukou reform and non-restrictive Hukou reform as the treatment, respectively. The results show some interesting differences— Skill-biased Hukou reform attracts more migrant entrepreneurs into the city, but at the cost of crowding out local entrepreneurs. It leads to an increase of the number of migrant entrepreneurs by 4.8%, but a decrease of the number of local entrepreneurs by 4.6%. This explains the null effect of a skill-biased Hukou policy on the total number of entrepreneurs as shown in Table 1. On the other hand, as shown in Table 4, non-restrictive Hukou reform spurs overall entrepreneurship— the number of migrant entrepreneurs increases by 12%, and the number of local entrepreneurs increases by 5.2%. We explore the mechanism by which the two types of policy reform lead to different effects on entrepreneurship in more details in Section 5, but it is beneficial to briefly explain the possible mechanism here: skill-biased Hukou reform only attracts high-skill workers, and thus firms and entrepreneurs in high-skill intensity industries, who may in turn also hire more low-skill workers due to the better market opportunity. With limited labor supply of low-skilled workers, the growth of the high-skill intensity industry may crowd out the local small firms that tend to concentrate more on service industries and employ more low-skill workers.[7] On the other hand, non-restrictive Hukou reform attracts both high-skill and low-skill workers, and thus mitigate the crowding out effect. As a result, it may benefit both the high-skill-intensity industries as well as the low-skill-intensity industries.

[Table 3 about here]

[Table 4 about here]

The key underlying "parallel trend" assumption for the validity of our DID strategy is that, in the absence of Hukou reform, regions would have the same trend of the evolution

[7]Table A1 provide evidence that firms established by migrant entrepreneurs on average perform better— They are larger in size, higher in profitability, and invest more in R&D.

of entrepreneurship. We now provide supporting evidence for this assumption, and also examine the dynamic effect of the Hukou reform on the evolution of entrepreneurship. We employ the event-study approach and estimate the following augmented regression equation:

$$Y_{cdt} = \beta_0 + \sum_{d=-5}^{10} \beta_{1d} HukouReform_{cdt} + \gamma_c + \alpha_d + \eta_t + \delta_{ct} + \epsilon_{pt}, \quad (5)$$

where d represents event year (i.e. the year relative to the starting year of the Hukou reform), and t represents calendar year; $HukouReform_{cdt}$ is a set of dummy variables that takes the value 1 for the city-year cells that have implemented a Hukou policy relaxation, and the year before the policy started is omitted as the reference year; γ_c, η_t, α_d and δ_{ct} are province, year, and event year fixed effects, and city-specific time trends, respectively; and ϵ_{ct} is the error term. Our coefficients of interest are the β_{1d}, which capture the difference in the number of new entrepreneurs for cities with and without a Hukou reform.

Figure 3 plots the estimated $\hat{\beta}_{1t}$ with 90% confidence intervals. It shows that, before the Hukou reform, cities in the treatment group and in the control group do not have statistically significant differences in the number of new entrances each year, for both migrant entrepreneurs and local entrepreneurs. The difference for migrant entrepreneurs immediately emerges after the reform, and the effect is persistent over time. On the other hand, the difference for local entrepreneurs starts to get larger gradually and turns statistically significant over time after the reform, suggesting that the crowding-out effect on the local entrepreneurs takes place gradually.

[Figure 3 about here]

4.2 Entrepreneur sorting and regional inequality

As the relaxation of Hukou restrictions facilitates the inter-city flow of entrepreneurs and induce a regional re-distribution of entrepreneurial activities, it is thus interesting to further examine the distributional effect of the relaxation of Hukou restriction on regional inequality and the pattern of firm sorting. Thus, we turn to the more granular firm-level data and examine the heterogeneous response to Hukou relaxation by the entrepreneurs' characteristics.

Table 5 reports the results from estimating Equation (3), with the dummy variable which takes the value 1 if the firm is established by a migrant entrepreneur being the dependant variable. Columns (1)-(3) report the regression results using the full sample of the firms whose largest shareholder is an individual (rather than a firm or legal entity), and controls for the firms' registration city and year fixed effects. Columns (4)-(6) report the regression results using only the "movers" sample— entreprneurs who have established multiple firms

in multiple cities, and controls for the firms' registration city and year fixed effects, as well as the entrepreneur's individual fixed effect. The results confirms our findings in Section 4.1 that Hukou reforms attracts migrant entrepreneurs into the reformed cities. Columns (1) and (4) report the regression results using generally-defined Hukou reform as the treatment variable. They show that the coefficient for the interaction term is positive and statistically significant, suggesting that, overall, a general Hukou reform increases the chance that a firm is established by a migrant entrepreneur by 3.38% (column (1)), and increases the chance that an entrepreneur chooses to move to the city by 7.95% (column (4)). The effects of the skill-biased Hukou reform and the non-restrictive reform in qualitatively the same, while, as shown before, non-restrictive policies have a larger effect on spurring entrepreneurship quantitatively. Columns (2) and (5) report the regression results using skill-biased Hukou reform as the treatment variable. The results suggest that a skill-biased Hukou reform increases the chance that a firm is established by a migrant entrepreneur by 1.98% (column (2)), and increases the chance that an entrepreneur chooses to move to the city by 9.26% (column (5)). Lastly, columns (3) and (6) report the regression results using non-restrictive Hukou reform as the treatment variable, and its effect is larger in magnitude— it increases the chance that a firm is established by a migrant entrepreneur by 5.50% (column (3)), and increases the chance that an entrepreneur chooses to move to the city by 13.7% (column (6)).

[Table 5 about here]

In order to understand the *distributional effect* of the Hukou reforms, we further dig into more details of the policy-induced migrant entrepreneurs by asking who are responding to the policy changes. If the more productive entrepreneurs from the poorer regions respond more to the policies in larger cities, one may expect that the policy-induced redistribution of entrepreneurial activities may lead to greater regional inequality, while if it is the opposite, the redistribution may lead to decreasing regional inequality. Thus, we examine the heterogeneous response to Hukou relaxation policies by the entrepreneurs' characteristics. Table 6 - Table 8 present the regression results with different dimensions of entrepreneurs' characteristics.

Table 6 present the results interacting the treatment dummy with the firms' registration cities' GDP (in log form) level. The coefficients for the interaction terms are all positive and statistically significant, suggesting that entrepreneurs respond to Hukou reforms in larger cities more— a 10% increase in the firm cities' GDP increases the chance that a firm is established by a policy-induced migrant entrepreneur by 0.8% (column (1)), and increases the chance that an entrepreneur moves to the city by 0.5% (column (3)). This result is intuitive as Hukou in larger cities usually has higher value— it is usually accompanied by better social welfare, better education, and faster increase in housing prices, etc.

[Table 6 about here]

Table 7 presents the results interacting the treatment dummy with the entrepreneurs' hometown cities' GDP level (in log form). The coefficients for the interaction terms are all negative and statistically significant, suggesting that entrepreneurs from smaller cities respond to Hukou reforms in other cities more— a 10% increase in the entrepreneurs' hometown cities' GDP decreases the chance that a firm is established by a policy-induced migrant entrepreneur from the origin city by 1.55% (column (1)), and decreases the chance that an entrepreneur moves to the reformed destination city by 0.91% (column (3)).[8] The results, in together with the previous results, suggest that the "increases" in city size plays an important role in the entrepreneurs' migration decision— overall, they tend to move from smaller cities to larger cities.

[Table 7 about here]

We further examine the determinants of the moving decisions by the entrepreneurs' characteristics. Table 8 presents the results interacting the treatment dummy with the entrepreneurs' age in the year of the firm establishment (in log form). The coefficients for the interaction terms are all negative and statistically significant, suggesting that younger entrepreneurs respond to Hukou reforms in other cities more— a 10% increase in the entrepreneurs' age decreases the chance that a firm is established by a policy-induced migrant entrepreneur by 0.31% (column (1)), and decreases the chance that an entrepreneur moves to the reformed destination city by 0.34% (column (3)). This is probably because that the younger cohort values Hukou in big cities more— they need a local Hukou for their children's education, family companion, as well as longer-term of social security net, or because that the older generation has already acquired a Hukou in a big city and thus does not need to respond to Hukou reforms.

[Table 8 about here]

Lastly, we examine the performance of the moving entrepreneurs. We divide firms' performance in terms of the value-added into 10 deciles in each city-year-3 digit industry cell, and interact the treatment variable with the entrepreneurs' previous firms' performance quantile— the purpose of the test is to examine whether the better-performed entrepreneurs are more likely to respond to Hukou reforms. Figure 4 plots the estimated coefficients and the corresponding 95% confidence intervals for each performance decile interacting with

[8] In Table A2 we present the results using the entrepreneurs' previous cities' GDP level as the mediator, which may be different than their hometown cities if the entrepreneurs' previous firm is also a "migrant firm", and the results remain quantitatively and qualitatively robust.

the treatment dummy, with the lowest decile being the reference group. The coefficients for the interaction terms are all positive and statistically significant, and the coefficients exhibit an upward trend as the performance decile increases, suggesting that the better-formed entrepreneurs respond to Hukou reforms in other cities more— moving from the lowest performance decile to the highest one increases the chance that a firm is established by a policy-induced migrant entrepreneur by about 5% (column (1)). However, the trend disappears once we control for the entrepreneurs' individual fixed effect, suggesting that the result is mainly driven by the fact that Hukou reform attracts high-ability entrepreneurs, and the effect disappears once we control for the entrepreneurs' ability with individual fixed effects.

[Figure 4 about here]

Overall, the results provide strong evidence for policy-induced firm sorting— with the reduction in Hukou restrictions, better firms and entrepreneurs from poorer regions are more likely to move to larger cities. This redistribution of better entrepreneurs to larger cities is consistent with the widely documented sorting of firms in the literature (e.g. Gaubert (2018)), but by a completely different mechanism— firm sorting is mainly driven by agglomeration effect in Gaubert (2018), but mainly driven by the reduction of labor mobility constraints in our context. The redistribution of firms and entrepreneurs, on one hand, may lead to an increase in regional inequality, and the difference can be enlarged persistently with the unequal relaxation of Hukou policies; on the other hand, it may be efficient and welfare-enhancing if firms are established in the cities with higher productivities, as we will illustrate in more details in Section 6.

5 Exploring the mechanism

In this section, we ask why different entrepreneurs respond to different types of Hukou reforms very differently as shown in Section 4. We start by examining the heterogeneous labor market reactions in Section 5.1, and then examine the heterogeneous responses of firms with different production technologies in Section 5.2.

5.1 Labor market response

Using data on inter-city migration flows constructed from the four waves of population census between 2000 - 2015, we first examine the effect of Hukou reform on the volume of migrant inflows in the city. Table 9 reports the results from estimating Equation (1) with the log of the number of *new* migrants— migrants that move the city in this year— as

the dependent variable. Columns (1)-(2) report the regression results for the full sample and they suggest that both the skill-biased Hukou policy reform and the non-restrictive Hukou reform lead to a statistically significant increase in the number of migrants in the city. Column (2) run a horserace between the two policies, and it shows that non-restrictive policies are more effective in attracting migrant workers— The number of migrant labor increases by 15% after the non-restrictive Hukou relaxation, and increases by 6% after the skill-biased Hukou relaxation. Columns (3)-(6) provide a breakdown of the results by the migrant labors' education level. Columns (3)-(4) use the log of the number of low-skill workers (measured as the number of migrant labor with education below college level) as the dependent variable. The results suggest that non-restrictive Hukou restriction relaxation has a large and statistically significant effect on the inflow of low-skill labor— the number of low-skill labor on average increase by 20.5% per year after the policy reform; while skill-biased Hukou reform does not have any statistically significant effect on the number of low-skill migrant labor. Columns (5)-(6) use the log of the number of high-skill workers (measured as the number of migrant labor with education at least above college level) as the dependent variable. The results show a stark difference in the effect of non-restrictive Hukou reform versus that of skill-biased Hukou reform— Skill-biased Hukou reform increases the number of high-skill migrant workers by 21.4%, while the effect of non-restrictive Hukou reform is positive but statistically insignificant.

To summarize, Hukou reform not only leads to more migrant worker inflow to the reformed cities, but also changes the skill composition of the migrant labor force. Non-restrictive Hukou restriction relaxation mainly attracts low-skill workers, while skill-biased Hukou reform mainly attracts high-skill workers.

[Table 9 about here]

5.2 Firm performance

As different types of Hukou reform have very different effects on the labor market, one may expect that the effects are passed on to firms with different production technologies. In this subsection, we empirical test the heterogeneous effect on firm performance with a wide set of outcome variables.

We start by examining the average effect of different types of Hukou policies. Table 10 report the regression results from estimating Equation (4), with the firms' net profit and total revenue being the dependent variables. The results suggest that all types of Hukou restriction relaxation reforms have led to greater firm revenue and profit. Columns (1) and (4) report the regression results using generally-defined Hukou reform as the treatment variable. They show that the coefficient for the interaction term is positive and statistically significant,

suggesting that a general Hukou reform increases the firms' profit by 6% and revenue by 4.6%. The effects of the skill-biased Hukou reform and the non-restrictive reform are qualitatively the same. Columns (2) and (5) report the regression results using skill-biased Hukou reform as the treatment variable. The results suggest that a skill-biased Hukou reform increases the firms' profit by 12.3% (column (2)), and increases the firms' revenue by 3.8% (column (5)). Lastly, columns (3) and (6) report the regression results using non-restrictive Hukou reform as the treatment variable, and it increases the firms' profit by by 3.3% (column (3)), and increases the firms' revenue by 4% (column (6))

[Table 10 about here]

Table 10 repeat the exercise with the firms' value-added and TFP being the dependant variables, and the results show very similar patterns— all types of Hukou restriction relaxation reforms have led to greater firm value-added and increased firm productivity. The magnitude of the effect is larger on value-added than on TFP, probably because that firms also expand their inputs.

[Table 11 about here]

We then turn to firms' labor market outcomes. Table 12 reports the effect of Hukou reforms on the firms' employment and wage. Column (1) and (4) suggests that the general Hukou reform leads to an increase in firm employment by 2.4% and a decrease in firms' average wage per worker by 0.8%. The effect of skill-biased Hukou reform is qualitatively the same. Column (2) and (5) suggests that the general Hukou reform leads to an increase in firm employment by 1.4% and a decrease in firms' average wage per worker by 2%. On the other hand, non-restrictive Hukou restriction relaxation increases firms' employment by 3.3%, the magnitude of which is larger than that of the general Hukou reform or of the skill-biased Hukou reform. Moreover, the non-restrictive Hukou policy has no statistically significant effect on the equilibrium firm wage— if there were to be any effect, the estimated coefficient is positive but statistically insignificant. We provide the rigorous rationale for the results in consistent with a spatial equilibrium model in Section 6, it is nevertheless beneficial to explain the core mechanisms briefly here: Skill-biased Hukou reform attracts migrant entrepreneurs but crowd out local entrepreneurs, and thus has no significant effect on the total number of entrepreneurs, which constitute the demand side of the labor market. It also attracts more skilled labor into the local market by relaxing their mobility constraints, which is the supply side of the labor market. With little change on the demand side but a more vibrant supply side, the equilibrium wage is lower as a result. On the other hand, the non-restrictive Hukou reform spurs both the entrepreneurial market (with more migrant entrepreneurs as well as local entrepreneurs), as well as the labor market. Thus it is possible that the net effect on wages can be in either direction.

[Table 12 about here]

Table 13 reports the effect of Hukou reforms on the firms' product market markup and labor market markdown, which correspond to the firms' product market power and labor market power. The two measures for market power are two important parameters in the theoretical model which will be explained in more detail in Section 6. We calculate the firms' markup and markdown following (Brooks et al., 2021).[9] The results suggest that general Hukou reform leads to statistically significant increases in the firms' labor markdown and total markup, and the results remain qualitatively robust with skill-biased Hukou reform as the shock. However, non-restrictive Hukou policies do not yield the same benefits to the firms— it has no statistically significant effect on either labor markdown or total markup. The intuition of the results is that the non-restrictive Hukou reform not only attracts more labor into the city and thus benefits the firms, but it also spurs the city's entrepreneurial market, and hence creates more competition among the firms. Therefore, the results show no effect on the firms' market power. This is consistent with our findings that non-restrictive Hukou reform does not lead to any decrease in the local labor cost. Moreover, the results yield interesting implications for labor welfare: with higher demand on the labor market and more competition among the firms, labor are not hurt by more abundant supply. This finding is consistent with (Beerli et al., 2021) that the reduction in cross-border labor mobility restriction does not hurt the local labor welfare.

[Table 13 about here]

Lastly, in order to understand why different types of policy reforms have different effects on the entrepreneurial market, we examine the heterogeneous policy effects on firms in different industries characterized by the industry's skill intensity. Skill intensity is defined at the 3-digit industry level as the percentage of workers in that industry that work in occupations that require a high level of training and preparation, that is, are high-skill workers Belo et al. (2017).

In Table 14 and Table 15, we interact the treatment dummy with the firms' industries' skill intensity. For the sake of space, we report the results comparing the treatment effects of skill-biased Hukou policies and that of non-restrictive Hukou policies. The results remain robust when we follow the same routine and separately examine each type of shock as before. Table 14 focuses on firms' performance. The results suggest that the two kinds of policies indeed have different implications for firms with different production technologies. The estimated coefficients for the interactions of the skill-biased Hukou reform and the skill measure

[9](Brooks et al., 2021) employs three methods to calculate markup and markdown based on different model assumptions, and our results are robust to different measures.

are positive and statistically significant, suggesting that firms in high-skill-intensity industries benefit more from the skill-biased Hukou reform. For example, column (1) suggests that as the skill intensity increases by 0.1, the treatment effect of the skill-biased Hukou reform on firms' profit increases by 1%. While, on the other hand, the estimated coefficients for the skill-biased Hukou reform treatment variable are mostly statistically insignificant— suggesting that the skill-biased Hukou reform does not benefit firms in the low-skill-intensity industries. The pattern is then reversed for non-restrictive Hukou reforms: the estimated coefficients for the non-restrictive Hukou reform treatment variable are positive and statistically significant— suggesting that the non-restriction Hukou reform also benefits firms in the low-skill-intensity industries. This corroborates our findings that the non-restrictive Hukou reform has no crowding-out effect on the local entrepreneurial market. Moreover, the interaction terms are also mostly positive and statistically significant as well, but the magnitude of which is smaller when comparing to that of the skill-biased Hukou reform, suggesting a smaller slope on the return to skill. Overall, the results suggest that both the non-restrictive Hukou reform and the skill-biased Hukou reform benefit the high-skill-intensity industries more, but the former does not crowd out low-skill-intensity industries while the latter may do.

[Table 14 about here]

Table 15 focuses on firms' labor market outcomes and market powers, and the differences in policy effects on firms with different skill intensities become more salient. The skill-biased Hukou reform hurt firms in the low-skill-intensity industries— they employ less labor and enjoy lower labor market power— but benefit firms in the high-skill-intensity industries— the higher the skill intensity, the larger the response in firms' employment and labor market power to the policy shock. For example, column (1) suggests that as the skill intensity increases by 0.1, the treatment effect of the skill-biased Hukou reform on firms' employment increases by 0.8%. The breaking-even point is a skill intensity of 0.25– which accounts for about 40% of the firms below the threshold on average. On the other hand, the estimated coefficients for the non-restrictive Hukou reform treatment variable are mostly statistically insignificant— suggesting that the non-restrictive Hukou reform does not hurt or crowd out firms in the low-skill-intensity industries. The return to skill in response to the non-restrictive Hukou reform is also smaller in magnitude when comparing to that of the skill-biased Hukou reform.

[Table 15 about here]

Remark 1 It is worth noting that the results on the effect of Hukou reform on firm performance are on the intensive margin— the DID identification can only estimate the causal

effect of the reform on the incumbent firms but not on the new entrants. While, on the other hand, our results on the evolution and redistribution of entrepreneurial activities are mainly on the extensive margin— entrepreneurs move and enter the market in response to the Hukou reforms. Nevertheless, the two should share the same performance and effect in equilibrium. Thus we believe our reduced-form evidence on firm performance helps to understand the heterogeneous effect of different Hukou policy reforms on the entrepreneurial market.

6 A Spatial equilibrium model

Our reduced form results provide consistent evidence that the relaxation of Hukou restrictions have increased labor mobility, and more importantly, facilitated a regional redistribution of entrepreneurial activities. In order to quantify the welfare and efficiency implications of the policy-induced redistribution of economic activities and study the heterogeneous effect of different types of Hukou reform, we build a standard spatial equilibrium model incorporating the key features of our study context— we allow for firms to have heterogeneous production technology and labors to face type-specific migration cost. We start with the full model for estimation purpose and use the simplified version to illustrate our key mechanism: labor sort in response to the reduction in mobility cost, and firms sort with labor. The model can be estimated using data on firms' location choices and labors' mobility.

6.1 Model setup

We model a closed economy with N cities indexed by o or d. A mass of H-type workers and a mass of L-type workers, each normalized to be of measure one. which impact how they sort across cities. Workers are born in a particular origin indexed by o, receive idiosyncratic preference shocks for each destination city d, and sort across destinations according to wages, amenities, and migration costs. Migration costs are relative to the birth location, and is modeled as an iceberg cost τ_{od}^s for workers of type $s = H, L$ migrating from o to d (migrant worker only enjoys $(1 - \tau_{od}^s)$ of the local amenity). Wages and amenities are endogenous and adjust to ensure equilibrium. Workers only receive labor income, which they spend in the city where they live. Note that we allow the migration cost to be heterogeneous on three dimensions— origin, destination and skill— to capture the variation in the Hukou policies: some relaxation of the policies are skill-biased, migration barrier is the highest in some big cities, etc.

Firms are owned by mobile entrepreneurs. They are single-plant and sell differentiated products. They use H-type labor and L-type labor to produce output. There is a fixed mass

of h-type firms producing H-type worker intensive products, and a fixed mass of l-type firms producing L-type worker intensive products, each also normalized to be of measure one, sorts across city according, in part, to idiosyncratic productivity draws. Goods are freely traded in the baseline model. Without loss of generality, we can allow for trade cost modeled as an iceberg cost δ_{od} of shipping from city o to city d (if one unit is shipped from o to d, $(1-\delta_{od})$ units arrive).

6.2 Household

Households choose their city d, employer ω, consumption of h-type product Q_{dh} and l-type product Q_{dl} to maximize

$$U_{ods\omega} = b_{d\omega} a_d (1-\tau^s_{od})(Q_h)^{\beta}(Q_l)^{(1-\beta)},\ Q_v = \Big[\int_{w\in\Omega_v} (q_v(w))^{\frac{\sigma-1}{\sigma}} dw\Big]^{\frac{\sigma}{\sigma-1}}$$

where $b_{d\omega}$ is an household-specific idiosyncratic preference shock for city d and employer ω; $\beta \in (0,1)$ is the expenditure share on h-type product; Q_v aggregates all product varieties w available in sector v, using a constant elasticity of substitution $\sigma > 1$[10]. Consumption is a Cobb-Douglas bundle of goods across sectors h, l and a CES bundle of varieties within sector.

Households draw the set of idiosyncratic shocks $b_{d\omega}$ from a nested Fréchet distribution, which guides their sorting decisions across space and across employers. The upper nest reflects preferences across locations with dispersion given by ξ, capturing a regional labor supply elasticity. The lower nest reflects preferences across employers with dispersion given by ϵ, capturing an employer-level labor supply elasticity. As a result, an employer ω in city d that wishes to hire $l_{ds}(\omega)$ workers of skill type s is required to pay a wage

$$w_{ds}(\omega) = L_{ds}^{-\frac{1}{\epsilon}} W_{ds} l_{ds}(\omega)^{-\frac{1}{\epsilon}},\ W_{ds} = \Big(\int_{\omega\in N_d} w_{ds}(\omega)^{\epsilon} d\omega\Big)^{-\frac{1}{\epsilon}}$$

where L_{ds} is the measure of type-s workers that choose location d and W_{ds} is the regional wage index for type-s workers. When the employer-specific labor supply elasticity is infinite ($\epsilon \to \infty$), all local employers pay a common wage equal to the index W_{ds}. Otherwise, firms need to pay higher wages to attract more workers.

Household location choice Each location is endowed with a fixed mass of labor with skill level s. Households locate to maximize their indirect utility which is a function of wage and mobility cost. (let me abstract away from the endogenous amenity for now... if amenity

[10] We are a bit abusing the notation by assuming the elasticity of substitution is the same in the two sectors, but should not change the results qualitatively

is endogenously generated from tax, this basically creates a similar "agglomeration effect" on the worker side and reinforces our mechanism)

$$\frac{L_{ods}}{\bar{L}_{os}} = \Big(\frac{(1-\tau^s_{od})W_{ds}}{\tilde{W}_{os}}\Big)^{\xi}$$

The implied regional labor supply, given by the probability that an agent of type s from origin d chooses city d, equals to:

$$L_{ds} = \sum_o L_{ods} = \sum_o \bar{L}_{os}\Big(\frac{(1-\tau^s_{od})W_{ds}}{\tilde{W}_{os}}\Big)^{\xi}$$

where L_{ds} is the measure of households of type s that choose city d, and W_{ds} is the regional skill-specific ideal wage index, aggregating the employer-specific wages $w_{ds}(\omega)$. $\tilde{W}_{os}$ is the origin-skill-specific "perceived" wage index, aggregating the "perceived" wage over all destination cities.

$$\tilde{W}_{os} = \Big(\sum_d \big((1-\tau^s_{od})W_{ds}\big)^{\xi}\Big)^{\frac{1}{\xi}}$$

Note that household's location choice is mainly driven by wage and the migration cost. In the presence of migration cost, labor may not work in the places where they have the highest productivity. Lowering migration cost facilitates labor sorting.

6.3 Firm

There exists a fixed mass of firms which must decide in which city to locate. Assuming that these firms heterogeneous in terms of their productivity across locations, which are mainly affected by two factors: labor cost and agglomeration effect. For simplicity purpose, we assume there are two types of firms with different skill intensity, firms are freely mobile across regions, and there is no trade costs. As shown in the literature, the model can be extended to incorporate the following features: 1) trade cost; 2) new firm entry; 3) more heterogeneity in the firms' production technology. The key mechanism and estimation won't be affected by these extensions.

High-type firms Each firm ω within the h-type sector produces a differentiated variety ω and is endowed with city-specific productivities, which guides their sorting decisions across space. The firms' productivity is a product of a idiosyncratic shock z_d and regional agglomeration effect. The random draw z_d follows Fréchet distribution with dispersion given by ε. The agglomeration effect is modeled as M^{ρ}_{dh} following Gaubert (2018), where M_{dh} is the mass of h-sector firms located in city d. This assumption is driven by the findings in the literature

that more efficient firms are disproportionately more productive in larger cities, pointing to such a complementarity as a potential explanation for this fact. Knowledge spillovers can arguably exhibit this type of complementarity. Note the the agglomeration effect is not the key driver of our results but do reinforces our mechanism, and may be crucial for the effect of reduction in mobility friction on regional wage.

Firms within the sector engage in monopolistic competition. Varieties produced by firms are freely tradable across space: there is a sectoral price index that is constant through space. Firms take it as given. What matters for location choice is the trade-off between production externalities and costs of production (the labor cost). It is worthwhile to note that with labor mobility frictions, wages do not necessarily increase with L— lower wages may be compensated with lower mobility costs.

To produce quantity q in city d sector h, firm ω combines its own productivity in that city d, high-skill labor, and low-skill labor, through a Cobb-Douglas technology:

$$q_{dh}(\omega) = \varphi_{dh}(\omega) l_{dhH}^{\alpha} l_{dhL}^{1-\alpha}$$

where $\varphi_{dh}(\omega) = M_{dh}^{\rho} z_{dh}(\omega)$ is firm-specific productivity.

Conditional on the firms' location choice, they solve the maximization problem:

$$\max_{l_{dH}, l_{dL}} P_h Q_h^{\frac{1}{\sigma}} \left(\varphi_{dh}(\omega) l_{dhH}^{\alpha} l_{dhL}^{1-\alpha}\right)^{\frac{\sigma-1}{\sigma}} - \sum_{s=L,H} W_{ds} L_{ds}^{-\frac{1}{\epsilon}} l_{dhs}^{1+\frac{1}{\epsilon}}$$

Note: $P_h Q_h^{\frac{1}{\sigma}}\ W_{ds} L_{ds}^{-\frac{1}{\epsilon}}$ and captures the market power of the firm in output and labor market. (?) Can we interpret this as the markup and markdown in our empirical results?

Thus, the implied revenues, type-s employment and type-s wages are given by

$$\begin{aligned}
r_{dh}(z_\omega) &= (1-\psi)^{\frac{1}{\psi}(1-\psi)} \left(P_h Q_h^{\frac{1}{\sigma}}\right)^{\frac{1}{\psi}} C_{dh}^{-\frac{1-\psi}{\psi}} \varphi_{dh}(\omega)^{\frac{1}{\psi}\frac{\sigma-1}{\sigma}} \\
l_{dhs}(z_w) &= W_{ds}^{-\frac{\sigma}{\epsilon+1}} L_{ds}^{\frac{-1}{\epsilon+1}} \left((1-\psi)\alpha r_{dh}(z_\omega)\right)^{\frac{\epsilon}{\epsilon+1}} \\
w_{dhs}(z_w) &= W_{ds}^{\frac{\sigma}{\epsilon+1}} L_{ds}^{-\frac{1}{\epsilon+1}} \left((1-\psi)\alpha r_{dh}(z_\omega)\right)^{\frac{1}{e+1}}
\end{aligned}$$

where

$$\psi = 1 - \frac{\sigma-1}{\sigma}\frac{\epsilon}{\epsilon+1}$$

captures the share of operating profits.

C_{dh} is a regional cost-shifter for the h-sector firms that summarizes the price and avail-

ability of labor in that market

$$C_{dh} = \left(\alpha W_{dh}^{-1} L_{dh}^{\frac{1}{\epsilon}}\right)^{-\alpha} \left((1-\alpha) W_{dL}^{-1} L_{dL}^{\frac{1}{\epsilon}}\right)^{-(1-\alpha)}$$

W_{ds} is a regional aggregated wage index.

$$W_{ds} = \left(\int_{\omega} w_{ds}(z_\omega)^{\epsilon} dw\right)^{\frac{1}{\epsilon}} \quad s = H, L$$

and the profit accrued to the entrepreneurs (capital owners) is

$$\pi_{dhs}(z_w) = \psi r_{dh}(z_w)$$

Firm-level employment and wages are both increasing in the firm's revenues. Note that in the limit of perfectly competitive labor markets, $\epsilon \to \infty$, branch-level wages are given by the regional skill-specific wage index W_{ds}.

Low-type firms For simplicity, assume that firms in the l-sector only employ low-skill worker. This assumption can be easily relaxed. I am making this assumption to focus on the key mechanism— while firms in the l-sector only employ low-skill worker, they are also affected by the mobility cost in the high-skill labor market. I also assume away agglomeration or congestion forces in the productivity of firms in the l-sector. Thus, the production function of firms in the l-sector is given by

$$q_{dl}(w) = \varphi_{dl}(w) l_{dl}$$

Then firm's maximization problem is.

$$\max_{l_s} P_l Q_l^{\frac{1}{\sigma}} (\varphi_{dl} l_{dl})^{1-\frac{1}{\sigma}} - W_{dl} L_{dl}^{-\frac{1}{\epsilon}} l_{dl}^{1+\frac{1}{\epsilon}}$$

Thus, the implied revenues, type-s employment and type-s wages are given by

$$
\begin{aligned}
r_{dl}\left(z_{\omega}\right) &= (1-\psi)^{\frac{1}{\psi}(1-\psi)}(P_l Q_l^{\frac{1}{\sigma}})^{\vec{\psi}} C_{dl}^{-\frac{1-\psi}{\psi}} \varphi_{dl}(\omega)^{\frac{\sigma-1}{\sigma}} \\
l_{dl} &= W_{dl}^{-\frac{1}{\epsilon+1}} L_{dl}^{\frac{1}{\epsilon+1}} \left((1-\psi) r_{dl}\left(z_{\omega}\right)\right)^{\frac{\epsilon}{\epsilon+1}} \\
\omega_{dl} &= W_{dl}^{\frac{\epsilon}{\epsilon+1}} L_{dl}^{-\frac{1}{\epsilon+1}} \left((1-\psi) r_{dL}\left(z_{\omega}\right)\right)^{\frac{1}{\epsilon+1}} \\
C_{dl} &= W_{dl} L_{dl}^{-\frac{1}{\varepsilon}}
\end{aligned}
$$

Firm location choice A fixed mass of firms in each sector decide in which city to locate to maximize the profit.

h-sector: The idiosyncratic component of productivity, is independent and identically distributed across firms and cities and is drawn from a Fréchet distribution with dispersion parameter ε. As a result, the profits of firm ω when it locates in city d, $\pi_d h(z_{\omega})$, are also Fréchet-distributed with shape parameter $\frac{\varepsilon}{\frac{1}{\psi}} \frac{\sigma-1}{\sigma}$. The fraction of firms located in city d is thus

$$
\frac{M_{dh}}{M_h} = \left(\frac{\gamma_{dh}}{\gamma_h}\right)^{\frac{\varepsilon}{\frac{1}{\psi}} \frac{\sigma-1}{\sigma}}
$$

where

$$
\gamma_{dh} = C_{dh}^{-\frac{1-\psi}{\psi}} M_{dh}^{\frac{\rho}{\psi} \frac{\sigma-1}{\sigma}}
$$

$$
\gamma_h = \left(\sum_{d=1}^{N} \gamma_{dh}^{\frac{\varepsilon}{\frac{1}{\psi}\frac{\sigma-1}{\sigma}}}\right)^{\frac{\frac{1}{\psi}\frac{\sigma-1}{\sigma}}{\epsilon}}
$$

This sorting equation illustrate the point the agglomeration factor ρ reinforces the sorting equilibrium.

l-sector:

$$
\frac{M_{dl}}{M_l} = \frac{\left(C_{dl}\right)^{\frac{(1-\psi)\varepsilon\sigma}{1-\sigma}}}{\sum_i \left(C_{il}\right)^{\frac{(1-\psi)\varepsilon\sigma}{1-\sigma}}}
$$

Firms' location choice in the l-sector is solely driven by the labor cost of low skill workers, which is determined in equilibrium jointly with the h-sector labor supply and demand, which is affected by the h-type firms' location choice and high-skill labor's mobility cost and location choice.

6.4 Equilibrium

A general equilibrium of this economy consists of distributions of workers and firms $\{L_{ods}, M_{dv}, s = H/L, v = h/l\}_{o,d=1}^{N}$, aggregate quantities $\{Q_h, Q_l\}$, wages $\{W_{ds}, s = H/L\}_{o,d=1}^{N}$, and final good prices $\{Q_h, Q_l\}$ such that: i) firms optimize on their location choice and labor demand; ii) workers make consumption and location decisions optimally; iii) final good markets clears in every sector; iv) the labor market clears in every city and skill type.

6.5 Identification arguments

We summarize our identification strategies as follows:

- Worker's preference over regions ξ is identified from workers' mobility elasticity on wage following (Tombe and Zhu, 2019*a*).
- Worker's mobility cost τ are identified from regional wage distributions and the mobility of labors L_{ods}.
- Workers' employer preference parameters ϵ are identified from within region-sector wage distribution.
- Firms' preference over regions ε is identified from firms' location choice.
- City-year level skill-specific wage W_H and W_L are calibrated from the firm level wage in the tax survey data. The key source of identification is the firms' skill intensity joint with the firms' average wage.
- Firms' production technology parameter α is then calibrated from the industry level skill intensity joint with the calibrated skill-specific wage from the last step.
- Firms' market power σ is identified from firms' pricing equation.
- Agglomeration parameter is taken from literature to be 0.2 following (Gaubert, 2018).

6.6 Impact of labor mobility cost change

In this subsection, we discuss how changes in the Hukou policies impact the regional allocation of labor, firm and wage. We consider a special case of the model. In order to focus on the key friction of the model— worker-type specific migration cost— we assume away trade frictions, workers' preference over employers (so that $\epsilon \to \infty$), the endogenous amenity level, and the asymmetry between incumbents and migrants. This simplified version retains the key spatial economics forces such as location-specific migration cost and agglomeration

through high-skill labor. We provide here an intuitive discussion of the predictions of this simplified model with some simulations. The intuitions derived in this simpler model hold up in the full quantitative model.

In the simplified version, firms' location choice is purely driven by labor costs and possible agglomeration forces. Thus, for h-type firms, they face the labor cost:

$$C_{dh} = \alpha {W_{dh}}^{\alpha}(1-\alpha){W_{dl}}^{(1-\alpha)}$$

A firm in the h-sector has the labor demand:

$$l = \frac{(1-\psi)\alpha r}{w} \quad \propto \quad \frac{C_{dh}^{1-\sigma}}{w}$$

In firms' sorting equation, h type firms locate to where max $C_{dh}^{-\frac{1-\psi}{\psi}}\varphi_{dh}(\omega)^{\frac{1}{\psi}\frac{\sigma-1}{\sigma}}$ is the highest. where:

$$\begin{aligned}
&C_{dh}^{1-\sigma}M_{dh}^{(\sigma-1)\rho}z^{(\sigma-1)} \\
&M_{dh} = \left(\frac{\gamma_{dh}}{\gamma_h}\right)^{\frac{\varepsilon}{\sigma-1}} \\
&\gamma_{dh} = C_{dh}^{1-\sigma}M_{dh}^{(\sigma-1)\rho} \\
&\gamma_h = \left(\sum_{d=1}^{N}\gamma_{dh}^{\frac{\varepsilon}{\sigma-1}}\right)^{\frac{\sigma-1}{\varepsilon}}
\end{aligned}$$

In equilibrium, we have

$$\Rightarrow M_{dh} \propto C_{dh}^{-\frac{\varepsilon}{1-\rho\varepsilon}}$$

where $(1-\rho\varepsilon)$ captures the fact that agglomeration effect (parameterized by ρ reinforces the channel.

In order to illustrate the mechanism in a succint way and to conduct model simulations, it is worth noting that the equlibrium type-specific regional wage index is solved in equilibrium from the labor market clearing conditions. To be more specific, the high-skill labor market clearing is:

$$\begin{aligned}
&\int_{w\in M_{dh}} \cdot l_{dhH}(\omega)d\omega = L_{dH} \\
&\Rightarrow AC_{dh}^{-\frac{\varepsilon}{1-\rho\varepsilon}}\frac{BC_{dh}^{(1-\sigma)}\varphi^{\sigma-1}}{W_{dH}} = C\cdot\left[(1-\tau_{dH})\,W_{dH}\right]^{\xi}
\end{aligned}$$

And the low -kill labor market clearing is:

$$\int_{w\in M_{dh}} \cdot l_{dhL}(\omega)d\omega + \int_{w\in M_{dl}} \cdot l_{dlL}(\omega)d\omega = L_{dL}$$
$$\Rightarrow AC_{dh}^{-\frac{\varepsilon}{1-\rho\varepsilon}} \frac{BC_{dh}^{(1-\sigma)}\varphi^{\sigma-1}}{W_{dL}} += C\cdot\left[\left(1-\tau_{dL}\right)W_{dL}\right]^{\xi}$$

The two labor market clearing conditions illustrates the key mechanism and trade-offs in our model. With a skill-biased relaxation of hukou policy, high-skill labor flows into the city, thus lowering the cost and increase the profitability of the firms in the h-sector and attracts more h-sector firms into the market. This creates higher demand for low skill workers and increases the wage of the low skill workers. The higher wage of the low skill workers increases the cost of firms in the l-sector and thus crowd out firms in the l-sector. Overall, the effect on high-skill workers' wage is not determined– the demand and supply for high-skill labor both increase, and the lower mobility costs may compensate the high-skill workers for lower wage. When demand for labor increases faster than the supply of labor (mainly driven by strong agglomeration effect in the h-sector), we may expect an increase in the wage of high-skill workers. On the other hand, the effect of a non-restrictive hukou policy is different: labor and firms in both sectors move towards the low-mobility cost city. These intuitions are formalized in the following proposition.

Proposition 1 *Consider an economy with two cities. Migration costs is denoted as* $\tau = [\tau_{AH}, \tau_{AL}, \tau_{BH}, \tau_{BL}]$

(a) (The effect of skill-biased hukou policy) For any given level of $\tau_{AL}, \tau_{BH}, \tau_{BL}$*, we have* $\frac{\partial L_{AH}}{\partial \tau_{AH}} < 0, \frac{\partial L_{AL}}{\partial \tau_{AH}} < 0, , \frac{\partial M_{AH}}{\partial \tau_{AH}} < 0, \frac{M_{AL}}{\partial \tau_{AH}} > 0, \frac{W_{AL}}{\partial \tau_{AH}} < 0$*, and the sign of* $\frac{W_{AH}}{\partial \tau_{AH}}$ *is not determined.*

(b) (The effect of no-restriction hukou policy) For any given level of τ_{BH}, τ_{BL}*, assume that* $\tau_{AH} = \tau_{AL} = \tau_A$*, we have* $\frac{\partial L_{AH}}{\partial \tau_A} < 0, \frac{\partial L_{AL}}{\partial \tau_A} < 0, , \frac{\partial M_{AH}}{\partial \tau_A} < 0, \frac{M_{AL}}{\partial \tau_A} < 0$*, and the sign of* $\frac{W_{AL}}{\partial \tau_A}, \frac{W_{AH}}{\partial \tau_A}$ *is not determined.*

Lastly, under both scenarios, high-skill labor and firms in the h-sector respond more to reductions in labor mobility cost because of the agglomeration effect. It is worth noting that this result is very consistent with our reduced form evidence that both the skill-biased Hukou reform and the non-restrictive Hukou reform benefit the firms in the high-skill-intensity industries more. The intuitions are formalized in the following proposition regarding the cross-derivative of the effect with respect to the firms' skill intensity parameterized by α.

Proposition 2 *Consider an economy with two cities. Migration costs is denoted as* $\tau =$

$[\tau_{AH}, \tau_{AL}, \tau_{BH}, \tau_{BL}]$. *Under the following two scenarios: 1) For any given level of* $\tau_{AL}, \tau_{BH}, \tau_{BL}$*; 2) For any given level of* τ_{BH}, τ_{BL}*, assume that* $\tau_{AH} = \tau_{AL} = \tau_A$*; we have* $\frac{\partial L_{AH}}{\partial \tau_{AH}} < \frac{\partial L_{AL}}{\partial \tau_{AH}}, \frac{\partial M_{AH}}{\partial \tau_{AH}} < \frac{M_{AL}}{\partial \tau_{AH}}$.

6.7 Quantitative Analysis and Welfare Implications

Our empirical practice shows that reductions in migration frictions and the resulting reduction in misallocation of labor and entrepreneur had played a major role in China's recent spur in entrepreneurial activities and regional equality. How much additional scope is there for further reductions in migration costs?

In this section, we calibrate the parameters of the model in two ways. First, for the parameters that affect individuals' and firms' preferences (i.e., workers' mobility elasticity on wage, and firms' mobility elasticity on cost, we use the values match some aggregate moments of the Chinese economy in 2010 from the micro panel data in Section 4, including micro cenus data and universe firm registration data. Second, for other parameters in the general equilibrium model, we either take the values from the literature or empirically estimate them. Our calibrations are summarized in Table 16. Finally, we vary the two sets of key parameters in our theoretical framework— the worker-type specific migration cost and the agglomeration parameter ρ.

Worker location choice regression. We follow (Tombe and Zhu, 2019*a*) to estimate workers' income elasticity in migration. To address potential endogeneity concerns, we also construct the IV for wage as the weighted average wage of adjacent cities (as shown in Table A3 and Figure **??**).

Wage distribution. We calibrate region-skill specific wage W_{dh} and W_{dl} using firm-level data from the tax survey. First, we calibrate industry-specific skill intensity from (Belo et al., 2017). Skill intensity combined with firm-level average wage give rise to the identification of skill-specif wage (as shown in Table **??**).

α **distribution**. Skill intensity combined with skill-specific wage give rise to the identification of α (the skill-specif labor income share) (as shown in Table **??**).

Firm location choice regression. We then calculate the region d-industry h specific cost-shifter C_{dh} that summarizes the price and availability of labor in that market

$$C_{dh} = \left(\alpha W_{dh}^{-1} L_{dh}^{\frac{1}{\epsilon}}\right)^{-\alpha} \left((1-\alpha) W_{dL}^{-1} L_{dL}^{\frac{1}{\epsilon}}\right)^{-(1-\alpha)}$$

and estimate the firms' elasticity to labor cost (as shown in Table A4).

Using these parameters, we consider four different scale of counterfactual experiments and estimate their distributional effects and contributions to overall welfare. The first one is to hypothetically reduce migration costs by 50% in a random city with either non-restricted

policy reform or skilled-biased policy reform; the second one is to hypothetically reduce migration costs in 20 randomly selected cities. While the third and fourth counterfactual experiments are to reduce migration costs in top 20 largest cities (in terms of population) and in the smallest 20 cities.

6.8 Potential Gains from Reform and Magnitude Comparisons

In Table 17, we evaluate how the measured cost changes affect the migration flow workers (of high-skilled and low-skilled) and entrepreneurs (of high-type and low-type). We compare the effect of the Hukou relaxation to (1) the total possible welfare gain after eliminating all wedges and implementing skilled-biased reform (2) the total possible welfare gain after eliminating all wedges and implementing non-restricted Hukou reform.

In the scenario of implementing Hukou reform in one random city, we find that skill-biased and non-restricted Hukou reforms increase overall welfare by 0.8% and 2.63%, respectively. Specifically, skill-biased Hukou relaxation increases the treated city's welfare by 35.49%, while it decreases the welfare of unrelaxed cities by -0.49%. Similarly, non-restricted Hukou relaxation increases the welfare of treated city by 98.91%, while it reduces unrelaxed cities' welfare by -0.94%. As for the welfare of workers (of high-skilled and of low-skilled), skill-biased Hukou relaxation increases overall welfare of high-skilled workers by 4.92% and that of low-skilled workers by -0.4%. To be more specific, skill-biased Hukou relaxation increases the welfare of skilled workers in the relaxed region by 89.04% and the welfare of skilled workers in the unrelaxed cities by -0.77%. Interestingly, skill-biased Hukou relaxation also increases the welfare of low-skill workers in the relaxed region by 5%, although it harms the welfare of low-skill workers in other cities by -0.36%. Additionally, we find that non-restricted Hukou relaxation increases the welfare of low-skilled workers by 93.51% in the treated city and reduces that of unrelaxed cities by -0.09%. Moreover, after the reform of non-restricted policy, the welfare of skilled workers in the relaxed city has increased by 108.4% and the welfare of skilled workers in the unrelaxed cities has declined by -0.11%.

In terms of the effect on labor mobility and entrepreneur mobility, skilled-biased Hukou relaxation increases high-skill labor by 4.27% while merely having any effect on the number of low-skill labor, and it increases the number of firms in high-skill intensity industries in the relaxed cities by 4.78% while crowding out firms in low-skill intensity industries by 3.91%—the two almost canceled out with each other and lead to the null aggregate effect. In contrast, non-restricted Hukou relaxation increases the number of high-skill worker by 4.29% and the number of low-skill worker by 2.51%, and as a result, it increases the number of firms in high-skill intensity industries in the relaxed cities by 4.21% and firms in low-skill industries by 1.95%. The results are consistent with reduced-form evidence on the heterogeneous policy effects on labor mobility and entrepreneur mobility.

We next analyze the scenario of implementing Hukou reform among top 20 largest cities, we find that both skill-biased and non-restricted policy increase overall welfare, at the cost of larger inequality across regions. If policymakers implement a skill-biased Hukou reform by reducing the migration cost of skilled workers by 50% in the largest 20 cities, the welfare of all cities, treated cities, and untreated cities will increase by 2.56%, 17%, and -2.52%, respectively. If we reduce the average migration cost of all workers by 50% by implementing the unrestricted Hukou relaxation policy, the aggregate welfare across all regions would increase by 19.30%, while the welfare of relaxing cities and unchanged cities will increase by 108.88% and -4.27%, respectively. In this exercise, a skill-biased policy reform could change the wage of high-skilled workers (or low-skilled workers) in the relaxing cities and non-relaxing cities by -7.02% (3.89%) and 4.56% (-2.25%). While a non-restricted policy reform will change the wage of low-skilled workers (or high-skilled workers) in the relaxing cities and non-relaxing cities by -0.84% (-3.73%) and -0.77% (4.12%). These results show that migration barriers have significant effects on the aggregate welfare, distributional effects, and regional disparity in China.

In terms of workers' welfare under this scenario, skill-biased Hukou relaxation increases overall welfare of high-skilled workers by 29.02% and that of low-skilled workers by -1.17%. Specifically, skill-biased Hukou relaxation increases the welfare of skilled workers in the relaxed region by 98.23% and the welfare of skilled workers in the unrelaxed cities by -3.06%. Skill-biased Hukou relaxation also increases the welfare of low-skill workers in the relaxed region by 4.12%, although it harms the welfare of low-skill workers in other cities by -2.47%. Furthermore, we find that non-restricted Hukou relaxation increases the welfare of low-skilled workers by 108.73% in the treated city and reduces that of unrelaxed cities by -4.24%. Moreover, after the reform of non-restricted policy, the welfare of skilled workers in the relaxed city has increased by 109.79% and the welfare of skilled workers in the unrelaxed cities has declined by -4.61%.

We also present the results of implementing Hukou reform in 20 randomly selected cities and the smalles cities in Table 17. By comparing the impacts of Hukou relaxation among big cities and small cities, we find that both skill-biased and non-restricted policies usually have larger effects on skilled workers in small treated cities compared with large treated cities. However, they also deliver less shocks to the untreated cities since the treated cities are relatively smaller.

There are three important takeaways. 1) The relaxation of Hukou restriction and the reduction in labor mobility cost induces a redistribution of entrepreneurial activities across regions and also a change in the composition of the local entrepreneurs' market and of the labor market. With the redistribution of economic activities, one may well expect an enlarging regional inequality. However, the impact on the total household welfare is less

straightforward: the household welfare in region with reform increases with the reduction in mobility cost, while the welfare in other regions slightly decreases due to the outflow of labor and firms. 2) The effect of reform on total welfare is also positive— thus while the difference between the two regions becomes larger, the total household welfare is enhanced. 3) The positive effect on social welfare is larger with the non-restrictive Hukou reform— the more frictions being eliminated from the market, the more welfare improvement the society as a whole may enjoy.

7 Conclusion

A central question in economics is why productivity varies so much between firms (Syverson, 2011). Most literature has focused on firm's selective sorting. On the one hand, location choices made by individual firms arguably play an essential role in firm growth (Behrens, Duranton, and Robert-Nicoud, 2014; Fajgelbaum et al., 2019; Amornsiripanitch et al., 2021); On the other hand, sorting creates spatial disparities (Gaubert, 2018; Kleinman, 2022). In this paper, we combine firm sorting and labor sorting simultaneously in a simple framework and study the consequence of these two types of sorting under the context of Chinese migration restrictions, the Hukou. We distinguish hukou policies into two different types, non-restrictive Hukou policy relaxation without any restrictions and skill-biased policy.

We have shown that reduction in policy-induced barriers to migration is an important driver of the recent increase in internal migration (labor sorting) as well as the rise of cross-region entrepreneurial activities (firm sorting) in China. Non-restrictive Hukou policy has, on average, increased the number of low-skill labor by 20.5% per year after the policy reform; while skill-biased Hukou reform does not have any statistically significant effect on the number of low-skill migrant labor. While skill-biased Hukou reform only increases the number of high-skill migrant workers by 21.4%.

Furthermore, we find non-restrictive and skill-biased Hukou policies have heterogeneous effects on the flow of entrepreneurs. A skill-biased Hukou reform increases the chance that a firm is established by a migrant entrepreneur by 1.98%, and increases the chance that an entrepreneur chooses to move to the city by 9.26%. While non-restrictive Hukou reform increases the chance that a firm is established by a migrant entrepreneur by 5.50% and increases the chance that an entrepreneur chooses to move to the city by 13.7%.

Overall, according to our quantitative framework which incorporates salient features of the Chinese migration restriction system, we find aggregate output gains but they are unevenly distributed across regions, varying by the strength of agglomeration. The biggest winners are always high-type or younger firms and large cities. In a setting of low agglomeration effect, non-restrictive policy creates gains for both types of firms and decreases wages

for both types of workers, while skill-biased policy spurs high-type firms but hurts low-type firms. This pattern might be applicable to cities of small and medium size. While in a setting of high agglomeration effect, non-restrictive policy creates gains for both types of firms and high-skill workers, but decreases wages for low types of workers. This pattern might be applicable to cities of large size.

If we look at the poorest group of workers, the ability to migrate has contributed to lifting them out of poverty directly through better access to jobs and more productive locations with higher GDP, and indirectly through proximity to other types of workers and better amenities. Thus, spatial labor market integration has been a key driver behind the success of China lifting hundreds of millions of people out of poverty and formation of entrepreneurs.

Importantly, many distortions remain. Moreover, were all cities to abolish the Hukou, at least implementing non-restrictive relaxation, we expect a much large gains and lower degree of regional inequality.

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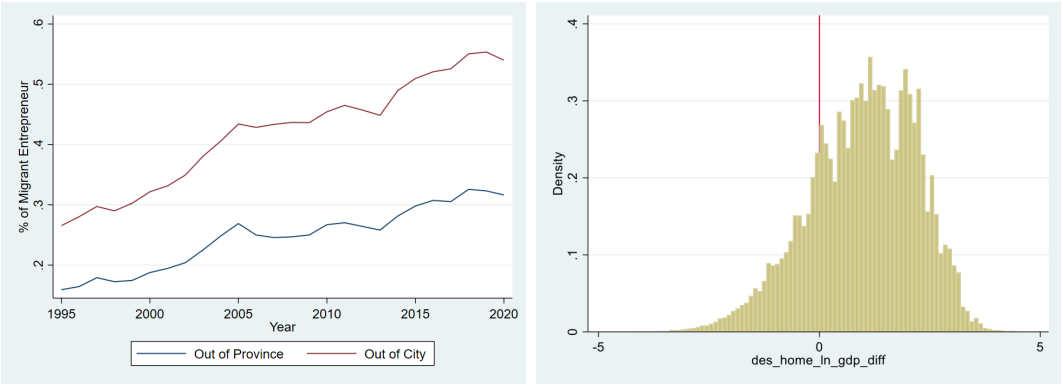
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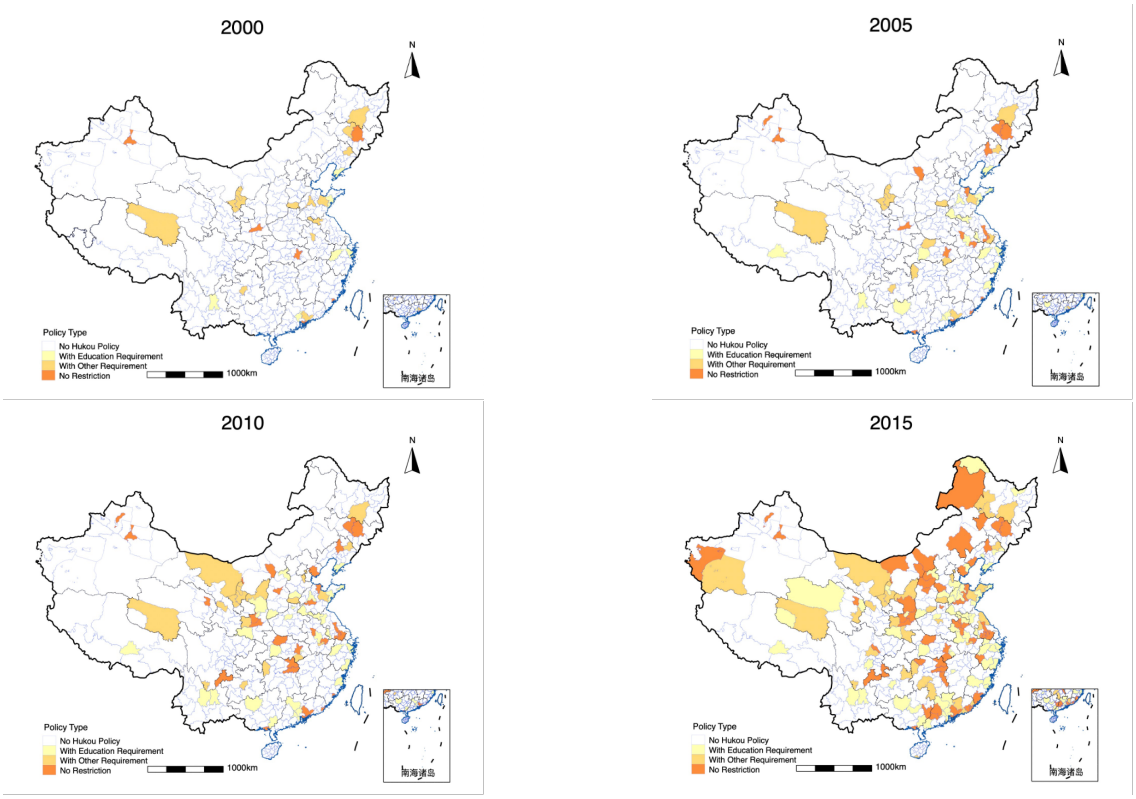
Figure 1: The Rise of the Migrant Entrepreneurs in China



(a) Share of Migrant Entrepreneur (b) Entrepreneur Migration Direction

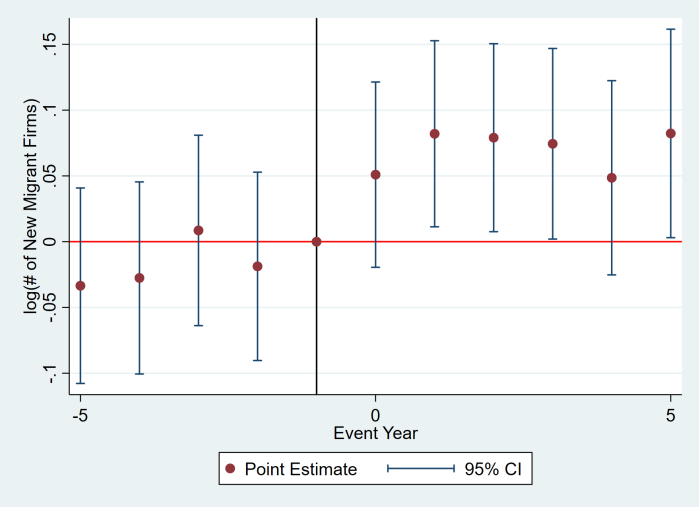
Notes: Figure 1a plots the percentage of migrant entrepreneurs in total entrepreneurs over time. Figure 1b plots the distribution of entrepreneur migration direction— the horizontal axis is the difference between entrepreneur's destination GDP and the entrepreneur's origin GDP, and the vertical axis is the density.

Figure 2: Geographical Distribution of Hukou Reform

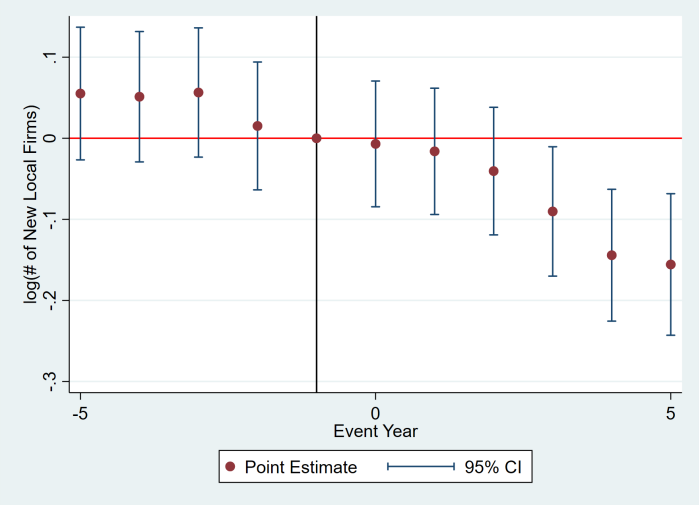


Notes: The figure plots the regional distribution of Hukou reforms over time.

Figure 3: Event Study for the Effect of Hukou Reform



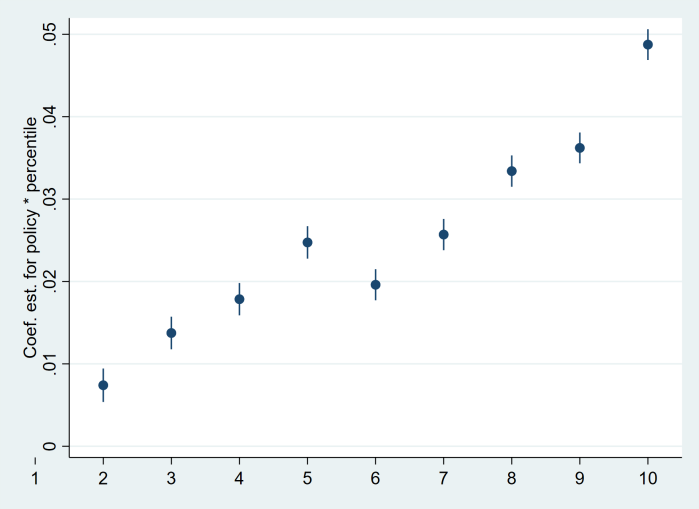
(a) Migrant Entrepreneur



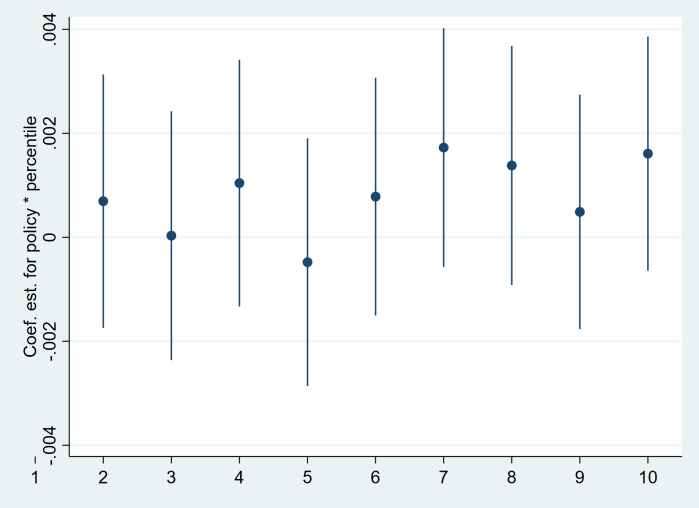
(b) Local Entrepreneur

Notes: The figure plots the event study results estimating Equation (5) for the effect of the Hukou reform on the number of migrant entrepreneurs (panel a), and on the number of local entrepreneurs (panel b).

Figure 4: The Heterogeneous Response to Hukou Reform



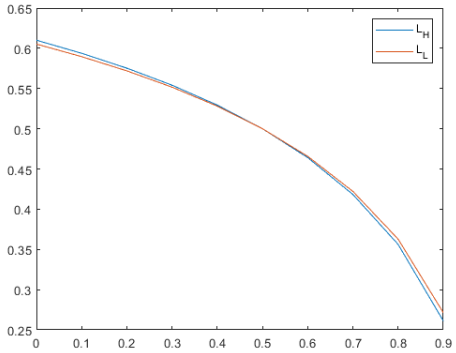
(a) With City, Year FE



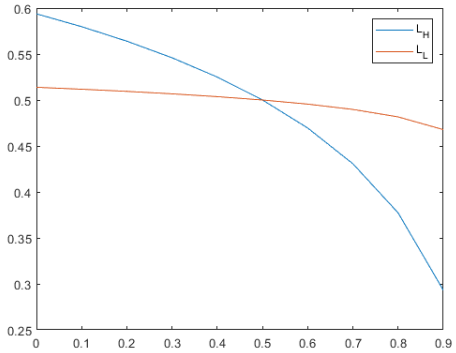
(b) With City, Year, and Entrepreneur FE

Notes: The figure plots the coefficient estimates estimating Equation (3) for the *heterogeneous* effect of the Hukou reform migrant entrepreneurs. We divide firms' performance in terms of the value-added into 10 deciles in each city-year-3 digit industry cell, and interact the treatment variable with the entrepreneurs' previous firms' performance decile. The figure plots the estimated coefficients and the corresponding 95% confidence intervals for each performance decile interacting with the treatment dummy, with the lowest decile being the reference group.

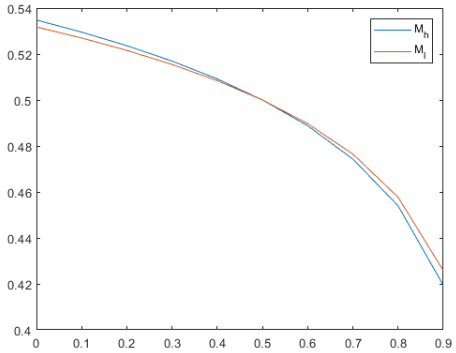
Figure 5: The Effect of Hukou Policy Relaxation (Low Agglomeration)



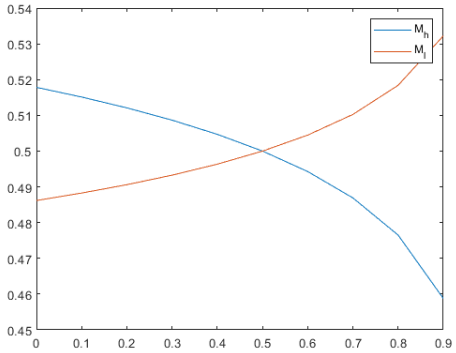
(a) Labor- No restriction



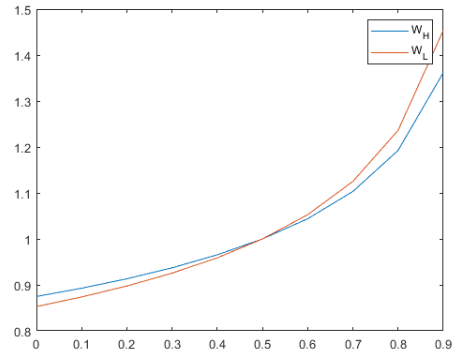
(b) Labor- Skill bias



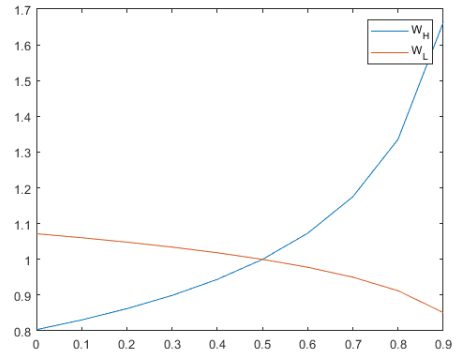
(c) Firm- No restriction



(d) Firm- Skill bias



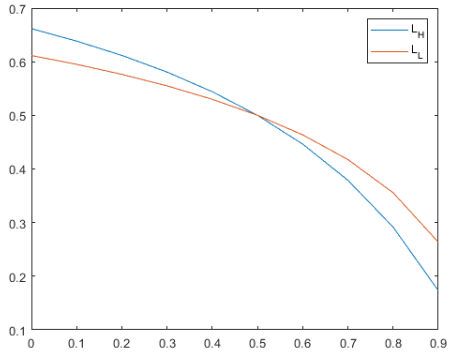
(e) Wage- No restriction



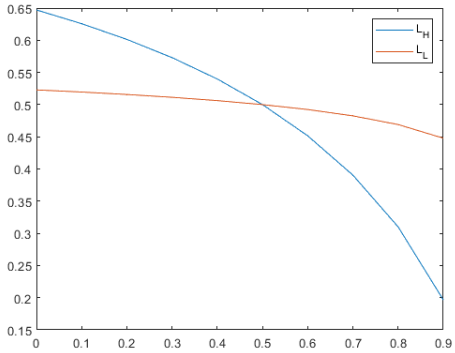
(f) Wage- Skill bias

Notes: The figure plots the model simulation results. The parameter values are specified in Table 16. The left panels plot the results for non-restrictive Hukou restriction relaxations— the scenario where the migration cost of high-skill labor and low skill labor changes at the same time. The right panels plot the results for skill-biased Hukou restriction relaxations— the scenario where the migration cost of high-skill labor changes while that of low skill labor remain unchanged.

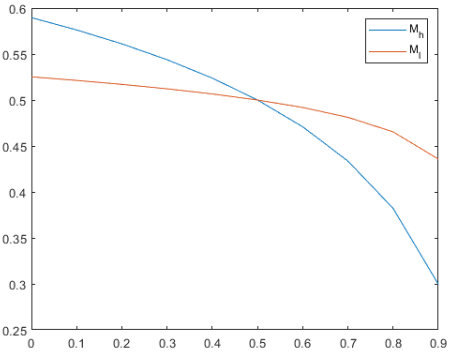
Figure 6: The Effect of Hukou Policy Relaxation (High Agglomeration)



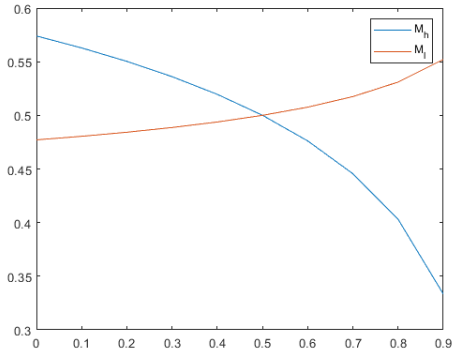
(a) Labor- No restriction



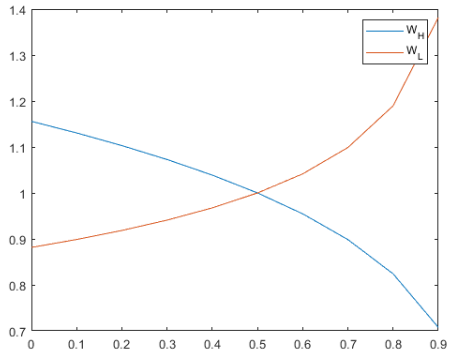
(b) Labor- Skill bias



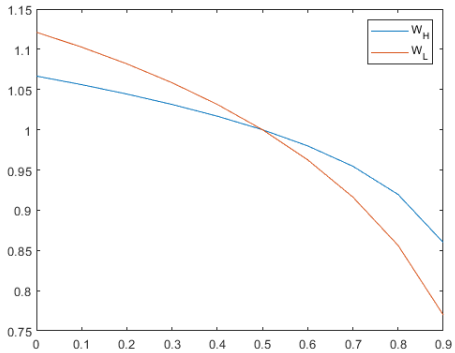
(c) Firm- No restriction



(d) Firm- Skill bias



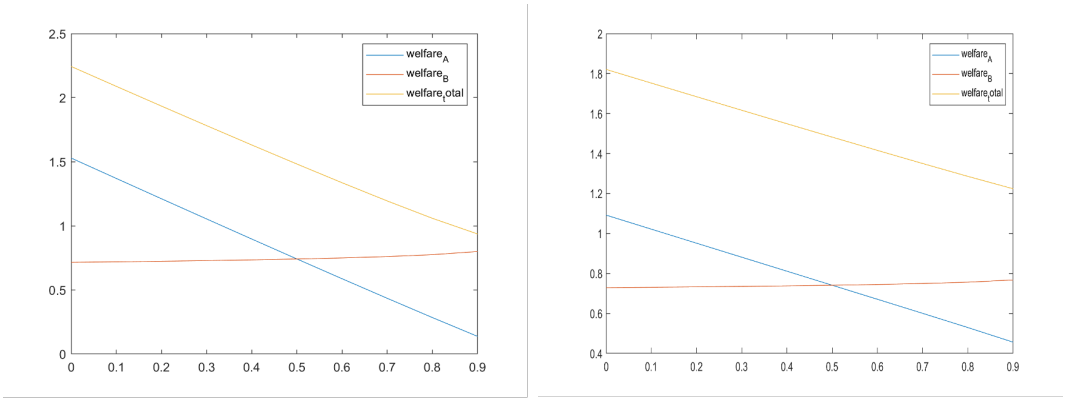
(e) Wage- No restriction



(f) Wage- Skill bias

Notes: The figure plots the model simulation results. The parameter values are specified in Table 16. The left panels plot the results for non-restrictive Hukou restriction relaxations— the scenario where the migration cost of high-skill labor and low skill labor changes at the same time. The right panels plot the results for skill-biased Hukou restriction relaxations— the scenario where the migration cost of high-skill labor changes while that of low skill labor remain unchanged.

Figure 7: The Effect of Hukou Policy Relaxation on Labor Welfare



(a) Welfare- No restriction

(b) Welfare- Skill bias

Notes: The figure plots the model simulation results. The parameter values are specified in Table 16. The left panels plot the results for non-restrictive Hukou restriction relaxations— the scenario where the migration cost of high-skill labor and low skill labor changes at the same time. The right panels plot the results for skill-biased Hukou restriction relaxations— the scenario where the migration cost of high-skill labor changes while that of low skill labor remain unchanged.

Table 1: Effect of Hukou Reform on Entrepreneurship

	(1)	(2)	(3)
Hukou	0.0154		
	(0.0160)		
Hukou_biased		-0.0212	
		(0.0170)	
Hukou_no restriction			0.0616**
			(0.0255)
log(Population)	0.0456**	0.0463**	0.0459**
	(0.0215)	(0.0215)	(0.0214)
log(GDP)	0.102***	0.103***	0.102***
	(0.0139)	(0.0138)	(0.0138)
Constant	5.867***	5.865***	5.864***
	(0.145)	(0.145)	(0.145)
City, Year FE, City Trend	Yes	Yes	Yes
Observations	6,816	6,816	6,816
R-squared	0.981	0.981	0.981

Note: This table reports the results of estimating Equation (1), with the log of the total number of new entrepreneurs in each city-year cell as the dependent variable. The data sample includes all firms established between 1995 and 2019. Standard errors are clustered at the city level. ***, **, and * represent significance at 1%, 5%, and 10%, respectively.

Table 2: Effect of Hukou Reform on Entrepreneurship– Migrant vs. Local

	log(Firm)		log(Entrepreneur)	
	Migrant	Local	Migrant	Local
Hukou	0.0807***	-0.0201	0.0447***	-0.0187
	(0.0185)	(0.0172)	(0.0168)	(0.0177)
log(Population)	-0.00941	0.0343	0.0221	0.0308
	(0.0249)	(0.0231)	(0.0225)	(0.0238)
log(GDP)	0.0969***	0.105***	0.0957***	0.107***
	(0.0161)	(0.0149)	(0.0145)	(0.0154)
Constant	4.199***	5.339***	4.589***	5.207***
	(0.168)	(0.157)	(0.153)	(0.161)
City, Year FE, City Trend	Yes	Yes	Yes	Yes
Observations	6,816	6,816	6,816	6,816
R-squared	0.977	0.983	0.981	0.981

Note: This table reports the results of estimating Equation (1), with the log of the total number of new entrepreneurs or new firms in each city-year cell as the dependent variable. *Hukou* refers to a general Hukou reform— i.e. treatment variable turns on as long as the city has relaxed its Hukou restriction, no matter with any requirement or not. The data sample includes all firms established between 1995 and 2019. Standard errors are clustered at the city level. ***, **, and * represent significance at 1%, 5%, and 10%, respectively.

Table 3: Effect of Hukou Reform on Entrepreneurship– Migrant vs. Local

	log(Firm)		log(Entrepreneur)	
	Migrant	Local	Migrant	Local
Hukou_biased	0.0480**	-0.0459**	0.0162	-0.0448**
	(0.0197)	(0.0183)	(0.0178)	(0.0188)
log(Population)	-0.00974	0.0352	0.0222	0.0317
	(0.0249)	(0.0231)	(0.0225)	(0.0238)
log(GDP)	0.0997***	0.105***	0.0974***	0.107***
	(0.0161)	(0.0149)	(0.0145)	(0.0153)
Constant	4.194***	5.339***	4.586***	5.206***
	(0.169)	(0.157)	(0.153)	(0.161)
City, Year FE, City Trend	Yes	Yes	Yes	Yes
Observations	6,816	6,816	6,816	6,816
R-squared	0.977	0.983	0.981	0.981

Note: This table reports the results of estimating Equation (1), with the log of the total number of new entrepreneurs or new firms in each city-year cell as the dependent variable. Hukou_biased refers to a skill-biased Hukou reform. The data sample includes all firms established between 1995 and 2019. Standard errors are clustered at the city level. ***, **, and * represent significance at 1%, 5%, and 10%, respectively.

Table 4: Effect of Hukou Reform on Entrepreneurship– Migrant vs. Local

	log(Firm)		log(Entrepreneur)	
	Migrant	Local	Migrant	Local
Hukou_no restriction	0.123***	0.0521*	0.0981***	0.0532*
	(0.0296)	(0.0275)	(0.0268)	(0.0283)
log(Population)	-0.00818	0.0342	0.0228	0.0308
	(0.0249)	(0.0231)	(0.0225)	(0.0238)
log(GDP)	0.0991***	0.103***	0.0966***	0.106***
	(0.0160)	(0.0149)	(0.0145)	(0.0153)
Constant	4.188***	5.339***	4.582***	5.206***
	(0.168)	(0.157)	(0.152)	(0.161)
City, Year FE, City Trend	Yes	Yes	Yes	Yes
Observations	6,816	6,816	6,816	6,816
R-squared	0.977	0.983	0.981	0.981

Note: This table reports the results of estimating Equation (1), with the log of the total number of new entrepreneurs or new firms in each city-year cell as the dependent variable. Hukou_no restriction refers to a non-restrictive Hukou reform. The data sample includes all firms established between 1995 and 2019. Standard errors are clustered at the city level. ***, **, and * represent significance at 1%, 5%, and 10%, respectively.

Table 5: Effect of Hukou Reform on Entrepreneur Redistribution

	(1)	(2)	(3)	(4)	(5)	(6)
Hukou	0.0338***			0.0795***		
	(0.000340)			(0.000358)		
Hukou_biased		0.0198***			0.0926***	
		(0.000333)			(0.000344)	
Hukou_no restriction			0.0550***			0.137***
			(0.000400)			(0.000359)
Constant	0.446***	0.437***	0.429***	0.427***	0.424***	0.431***
	(0.000238)	(0.000211)	(0.000159)	(0.000257)	(0.000225)	(0.000154)
City, Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Person FE	No	No	No	Yes	Yes	Yes
Observations	27,899,784	27,899,784	27,899,784	11,587,009	11,587,009	11,587,009
R-squared	0.257	0.257	0.257	0.814	0.814	0.816

Note: This table reports the results of estimating Equation (2), with the dummy variable of the firm being established by a migrant entrepreneur being the dependent variable. The unit of observation is firm. Hukou_biased refers to a skill-biased Hukou reform. Hukou_no restriction refers to a non-restrictive Hukou reform. The data sample includes all firms established between 1995 and 2019. Standard errors are clustered at the city level. ***, **, and * represent significance at 1%, 5%, and 10%, respectively.

Table 6: Effect of Hukou Reform on Entrepreneur Redistribution

	(1)	(2)	(3)	(4)
Hukou	-0.581***	-0.555***	-0.350***	-0.140***
	(0.00183)	(0.00224)	(0.00235)	(0.00281)
Hukou*log(GDP)	0.0819***	0.0776***	0.0532***	0.0228***
	(0.000253)	(0.000302)	(0.000318)	(0.000375)
Hukou_no restriction		0.0174***		-0.204***
		(0.00270)		(0.00313)
Hukou_no restriction*log(GDP)		0.00168***		0.0356***
		(0.000331)		(0.000378)
log(GDP)	-0.0332***	-0.0355***	0.0208***	0.0121***
	(0.000639)	(0.000641)	(0.000326)	(0.000327)
Constant	0.642***	0.655***	0.246***	0.307***
	(0.00500)	(0.00502)	(0.00236)	(0.00237)
City, Year FE	Yes	Yes	Yes	Yes
Person FE	No	No	Yes	Yes
Observations	27,456,853	27,456,853	11,326,829	11,326,829
R-squared	0.259	0.259	0.819	0.820

Note: This table reports the results of estimating Equation (2), with the dummy variable of the firm being established by a migrant entrepreneur being the dependent variable. The unit of observation is firm. Hukou_biased refers to a skill-biased Hukou reform. Hukou_no restriction refers to a non-restrictive Hukou reform. log(GDP) represents the city-year level GDP in the firms' registration city. The data sample includes all firms established between 1995 and 2019. Standard errors are clustered at the city level. ***, **, and * represent significance at 1%, 5%, and 10%, respectively.

Table 7: Effect of Hukou Reform on Entrepreneur Redistribution

	(1)	(2)	(3)	(4)
Hukou	1.119***	0.922***	0.741***	0.616***
	(0.00141)	(0.00167)	(0.00227)	(0.00261)
Hukou*log(home GDP)	-0.155***	-0.131***	-0.0907***	-0.0820***
	(0.000192)	(0.000226)	(0.000306)	(0.000349)
Hukou_no restriction		0.465***		0.424***
		(0.00169)		(0.00280)
Hukou_no restriction*log(home GDP)		-0.0514***		-0.0372***
		(0.000218)		(0.000360)
ln_GDP	-0.0485***	-0.0422***	0.0341***	0.0359***
	(0.000178)	(0.000179)	(0.000840)	(0.000833)
Constant	0.860***	0.796***	0.194***	0.171***
	(0.00129)	(0.00131)	(0.00635)	(0.00629)
City, Year FE	Yes	Yes	Yes	Yes
Person FE	No	No	Yes	Yes
Observations	27,226,186	27,226,186	11,230,443	11,230,443
R-squared	0.331	0.333	0.815	0.819

Note: This table reports the results of estimating Equation (2), with the dummy variable of the firm being established by a migrant entrepreneur being the dependent variable. The unit of observation is firm. Hukou_biased refers to a skill-biased Hukou reform. Hukou_no restriction refers to a non-restrictive Hukou reform. home GDP represents the city-year level GDP in the entrepreneurs home city's GDP in the year of the firm establishment. The data sample includes all firms established between 1995 and 2019. Standard errors are clustered at the city level. ***, **, and * represent significance at 1%, 5%, and 10%, respectively.

Table 8: Effect of Hukou Reform on Entrepreneur Redistribution

	(1)	(2)	(3)	(4)
Hukou	0.125***	0.0910***	0.215***	0.122***
	(0.000763)	(0.000866)	(0.00135)	(0.00151)
Hukou*log(age)	-0.00308***	-0.00245***	-0.00344***	-0.00242***
	(1.72e-05)	(2.00e-05)	(3.30e-05)	(3.69e-05)
Hukou_no restriction		0.104***		0.253***
		(0.000885)		(0.00158)
Hukou_no restriction*log(age)		-0.00128***		-0.00315***
		(2.02e-05)		(3.80e-05)
ln_GDP	-0.00193***	-0.00191***		
	(1.39e-05)	(1.39e-05)		
Constant	0.521***	0.507***	0.427***	0.415***
	(0.000603)	(0.000611)	(0.000257)	(0.000258)
City, Year FE	Yes	Yes	Yes	Yes
Person FE	No	No	Yes	Yes
Observations	27,616,743	27,616,743	11,520,576	11,520,576
R-squared	0.264	0.264	0.814	0.817

Note: This table reports the results of estimating Equation (2), with the dummy variable of the firm being established by a migrant entrepreneur being the dependent variable. The unit of observation is firm. Hukou_biased refers to a skill-biased Hukou reform. Hukou_no restriction refers to a non-restrictive Hukou reform. Age represents the entrepreneurs' age in the year of the firm registration. The data sample includes all firms established between 1995 and 2019. Standard errors are clustered at the city level. ***, **, and * represent significance at 1%, 5%, and 10%, respectively.

Table 9: Effect of Hukou Reform on Internal Labor Mobility

	All		Below College		College and Above	
	(1)	(2)	(3)	(4)	(5)	(6)
Hukou	0.0908***		0.0542*		0.217***	
	(0.0324)		(0.0314)		(0.0416)	
Hukou_No restriction	0.134***	0.150***	0.192***	0.205***	0.0905	0.0915
	(0.0482)	(0.0484)	(0.0468)	(0.0469)	(0.0619)	(0.0620)
Hukou_biased		0.0613*		0.0281		0.214***
		(0.0328)		(0.0318)		(0.0421)
Constant	2.971***	2.979***	2.740***	2.746***	1.405***	1.417***
	(0.00998)	(0.00910)	(0.00968)	(0.00882)	(0.0128)	(0.0117)
City FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
City Trend	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,292	6,292	6,292	6,292	6,292	6,292
R-squared	0.863	0.863	0.863	0.863	0.767	0.767

Note: This table reports the results of estimating Equation (2) with the city-year level number of migrant workers (in log form) as the dependent variable, for the full sample of migrant workers (columns (1)-(2)), and subsample of below-college migrant workers (columns (3)-(4)) and of college and above migrant workers (columns (5)-(6)), resepctively. The data sample includes all cities across 1996-2015. Hukou_biased refers to a skill-biased Hukou reform. Hukou_no restriction refers to a non-restrictive Hukou reform. Standard errors are clustered at the province-by-year-by-industry level. ***, **, and * represent significance at 1%, 5%, and 10%, respectively.

Table 10: Effect of Hukou Reform on Firm Performance

	log(Profit)			log(Revenue)		
	(1)	(2)	(3)	(4)	(5)	(6)
Hukou	0.0599***			0.0463***		
	(0.00665)			(0.00355)		
Hukou_biased		0.123***			0.0387***	
		(0.00616)			(0.00335)	
Hukou_no restriction			0.0326***			0.0396***
			(0.00716)			(0.00389)
log(Asset)	0.394***	0.401***	0.394***	0.403***	0.403***	0.403***
	(0.00165)	(0.00171)	(0.00165)	(0.000702)	(0.000702)	(0.000702)
Constant	2.251***	2.185***	2.280***	5.675***	5.683***	5.693***
	(0.0174)	(0.0179)	(0.0170)	(0.00720)	(0.00708)	(0.00694)
Firm, Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,888,038	1,770,622	1,888,038	3,611,719	3,611,719	3,611,719
R-squared	0.906	0.905	0.906	0.911	0.911	0.911

Note: This table reports the results of estimating Equation (3). The unit of observation is firm-year. Hukou_biased refers to a skill-biased Hukou reform. Hukou_no restriction refers to a non-restrictive Hukou reform. The data sample includes all firms established between 1995 and 2019 in the tax survey data. Standard errors are clustered at the city level. ***, **, and * represent significance at 1%, 5%, and 10%, respectively.

Table 11: Effect of Hukou Reform on Firm Performance

	log(Value-added)			TFP		
	(1)	(2)	(3)	(4)	(5)	(6)
Hukou	0.0626***			0.0537***		
	(0.0102)			(0.00400)		
Hukou_biased		0.142***			0.0564***	
		(0.00970)			(0.00373)	
Hukou_no restriction			0.152***			0.0183***
			(0.0128)			(0.00512)
log(Asset)	0.453***	0.455***	0.453***	0.131***	0.133***	0.131***
	(0.00325)	(0.00335)	(0.00325)	(0.00126)	(0.00131)	(0.00126)
Constant	3.373***	3.326***	3.370***	-1.304***	-1.315***	-1.276***
	(0.0339)	(0.0349)	(0.0336)	(0.0129)	(0.0133)	(0.0127)
Firm, Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,349,744	1,270,997	1,349,744	1,713,071	1,602,045	1,713,071
R-squared	0.754	0.754	0.754	0.753	0.754	0.753

Note: This table reports the results of estimating Equation (3). The unit of observation is firm-year. Hukou_biased refers to a skill-biased Hukou reform. Hukou_no restriction refers to a non-restrictive Hukou reform. The data sample includes all firms established between 1995 and 2019 in the tax survey data. Standard errors are clustered at the city level. ***, **, and * represent significance at 1%, 5%, and 10%, respectively.

Table 12: Effect of Hukou Reform on Firm Performance

	Log(Employment)			Log(Wage)		
	(1)	(2)	(3)	(4)	(5)	(6)
Hukou	0.0235***			-0.00821***		
	(0.00225)			(0.00304)		
Hukou_biased		0.0144***			-0.0204***	
		(0.00214)			(0.00287)	
Hukou_no restriction			0.0331***			0.00186
			(0.00247)			(0.00330)
log(Asset)	0.177***	0.179***	0.177***	-0.107***	-0.109***	-0.108***
	(0.000441)	(0.000461)	(0.000441)	(0.000658)	(0.000690)	(0.000658)
Constant	1.879***	1.872***	1.885***	-2.123***	-2.118***	-2.129***
	(0.00453)	(0.00468)	(0.00437)	(0.00674)	(0.00700)	(0.00653)
Firm, Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,640,700	3,382,582	3,640,700	3,413,090	3,173,428	3,413,090
R-squared	0.926	0.926	0.926	0.642	0.644	0.642

Note: This table reports the results of estimating Equation (3). The unit of observation is firm-year. Hukou_biased refers to a skill-biased Hukou reform. Hukou_no restriction refers to a non-restrictive Hukou reform. The data sample includes all firms established between 1995 and 2019 in the tax survey data. Standard errors are clustered at the city level. ***, **, and * represent significance at 1%, 5%, and 10%, respectively.

Table 13: Effect of Hukou Reform on Firm Performance

	Labor Markdown			Markup		
	(1)	(2)	(3)	(4)	(5)	(6)
Hukou	0.0296**			0.0322***		
	(0.0129)			(0.00551)		
Hukou_biased		0.0192			0.0185***	
		(0.0124)			(0.00531)	
Hukou_no restriction			-0.00834			-0.00227
			(0.0181)			(0.00771)
Constant	-0.618***	-0.588***	-0.596***	2.362***	2.372***	2.383***
	(0.0314)	(0.0310)	(0.0307)	(0.0134)	(0.0132)	(0.0131)
K,L,M	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
City Trend	Yes	Yes	Yes	Yes	Yes	Yes
Observations	359,188	359,188	359,188	359,188	359,188	359,188
R-squared	0.822	0.822	0.822	0.603	0.603	0.603

Note: This table reports the results of estimating Equation (3). The unit of observation is firm-year. Hukou_biased refers to a skill-biased Hukou reform. Hukou_no restriction refers to a non-restrictive Hukou reform. The data sample includes all firms established between 1995 and 2019 in the tax survey data. Standard errors are clustered at the city level. ***, **, and * represent significance at 1%, 5%, and 10%, respectively.

Table 14: Effect of Hukou Reform on Firm Performance

	log(Profit)	log(Value-added)	log(Revenue)	TFP
Hukou_biased	0.00695	-0.0126	-0.0103*	0.0240***
	(0.0118)	(0.0178)	(0.00626)	(0.00691)
Hukou_biased*Skill	0.102***	0.129***	0.107***	0.0618***
	(0.0187)	(0.0285)	(0.00992)	(0.0114)
Hukou_no restriction	0.0289**	0.101***	0.0139**	-0.0223**
	(0.0129)	(0.0230)	(0.00697)	(0.00898)
Hukou_no restriction*Skill	-0.00573	0.0799**	0.0411***	0.0714***
	(0.0202)	(0.0358)	(0.0111)	(0.0145)
log(Asset)	0.394***	0.453***	0.406***	0.131***
	(0.00168)	(0.00329)	(0.000724)	(0.00127)
Constant	2.230***	3.330***	5.627***	-1.313***
	(0.0177)	(0.0344)	(0.00746)	(0.0131)
Firm, Year FE	Yes	Yes	Yes	Yes
Observations	1,832,381	1,318,942	3,503,124	1,678,137
R-squared	0.906	0.754	0.909	0.753

Note: This table reports the results of estimating Equation (4). The unit of observation is firm-year. Hukou_biased refers to a skill-biased Hukou reform. Hukou_no restriction refers to a non-restrictive Hukou reform. Skill intensity is defined at the 3-digit industry level as the percentage of workers in that industry that work in occupations that require a high level of training and preparation, that is, are high-skill workers. The data sample includes all firms established between 1995 and 2019 in the tax survey data. Standard errors are clustered at the city level. ***, **, and * represent significance at 1%, 5%, and 10%, respectively.

Table 15: Effect of Hukou Reform on Firm Performance

	log(Employment)	log(wage)	Labor Markdown	Markup
Hukou_biased	-0.0204***	-0.0175***	-0.0306**	0.0178***
	(0.00392)	(0.00530)	(0.0128)	(0.00547)
Hukou_biased*Skill	0.0803***	0.0196**	0.0982***	0.00596
	(0.00620)	(0.00841)	(0.0269)	(0.0115)
Hukou_no restriction	0.00162	-0.00142	-0.0155	-0.00612
	(0.00436)	(0.00584)	(0.0189)	(0.00805)
Hukou_no restriction*Skill	0.0546***	0.00968	0.0536	0.0288*
	(0.00691)	(0.00926)	(0.0408)	(0.0174)
log(Asset)	0.176***	-0.107***	-0.137***	0.172***
	(0.000448)	(0.000669)	(0.000622)	(0.000559)
Constant	1.874***	-2.127***	-0.597***	2.383***
	(0.00463)	(0.00687)	(0.0307)	(0.0131)
Firm, Year FE	Yes	Yes	Yes	Yes
Observations	3,530,728	3,315,349	359,188	359,188
R-squared	0.927	0.642	0.822	0.603

Note: This table reports the results of estimating Equation (4). The unit of observation is firm-year. Hukou_biased refers to a skill-biased Hukou reform. Hukou_no restriction refers to a non-restrictive Hukou reform. Skill intensity is defined at the 3-digit industry level as the percentage of workers in that industry that work in occupations that require a high level of training and preparation, that is, are high-skill workers. The data sample includes all firms established between 1995 and 2019 in the tax survey data. Standard errors are clustered at the city level. ***, **, and * represent significance at 1%, 5%, and 10%, respectively.

Table 16: Parameters Estimated and Used for Simulation

Parameter	Detail	Value
ξ	Workers' mobility elasticity on wage	1.4 (estimated from 2010 census)
τ	Worker's type- and destination- specific mobility cost	See Figure A2 for estimates
ϵ	Workers' employer preference dispersion	Set to be 5 from (Fajgelbaum et al., 2019)
ε	Firms' mobility elasticity on cost	0.5 (estimated from firm registration data)
α	Firms' production technology parameter	See Figure A3 for estimates
σ	Firms' market power	Set to be 5 from (Fajgelbaum et al., 2019)
ρ	Agglomeration effect	Set to be 0.2 from (Gaubert, 2018)

Note: The table reports the estimated or calibrated parameter values from the structural model used in the simulation practice.

Table 17: Counterfactual Experiments for Further Migration Liberalization

	Biased			Unrestrictive		
	Overall	Relaxed	Unrelaxed	Overall	Relaxed	Unrelaxed
Panel A: Random 1 City						
Total Welfare	0.80%	35.49%	-0.49%	2.63%	98.91%	-0.94%
Welfare (High Skill)	4.92%	89.04%	-0.77%	5.79%	108.40%	-0.11%
Welfare (Low Skill)	-0.40%	5.02%	-0.36%	2.25%	93.51%	-0.09%
Wage (High Skill)	0.74%	-9.35%	0.77%	0.75%	-0.09%	0.77%
Wage (Low Skill)	-0.37%	4.62%	-0.39%	-0.09%	-0.75%	-0.02%
Labor (High Skill)	-	4.27%	-1.53%	-	4.29%	-0.87%
Labor (Low Skill)	-	0.38%	-0.03%	-	2.51%	-0.07%
Firm (High Skill)	-	4.78%	-1.60%	-	4.21%	-1.49%
Firm (Low Skill)	-	-3.91%	1.05%	-	1.95%	-0.48%
Panel B: Random 20 Cities						
Total Welfare	1.50%	14.64%	-0.75%	10.17%	100.96%	-1.50%
Welfare (High Skill)	15.09%	95.24%	-0.98%	16.17%	104.47%	-1.52%
Welfare (Low Skill)	-0.40%	2.33%	-0.73%	9.58%	100.42%	-1.50%
Wage (High Skill)	0.91%	-4.86%	1.27%	0.91%	-1.87%	1.08%
Wage (Low Skill)	-0.47%	2.93%	-0.69%	-0.36%	-2.40%	0.23%
Labor (High Skill)	-	2.61%	-2.22%	-	4.18%	-2.57%
Labor (Low Skill)	-	0.58%	-0.04%	-	2.67%	-1.73%
Firm (High Skill)	-	2.70%	-2.37%	-	3.99%	-1.25%
Firm (Low Skill)	-	-2.13%	1.82%	-	2.08%	-0.88%
Panel C: Largest 20 Cities						
Total Welfare	2.56%	17.06%	-2.52%	19.30%	108.88%	-4.27%
Welfare (High Skill)	29.02%	98.23%	-3.06%	31.61%	109.79%	-4.61%
Welfare (Low Skill)	-1.17%	4.12%	-2.47%	18.07%	108.73%	-4.24%
Wage (High Skill)	1.04%	-7.02%	4.56%	3.66%	-3.73%	4.12%
Wage (Low Skill)	-1.89%	3.89%	-2.25%	-0.77%	-0.84%	-0.77%
Labor (High Skill)	-	6.60%	-4.29%	-	8.96%	-8.38%
Labor (Low Skill)	-	0.22%	-0.13%	-	5.25%	-3.50%
Firm (High Skill)	-	6.65%	-5.53%	-	6.98%	-5.30%
Firm (Low Skill)	-	-5.21%	4.30%	-	6.17%	-5.09%
Panel D: Smallest 20 Cities						
Total Welfare	0.10%	17.50%	-0.08%	0.24%	108.48%	-0.28%
Welfare (High Skill)	0.33%	110.10%	-0.19%	0.30%	123.91%	-0.29%
Welfare (Low Skill)	-0.20%	8.44%	-0.06%	0.23%	106.97%	-0.28%
Wage (High Skill)	-0.77%	-12.13%	-0.06%	-0.57%	-7.41%	-0.14%
Wage (Low Skill)	0.47%	9.09%	-0.07%	-0.30%	-2.82%	-0.14%
Labor (High Skill)	-	19.55%	-0.13%	-	20.91%	-0.15%
Labor (Low Skill)	-	-0.60%	0.01%	-	6.49%	-0.14%
Firm (High Skill)	-	18.76%	-0.15%	-	19.58%	-0.16%
Firm (Low Skill)	-	-15.03%	0.02%	-	13.24%	-0.13%

Appendix A: Supplementary Tables and Figures

Figure A1: Calibrated Skill-Specific Wage Distribution

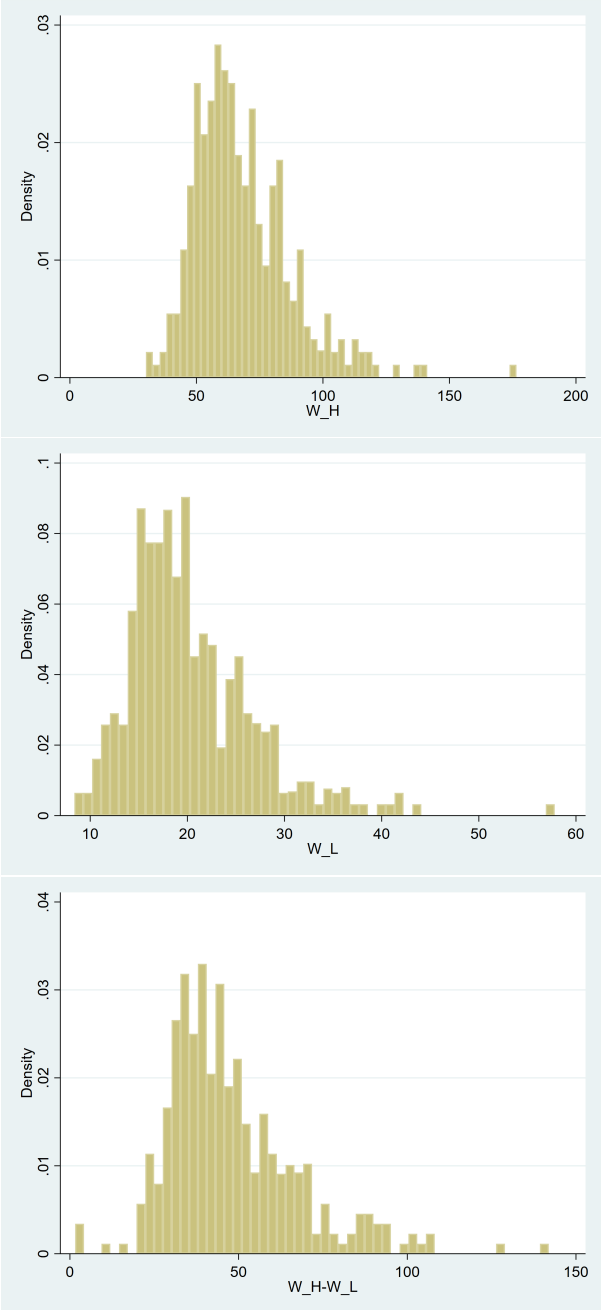


Figure A2: Calibrated Skill-Specific Migration Cost Distribution

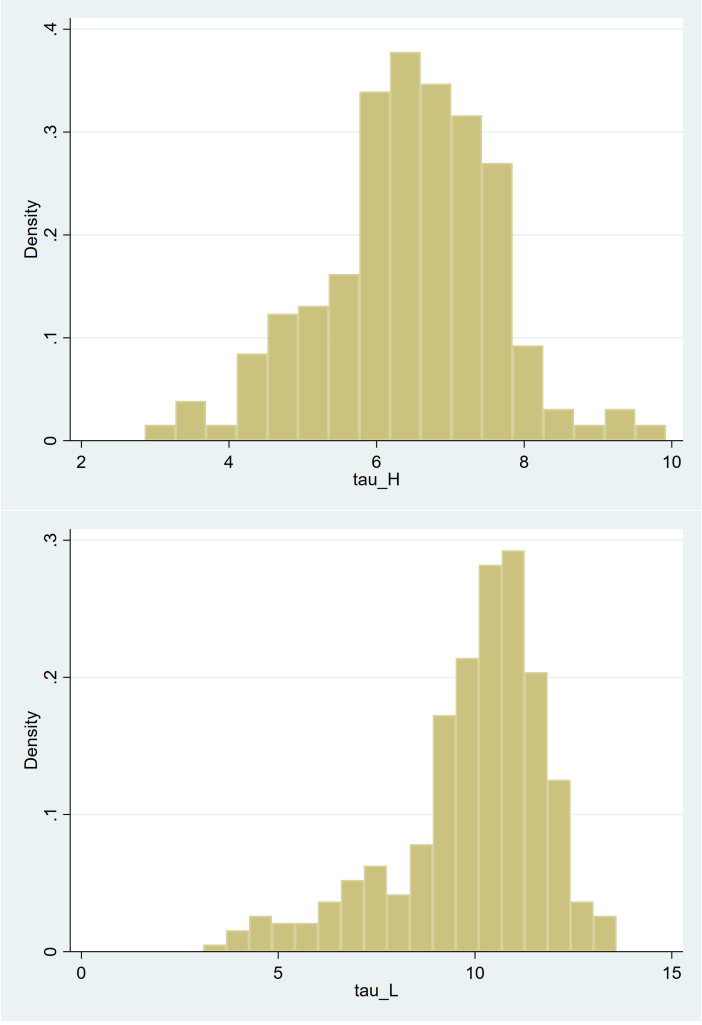


Figure A3: Calibrated Production Technology High-skill Labor Share Distribution

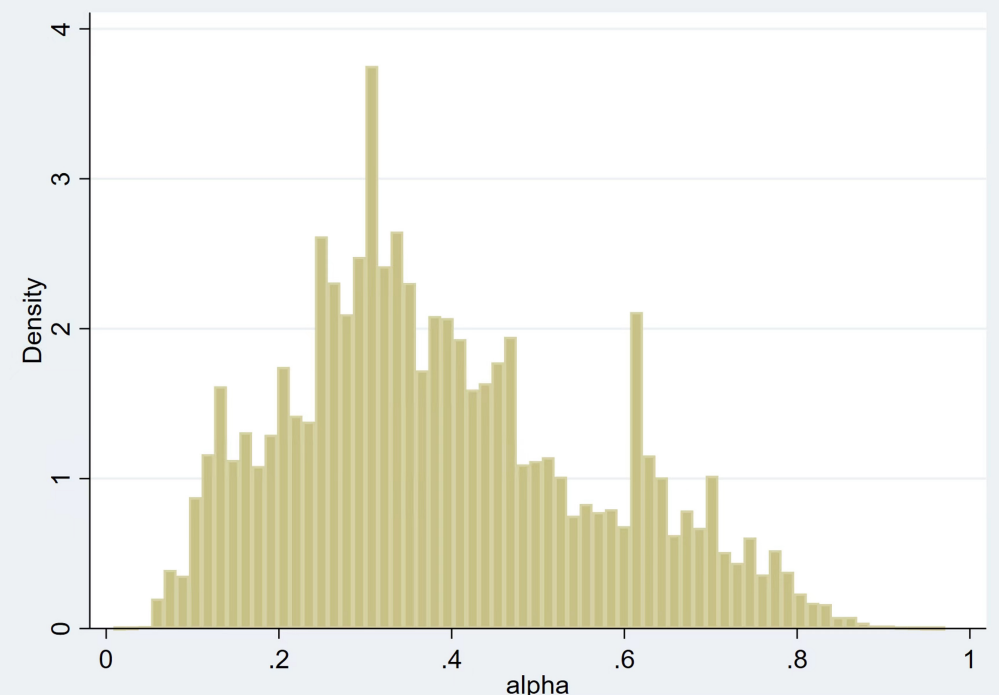


Table A1: Migrant Entrepreneur Performance Premium

	log(Revenue)	log(Employment)	log(Profit)	TFP	log(R&D)	log(Wage)
Migrant	0.100***	0.00645***	0.0204***	0.0916***	0.0619***	-0.0128***
	(0.00495)	(0.00159)	(0.00402)	(0.00221)	(0.00312)	(0.00114)
Constant	7.037***	3.064***	4.993***	-0.0827***	0.426***	-2.970***
	(0.00249)	(0.000871)	(0.00218)	(0.00114)	(0.00166)	(0.000620)
C, I, Y, H FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,144,462	2,858,838	1,549,195	1,452,648	1,528,346	2,693,550
R-squared	0.242	0.393	0.329	0.134	0.184	0.237

Note: This table reports the results comparing the performance of migrant entrepreneurs versus that of local entrepreneurs. The data sample includes all firms established between 1995 and 2019. The unit of observation is firm-year. Standard errors are clustered at the city level. ***, **, and * represent significance at 1%, 5%, and 10%, respectively.

Table A2: Effect of Hukou Reform on Entrepreneur Redistribution

	(1)	(2)	(3)	(4)
Hukou	0.199***	-0.0269***	0.130***	0.0788***
	(0.00301)	(0.00356)	(0.00375)	(0.00434)
Hukou*log(l.GDP)	-0.0303***	-0.00361***	-0.0107***	-0.0111***
	(0.000385)	(0.000451)	(0.000469)	(0.000542)
Hukou_no restriction		0.486***		0.230***
		(0.00376)		(0.00449)
Hukou_no restriction*log(l.GDP)		-0.0535***		-0.0132***
		(0.000443)		(0.000532)
ln_GDP	0.0726***	0.0746***	6.36e-05	0.00832***
	(0.000339)	(0.000339)	(0.000438)	(0.000439)
Constant	-0.0593***	-0.0837***	0.494***	0.419***
	(0.00266)	(0.00269)	(0.00352)	(0.00353)
City, Year FE	Yes	Yes	Yes	Yes
Person FE	No	No	Yes	Yes
Observations	7,132,888	7,132,888	3,814,290	3,814,290
R-squared	0.213	0.215	0.789	0.792

Note: This table reports the results of estimating Equation (2), with the dummy variable of the firm being established by a migrant entrepreneur being the dependent variable. The unit of observation is firm. Hukou_biased refers to a skill-biased Hukou reform. Hukou_no restriction refers to a non-restrictive Hukou reform. l.GDP represents the city-year level GDP in the entrepreneur's previous firm's city in the year of the firm establishment. The data sample includes all firms established between 1995 and 2019. Standard errors are clustered at the city level. ***, **, and * represent significance at 1%, 5%, and 10%, respectively.

Table A3: The Income Elasticity of Migration in China

	OLS	IV
log(Destination real income)	0.125***	0.157***
	(0.009)	(0.022)
Origin-dest. city FE	Yes	Yes
Cohort FE	Yes	Yes
Skill FE	Yes	Yes
Observations	133958	133958
R2	0.473	0.452

Table A4: The Labor Cost Elasticity of Firm Location Choice in China

	OLS	IV
log(Labor cost)	-0.193***	-0.363***
	(0.069)	(0.098)
City FE	Yes	Yes
Industry FE	Yes	Yes
Observations	35020	35020
R2	0.739	0.711