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Provincial valuations of human capital in urban China, inter-provincial inequality and the implicit value of a Guangdong *hukou*

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Abstract

This paper assesses regional inequality in urban China. It predicts earnings for each worker in multiple provinces, compares provinces of residence and maximum predicted earnings, and estimates predicted relocation gains. It presents a reference comparison for the U.S. in 1940. Only 7.4% of U.S. workers predicted maximum earnings outside their home divisions that exceeded predicted home division earnings by more than 20%. In contrast, in 1988, 1995, 2002, 2008 and 2013, respectively, 45%, 54%, 74%, 57% and 42% of urban Chinese workers predicted maximum earnings outside their home provinces that exceeded predicted home province earnings by more than 50%. These potential gains were equivalent to those that would have been associated with at least seven years of additional schooling. If workers had received maximum predicted earnings, average earnings would have been greater by between 42% and 83% and interpersonal inequality would have been less in all but 2013. If they had received maximum predicted earnings in their home provinces, inter-provincial inequality would have vanished. Predicted earnings were generally greatest in Guangdong, most strikingly in the earliest years.

J.E.L. codes: J24, J31, J61, O15, P25, R12, R23

Keywords: Regional inequality, human capital, law of one price, equality of opportunity

Regional inequality in China is a subject of substantial scholarly and policy interest. Almost all of that interest is directed at comparisons of average income measures across provinces and regions. The extent to which these comparisons offer insight into the regional components, if any, of differences in individual welfare is unknown.

This paper attempts to estimate these differences. It constructs measures of the extent to which welfare could vary depending upon the province of residence for urban Chinese workers. These measures are based on estimates of potential earnings in multiple provinces. As workers reside in only one province, these estimates require the construction of counter-factual comparisons.

The counter-factual comparisons here are based on simple province-specific regressions of observed labor earnings on measures of human capital. These regressions predict earnings in every province for all workers, regardless of the province in which they actually reside. These predictions identify the province in which each worker would maximize predicted labor earnings.

The difference between predicted earnings in this province and the province of residence measures the earnings gains that might be available through increased economic mobility. If these potential gains are small, they may plausibly be attributed to personal preferences for characteristics of the residence location other than earnings. If they are large, they may suggest meaningful inequality in attainable welfare across provinces. Any such inequality would presumably be attributable to non-market impediments to inter-provincial flows of labor, and perhaps of other factors and final goods.

The 1988, 1995, 2002, 2008 and 2013 urban surveys of the China Income Project (CHIP) provide the data for these analyses. The first of these surveys took place when China was at a less-developed stage, early in economic reform. The most recent took place when China was a middle-income country, after 25 years of rapid growth. The evolution of potential gains from economic mobility over time should illuminate the relationship between macroeconomic growth and inter-regional integration in China.

An additional counter-factual addresses the question of whether the pattern of potential mobility gains in China is distinctive. The United States has arguably had greater inter-regional integration than has China. However, China in the years under examination differs from the contemporary U.S. in income levels as well as, perhaps, inter-regional integration. The U.S. in 1940, the earliest year in which its Census recorded individual income, was at a more comparable level of economic development. The same analysis of predicted income in multiple regions, applied to the urban U.S. in 1940, provides an external reference.

Section 1 of this paper summarizes the current understanding of inter-provincial inequality in China. Section 2 summarizes the literatures that are most closely related to the work here. Section 3 specifies methodology and discusses the complex conceptual issues associated with inter-regional price variations.

Section 4 establishes an informal baseline by analyzing predicted earnings across divisions in the U.S. in 1940. Section 5 compares the province of residence and province of maximum predicted earnings for China in 1988. It explores the implications of this comparison for actual and counter-factual individual and inter-provincial inequality. Section 6 summarizes the same analyses for 1995, 2002, 2008 and 2013. Section 7 considers the evolution of these comparisons across time and differing samples. Section 8 summarizes the contributions of this work, discusses their implications for the understanding of internal migration and the urban system in China, and concludes.

1. Previous analyses of regional inequality in China

The extent of economic and political coherence is a central theme in the study of China (Goodman and Segal, 1995; Naughton and Yang, 2004). Two subsidiary economic themes are prominent. The first assesses the degree of economic integration by comparing flows and prices of goods and non-labor factors to the standards that would prevail if China's internal markets were unified. The literature investigating this theme, broadly characterized as addressing the Law of One Price, is inconclusive regarding the extent of other market barriers (Zax and He, forthcoming).

The second subsidiary theme pursues a parallel inquiry. In essence, it compares average prices of labor across provinces. In practice, papers in this theme more often compare levels of development, or incomes per capita, than wages or earnings. In addition, they tend to explain differences across provinces as dependent on geography and regional development policy rather than market imperfections.

The analysis here contributes to the literature that addresses the first theme by exploring the extent to which labor compensation in China adheres to the Law of One Price. However, it derives its inspiration from the literature on this second theme. It expands this literature by examining variations in earnings and comparing them to the variations that might be expected in a relatively integrated market.

The literature addressing inter-regional inequality is already voluminous. The bulk of existing papers yield a rough chronological consensus. There appears to have been no discernible change in inter-provincial inequality between 1952 and the mid-1960s. There may have been an increase in the middle of this period, during the Great Leap Forward, but data from that era are untrustworthy (Lyons, 1991; Tsui, 1991; Chen and Fleisher, 1996; Jian, Sachs and Warner, 1996; Kanbur and Zhang, 2005).

Inter-provincial inequality appears to have increased during the Cultural Revolution, from the mid-1960s through the mid-1970s (Lyons, 1991; Tsui, 1991; Chen and Fleisher, 1996; Jian, Sachs and Warner, 1996; Kanbur and Zhang, 2005). It declined into either the early 1980s (Lyons, 1991; Tsui, 1991 and 1996; Chen and Fleisher, 1996; Jian, Sachs and Warner, 1996; Demurger, 2001; Kanbur and Zhang, 2005) or to approximately 1990 (Cai, Wang and Du, 2002; Lu and Wang, 2002; Fan and Sun, 2008; Lu, 2008). It subsequently increased (Lyons, 1991; Jian, Sachs and Warner, 1996; Tsui, 1996; Kanbur and Zhang, 1999; Demurger, 2001; Demurger, et al., 2002; Lu and Wang 2002; Pedroni and Yao, 2006) to as recently as 2000 (Kanbur and Zhang, 2005) and perhaps to 2005 (Lu, 2008; Lau, 2010). However, Fan and Sun (2008) detect a decline in 2005 and 2006.[1]

The apparent increase in interprovincial inequality since at least 1990 appears to be largely spurious. During most of this period, most official Chinese sub-national per capita statistics were based on registered population, those with *hukou* in the relevant jurisdiction, rather than resident population (Chan and Wang, 2008; Li and Gibson, 2013; Jin et al., 2014). These two counts were relatively similar in 1990 because migration was minimal (Chan and Wang, 2008, 31). However, it increased dramatically thereafter. By 2010, residents without *hukou* constituted approximately 39% of Shanghai's population. Approximately 20% of Guizhou's registered population lived elsewhere (Li and Gibson, 2013, 22).

As would be expected, these differences were correlated with income levels. In-migrants were attracted to high-income areas, which acquired resident populations that were larger than registered populations. Out-migrants came from low-income areas, which were left with resident populations that

[1] According to Andersson, Edgerton and Opper (2013), inequality in labor productivity followed a similar trajectory until 2000, was roughly constant until 2007 and then declined in 2008 and 2009. Tsui (1991) and Lyons (1991) analyze the socialist accounting concepts of per capita Net Material Product and per capita Net Income Utilized. Tsui (1996), Fan and Sun (2008) and Lu (2008) examine per capita GDP. Kanbur and Zhang (1999, 2005) study per capita consumption expenditures. Chen and Fleisher (1996), Jian, Sachs and Warner (1996), Demurger (2001), Cai, Wang and Du (2002), Demurger, et al. (2002), Pedroni and Yao (2006) and Lau (2010) analyze growth in per capita GDP.

were smaller than registered populations. Therefore, official statistics overstated actual per capita incomes in high-income areas and understated them in low-income areas.

Consequently, inter-provincial inequality in income per registered capita differed substantially from inequality in income per resident capita. According to the corrections in Chan and Wang (2008) inequality per resident capita increased slightly from 1990 through 1995 and then returned to nearly its 1995 level by 1999. Tsui (2007), using a different correction, estimates a similar trend over the same period, with perhaps a smaller decline towards the end.

The separate corrections in Chan and Wang (2008) for 2000 through 2006 indicate slightly declining inter-provincial inequality over that period.[2] Li and Gibson (2013, 24) estimate that inequality per resident capita increased slightly between 1990 and 2000. It then declined to 1990 levels by 2010.

These fundamental issues of measurement present a substantial challenge to the literature on regional inequality in China. The commitment to aggregate measurement, generally at the provincial level, presents another. This commitment arises, first, from the macroeconomic tradition of convergence analysis (Baumol, 1986; Barro and Sala-I-Martin, 1991; Magrini, 2004). Second, it derives from the Chinese government's preoccupation with the possibility that regional inequality will threaten social stability. Conceptual problems arise out of both the macroeconomic tradition and the political concern.

In general, the relationships between neo-classical growth theory and its empirical implementations in the study of convergence are problematic (Magrini, 2004). The relevant problem here is the limited characterizations of inter-region heterogeneity that are typical in the convergence literature. As extreme examples, Pedroni and Yao (2006) and Lau (2010) distinguish Chinese provinces solely by their time series of growth rates.

More generally, growth theory provides little guidance regarding the region-specific characteristics that might affect output levels and growth paths. Consequently, most analyses adopt limited and arbitrary collections of explanatory variables. These collections are inconsistent across analyses.

As examples, Tsui (1991) decomposes aggregate inequality into agricultural, industrial and transfer components with some causal intuition, but without statistical inference. Jian, Sachs and Warner

[2] Yao (2009, Figure 14.2) provides similar estimates for this period, although without any discussion of population corrections. It is possible that, by then, the official use of per-resident calculations had become sufficiently common that additional corrections were not essential.

(1996) suggest that average provincial incomes depend on the agricultural share in output and coastal location. Coastal location is also explanatory for Kanbur and Zhang (1999), Yang (1999) and Demurger, et al. (2002). Demurger, et al. (2002) find significant effects of provincial topography and zones with preferential policies. Kanbur and Zhang (2005) assert that inter-provincial differences in average income depend on fiscal decentralization, engagement in trade and the prominence of heavy industry.[3]

Variables such as these probably capture some of the relevant heterogeneity across provinces.[4] However, they are clearly not comprehensive. In particular, they typically omit province-specific measures of human capital accumulation.[5] If, hypothetically, all workers in one province had not completed high school and all workers in another were college graduates, substantial differences in average provincial incomes, and perhaps in growth rates, would be expected rather than exceptional.

Measures of human capital appear as explanatory variables in a minority of the papers in this literature. In Demurger (2001), Jones, Li and Owen (2003) and Lau (2010), they appear as informal extensions of the neoclassical growth model. Chen and Fleisher (1996), Fleisher and Chen (1997), Tsui (2007), Lu (2008) and Fleisher, Li and Zhao (2010) introduce them formally in estimations of provincial-level production functions.[6]

Nevertheless, even these papers are concerned with aggregate-level analysis. This is consistent with the Chinese government's concern regarding inter-regional disparities. According to Ye (1996, 83), Chinese Communist Party [CCP] General Secretary Jiang Zemin asserted that "if the disparities become great and are allowed to expand, serious and many-sided consequences will ensue." Liu (2006, 377) reports that "the People's Congress listed regional inequality as one of the most pressing problems to be

[3] The most comprehensive array of determinants of inter-provincial differences is in Demurger (2001): coastal location, urban character, industrial structure, gross fixed capital formation and foreign direct investment as shares of GDP, population density, density of transportation infrastructure and the share of the population that has completed secondary education.

[4] This literature generally ignores potential simultaneity between dependent variables and contemporaneous regressors.

[5] Combes, Duranton and Gobillon (2008, footnote 2) observe that analyses of regional wage differences largely ignore regional skill differences, regardless of the country under examination.

[6] Fleisher and Chen (1997), estimating determinants of provincial-level variations in TFP, find that returns to education vary dramatically across provinces. Fleisher, Li and Zhao (2010), using similar methodology, find similar results across regions. These results are consistent with those below.

targeted during the Ninth Five-Year Plan (1996–2000)". At the Communist Party Congresses in 2003 and 2007 "[e]conomic inequality [was] a major policy issue on the agenda" (Chan and Wang, 2008, 21).

This concern is commonly acknowledged in the literature examining inter-regional inequality in China (Chen and Fleisher, 1996, 154; Jian, Sachs and Warner, 1996, 2; Tsui, 1996, 354; Fleisher and Chen, 1997, 221; Kanbur and Zhang, 2005, 101; Tsui, 2007, 60; Fan and Sun, 2008, 1; Andersson, Edgerton and Opper, 2013, 239). According to Shaoguang and Hu (1999, 201), the concern is well-motivated: "For a regime whose claim to legitimacy has long been based upon egalitarian principles, it is impossible to justify rapid growth in levels of inequality. ... if it persists in failing to distribute the gains from reforms more or less evenly, and if the gap between those who flourish and those who stagnate becomes unacceptably large, the moral foundations of the regime will be shaken." Consequently, "(g)eographic imbalance is a politically divisive issue that can undermine national unity" (Shaoguang and Hu, 1999, 202).

The Chinese government has attempted to address these concerns with policies that have the intent of directing development towards inland provinces. These initiatives began as early as 1993, with the "Decision on Speeding up the Development of Rural Enterprises in Central and Western Regions" issued by the State Council (Liu, 2006, 383). They continued with the "Western Development Program" proclaimed by Jiang Zemin in 1999 (Naughton, 2004, 253; Yao, 2009, 231-2), the "Reviving the Northeast" program of the subsequent decade (Yao, 2009, 232-234) and the "Central Rising" program inaugurated by the Central Committee of the CCP and the State Council in 2006 (Yao, 2009, 234).

These policies are nominally targeted at regions and provinces. Therefore, assessment at the regional and provincial level may appear to be appropriate. However, geographic areas are uncertain proxies for the individuals who are affected by these policies.

2. Individual-specific data, simulation and inter-regional inequality

Conceptually, analysis at the aggregate level alone is unsatisfactory. Ravaillon and Jalan (1999) argue that disaggregate as well as aggregate data are necessary simply to adequately identify geographic externalities.[7] This position is all the more compelling for inquiry regarding welfare, because welfare concerns apply first to individuals rather than to aggregates.[8]

From the perspective of individual welfare, the important question is not whether average incomes vary across regions, but whether individual incomes vary appropriately and consistently with individual characteristics. This question cannot, a priori, be answered affirmatively in China because of the limitations on inter- and even intra-provincial mobility imposed by its *hukou* system of residential registration (Chan, 2009).

This paper addresses this question in order to further explore the sources of variations in average earnings across provinces. It attempts to measure inequality across provinces in the potential earnings of individual urban Chinese workers. For this purpose, it engages two additional themes in the literature that analyzes the Chinese economy: measurements of inter-provincial differences in individual returns to human capital and regression-based simulations for the purpose of constructing counterfactuals.

A small literature has examined inter-provincial differences in individual returns to education. Liu (1998) and Li (2003) study these differences in single cross-sections. Liu (1998), using the 1988 CHIP urban survey, estimates much higher returns to education for younger workers, but slightly lower returns to education for older workers in Guangdong in comparison to workers in the aggregate of the other nine provinces in that survey. Li (2003), using the 1995 CHIP urban survey, estimates higher returns to education in Gansu than in Guangdong.

Zhang, et al. (2005) estimate province- and year-specific returns to education in Beijing, Guangdong, Liaoning, Shaanxi, Sichuan and Zhejiang, using the annual National Bureau of Statistic (NBS) urban household surveys from 1988 through 2001. These returns increased over time in all provinces, were initially lower in richer provinces but converged across provinces by 2001.

Whalley and Xing (2014) has the most in common with this paper. They estimate province-

[7] "To have any hope of identifying geographic externalities in a growth process, both household panel data and geographic data are called for. Allowing for latent household heterogeneity will protect against spurious geographic effects that arise solely because geographic variables proxy for omitted nongeographic, but spatially correlated, household characteristics." (Ravaillon and Jalan, 1999,302).

[8] "The individualistic roots of the economic literature on the measurement of inequality run very deep. ... groupings of individuals have significance only in so far as individual outcomes are aggregated across the group, and group patterns have significance only as part of the overall picture of inequality across persons." (Kanbur, 2006, 369).

specific returns to education in the 1995, 2002 and 2007 CHIP urban surveys.[9] They conclude that returns increased across surveys. Most of that increase was attributable to increases in the return to tertiary education. Most importantly, returns varied widely across provinces in all three years, with that variation increasing over time.[10] This suggests, as the following sections will demonstrate, that potential earnings for individual Chinese urban workers varied substantially across provinces in these years.

A smaller literature uses simulations to create counter-factual predictions. Zhang, Zhang and Zhang (2015) use provincial-level data to estimate the effects of differences in population age structure on economic growth. They then use these estimated effects to simulate provincial growth with homogeneous age structures. The comparison between this counterfactual and the historical experience implies that differences across provinces in population age composition were responsible for approximately 13% of the inter-provincial Gini coefficient for provincial output per capita.

In the work that is closest in spirit to that here, Demurger, et al. (2009), Xing and Zhang (2013) and Xing (2014) use micro-data to simulate counter-factual earnings. Demurger, et al. (2009) create counter-factual earnings estimates in order to identify the sources of differences in urban migrant and non-migrant average earnings. Xing and Zhang (2013) predict the earnings of migrants in all potential destination cities for the purpose of estimating migrant preferences for city size. Xing (2014) predicts the earnings distributions that would have prevailed among temporary and permanent migrants to urban areas had they remained in their rural homes, for the purpose of examining selection into migration.

3. Methodology

The intent of this paper is to estimate and compare the potential value of each urban worker's human capital in each province. These estimates are based on province-specific human capital-style regressions that estimate the determinants of earnings in the 1988, 1995, 2002, 2008 and 2013 urban CHIP surveys[11],

[9] Gustaffson, et al. (2008) examine the CHIP surveys of 1988, 1995 and 2002. However, they include rural households, and present measures of intra-national inequality at only the regional level.

[10] The contradiction between these results and those in Zhang, et al (2005) may be partially attributable to different geographies, but four of their six provinces are also in Whalley and Xing (2014).

[11] These data are available at http://www.ciidbnu.org/chip/index.asp?lang=EN, last accessed on 23 May 2016.

and, for informal comparison, in the 1940 United States Integrated Public Use Microdata Sample (IPUMS).[12] These regressions take the simple form

$$y_{ji} = \beta_{j0} + \sum_{s=1}^{S} \beta_{js} x_{jis} + \varepsilon_{ji}, \quad \textbf{(1)}$$

where *j* indexes province, *i* indexes individuals within province, *s* indexes individual characteristics and *S* represents the number of those characteristics. The definition of earnings, y_{ji} differs across surveys because of differences in urban Chinese compensation practices over the years. The explanatory variables x_{jis} include sex, education, age and age squared.[13] The idiosyncratic component of earnings is ε_{ij}.

The dependent variable in equation 1 is the level of earnings rather than the more conventional natural log. The conventional specification estimates returns to investments in human capital. However, factor mobility and trade in goods are the mechanisms that determine national, inter-provincial and intra-provincial inequality. These mechanisms should equalize compensation for given levels of human capital, rather than returns to investments necessary to create those levels. The same is true for trade in final goods (Jones and Neary, 1984, 15-6). Therefore, the interest here is in earnings rather than in its natural log, and in the contribution that differences in human capital characteristics make to differences in earnings.[14]

Predicted earnings in the province of residence are

$$\hat{y}_{jji} = \hat{\beta}_{j0} + \sum_{s=1}^{S} \hat{\beta}_{js} x_{jis}, \quad \textbf{(2)}$$

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[12] These data are available at https://usa.ipums.org/usa/, last accessed on 16 December 2015.

[13] Liu (1998), Li (2003) and Whalley and Xing (2014) include indicators for employer industry and ownership type in their specifications. In analyses of regional disparities in other countries, Combes, Duranton and Gobillon (2008), Ehrl (2014) and Gibbons, Overman and Pelkonen (2014) use industry, occupation controls or both. The specification here omits them because workers simultaneously choose industry, employer and earnings (Angrist and Pischke, 2015, 214-7). Therefore, these variables are arguably endogenous. Liu (1998), Li (2003), Zhang, et al. (2005) and Whalley and Xing (2014) use imputed experience, calculated as age minus six years, rather than age. Their specification and that of equation 1 are econometrically equivalent because imputed experience is a linear transformation of age. The purpose of either variable is to serve as a proxy for unobserved work experience (Angrist and Pischke, 2015, 217). Estimated coefficients on either may be biased (Garvey and Reimers, 1980; Light and Ureta, 1995; Regan and Oaxaca, 2009). However, the predictions that are relevant here should not be. Liu (1998), Combes, Duranton and Gobillon (2008), Ehrl (2014) and Gibbons, Overman and Pelkonen (2014) include regional indicators in their specifications. Li (2003) and Zhang, et al. (2005) include provincial indicators in theirs. These are superseded here by province-specific regressions.

[14] In Lu (2008) marginal labor productivity and per capita income are very highly correlated across provinces.

where carets (^) represent estimates, the first subscript on ŷ represents the province of residence and the second represents the province within which earnings are predicted. Average predicted earnings in the province of residence are, therefore,

$$\bar{\hat{y}}_{jj} = \frac{\sum_{i=1}^{n_j} \hat{y}_{jji}}{n_j} = \bar{y}_j, \tag{3}$$

where n_j is the number of workers in province j. The properties of OLS regression guarantee that average predicted earnings in the province of residence equal average observed earnings in that province.

Correspondingly, when province of residence is j, predicted earnings in province k are

$$\hat{y}_{jki} = \hat{\beta}_{k0} + \sum_{s=1}^{S} \hat{\beta}_{ks} x_{jis}.$$

This calculation combines the characteristics of workers in province j, x_{jis}, with the estimated values of those characteristics in province k, $\hat{\beta}_{ks}$.[15] Maximum predicted earnings across provinces j, k and l are

$$\hat{y}_{jm_i i} = \max\left(\hat{y}_{jji}, \hat{y}_{jki}, \hat{y}_{jli}\right) \tag{4}$$

where $m_i \in (j,k,l)$ indicates the province of maximum predicted earnings for worker i resident in province j.

This comparison relies on predicted rather than actual earnings in the home province for two reasons. Mechanically, actual earnings incorporate random components, ε_{ji}, that cannot be predicted for earnings in other provinces k and l. Economically, these idiosyncratic components can be taken as representing transitory earnings. From this perspective, $\hat{y}_{jji}$, $\hat{y}_{jki}$ and $\hat{y}_{jli}$ each predict permanent earnings in provinces j, k and l, respectively. The comparison among them captures the considerations relevant to locational decisions because transitory earnings should average to approximately zero over the time

[15] The empirical objective here is more straightforward than those in Xing and Zhang (2013) and Xing (2014). Consequently, the estimation procedure here is less sophisticated. Xing and Zhang (2013) observe migrants in their destination locations. Their intent is to reconstruct the array of predicted earnings that these migrants considered when they made their relocation choice. This requires corrections for selection into destinations. Here, the intent is to identify the relationship between earnings and worker characteristics that characterizes each province. For that purpose, the observed working population of each province is appropriate. The counterfactuals in Xing (2014) compare residents of rural areas to migrants to urban areas. This requires an adjustment to account for differences in the demographic characteristics of the two groups. The counterfactuals here do not require adjustments for population differences because they compare multiple predictions for the same samples.

horizon associated with these decisions, regardless of location.

The difference across all workers resident in a province between average maximum predicted earnings across all provinces and average predicted earnings in the province of residence is of primary interest. The average of maximum predicted earnings for all workers resident in province *j* is

$$\bar{\hat{y}}_{jm} = \frac{\sum_{i=1}^{n_j} \hat{y}_{jm_i i}}{n_j}. \tag{5}$$

This difference, from equations 2, 3 and 5, is therefore

$$\bar{\hat{y}}_{jm} - \bar{\hat{y}}_{jj} = \frac{\sum_{i=1}^{n_j} \left[\beta_{m_i 0} + \sum_{s=1}^{S} \beta_{m_i s} x_{jis} \right]}{n_j} - \left[\beta_{j0} + \sum_{i=1}^{S} \beta_{js} \bar{x}_{js} \right]. \tag{6}$$

If all workers in province *j* achieve their maximum predicted earnings in the same alternative province *k*, then $m_i=k$ for all *i* and this difference simplifies to

$$\bar{\hat{y}}_{jm} - \bar{\hat{y}}_{jj} = \beta_{k0} - \beta_{j0} + \sum_{s=1}^{S} \left(\beta_{ks} - \beta_{js} \right) \bar{x}_{js}.$$

This is the Oaxaca-Blinder calculation of the contribution of differences in treatments to differences in means. In general, equation 6 will not simplify in this way because maximum predicted earnings will not occur in the same province for all workers.

Three additional quantities are also of interest. The second represents inequality across workers within province in predicted earnings within that province, $\hat{y}_{jji}$, measured by the Gini coefficient. The third represents inequality across workers within province in predicted maximum earnings in any province, $\hat{y}_{jm_i i}$, again measured by the Gini coefficient. The fourth quantity of interest is the inequality across provinces of average maximum predicted earnings, $\bar{\bar{y}}_{jm}$, $\bar{\bar{y}}_{km}$, and $\bar{\bar{y}}_{lm}$.[16]

[16] These quantities address the same questions as those of Gibbons, Overman and Pelkonen (2014, 747). However, their analysis relies on region-specific explanatory variables in pooled regressions for individual incomes. The analysis here is based on region-specific regressions that provide region-specific valuations of individual characteristics. These questions are also in the spirit of the literature on inequality of opportunity (Ferreira and Peragine, 2015; Roemer and Trannoy, 2015; Ramos and Van de gaer, forthcoming). However, that literature typically compares opportunities for different individuals in the same locations (as examples, World Bank, 2005; de Barros, et al., 2009; Carpantier and Sapata, 2013). These comparisons are problematic because they require difficult distinctions between individual

This analysis does not adjust these quantities for provincial costs-of-living. Conventional cost-of-living measures clearly vary across provinces (Brandt and Holz, 2006; Gong and Meng, 2008; Almås and Johnsen, 2012).[17] However, the implications of this variation for welfare comparisons are unclear.

In principle, the objective is to compare utilities that a worker might experience in different provinces. This comparison is not trivial because, as in the motivation for this paper, estimated earnings may vary across provinces. Moreover, prices for consumption goods may also differ. If they do, then inferences regarding differences in unobserved estimated utility based on differences in observed estimated earnings may not be straightforward.

Formally, the appropriate comparison is between $V(\hat{y}_{jji},P_j)$ and $V(\hat{y}_{jki},P_k)$, where V is the indirect utility function and P_j is the price vector prevailing in province *j*. If $P_j \neq P_k$, the relationship between the observed difference $\hat{y}_{jji}-\hat{y}_{jki}$ and the unobserved difference $V(\hat{y}_{jji},P_j)-V(\hat{y}_{jki},P_k)$ is uncertain.

Cost-of-living adjustments estimate real earnings, $\hat{y}_{jji}^r=F(\hat{y}_{jji},P_j)$ and $\hat{y}_{jki}^r=F(\hat{y}_{jki},P_k)$, where F is a function of predicted earnings and price vectors. The intent is that estimated real earnings, at some reference vector of consumption good prices P^*, should yield the same utility as estimated earnings at prevailing consumption good prices: $V(\hat{y}_{jji}^r,P^*)=V(\hat{y}_{jji},P_j)$ and $V(\hat{y}_{jki}^r,P^*)=V(\hat{y}_{jki},P_k)$.

If this intent is realized, the comparison between utilities with estimated earnings and prevailing prices, $V(\hat{y}_{jji},P_j)$ and $V(\hat{y}_{jki},P_k)$, would be the same as that between utilities with estimated real earnings and reference prices, $V(\hat{y}_{jji}^r,P^*)$ and $V(\hat{y}_{jki}^r,P^*)$: $V(\hat{y}_{jji}^r,P^*)-V(\hat{y}_{jki}^r,P^*)=V(\hat{y}_{jji},P_j)-V(\hat{y}_{jki},P_k)$. The comparison between $\hat{y}_{jji}^r$ and $\hat{y}_{jki}^r$ would then at least reproduce the ordinal comparison between $V(\hat{y}_{jji}^r,P^*)$ and $V(\hat{y}_{jki}^r,P^*)$, $\mathrm{sgn}[\hat{y}_{jji}^r-\hat{y}_{jki}^r]=\mathrm{sgn}[V(\hat{y}_{jji}^r,P^*)-V(\hat{y}_{jki}^r,P^*)]$, because prices are constant and indirect utility increases monotonically with earnings. Therefore, this comparison would also reproduce the ordinal comparison between estimated utilities: $\mathrm{sgn}[\hat{y}_{jji}^r-\hat{y}_{jki}^r]=\mathrm{sgn}[V(\hat{y}_{jji},P_j)-V(\hat{y}_{jki},P_k)]$.

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characteristics that are, arguably, potentially compensable endowments and those that are, again arguably, presumably non-compensable consequences of individual choice (Roemer, 2008; Kanbur and Wagstaff, 2014). These problems are not relevant here because this analysis compares predicted opportunities in multiple provinces for the same individual. In this case, the relevant "endowment" is simply the province of residence. This endowment is endogenous only within the strict migration limitations embodied in the *hukou* system.

[17] Brandt and Holz (2006) estimate that 1990 provincial costs-of-living in urban China varied between 93% and 110% of the national urban cost-of-living, with the exception of values more than 30% above the national average in Hainan and Guangdong. Overall dispersion was similar in 2000, with both lower minimum and maximum values.

In the simplest, unrestricted inter-regional model, this comparison is trivial. All goods would be freely mobile across regions. Therefore, goods prices would equate in equilibrium: $P_j=P_k=P$. With constant prices, estimated earnings themselves would reproduce the ordinal comparison between utilities: $sgn[\hat{y}_{jji}-\hat{y}_{jki}]=sgn[V(\hat{y}_{jji},P)-V(\hat{y}_{jki},P)]=sgn[V(\hat{y}_{jji},P_j)-V(\hat{y}_{jki},P_k)]$. Estimated real earnings would provide no additional information.

Moreover, factors would also be mobile. In production markets, this would equate labor earnings across regions, $\hat{y}_{jji}=\hat{y}_{jki}=\hat{y}_{ji}$. In consumption markets, it would equate utility, $V(\hat{y}_{jji},P_j)=V(\hat{y}_{ji},P)=V(\hat{y}_{jki},P_k)$.

The Hecksher-Ohlin-Samuelson (HOS) model of international trade restricts this model by prohibiting inter-regional factor mobility. However, trade in final goods still ensures that $P_j=P_k$. As a consequence, the Factor Price Equalization theorem again requires that, in equilibrium, $\hat{y}_{jji}=\hat{y}_{jki}$ (Samuelson, 1948; Ethier, 1984; Jones and Neary, 1984). Once again, $V(\hat{y}_{jji},P_j)=V(\hat{y}_{jki},P_k)$ and estimated real earnings are not informative. This implies, for example, that the immobility of land as a factor of production does not change the inter-regional equilibrium or the irrelevance of cost-of-living adjustments.

The Roback (1982) model of inter-regional equilibrium imposes different restrictions on the basic model. In it, land is immobile, and may be both a factor of production and one of two final goods. Nevertheless, if unpriced amenities are absent, this model again predicts equalization of wages and prices across regions.[18] In this, as in the unrestricted and HOS models, $P_j=P_k$, $\hat{y}_{jji}=\hat{y}_{jki}$ and $V(\hat{y}_{jji},P_j)=V(\hat{y}_{jki},P_k)$. Estimated real earnings reveal nothing that is not already known.

The Roback (1982) model implies that unpriced amenities must be present and differ across regions in order to yield meaningful contemporaneous inter-regional differences in prices. However, while this requirement is empirically relevant, its empirical implications are unclear.

They are unambiguous only if neither land nor unpriced amenities are factors of production. In this case, interregional differences in amenities capitalize entirely in rents (Roback, 1982, equation 4).[19] Equilibrium in the spatial distribution of production ensures that estimated earnings are equal, $\hat{y}_{jji}=\hat{y}_{jki}$.

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[18] In the absence of amenities, equilibrium conditions for workers and firms both depend on only wages and land rent. Consequently, a unique solution for the two prevails in both regions.

[19] Moretti (2011, 1255) asserts that "(i)n its simplest form, and the one that is most commonly used in the literature (Roback, 1982, Section I), the Rosen–Roback key insight is that any local shock to the demand or supply of labor in a city is, in equilibrium, *fully* capitalized in the price of land." (emphasis in original).

Labor mobility ensures that utility equilibrates across regions, $V_{jji}=V_{jki}$. Therefore, if amenities A_j contribute positively to utility and $A_j>A_k$, $P_j>P_k$ is necessary to ensure that $V(\hat{y}_{jji},P_j:A_j)=V(\hat{y}_{jki},P_k:A_k)$.[20]

In practice, estimated real earnings functions $F(\hat{y}_{jji},P_j)$ are increasing in $\hat{y}_{jji}$ and decreasing in P_j.[21] Consequently, in this equilibrium, $\hat{y}_{jji}=\hat{y}_{jki}$ and $P_j>P_k$ imply that $\hat{y}_{jji}^r=F(\hat{y}_{jji},P_j)<\hat{y}_{jki}^r=F(\hat{y}_{jki},P_k)$. Here, the calculation of estimated real earnings would be worse than uninformative. It would incorrectly imply that utility would be lower in the amenity-rich region.[22]

In this case, differences in prices do not impose differences in utility. To the contrary, they are necessary to achieve the equilibrium in which utilities equate across regions. Moreover, the ordinal comparison between "nominal" earnings exactly reproduces that between utilities. Any form of "deflation", based on equilibrium price differences, would erroneously suggest that utilities were different.

If land is a factor of production, Roback (1982, equation 4) predicts that amenities will capitalize in both rents and wages. This implies that wages deflated by land rents may still differ across regions, even though utility must be constant. However, the bias in deflated wages is indeterminate. Wages increase with amenities if amenities reduce utility and production costs. They decline with amenities if amenities increase utility and production costs. If the effects of amenities on utility and production costs are in opposite directions, their effects on wages are ambiguous.[23]

In sum, the Roback (1982) model demonstrates that, in many circumstances, differences in "nominal" wages are more accurate indicators of differences in utility than would be differences in "real" wages based on conventional price indices. In circumstances where "deflation" might be appropriate, the correct deflator is indeterminate.

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[20] Chauvin, et al. (2016, 3) make the same assertion intuitively.

[21] These properties are apparent in the typical real earnings function, $F(\hat{y}_{jji},P_j)=\hat{y}_{jji}/wP_j$, where w is a vector of fixed weights.

[22] More generally, Moretti (2013, 66) asserts that "(s)ince local amenities differ significantly across cities, changes in real wages do not necessarily equal changes in well-being."

[23] The model in Moretti (2013, Appendix A, equation 18) also predicts that consumption amenities capitalize in wages as well as rents. It yields explicit expressions and unambiguous signs for the amounts of capitalization. However, these expressions do not suggest practicable deflation formulas. They depend on a specific, linear indirect utility function and on unmeasured preferences for location that are independent of measured location characteristics.

More elaborate models do not resolve this indeterminacy.[24] As an example, Albouy (2009, equations 5 and 6) distinguishes between amenities in consumption, production of the traded good and production of the non-traded good. Consequently, wage differences across regions depend on the unmeasured levels of all three, and the indeterminate signs of their effects.

Overall, available models of inter-regional wage determination suggest that amenity differences can capitalize in wages as well as rents. However, with labor mobility or perhaps with only mobility of other factors and goods, all capitalization should serve to equilibrate rather than differentiate utility across regions. Even if the only effect of amenity differences is to convey a productivity advantage in one region, migration should eliminate utility differences by increasing the prices of non-traded goods in that region.[25] Therefore, there is no useful guidance as to whether or how wages should be adjusted so as to account for this capitalization.[26]

Perhaps for this reason, Moretti (2011, 1249) concludes that "(w)hen thinking about localization of economic activity, nominal wages are more important than income because they are related to labor productivity. Since labor, capital and goods can move freely within a country, it is difficult for an economy in a long run equilibrium to maintain significant spatial differences in nominal labor costs in the absence of equally large productivity differences." Similarly, Baum-Snow and Pavan (2012, 91) assert that "wages unadjusted for cost of living differences across locations are most informative about workers' marginal productivities".[27]

Consequently, the following sections analyze nominal incomes without cost-of-living

[24] Models that examine inter-regional variation in prices typically assume that utility is equilibrated across regions (Albouy, 2009; Black, Kolesnikova and Taylor, 2009; Davis and Ortalo-Magne, 2011; and Baum-Snow and Pavan, 2012). In Suedekum (2006), this assumption applies to manufacturing workers only. In these models, as in Roback (1982), inter-regional price variation does not cause inter-regional variations in utility. Instead, it is necessary to equilibrate utility across regions.

[25] There is also, presumably, a corner solution in which all workers relocate to the favored region.

[26] Baum-Snow and Pavan (2012) derive a deflator from the assumption that utility is equalized across regions. However, they ignore unpriced, non-traded goods such as amenities. Consequently, they treat price differences as requiring compensation rather than as requirements for utility equalization.

[27] In a related analysis, Combes and Gobillon conclude (2015, 254-5) "As far as the effect of agglomeration economies on productivity only is concerned, the nominal wage constitutes the relevant dependent variable".

adjustments.[28] Differences in costs-of-living will therefore be among the potential explanations for any observed differences in nominal incomes. The composition of differences in nominal incomes may help assess the relative importance of the various explanations.

4. Earnings and regional inequality in the U.S., 1940

The analysis of inter-provincial inequality in China is motivated, in part, by concern that it may be exacerbated by impediments to goods and factor mobility across provinces. From this perspective, a comparable analysis in a context presumably less afflicted with impediments may be a useful standard of reference.

This section presents this analysis for the United States in 1940. By that time, commerce in the U.S. had been governed for approximately 150 years by Article 1, Section 8, Clause 3 of its Constitution. This clause assigns to Congress the right "(t)o regulate commerce with foreign nations, and among the several states". This right has generally been interpreted as to restrict or prohibit state laws from interfering with interstate commerce.[29] In addition, Clause 1 states that "all Duties, Imposts and Excises shall be uniform throughout the United States". This suggests that inter-regional factor and good flows in the U.S. might have been relatively free of obstructions.

Unfortunately, the comparison between the urban U.S. in 1940 and urban China in recent years is

[28] The literature has no consensus regarding the appropriate treatment of inter-regional price differences. In research on China, Liu (1998), Demurger (2001), Demurger, et al. (2002), Cai, Wang and Du (2002), Li (2003), Jones, Li and Owen (2003), Andersson, Edgerton and Opper (2013), Li and Gibson (2013) and Xing and Zhang (2013) do not discuss the issue. The same is true for the analysis of Britain in Gibbons, Overman and Pelkonen (2014). Multi-year analyses of China in Yang (1999, 307), Fan and Sun (2008, 6), Zhang, et al. (2015, 176) deflate nominal values for intertemporal variation, but do not discuss cross-sectional variation. The analysis of France in Combes, Duranton and Gobillon (2008, 725) adopts the same approach, as does that of the U.S. in Barro and Sala-I-Martin (1991,114 footnote 12). However, the latter would adjust for contemporaneous inter-regional price differentials if adequate local deflators were available. The multi-year analyses of China in Tsui (1991, 5), Chen and Fleisher (1996, 146), Jian, Sachs and Warner (1996, 5), Fleisher and Chen (1997, 234), Kanbur and Zhang (1999, 689), Kanbur and Zhang (2005, 102), Pedroni and Yao (2006, 297), Tsui (2007, 71), Chan and Wang (2008, 26), Gustaffson, et al. (2008, 41), Lu (2008, 39), Lau (2010, 295), Whalley and Xing (2014, 402) and Xing (2014, 550) adjust for time-series price variation with province-specific price indices, which may also adjust for contemporaneous inter-province price variation. The analyses of China in Tsui (1996), Zhang, et al. (2005) and Yao (2009) mention price adjustments, but with insufficient detail to determine the treatment of inter-provincial price differences. In the literature regarding China, only Fleisher, Li and Zhao (2010, 222) explicitly adjust for inter-temporal and inter-provincial differences in costs of living. Ehrl (2014, 7) does the same for Germany, but concludes that these adjustments do not affect his results.

[29] "Despite criticism from some corners, dormant Commerce Clause doctrine limits on state protectionism have a longstanding basis in constitutional law and continue to be widely understood as essential to American understandings of federalism." (Klass and Rossi, 2015, 155).

not entirely satisfactory, because the former was already more developed than was the latter. Per capita annual earnings in the urban U.S. sample analyzed here was $18,678 in 2013 dollars. Per capita annual earnings in the 2013 Chinese survey analyzed in section 6 below was $7,002 in 2013 dollars according to official exchange rates and $11,537 in 2013 dollars adjusted for purchasing power parity. In 1988, these same values were $951 and $1,345.[30]

The analysis here cannot be applied to U.S. experiences at stages of development that are more comparable to that of contemporary China because the U.S. Census did not record individual incomes prior to 1940. Consequently, comparisons between the results of this section and of the following two must acknowledge differences in levels of development as well as in institutional structure.

The sample analyzed here consists of all white urban residents aged greater than 14 with at least 30 weeks of work in the previous year and at least 20 hours of work in the previous week. The dependent variable is annual wage and salary income. The sample excludes individuals with annual incomes below $200 because of the risk that either they were not fully engaged in the labor market or that their incomes were misreported. It also excludes those with topcoded incomes. The explanatory variables are sex, imputed years of education[31], age and age squared.

Table 1 presents illustrative estimates of equation 1 for each of the nine Census divisions. All coefficient estimates are statistically significant. In all divisions, women's monthly earnings were lower than men's by roughly $50, or approximately 40% of the $125 monthly earnings average in this sample. Monthly earnings increased by approximately $8 with each year of education. Earnings increased at a declining rate with age, with maximum predicted earnings occurring between 52 and 57 years of age.

These regressions are very similar. With the exception of the Pacific division, R^2 values were all between .30 and .34. The minimum absolute value for any coefficient was no less than approximately

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[30] The samples analyzed here yield average nominal incomes in current currency units. Deflators implicit in the Bureau of Economic Analysis reports of nominal and real U.S. GDP convert dollar quantities into 2013 dollars (http://www.bea.gov/national/index.htm#gdp). The World Bank's World Development Indicators provide official exchange rates and estimates of purchasing price parity conversions for private consumption. Purchasing price parity conversions begin in 1990. The calculation in the text employs the value for that year to convert 1988 urban Chinese incomes into dollars.

[31] The imputation assigns three years of schooling to "nursery school to grade 4", seven years to "Grade 5, 6, 7, or 8", nine years to "Grade 9", 10 years to "Grade 10", 11 years to "Grade 11", 12 years to "Grade 12", 13 years to "1 year of college", 14 years to "2 years of college", 15 years to "3 years of college", 16 years to "4 years of college" and 18 years to "5+ years of college".

Table 1

Monthly earnings regressions by U.S. Census division, 1940

	Division								
Explanatory variables	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	East North Central	Mountain	Pacific
Intercept	**-98.4**	**-145.3**	**-139.1**	**-133.2**	**-130.5**	**-118.0**	**-151.0**	**-124.2**	**-140.1**
Female	**-44.2**	**-46.2**	**-53.7**	**-50.9**	**-43.8**	**-48.2**	**-51.2**	**-54.5**	**-49.7**
Years of school	**7.5**	**8.1**	**7.8**	**7.9**	**8.2**	**7.5**	**8.4**	**7.2**	**7.9**
Age	**6.6**	**9.2**	**9.0**	**7.9**	**7.6**	**7.2**	**8.6**	**8.0**	**9.0**
(Age/10) squared	**-5.8**	**-8.8**	**-8.5**	**-7.2**	**-6.8**	**-6.3**	**-8.0**	**-7.4**	**-8.6**
Observations	13,507	50,394	43,599	13,940	12,526	5,777	9,308	3,610	14,778
R-square	0.3175	0.3006	0.3151	0.3241	0.3368	0.3018	0.3163	0.3035	0.2713
Adjusted R-square	0.3173	0.3006	0.3150	0.3239	0.3366	0.3014	0.3160	0.3027	0.2711
F-statistic	**1570.5**	**5414.6**	**5013.5**	**1670.4**	**1589.6**	**623.9**	**1076.0**	**392.7**	**1375.3**
p-value	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
Age of maximum age contribution	56.5	52.7	52.8	54.8	56.5	56.5	53.2	54.3	52.3

Note: Estimates in bold are significant with p-values of less than .0001.

two-thirds of the maximum value. In all divisions, six or seven additional years of schooling were required to compensate for the female earnings reduction.

These comparisons suggest that the predicted incomes associated with combinations of individual characteristics may also have been similar across Census divisions. In order to maximize the accuracy of these predictions, the remainder of this section relies on regressions employing a more elaborate specification of equation 1. This specification replaces the continuous variable in education with complete interactions between the dummy variable for sex and the educational categories presented in footnote 31. It replaces the variables for age and age squared with interactions between these two variables and the dummy variable for sex. This specification attains higher explanatory power for each of the divisions, but retains the essential similarity of results across divisions.[32]

Table 2 compares maximum predicted earnings from equation 4 to predicted earnings in the home division for each worker from equation 2. It demonstrates, first that many workers were located “optimally”, at least with respect to earnings. Almost one quarter of all workers achieved their maximum predicted earnings in their home division.

This table also confirms that predicted incomes were similar across divisions. Among the 76.6% of workers who predicted maximum earnings in divisions other than that of their residence, nine-tenths predicted gains of no more than 20% compared to predicted earnings in the home division. “Losses” of these magnitudes may plausibly have been too small to motivate relocations, given the many considerations other than income that determine residential location (Kanbur, 2006, 371).

Only 7.4% of the sample predicted earnings in divisions other than the home division that exceeded predicted earnings in the home division by more than 20%. Some or even many of these individuals may have been in locational disequilibrium. However, they were not sufficiently numerous to dispel the general impression that worker characteristics were generally rewarded similarly in all parts of the United States of 1940. This suggests that the equilibrating mechanisms of mobility in labor, other

[32] The F-test that compares this expanded model to that of table 1 yields a value of 26.85 with 189 and 167,205 degrees of freedom, significant at better than .01%. These regressions and their counterparts in subsequent sections are available from the author.

Table 2

Potential gains from moving to another U.S. Census Division, 1940

Gains as % of predicted earnings in home Division	Workers	% of all workers
None - maximum predicted earnings are in home Division	39,258	23.4%
10% or less	79,341	47.4%
10%-20%	36,504	21.8%
20%-30%	8,702	5.2%
>30%	3,634	2.2%
Total	167,439	100.0%

factors of production and final goods were largely functional at that time.[33]

Table 3 demonstrates the implications of these predictions for earnings inequality. As given in the second column, inter-divisional inequality was minimal. Average earnings were very similar across divisions. The minimum, in the East South Central Division, was 82.7% of the maximum in the Pacific. The coefficient of variation for provincial average earnings was very small, at .0631.

Moreover, inter-worker inequality in the country as a whole was similar to inter-worker inequality within each division. In the third column of table 3, division-specific Gini coefficients for actual earnings varied only between .2844 and .3407. The national Gini for actual earnings was in the middle of this range, at .3081. Similarly, the range of Gini coefficients for predicted earnings in the fourth column of table 3 was only between .1681 and .2171. The national Gini coefficient was again in the middle of this

[33] Maximum predicted earnings occurred in just two divisions for 91.6% of the sample. Between 64.9% and 69.3% of workers in each of the divisions predicted their highest earnings in the Middle Atlantic Division. Between 20.5% and 26.2% predicted their highest earnings in the Pacific Division. These results suggest that the comparisons in this section are not attributable to inter-divisional differences in costs-of-living . To the extent that cost-of-living levels were roughly similar within division for workers at all income levels, they would have been captured in the intercepts of table 1. According to that table, the intercepts for the Middle Atlantic and Pacific divisions were negative and larger in magnitude than those for any other Division except the East North Central. Higher predicted earnings in these divisions arose from higher valuations of individual characteristics rather than from higher compensation for division-specific effects. Baum-Snow and Pavan (2012, abstract) find that, more recently in the U.S., "variation in returns to experience and differences in wage intercepts across location type are the most important mechanisms contributing to observed city size wage premia".

Table 3

Actual and predicted inequality, urban U.S., 1940

	Workers in home division				Workers in division of maximum predicted earnings			Workers in home division with maximum predicted earnings	
Home Census Division	Number of workers	Average earnings	Gini coefficient of actual earnings	Gini coefficient of predicted earnings	Number of workers	Average predicted earnings	Gini coefficient of predicted earnings	Average predicted earnings	Gini coefficient of predicted earnings
New England	13,507	114.8	0.2915	0.1931	2,022	90.0	0.2376	127.1	0.1936
Middle Atlantic	50,394	128.0	0.3103	0.1963	112,842	144.6	0.1531	128.8	0.1928
East North Central	43,599	129.4	0.2972	0.1897	8,206	151.3	0.1515	133.5	0.1792
West North Central	13,940	116.5	0.3153	0.2062				134.5	0.1830
South Atlantic	12,526	118.8	0.3224	0.2146	1,185	187.6	0.1165	131.4	0.2012
East South Central	5,777	112.3	0.3222	0.2077	1,119	117.4	0.2306	131.5	0.1883
West South Central	9,308	117.5	0.3407	0.2171				136.2	0.1891
Mountain	3,610	125.0	0.3102	0.1933	1,624	123.7	0.0838	139.9	0.1796
Pacific	14,778	135.8	0.2844	0.1681	40,441	95.5	0.1649	140.1	0.1724
Total	167,439	125.1	0.3081	0.1978	167,439	132.3	0.1873	132.3	0.1873

range, at .1978.[34]

Neither individual worker welfare nor inequality would have changed substantially if workers had been reallocated to their division of maximum predicted earnings. Comparing the second to the sixth column of table 3, average earnings would have increased only from \$125.1 to \$132.3, or by 5.7%. Comparing the fourth to the seventh columns, the Gini coefficient for predicted earnings would have declined only from .1978 to .1873.

Similarly, neither inter- nor intra-divisional inequality would have been substantially affected if workers had been assigned their maximum predicted earnings, but remained in their home division. The eighth column, from equation 5, and the ninth column of table 3 present this counterfactual. The eighth column demonstrates that the distribution of average divisional earnings would have been compressed, but only slightly. The minimum divisional average predicted earnings would have been 90.1% of the maximum and the coefficient of variation for provincial averages of maximum predicted earnings would have been .0343. The ninth column demonstrates that the range of within-division Gini coefficients would also have been compressed but again only slightly, from a minimum of .1724 to a maximum of .2012.[35]

Finally, table 4 analyzes the distributional implications of the differences between predicted earnings in the home division and maximum predicted earnings. At the divisional level, these differences were regressive. Divisions with lower average earnings, in the second column, predicted greater losses in comparison to average maximum predicted earnings in the third column. The correlation between average earnings and average losses was .8205.

However, the distributional consequences at the individual level were negligible. Within six of the

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[34] The variation in predicted earnings must be less than that in actual earnings because the regressions allocate part of the variance in observed earnings to the residual. Inequality in the predicted dependent variable must also be less then that in the actual dependent variable because the residuals are orthogonal to the latter. If the specification of explanatory variables captured all of permanent income, these comparisons would suggest that inequality in permanent income was no more than two-thirds of inequality in observed income. To the extent that this specification is incomplete, these comparisons would set an approximate lower bound on the inequality in permanent income.

[35] Black, Kolesnikova and Taylor (2009) find inter-regional differences in the returns to education in contemporary U.S. and cite earlier literature with similar findings. Gibbons, Overman and Pelkonen (2014) and Ehrl (2014) rely on variance decomposition techniques to examine regional differences in wage inequality in, respectively, Britain and Germany. Both conclude that these differences contribute little to wage inequality. Combes, Duranton and Gobillon (2008) conclude that differences in individual skills are responsible for most observed spatial wage disparities in France.

Table 4

Location costs and predicted earnings, urban U.S., 1940

Home Census Division	Number of workers	Average earnings	Location cost: Predicted earnings in home province minus maximum predicted earnings	Location costs as proportion of average earnings	Correlation, location cost and predicted earnings in home Division
New England	13,507	114.8	-12.3	-10.7%	-0.6445
Middle Atlantic	50,394	128.0	-0.8	-0.6%	0.2538
East North Central	43,599	129.4	-4.1	-3.2%	0.2759
West North Central	13,940	116.5	-18.0	-15.5%	-0.1669
South Atlantic	12,526	118.8	-12.6	-10.6%	-0.0998
East South Central	5,777	112.3	-19.2	-17.1%	-0.2154
West South Central	9,308	117.5	-18.7	-15.9%	0.0324
Mountain	3,610	125.0	-14.9	-11.9%	-0.1146
Pacific	14,778	135.8	-4.3	-3.2%	-0.4416
Total	167,439	125.1	-7.1	-5.7%	0.0830

nine divisions, the distribution of the losses imposed as a consequence of predicting maximum earnings outside the home province was progressive: the correlation between these losses and individual earnings was negative. This counteracted the regressive across-province distribution. For the sample as a whole, the correlation was insubstantial, at .0830.

5. Earnings and regional inequality in China, 1988

In 1988, labor compensation in urban China was comprised of a large array of cash and in-kind payments. Most, if not all, were reported by the 1988 CHIP urban survey. Here, labor "earnings" consists of the sum of regular wage; "floating wage"; contract income; bonuses and above-quota wages; all subsidies including those for housing, heating, water and electricity, books and newspapers; "other wages"; "other cash income received from work unit" including bath and haircut subsidies, transportation subsidies, single-child subsidies, bonuses for birth control, and a variety of other productivity-related subsidies; "hardship allowances"; monetized value of meals in the work unit's dining room and baths in the work unit's bathhouse; other working income including that from a second job[36]; market value of all tickets received from the employer; and the excess of all private enterprise income over business expenses excluding taxes.

The 1988 urban CHIP survey drew a subsample from the urban sample maintained by China's State Statistical Bureau for its own surveys. This sample was restricted to households in non-agricultural parts of urban areas (Eichen and Zhang, 1993, 332). This restriction, the absence of survey questions addressing *hukou* status, the difficulty of surveying those without appropriate *hukou* status and the absence of significant migration in China at this time[37] imply that the survey expected sample members to have *hukou* in their place of residence.

The 1988 urban CHIP survey does not identify full-time workers, measure hours worked per week or weeks worked per year. In order to restrict the analysis to workers who were likely to be fully engaged in the labor market, the sample here includes only those who were older than 14 and whose monthly earnings exceeded 49 yuan. Average monthly earnings in this sample were 171.0 yuan. According to the sources in footnote 30, this was equivalent to $46 at official exchange rates and perhaps $70 at purchasing power parity in 1988 dollars.

This survey sampled from ten provinces.[38] Each column of table 5 presents the regression of equation 1 for one of these provinces. These regressions share some common attributes. In all provinces, earnings were significantly lower for women. They increased with education.[39] They increased at declining

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[36] Income from second jobs is included because the intent is to estimate earning capacity, regardless of whether or not earnings derive from a single employer. In the previous section, U.S. earnings in 1940 also included all wage and salary income.

[37] Chan (2013, 10) estimates that, as late as 1995, only 9.3 million Chinese, or 0.75% of the population, were resident in a province other than that in which they held *hukou*. Their residences were not necessarily urban. The urban population of China in that year was 373 million (World Bank, World Development Indicators).

[38] This paper refers to Beijing, Chongqing and Shanghai as "provinces", although, formally, they are "municipalities". Functionally, there is no important difference.

[39] The effects of education were small, typically around three yuan, or less than 2% of average earnings, per year of education. In contrast, according to table 1, one year of education was worth more than 6% of average earnings in the urban U.S. of 1940. The 1988 CHIP urban survey records level of educational attainment rather than years of schooling. The conversion here assigns 16 years to "college (daxue) graduate or above", 14 years to "community college (dazhuan) graduate", 13 years to "professional school graduate", 12 years to "upper middle school graduate", nine years to "lower middle school graduate", six years to "primary school graduate", three years to "three years or more of primary school" and one year to "less than three years of primary school".

Table 5

Monthly earnings regressions by Chinese province, 1988

Provinces

Explanatory variables	Beijing	Shanxi	Liaoning	Jiangsu	Anhui	Henan	Hubei	Guangdong	Yunnan	Gansu
Intercept	-41.47	-40.60	-12.09	-18.33	**-47.50**	-23.22	**-48.18**	**-123.00**	-26.47	**-93.80**
p-value	0.0954	0.1560	0.4372	0.3304	0.0402	0.0920	0.0047	0.0013	0.2585	0.0007
Female	**-25.97**	**-17.36**	**-15.19**	**-22.89**	**-22.22**	**-16.57**	**-10.73**	**-39.60**	**-22.44**	**-26.71**
p-value	<.0001	0.0004	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
Years of school	**2.50**	**2.73**	**2.75**	**2.80**	**3.20**	**2.86**	**3.45**	**3.52**	**2.61**	**6.05**
p-value	0.0007	0.0017	<.0001	<.0001	<.0001	<.0001	<.0001	0.0011	<.0001	<.0001
Age	**9.21**	**6.86**	**5.84**	**7.57**	**7.67**	**5.54**	**7.63**	**16.79**	**7.86**	**7.99**
p-value	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
(Age/10) squared	**-8.63**	**-5.95**	**-4.32**	**-7.27**	**-6.89**	**-4.54**	**-7.40**	**-18.67**	**-7.04**	**-6.05**
p-value	<.0001	0.0026	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	0.0162	0.0007
Observations	865	1,851	1,851	2,257	1,715	2,010	1,925	2,092	1,808	1,125
R-square	0.1993	0.0718	0.2407	0.1236	0.1294	0.2022	0.1499	0.0787	0.1439	0.2221
Adjusted R-square	0.1956	0.0698	0.2391	0.1221	0.1273	0.2006	0.1481	0.0769	0.1420	0.2193
F-statistic	**53.52**	**35.7**	**146.31**	**79.41**	**63.51**	**127.01**	**84.64**	**44.57**	**75.76**	**79.94**
p-value	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
Age of maximum age contribution	53.4	57.6	67.6	52.0	55.7	61.1	51.5	45.0	55.8	66.0

Note: Estimates in bold are significant with p-values that are less than or equal to .05.

rates with age, with peak earnings in the later work years.

At the same time, these regressions differ more dramatically than do those for the U.S. in table 1. The smallest female effect, in Hubei, was approximately one-fourth as large as the largest, in Guangdong. The smallest education effect, in Beijing, was less than half as large as the largest, in Gansu. Women required approximately four additional years of school to compensate for the negative female coefficient in Hubei, five in Gansu, six in Henan and Liaoning, seven in Shanxi and Anhui, nine in Yunnan and Jiangsu, 11 in Beijing and 12 in Guangdong. The age of maximum earnings varied from 45 years in Guangdong to 67.6 years in Liaoning.

In general, the magnitudes of all coefficients were larger for Guangdong than for any of the other provinces. The value of years of schooling in Guangdong was larger than in any province other than Gansu.[40] The linear effect for age was much larger than elsewhere. However, the quadratic effect for age, the female effect and the intercept were also larger than elsewhere, and negative. Therefore, while Guangdong appears distinctive, the consequences of that distinction are not apparent in table 5.

These consequences require comparisons across earnings predictions. As in section 4, the rest of this section relies on expanded versions of the regression models in table 5. In these models, the variable for years of school is again replaced with dummy variables for each of the levels of educational attainment in footnote 39. These models interact the dummy variables for educational attainment and the variables for age and age squared with the female dummy variable. They yield conclusions that are very similar to those that derive from the regressions of table 5, but with greater precision.[41]

As in table 2, table 6 compares predicted earnings in the home province with predicted maximum earnings. In urban China of 1988, the proportion of workers with maximum predicted earnings in their home province was slightly more than one-tenth. The analogous proportion in the urban U.S. of 1940 was 2.5 times greater.

For 92.6% of urban U.S. workers in 1940, the difference between predicted maximum earnings

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[40] Liu (1998) reported that the rate of return to education in Guangdong exceeded that in the aggregate of the other nine provinces.

[41] The F-test that compares this expanded model to that of table 5 yields value of 1.744 with 148 and 17,301 degrees of freedom, significant at better than .01%.

Table 6

Potential gains from moving to another Chinese province, 1988

Gains as % of predicted earnings in home province	Workers	% of all workers
None - maximum predicted earnings are in home province	2,087	11.9%
10% or less	118	0.7%
10%-20%	405	2.3%
20%-30%	1,247	7.1%
30%-40%	2,455	14.0%
40%-50%	3,301	18.9%
50%-60%	2,912	16.6%
60%-70%	2,322	13.3%
70%-80%	1,432	8.2%
>80%	1,220	7.0%
Total	17,499	100.0%

and predicted earnings in their home division was 20% or less of the latter. For urban Chinese workers in 1988, this was true for only 14.9%. Only 2.1% of American workers predicted maximum earnings that would exceed predicted earnings in their home divisions by 30% or more. The corresponding proportion for Chinese urban workers in 1988 was 75.5%. More than 40% of all Chinese workers predicted earnings gains of more than 50% in some province other than that of their residence.

Table 7 reproduces table 3 for urban China in 1988. The second column presents average earnings in the province of residence. It demonstrates the essential fact that motivates the entire literature discussed in section 1. Average incomes varied dramatically across provinces, and by much more than across U.S. divisions in 1940. The lowest average, in Henan, was less than 60% of the highest, in Guangdong. The coefficient of variation for average home province predicted provincial earnings was .1683.

According to the fifth column, the regression for Guangdong predicted the highest earnings for 17,124, or 97.9% of the 17,499 workers in the sample.[42] This represents much greater concentration than

[42] As in footnote 33, this result is a consequence of the returns to human capital characteristics in Guangdong rather than a cost-of-living effect. The intercept for the Guangdong regression was larger in magnitude than any other, and negative.

Table 7

Actual and predicted inequality, urban China 1988

	Workers in home province				Workers in province of maximum predicted earnings			Workers in home province with maximum predicted earnings	
Province	Number of workers	Average earnings	Gini coefficient of actual earnings	Gini coefficient of predicted earnings	Number of workers	Average predicted earnings	Gini coefficient of predicted earnings	Average predicted earnings	Gini coefficient of predicted earnings
Beijing	865	189.3	0.1899	0.1001	161	159.4	0.1666	244.2	0.0919
Shanxi	1,851	146.6	0.2366	0.1241	0			240.7	0.1032
Liaoning	1,851	162.4	0.1773	0.0995	34	196.0	0.0467	243.6	0.0972
Jiangsu	2,257	172.0	0.1799	0.0938	11	115.2	0.0064	240.6	0.1033
Anhui	1,715	154.8	0.2287	0.1251	0			237.7	0.1090
Henan	2,010	138.0	0.2053	0.1135	0			240.3	0.1050
Hubei	1,925	159.5	0.1780	0.0864	0			245.9	0.0965
Guangdong	2,092	240.9	0.2690	0.1027	17,124	242.9	0.0994	241.2	0.1021
Yunnan	1,808	179.6	0.2020	0.1009	100	235.8	0.0849	244.7	0.0965
Gansu	1,125	168.3	0.2468	0.1552	69	257.3	0.0425	242.5	0.1035
Total	17,499	171.0	0.2308	0.1419	17,499	242.0	0.1015	242.0	0.1015

in the urban U.S. of 1940. A few workers attained maximum predicted earnings in Beijing, Liaoning, Jiangsu, Yunnan and Gansu. None attained highest predicted earnings in the other four provinces.

Taken literally, these results imply that, if urban labor were freely mobile in China of 1988, nearly every worker would have migrated to Guangdong. Inequality in average incomes across provinces would have actually increased, though this would have been trivial because almost all workers would have resided within the single province of Guangdong.

Obviously, this scenario cannot be understood as a plausible "prediction". First, residential location decisions respond to many location-specific attributes in addition to expected earnings. These include familial and social relationships, local public goods and local institutions.

Second, this scenario relies on partial equilibrium predictions, based on the assumption that the values of human capital components would be fixed within province. Those values would change, perhaps radically, were anything like the implied migrations to take place. Consequently, this scenario is properly construed as an "illustration" rather than a "projection".

At the same time, the restrictions that prevented equalization of human capital valuations across provinces were responsible for all of inter-provincial inequality. The eighth column of table 7 reports average earnings by province if workers resident in those provinces had earned the maximum earnings predicted for them in any province. Under this counterfactual, average earnings would have been nearly identical across all ten provinces. They would have ranged from a minimum of 237.2 yuan per month in Anhui to a maximum of 246.2 yuan per month in Hubei. The difference between the two would have been only nine yuan per month, or 3.8% of the average in Anhui. The coefficient of variation for average maximum predicted earnings would have been .0102, less than one-tenth of that for average home province predicted earnings.

Despite inter-provincial differences in average earnings, urban China in 1988 was relatively egalitarian among individuals. The aggregate Gini coefficient, in the last row of the third column of table 7, was relatively low, at .2308.[43] Within-province inequality was less than in the aggregate, except in

[43] These calculations omit implicit subsidies associated with housing allocations. Zax (2015) demonstrates that they were sizable and inequitable. Consequently, the Gini coefficient for household income including these subsidies could have been 15% higher than that for measured income. These subsidies cannot be incorporated in the analysis here because the 1988 CHIP survey identified households

Shanxi and Gansu. The relatively larger magnitude of the aggregate Gini coefficient was attributable to differences across provinces in average earnings.

As in table 3, the replacement of actual with predicted earnings in the home province, in the fourth column, reduced the aggregate Gini coefficient from .2308 to .1381, or by 40.2%. The analogous reductions were similar in each of the provinces. This implies that the permanent components of earnings may have been responsible for as little as 60% of observed inequality.

The seventh column of table 7 presents the Gini coefficients for maximum predicted earnings, as determined by equation 4. For the sample as a whole, this coefficient was .0961. This demonstrates that, if workers were located in the province which predicted their maximum earnings, the aggregate Gini coefficient for predicted earnings would have declined by 30.4%.

The ninth column presents the Gini coefficients of maximum predicted earnings for each worker, assigned to their home provinces. These were typically smaller than those for predicted earnings, themselves. This demonstrates that the reduction in interpersonal inequality associated with maximum predicted earnings was composed of reductions in both inter- and intra-provincial inequality.

Finally, exaggerated inter-provincial inequality was associated with substantial reductions in individual welfare. According to the sixth column, the average of maximum predicted earnings across all provinces was 241.8 yuan per month, 70.8 yuan per month greater than the average of predicted and actual earnings in home provinces. This represents a loss equal to 41.4% of actual average earnings.[44] According to the estimated effects of years of schooling in table 5, workers in Gansu would have required more than 12 additional years of schooling in order to equate their average earnings to their average maximum earnings. Those in Henan would have required nearly 36.

Table 8 explores the distributional consequences of the failure to equilibrate human capital valuations across provinces in urban China of 1988. The third column presents the average difference between the maximum predicted earnings for each worker resident in each province and the predicted

that resided in public housing, but not the individual, if any, to whom the dwelling unit was assigned.

[44] Analogously, Hendricks (2002) estimates that inter-country differences in human capital endowments are much less than inter-country differences in average incomes. He concludes that much of these latter differences probably arise from inter-country differences in total factor productivity.

Table 8

Location costs and predicted earnings, urban China, 1988

Province	Number of workers	Average earnings	Location cost: predicted earnings in home province minus maximum predicted earnings	Location costs as proportion of average earnings	Correlation, location cost and predicted earnings in home province
Beijing	865	189.3	-54.9	-29.0%	-0.0347
Shanxi	1,851	146.6	-94.1	-64.2%	-0.2664
Liaoning	1,851	162.4	-81.2	-50.0%	-0.3996
Jiangsu	2,257	172.0	-68.6	-39.9%	-0.4906
Anhui	1,715	154.8	-82.9	-53.5%	-0.4233
Henan	2,010	138.0	-102.3	-74.1%	-0.5492
Hubei	1,925	159.5	-86.3	-54.1%	-0.6231
Guangdong	2,092	240.9	-0.3	-0.1%	0.1072
Yunnan	1,808	179.6	-65.0	-36.2%	-0.1839
Gansu	1,125	168.3	-74.3	-44.1%	0.2896
Total	17,499	171.0	-71.0	-41.5%	0.4119

earnings for those workers in their provinces of residence.

These losses were, of course, trivial for workers resident in Guangdong. Of them, 98.3% had their highest predicted earnings in their home province. The tiny aggregate losses for these workers in table 8 were entirely attributable to small gains that would have accrued to the 36 Guangdong workers whose maximum predicted earnings occurred elsewhere.

In all other provinces, average losses were substantial. They ranged from 54.9 yuan per month in Beijing to 102.3 yuan per month in Henan. They were equal to or greater than 50% of average earnings in Shanxi, Liaoning, Anhui, Henan and Hubei.

Moreover, average losses were heavily regressive. The greatest losses in absolute terms were in Henan, which also had the lowest average earnings among all ten provinces. The smallest losses in absolute terms were in Beijing, which had the highest average earnings apart from Guangdong. Over all ten provinces, the correlation between average earnings and average location costs was 0.9963.

Within province, however, absolute losses were generally progressive. In all except Guangdong and Gansu, the correlation between individual predicted earnings in the home province and location costs was large and negative. Within province, those with higher predicted earnings in the home province also predicted the largest losses in comparison to their maximum predicted earnings.

Nevertheless, the net distributional effect of rigidities afflicting urban labor markets was regressive. The combination of largely progressive losses within province and overwhelmingly regressive losses across provinces yielded an aggregate correlation between predicted earnings in home provinces and losses of .4119. In the aggregate, higher earnings were associated with losses that were less negative, or smaller. Workers who predicted lower incomes, and therefore were presumably of lower skill, also predicted greater gains were they able to earn the maximum valuation of their human capital.

Tables 5 through 8 demonstrate that, in terms of predicted earnings, Guangdong dominated every other province for almost every worker in 1988. Implicit in these tables are estimates of the actual value of the Guangdong urban *hukou*, the right to live in Guangdong at that time.

This valuation was most straightforward for the 2,056 workers in Guangdong whose highest predicted earnings were also in Guangdong. As given in the first column of the first panel in table 9, average predicted earnings in Guangdong for these workers were 241.7 yuan per month. On average, these exceeded the next highest predicted earnings for these workers by 52.2 yuan per month.

This difference represents the value of the Guangdong *hukou* to these workers. It was equivalent, on average, to 21.6% of their predicted earnings in Guangdong, or to 27.5% of their greatest predicted earnings elsewhere. This difference is interpretable as a rent. It would almost surely have dissipated if workers from other provinces had been able to migrate freely to Guangdong.

This rent was distributed regressively. Among these 2,056 workers, the correlation between the the Guangdong rent and predicted earnings in Guangdong was .6352. In other words, workers who predicted higher earnings in Guangdong also predicted a larger difference between those predicted earnings and their highest earning prediction in any of the other nine provinces.

The second column of the first panel in table 9 reports that the right to live in Guangdong carried only a small penalty, averaging 15.0 yuan per month, for the 36 Guangdong residents who predicted higher earnings elsewhere. This had negligible impact on the average value of Guangdong residence for all of its workers, as given in the third column of that panel.

The value of Guangdong residence to workers resident in other provinces was somewhat more complicated. The first complication replicates that associated with valuing Guangdong residence for

Table 9

The value of Guangdong residence, 1988

Home province		Province of maximum predicted earnings: Guangdong	Other	Any
Guangdong	Observations	2,056	36	2,092
	Average predicted earnings in home province	241.7	195.6	240.9
	Average difference, predicted earnings in Guangdong and highest predicted earnings elsewhere	52.2	-15.0	51.1
	Average difference, as percent of predicted earnings in home province	21.6%	-7.7%	21.2%
Other	Observations	15,068	339	15,407
	Average predicted earnings in home province	161.6	156.3	161.5
	Average difference, predicted earnings in Guangdong and predicted earnings in home province	81.5	24.6	80.2
	Average difference, as percent of predicted earnings in home province	50.4%	15.8%	49.7%
	Average predicted earnings in province of maximum earnings other than Guangdong	191.8	198.7	191.9
	Average difference, predicted earnings in Guangdong and highest predicted earnings elsewhere	51.3	-17.7	49.8
	Average difference, as percent of predicted earnings in province with highest predicted earnings other than Guangdong	26.8%	-8.9%	25.9%
All	Observations	17,124	375	17,499
	Average predicted earnings in home province	171.2	160.1	171.0
	Average difference, predicted earnings in Guangdong and predicted earnings in home province	71.7	22.3	70.6
	Average difference, as percent of predicted earnings in home province	41.9%	13.9%	41.3%
	Average predicted earnings in province of maximum earnings other than Guangdong	191.5	199.8	191.4
	Average difference, predicted earnings in Guangdong and highest predicted earnings elsewhere	51.4	-17.5	50.0
	Average difference, as percent of predicted earnings in province with highest predicted earnings other than Guangdong	26.9%	-8.7%	26.1%

Guangdong residents: the optimal province for a small number of residents in other provinces was not Guangdong. The second complication arises out of alternative mobility assumptions: if Guangdong were the optimal province for a worker, that worker's next highest predicted earnings may have also been in a province other than that in which the worker was resident.

The second panel of table 9 addresses these complexities. The first column analyzes the 15,068 workers resident in other provinces whose highest predicted earnings occurred in Guangdong. The first three rows of this panel assume that workers' alternatives to relocating in Guangdong were to remain in their home provinces. Their average predicted earnings there were 161.6 yuan per month. Had they earned the valuations available in Guangdong, their earnings would have increased by 80.6 yuan per month, or half of their predicted earnings in their home provinces.

The final three rows of the second panel of table 9 compare, instead, earnings that workers would have received in Guangdong to those in the province other than Guangdong offering the highest predicted earnings.[45] The latter, on average, amounted to 191.8 yuan per month. The additional premium that these workers would have received, with their predicted earnings in Guangdong, would have been 51.3 yuan per month, or 26.8% of their greatest predicted earnings elsewhere.

The second column of the second panel of table 5 presents the same comparisons for the 339 residents of provinces other than Guangdong whose highest predicted earnings were not in Guangdong. Average predicted earnings for these workers were higher in Guangdong than in their home provinces by 24.6 yuan per month. However, their predicted earnings were higher still in other provinces, by 42.4 yuan. Nevertheless, there were so few of these workers that the aggregate comparisons for all workers resident outside of Guangdong, in the third column of the second panel of table 9, were almost identical to those for workers whose highest predicted earnings were in Guangdong.

The third panel of table 9 presents the same comparisons for the sample, aggregated over province of residence. The first and second columns are most similar to those in the second panel, because the number of workers resident in Guangdong was only 12.0% of the sample. More importantly, though, for workers whose highest predicted earnings were in Guangdong, the absolute premium associated with those

[45] For 15,496 workers, or 88.6% of the sample, their highest earnings in the nine provinces other than Guangdong occurred in Beijing. Section 7 examines this result in greater detail.

earnings was nearly identical for residents of other provinces when compared to their maximum predicted earnings elsewhere, and for Guangdong residents, themselves. The average value of this premium was essentially unaffected by the incorporation of the small number of workers whose maximum predicted earnings were not in Guangdong.

Consequently, the value of the Guandong *hukou* appears to have been approximately 50 yuan per month. This represented approximately one-fourth of alternative predicted earnings elsewhere.

In sum, this section demonstrates that, in urban China of 1988, substantial inter-provincial inequality coexisted with substantial inter-personal equality. However, disparities in human capital valuations across provinces was responsible for large reductions in individual welfare, 30% of inter-personal inequality and all of inter-provincial inequality.[46] These disparities indicate that urban China was in substantial spatial disequilibrium at this time.

6. Earnings and inequality by province in 1995, 2002, 2008 and 2013

The CHIP conducted additional urban surveys in 1995, 2002, 2008 and 2013. The surveyed provinces varied across surveys, as reported in table 10. Five provinces – Jiangsu, Anhui, Henan, Hubei and Guangdong – appeared in all five surveys. Five additional provinces – Beijing, Shanxi, Liaoning, Yunnan and Gansu – appeared in four surveys, all but that of 2008. Sichuan also appeared in four surveys, but in 2008 and not in 1988. Chongqing appeared in the three most recent surveys. Shanghai, Zhejiang, Shandong and Hunan each appeared in only one survey.

The 1995 and 2002 urban CHIP samples were constructed similarly to that for 1988 (Li, et al., 2008). Chuliang, et al. (2013) describe the similarities and differences between the 2008 and earlier surveys. The CHIP has only recently released the 2013. The available documentation appears to be limited to http://www.ciidbnu.org/chip/chips.asp?year=2013.

As in 1988, the 1995 urban CHIP survey did not inquire regarding *hukou* status. However, in 2000, 42.4 million people, or 3.4% of the Chinese population, were resident in provinces other than those

[46] The 1990 urban cost-of-living was higher in Guangdong than in any other province (Brandt and Holz, 2006, table 5). This section suggests that, nevertheless, urban Guangdong was underpopulated relative to an equilibrium with free mobility. Consequently, the equilibrium Guangdong "cost-of-living" would likely have been higher, and perhaps greatly so. This implication holds for all later years, as well.

Table 10

Provinces included in CHIP urban surveys

	Year				
Province	1988	1995	2002	2008	2013
Beijing	Included	Included	Included		Included
Shanxi	Included	Included	Included		Included
Liaoning	Included	Included	Included		Included
Shanghai				Included	
Jiangsu	Included	Included	Included	Included	Included
Zhejiang				Included	
Anhui	Included	Included	Included	Included	Included
Shandong					Included
Henan	Included	Included	Included	Included	Included
Hubei	Included	Included	Included	Included	Included
Hunan					Included
Guangdong	Included	Included	Included	Included	Included
Chongqing			Included	Included	Included
Sichuan		Included	Included	Included	Included
Yunnan	Included	Included	Included		Included
Gansu	Included	Included	Included		Included

in which they held *hukou* (Chan, 2013). Consequently, the 2002, 2008 and 2013 urban surveys recorded *hukou* status. The samples examined here from these years consist only of those reporting urban *hukou* in the city of residence.[47]

As in 1988, the samples for all later years exclude workers aged younger than 15. However, the surveys differ in the information that they record regarding work force engagement. Consequently, the exclusions employed here to restrict the sample to arguably full-time workers differ by sample.

The 1995 urban CHIP survey recorded average work hours per day and average work days per week. The sample here excludes those reporting fewer than 21 weekly work hours. The 2008 survey recorded only average work hours per week. Therefore it too excludes those whose average weekly work hours were less than 21. Both the 2002 and 2013 surveys recorded work hours per day, work days per month and work months per year. Both samples here exclude those who reported fewer than six months of

[47] The 2002 CHIP introduced a separate survey of migrants (Li, et al., 2008), which was repeated in 2008 and 2013.

work, fewer than 15 work days per month or fewer than six work hours per day.

Compensation practices in urban China evolved over the surveyed period. Most of the subsidies and alternative payments that had been present in 1988 vanished by the 2013, if not earlier. Correspondingly, the earnings variable employed here has also evolved across these surveys.

The components of labor compensation measured by the 1995 CHIP urban survey include “wages”, “other income from work unit”, “income of employees of individual enterprise”, “income of re-employed retired member”, “other employee income”, “other income generated from labor”, “private enterprise proprietor’s pre-tax net income”, “individual enterprise proprietor’s pre-tax net income” and “income from household sideline production”. The sum of these components constitutes labor earnings.

The sample here attempts to further exclude workers with only limited labor market attachment by retaining only those reporting labor earnings of 100 yuan per month or more. Average nominal monthly earnings among these observations were 529.6 yuan. According to the sources in footnote 30, this was equivalent to $63 at official 1995 exchange rates and $138 at purchasing power parity.

In 2002, the urban CHIP survey recorded only “total income”, “subsidy for minimum living standard”, “living hardship subsidies from work unit”, “second job and sideline income” and “monetary value of income in kind”. Earnings is again the sum of these components. The sample excludes those with monthly earnings below 150 yuan. Average nominal monthly earnings for those that remain were 1,084 yuan per month, or $131 at official 2002 exchange rates and $305 at purchasing power parity.

In 2008, earnings were “average total monthly income from all the jobs with pay”, as reported directly by the CHIP urban survey. The sample excludes those with values for this variable of 550 yuan or less. Within the sample, average nominal monthly earnings were 2,630 yuan, equivalent to $379 at official 2008 exchange rates and $737 at purchasing power parity.

Similarly, the 2013 earnings measure is the CHIP report of the sum of annual earnings from all jobs, rescaled by reported annual work months to represent monthly earnings. The sample omits those who reported less than 4,000 yuan in annual earnings from their primary job. Average nominal monthly earnings among sample observations were 3,615 yuan. According to official 2013 exchange rates, this corresponded to $584. At purchasing power parity, it was equivalent to $962.

Table 11 summarizes the results of the regressions of equation 1, applied to each of the provinces

Table 11

Summary of regression results, 1988, 1995, 2002, 2008 and 2013

	Ranges				
Explanatory variables	1988	1995	2002	2008	2013
Intercept	**-123.0** to -12.1	**-1111.4** to -144.0	**-2557.8** to -198.9	**-7632.7** to **-1465.6**	**-9609.7** to 213.7
Female	**-39.6** to **-10.7**	**-125.9** to **-23.8**	**-307.8** to **68.6**	**-1136.1** to **-379.4**	**-1612.9** to -215.3
Years of school	**2.5** to **6.1**	**16.2** to **53.7**	**53.2** to **130.2**	**121.4** to **443.6**	**120.6** to **593.0**
Age	**5.5** to **16.8**	**15.2** to **72.9**	2.8 to **136.1**	**88.5** to **352.9**	32.5 to **402.6**
(Age/10) squared	**-18.7** to **-4.3**	**-82.8** to **-9.3**	**-151.9** to 16.8	**-354.7** to **-93.8**	**-437.0** to **-23.4**
R-square	.0718 to .2407	.1214 to .3829	.0911 to .1976	.0394 to .2004	.0150 to .2197
Adjusted R-square	.0698 to .2391	.1172 to .3789	.0870 to .1934	.0320 to .1960	.0070 to .2159
Age of maximum age contribution	45.0 to 67.6	44.0 to 76.4	-8.4 to 144.6	41.1 to 48.0	41.9 to 69.3
Female discount in years of schooling	3.1 to 11.3	1.0 to 4.8	1.0 to 3.3	1.7 to 3.7	1.4 to 9.3
Number of provinces	10	11	12	9	14
Number of observations	17,499	11,393	9,357	6,116	8,825

Note: Estimates in bold are significant with p-values that are less than or equal to .05.

in each of the survey years. Each of the first five rows reports the range of coefficient estimates for the corresponding explanatory variable across all of the provinces surveyed in that year. The first column summarizes the regressions for 1988, presented in their entirety in table 5, for comparison.[48]

Table 11 demonstrates that these regressions differ substantially across provinces in every survey year. In absolute value, the minimum female coefficient was never more than one-third of the maximum value. The maximum effect of years of schooling was at least twice as large as the minimum effect in every year. That of age was at least three times as large as its minimum effect. With the exception of 2008, the age of maximum earnings varied across provinces by more than 20 years. The number of years of schooling necessary to compensate for the female earnings discount varied by at least a factor of two.

These differences suggest that, as in 1988, earnings predictions for a given worker might vary widely across provinces in all other survey years. The rest of this section relies on the expanded version of equation 1, with full interactions between sex and educational attainment, age and age-squared, to examine these predictions. This expanded model is statistically superior to the models of table 11 in all years at better than .01% significance.

Table 12 adds 1995, 2002, 2008 and 2013 to table 6. It confirms that workers predicted widely different earnings across provinces in all years. Inter-provincial imbalances worsened dramatically between 1988 and 1995. In the latter year, fewer than 10% of all workers had home province predicted earnings within 20% of their maximum predicted earnings. Almost half of all workers predicted maximum earnings that were more than twice their home province predicted earnings.

These imbalances subsided somewhat over the succeeding years. The proportions of workers predicting home province earnings within 20% of maximum predicted earnings increased to 15.0% in 2002, 22.9% in 2008 and 25.9% in 2013. Correspondingly, the proportions that predicted maximum earnings of more than twice their home province predicted earnings declined to 31.1% in 2002, 19.0% in 2008 and 11.1% in 2013.

Nevertheless, the distortions in 2013 were, substantively, at least as great as those in 1988. While many more workers predicted home province earnings that were reasonably close to maximum predicted

[48] Detailed results for all years are available from the author.

Table 12

Potential gains from moving to another province, 1988, 1995, 2002, 2008 and 2013

Gains as % of predicted earnings in home province	% of all workers 1988	1995	2002	2008	2013
None - maximum predicted earnings are in home province	11.9%	8.6%	9.4%	12.4%	7.8%
10% or less	0.7%	0.3%	3.5%	5.2%	7.3%
10%-20%	2.3%	0.6%	2.1%	5.3%	10.8%
20%-30%	7.1%	1.7%	2.0%	6.9%	11.1%
30%-40%	14.0%	2.6%	3.8%	6.1%	10.9%
40%-50%	18.9%	3.2%	4.2%	7.1%	9.6%
50%-60%	16.6%	4.1%	4.1%	5.8%	9.9%
60%-70%	13.3%	6.0%	6.8%	5.7%	8.3%
70%-80%	8.2%	6.8%	12.0%	8.0%	4.4%
80%-90%	4.6%	8.1%	11.0%	10.5%	4.5%
90%-100%	1.8%	8.5%	10.0%	8.1%	4.2%
>100%	0.6%	49.6%	31.1%	19.0%	11.1%
Number of workers	17,499	11,393	9,357	6,116	8,825

earnings in 2013 than in 1988, many more also reported maximum predicted earnings that were twice as large as home province predicted earnings, or more. In general, the 1988 distribution of predicted gains as a proportion of home province predicted earnings was highly concentrated in the range of 30% to 70%. The 2013 distribution was much more dispersed, with substantial proportions at either extreme.

Table 13 identifies the provinces that accounted for the three largest shares of workers by maximum predicted earnings in each survey year. Guangdong predicted maximum earnings for the largest numbers of workers in all five years. In 1995, as in 1988, almost all workers predicted their maximum earnings there. However, the share of workers predicting maximum earnings in Guangdong declined to only half over the final three surveys. The sharp decline between 2002 and 2008 was attributable, in part, to the inclusion, in the 2008 survey only, of Shanghai and Zhejiang. Nevertheless, it continued in 2013, when the sample was much more similar to those of earlier years.

Beijing predicted maximum earnings for the second largest share of workers in 1988, 1995 and 2002. It was omitted from the sample for 2008. Its relative importance was diminished by 2013, when its

Table 13

Province of maximum predicted earnings, 1988, 1995, 2002, 2008 and 2013

	1988		1995		2002		2008		2013	
	Province	Proportion of workers	Province	Proportion of workers	Province	Proportion of workers	Province	Proportion of workers	Province	Proportion of workers
Province predicting maximum earnings for the most workers	Guangdong	97.9%	Guangdong	97.4%	Guangdong	72.9%	Guangdong	55.2%	Guangdong	52.9%
Province predicting maximum earnings for the second most workers	Beijing	0.9%	Beijing	2.3%	Beijing	25.2%	Shanghai	21.7%	Jiangsu	16.2%
Province predicting maximum earnings for the third most workers	Yunnan	0.6%	Gansu	0.1%	Liaoning	0.9%	Zhejiang	15.2%	Chongqing	11.7%
Sum		99.3%		99.9%		99.0%		92.1%		80.8%

share of workers by maximum predicted earnings was surpassed by six other provinces. Four of them – Jiangsu, Anhui, Hubei and Guangdong – had been present in all four surveys that included Beijing.

Table 13 demonstrates that the general concentration of maximum predicted earnings diminished over time, along with the dominance of Guangdong. The three provinces assigned the largest shares of workers by maximum predicted earnings, together, accounted for more than 99% of all workers in 1988 and 1995. Their aggregate share declined to 80.8% by 2013. As urban China evolved, more provinces were able to offer at least some workers their best earnings opportunities.

The first two rows of table 14 demonstrate this conclusion more formally. They summarize the information in columns one and five of table 7 for all five samples. The first row measures the actual distribution of sample observations across provinces by the Herfindahl index of sample shares contributed by each province. It demonstrates that, as would be expected, sampling procedures in all five surveys distributed observations relatively equally across all surveyed provinces.

The second row reports the Herfindahl index of sample shares, if all workers were reassigned to the province in which they predicted their highest maximum earnings. As noted, this reassignment would allocate almost all workers in 1988 to Guangdong. Correspondingly, the second column of table 14 reports that, in this scenario, the value of the Herfindahl index of provincial worker shares would be close to the maximum of one, at .9577.

The remaining columns of the second row of table 14 report that, in aggregate, worker residences would continue to be more concentrated if they were reassigned to their provinces of maximum predicted earnings in subsequent years. However, that concentration would diminish dramatically. The Herfindahl index for 2013 was .3277, barely one-third of its value for 1988.

The third and fourth rows of table 14 summarize the information in the second and eighth columns of table 7 for all five samples. The third row reports the coefficient of variation for average provincial incomes in each sample year. This measure of inter-provincial inequality nearly doubled between 1988 and 1995. As with the imbalances displayed in table 12, this measure then declined over the subsequent years. By 2013 it had essentially returned to the level of 25 years prior.

However, inter-provincial inequality would have been much smaller in every year if workers were assigned their maximum predicted earnings without changing their province of residence. In this scenario,

Table 14

Interprovincial inequality, 1988, 1995, 2002, 2008 and 2013

	1988	1995	2002	2008	2013
Herfindahl index for provincial sample shares	0.1055	0.0948	0.0873	0.1135	0.0754
Herfindahl index for provincial sample shares with assignment to province of maximum predicted earnings	0.9577	0.9499	0.5949	0.3773	0.3277
Coefficient of variation, average provincial earnings	0.1683	0.3130	0.2721	0.2392	0.1737
Coefficient of variation, average maximum earnings assigned to home province	0.0102	0.0285	0.0286	0.0365	0.0431

described in the fourth row of table 14, the coefficient of variation for average maximum earnings assigned to home provinces would have been less than one-tenth of the coefficient of variation for actual average provincial earnings in 1988, 1995 and 2002. It would have been proportionately greater in 2008 and 2013, but still no more than one-fourth of that for actual average provincial earnings.

Table 15 summarizes the information regarding inter-personal inequality in columns three, four and nine of table 7 for all five samples. The Gini coefficient for actual earnings increased steadily from 1988 through 2008, and then declined slightly to 2013. The Gini coefficient for predicted earnings did the same, with a more marked decline in 2013. If the differences between the two are interpreted as the contributions of transitory income to inequality, those contributions were markedly greater in 2013 than in earlier years.

Inequality in maximum predicted earnings also increased regularly from 1988 to 2008, and at a faster rate than inequality in predicted home province earnings. Consequently, the assignment of maximum predicted earnings to workers in their home provinces would have reduced interpersonal inequality by smaller amounts, both absolutely and relatively, in the later years of this span.

Moreover, the Gini coefficient for maximum predicted earnings continued to increase between 2008 and 2013. Consequently, in 2013 the inequality in maximum predicted earnings was greater than that in predicted home province earnings. While, as suggested by table 12, differences between maximum and home province predicted earnings remained large in 2013, those differences were no longer equalizing.

Table 16 examines the distributional character of these differences in greater detail. The first column summarizes the results of table 8. The remaining columns present comparable results for later

Table 15

Interpersonal inequality, 1988, 1995, 2002, 2008 and 2013

	1988	1995	2002	2008	2013
Gini coefficient of actual earnings	0.2308	0.2866	0.3361	0.3785	0.3511
Gini coefficient of predicted earnings, home province	0.1419	0.1866	0.2091	0.2432	0.1996
Gini coefficient of maximum predicted earnings assigned to home province	0.1055	0.1257	0.1497	0.2017	0.2178

survey years. The evolution of these results demonstrates that losses associated with predicted home province earnings for the most part declined, in relative terms, after 1995. They also became markedly less regressive.

The first and second rows report that average monthly earnings grew in nominal terms over the period under study. Average differences between monthly earnings and predicted maximum earnings, the losses associated with spatial misallocations, also grew in nominal terms. The third row demonstrates that these losses doubled as a proportion of average home province earnings between 1988 and 1995, to 83.1%. This proportion declined through the rest of the period, but was still at 51.4% in 2013.

The fourth row of table 16 compares these losses to the earnings effects of an additional year of schooling. From this perspective, these losses declined from 1988 through 2008, but then increased. In 1988, nearly 24 additional years of schooling would have been necessary to increase average earnings to match average maximum predicted earnings. Less than a third as many years, 7.4, would have been required to accomplish the same match in 2008. However, 9.6 years would have been required in 2013.

According to the fifth row in table 16, the correlation between individual losses and individual home province predicted earnings in 1995 was almost the same, at about .4, as in 1988. This again implies that workers with higher incomes tended to experience smaller negative losses. In other words, these losses were distributed regressively.

They became less so in succeeding years. This correlation declined in value in 2002 and 2008. In 2013, it was slightly negative. By the end of this period the distribution of these losses was effectively neutral.

However, as reported by the last row of table 16, the distribution of average losses across provinces remained heavily regressive. Even in 2013, the correlation between average provincial earnings

Table 16

Interpersonal inequality, 1988, 1995, 2002, 2008 and 2013

	1988	1995	2002	2008	2013
Average earnings	171.0	529.6	1,083.7	2,629.6	3,614.8
Average location cost: predicted earnings in home province minus maximum predicted earnings	-71.0	-439.9	-717.4	-1,406.3	-1,856.6
Average location cost as proportion of average earnings	-41.5%	-83.1%	-66.2%	-53.5%	-51.4%
Average years of school necessary to compensate for location costs	23.8	21.5	10.8	7.4	9.6
Correlation: location cost and predicted earnings in home province	0.4119	0.4257	0.2858	0.1698	-0.0747
Correlation: average earnings and average location costs within province	0.9963	0.9860	0.9849	0.9736	0.9291

and average provincial losses was above .9. The evolution in the correlations between individual earnings and losses was driven by increasing progressivity of the distribution of losses within province.

7. Evolution of the Guangdong premium

The previous two sections demonstrate that the comparison of predicted earnings across provinces evolved over the 25 years spanned by the five samples. The decline in the proportions of each successive sample predicting maximum earnings in Guangdong suggests that its valuations for human capital characteristics became more closely approximated by those in at least some other provinces over this period.

Comparisons across the analyses of the previous sections are complicated by variations in sampled provinces. In particular, the anomalous provincial sample of the 2008 survey limits the comparisons that can be made with the other four surveys. However, these other surveys had the ten provinces of the 1988 survey in common. The analysis of that survey, along with analyses of those for 1995, 2002 and 2013 restricted to these ten provinces alone, are more appropriately comparable.

Table 17 presents this comparison. Each of the first four columns reports the nominal average earnings predicted by the interacted regression for each province for all observations from the ten common provinces in that year's sample. They demonstrate that the excess of predicted earnings in Guangdong over those in other provinces diminished over this period.

The fifth column supports this demonstration. It reports that the nominal annualized growth rate of

Table 17

Average predicted earnings, consistent samples

	Average predicted earnings				Annualized nominal growth rate	Average predicted earnings as proportion of average predicted earnings in Guangdong			
	Year					Year			
	1988	1995	2002	2013		1988	1995	2002	2013
Beijing	186.8	681.5	1,600.8	4,293.8	14.0%	0.77	0.71	0.92	0.92
Shanxi	146.1	421.9	894.6	2,928.0	13.3%	0.60	0.44	0.51	0.63
Liaoning	161.9	473.0	992.8	3,325.8	13.4%	0.67	0.49	0.57	0.71
Jiangsu	173.8	581.5	1,178.0	4,378.6	14.4%	0.72	0.60	0.68	0.94
Anhui	158.3	430.8	931.7	3,494.6	13.8%	0.66	0.45	0.54	0.75
Henan	138.3	409.7	831.8	3,018.7	13.7%	0.57	0.42	0.48	0.65
Hubei	157.1	485.0	925.8	3,609.9	14.0%	0.65	0.50	0.53	0.77
Guangdong	241.6	964.8	1,739.8	4,674.5	13.1%	1.00	1.00	1.00	1.00
Yunnan	177.5	480.0	1,016.1	3,115.1	12.7%	0.73	0.50	0.58	0.67
Gansu	164.7	403.0	866.0	2,767.7	12.5%	0.68	0.42	0.50	0.59
Observations	17,499	10,021	8,501	6,533		17,499	10,021	8,501	6,533

average predicted earnings in Guangdong over this period exceeded those of only Gansu and Yunnan. The seven other provinces, in particular Jiangsu, Beijing and Hubei, grew more quickly.

Columns six through nine of table 17 restate this comparison. In 1988, all provinces predicted average earnings that were less than 80% of those predicted in Guangdong. The unweighted average of the proportions in the sixth column, omitting Guandong, was .67. In other words, average predicted earnings in the average province other than Guangdong would have been only 67% of the Guangdong average.

In 1995, these discrepancies actually increased. Only one province predicted average earnings that were even 70% of those predicted in Guangdong. The average province would have predicted earnings that were 50% of those in Guangdong.

However, between 1995 and 2013 nominal average predicted earnings in Guangdong grew at only 9.7%. The growth rates in seven of the other provinces exceeded 12%. Those in the two remaining provinces were greater than 11%.

Consequently, predicted average earnings in Beijing were more than 90% of those in Guangdong in 2002. The same was true for both Beijing and Jiangsu in 2013. In the latter year, the average province would have had average predicted earnings that were 74% of those in Guangdong.

In sum, average valuations of human capital characteristics in Beijing and Jiangsu, which began

Table 18

Average predicted earnings, consistent samples for Guangdong, Sichuan and Chongqing

	Year			
	1995	2002	2008	2013
Average predicted earnings in Guangdong	963.6	1,673.7	3,763.0	4,283.2
Average predicted earnings in Sichuan	487.9	901.0	2,215.6	3,344.1
Average predicted earnings in Sichuan as a proportion of average predicted earnings in Guangdong	0.51	0.54	0.59	0.78
Observations		1,697	1,575	1,278
Average predicted earnings in Guangdong		1,711.4	3,594.7	4,428.0
Average predicted earnings in Chongqing		1,065.2	2,280.7	3,599.1
Average predicted earnings in Chongqing as a proportion of average predicted earnings in Guangdong		0.62	0.63	0.81
Observations		1,324	1,360	1,438

the period at approximately three-quarters of those in Guangdong, converged to nearly those of Guangdong by the end of the period. Average valuations in Hubei grew quickly, relative to those in Guangdong, but at the end of the period were still at the same level relative to those in Guangdong as had been true of Beijing and Jiangsu at the beginning. Average valuations in Anhui and Henan grew noticeably, but less quickly than those in Hubei. Average valuations in Shanxi and Liaoning converged only slightly to those in Guangdong. Average valuations in Yunnan and Gansu were actually smaller, relative to those in Guangdong, at the end of the period than they had been at the beginning.

The 1995, 2002, 2008 and 2013 surveys included Sichuan. The first four rows of table 18 compare average predicted earnings in Sichuan and Guangdong for all observations from either province in each of those years. Average predicted earnings in Sichuan were barely half of those in Guangdong in 1995. They were slightly more than three-quarters of those in Guangdong in 2013. This rate of convergence was comparable to those of the provinces in table 17 over the same period.

The last three surveys included Chongqing. The last four rows of table 18 compare average predicted earnings in Chongqing and Guangdong for all observations from either province in each of those surveys. Average predicted earnings in Chongqing rose from 62% of those in Guangdong in 2002 to 81% in 2013. This rate of convergence was again comparable to those in table 17 over the same period.

These results demonstrate that, in the early reform period, average Guangdong human capital valuations were dramatically higher than were valuations in other provinces for the same workers. This disparity diminished because valuations in most other provinces increased more rapidly to the present than did those in Guangdong. Those in Beijing and Jiangsu are currently similar to those in Guangdong. Those in Shanghai and Zhejiang might be as well, though these valuations are only available in 2008.

However, this convergence provides only limited evidence for reductions in the distortions that beset urban Chinese labor markets. Average valuations of human capital characteristics have become somewhat more similar across provinces. Nevertheless, the previous sections have demonstrated that valuations for any specific worker continue to vary greatly across provinces. Moreover, most workers still live in provinces where their predicted earnings are substantially below the maximum earnings predicted for them across all provinces. The welfare costs of these distortions are probably only somewhat mitigated by the partial convergence, across provinces, of average human capital valuations.

8. Conclusion

Table 19 summarizes the results of the analyses in sections 4 through 6. Regional inequalities in the valuation of human capital characteristics were minimal in the urban United States of 1940. On average, maximum predicted earnings across all nine Census divisions exceeded predicted earnings in home divisions by about 6%. This deficit was less than the return on one year of schooling. Differences in human capital valuations were responsible for almost none of inter-divisional or inter-personal inequality.

In contrast, inequalities in the valuation of human capital characteristics were enormous in urban China of 1988, 1995, 2002, 2008 and 2013. On average, maximum predicted earnings exceeded predicted earnings in home provinces by more than 50% in the latter four, and by 42% in the first year. The educational investments necessary to compensate for these disparities exceeded average educational levels in 1988 and 1995. In 2008, they were equivalent to more than seven years of additional education, or approximately two degree levels. In 2013, they had increased to more than nine years of schooling.

These disparities were responsible for between 17% and 33% of inter-personal inequality in the first four years. Most strikingly, they were responsible for essentially all of inter-provincial inequality in all five years.[49]

The implications of these results are also striking. Urban China continues to be characterized by

[49] Analogously, the aggregate analysis of Brandt, Tombe and Zhu (2013) reveals large, persistent inter-provincial differences in total factor productivity between 1985 and 2007, caused in part by continuing labor market distortions.

Table 19

Summary of results

Country		U.S.	Urban China				
Year		1940	1988	1995	2002	2008	2013
Average earnings, domestic currency per month		118	171	530	1,084	2,630	3,615
Lost income attributable to local valuations	Value in domestic currency	7	71	440	717	1,390	1,857
	% of average earnings	6%	42%	83%	66%	53%	51%
	In years of schooling	0.9	23.8	21.5	10.8	7.4	9.6
Share of inter-personal inequality attributable to local valuations		5%	28%	33%	28%	17%	-9%
Share of inter-provincial inequality attributable to local valuations		~0%	~100%	~100%	~100%	~100%	Nearly 100%

Note: The calculation of "in years of schooling" is as follows: The difference between average earnings and average predicted maximum earnings within each province, divided by the estimated value of years of education within that province, yields the aggregate number of years of schooling required by workers within that province in order to equate average and average predicted maximum earnings. This aggregate, summed over all provinces and divided by the sample size, yields the average value for "in years of schooling".

dramatic inequality of opportunity.[50] Residence appears to have substantial influence over economic well-being. This implies that, as a consequence of the *hukou* system, birthplace also has substantial influence. The extent of this influence indicates that deviations from the Law of One Price in China are also substantial. It suggests that mobility of other factors, and of final goods, as well as of labor, must be significantly impaired in order to sustain disparities of the magnitude demonstrated here.[51]

This suggestion may seem incongruous because "China has experienced the largest migration flow

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[50] World Bank (2005) discusses the problematic macroeconomic consequences of inequality in opportunity.

[51] Chauvin, et al. (2016) also conclude that urban China exhibits important indications of spatial disequilibrium. Gu, Tang and Wu (2015) suggest that labor compensation may also be subject to political influences that could vary across provinces. This contradicts Ge and Yang and (2011, 612) who assert that "major progresses [sic] have been made towards the integration of labor markets in China".

in history" (Zheng and Yang, 2016, 223). Moreover, these flows appear to have been consistent with economic incentives. Provincial migrant inflows reported by Chan (2012, table 2, updated in 2013, table 3) were highly correlated with earnings as predicted in this paper. Guangdong, Shanghai and Beijing were among the provinces that received the largest net inflows during the periods 1990-5, 1995-2000 and 2000-5. Anhui, Henan, Hubei and Sichuan experienced the largest net outflows.[52]

However, the samples analyzed here exclude migrants. The labor markets in which sample members participated probably excluded migrants, as well. According to the International Labour Organization (2004, 5), "discrimination against rural migrant workers in urban areas is severe". At least some of this discrimination is legal: "only individuals who hold an urban *hukou* are eligible to obtain certain types of jobs in urban areas" (Deng and Li, 2010, 74).

Consequently, Chinese urban labor markets appear to be segmented (Davin, 1999, chapter 6). "(T)he majority of migrants are single workers living in dormitories or construction sites" (Demurger, et al., 2009, 616). These workers are segregated from surrounding urban society (Zhou and Cai, 2008; Chan, 2009) as well as from the broader urban labor market. Moreover, most surveys omit them because their urban residency is usually temporary.

Apparently, longer term migrants have also been subject to segmentation. Meng and Zhang (2001) describe the Shanghai labor market in 1995 and 1996 as "two-tiered". Migrant workers were relegated to lower-paid occupations and paid substantially less within these occupations.

In the 2002 CHIP surveys, longer-term migrants differed substantially in both industry and occupation from residents with urban *hukou*. Demurger, et al. (2009, tables 1 and 2) demonstrate that, among those with *hukou*, only 4.2% were self- employed, 71.5% were employed in the public sector, 32.7% were in professional or technician occupations and 19.6% were office workers. The corresponding proportions for migrants were 57.0%, 7.1%, 4.5% and 2.2%.

Similar contrasts appear in the 2008 RUMIC surveys. Deng and Li (2010, 76 and 78) report that 51% of urban *hukou* holders worked for public sector employers and only 32% for private or individual enterprises. The corresponding proportions for migrants were 9% and 79%. Among *hukou* holders, 56%

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[52] Poncet (2006) concludes that internal migration within China became more responsive to economic factors between 1985 and 1995.

were employed in white-collar occupations and only 29.3% as “service workers or peddlers”. Among migrants, these proportions were 7% and 80.5%.

Labor market policies in China are apparently evolving with the intent to reduce segmentation: “The process of eliminating the two-tiered urban labour market that legitimizes the exploitation of migrants was initiated with two landmark policy documents from the State Council – *Document Number 2 of 2002* and *Document Number 1 of 2003*.” (Tuñón, 2006, 18).[53]

However, these policies do not yet seem to have been effective. Chan (2013, 6) asserts that “the rural and urban populations and the respective labor markets operate as two largely separate rural and urban *hukou*-based ‘circuits’”. The concentration of migrants in the informal sectors of dual urban labor markets prevents them from competing with residents for employment. Consequently, as this paper demonstrates, enormous earnings differentials persist across provinces despite huge migration flows.

It is even possible that migration in China has exacerbated rather than ameliorated the provincial inequalities revealed here. Combes, Demurger and Li (2015) find that cities with more migrants had significantly higher wages for native workers in the 2007 NBS Urban Household Survey. This implies that migrants were strong complements with resident workers (Combes, Demurger and Li, 2015, 263). In order for migration to equalize earnings across provinces, migrants would instead have to be, on net, substitutes.

The failure to integrate urban migrants despite labor market policies with that nominal intent may be attributable, in part, to countervailing urban development policies intended to limit city size. According to Gu, et al. (2012, 111-2) State Council policy actually evolved from “controlling the size of big cities” in 1980 to “strictly controlling the size of large cities” in 1989. Only in the late 1990s did that relax to “moderately control the fast growth of population in big cities”.[54] Throughout this period, policy encouraged faster growth in smaller cities.

These policies may have been effective. Au and Henderson (2006) and Desmet and Rossi-Hansberg (2013) construct counterfactual welfare measures for the Chinese urban system based on general

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[53] This process may reinforce a different dimension of segmentation. It redesignates migrants as members of the “working class”. They had previously been identified as “peasants” (Tuñón, 2006, 19), who are presumably at even greater disadvantage..

[54] China’s most recent guidelines regarding urban planning restate intentions to limit city growth (http://usa.chinadaily.com.cn/china/2016-02/22/content_23584448.htm). Apparently, local governments in Beijing and Shanghai continue to actively oppose growth (The Economist, 2016).

equilibrium models of city-level activity. Both conclude that larger Chinese cities are typically smaller than optimal size. Chauvin, et al. (2016) agree, based on estimates of Zipf's Law. Au and Henderson (2006) and Desmet and Rossi-Hansberg (2013) conclude that substantial welfare gains would be available if distortions that limit growth were absent. Moreover, according to Desmet and Rossi-Hansberg (2013), these potential gains are much greater than they would be for the contemporary United States.

This paper, examining the microeconomics of labor market valuations rather than the general equilibria of urban systems, arrives at the same conclusions. Distortions to equilibrium in the national urban labor market impose substantial welfare costs. If they were removed, at least some of the largest Chinese cities would be even larger. Moreover, their costs-of-living, though perhaps already superficially "high", would be higher still.[55]

Threats to these distortions would meet substantial opposition because they convey large rents to those with *hukou* in the most productive cities. However, these rents impose dramatic reductions in welfare for all those without. They can only persist if there are substantial barriers to mobility of both factors and goods. To reduce these distortions, China must function more as country and less as an empire.

[55] The spatial equilibria discussed in section 3 clearly do not prevail in contemporary China. Therefore, the implications of inter-provincial price differences are even more uncertain than if they did. The assertion in the text is based on the assumption that what trade in factors and goods does take place is, in general, moving the urban Chinese spatial economy in the direction of equilibrium. If so, then current net migration patterns would presumably be amplified in the absence of obstructions.

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