International Labour Review, Vol. 153 (2014), No. 3

The regional distribution of skill premia in urban China: Implications for growth and inequality

John WHALLEY* and Chunbing XING**

Abstract. *Based on urban household survey data, the authors find that skill premia increased significantly across all regions of China between 1995 and 2002, but only in coastal regions between 2002 and 2007. By then, these regions also displayed much wider wage inequality and thus contributed more to overall urban wage inequality than non-coastal regions. While privatization was the main driver of skill premia in 1995–2002, China's (regionally uneven) integration into the global economy became the dominant influence in 2002–07. Reducing skill premia and inequality, the authors argue, calls for reform of the Hukou registration system which impedes skilled labour mobility and possibly also growth.*

Since the 1990s, China's coastal provinces have had higher rates of growth than the hinterland provinces. By 2007, the GDP per capita of the richest province, Shanghai, was nearly ten times that of the poorest, Guizhou (National Bureau of Statistics, 2008). Regional income inequality has become a major contributor to China's overall inequality; and regional imbalance has become a threat to the sustainability of China's high levels of growth.

China's large gaps in economic development between provinces are thus a major reason for investigating the regional dimension of skill premia – i.e. the wage differentials between skilled and unskilled workers. Indeed, while the regional income gap has been studied extensively, little attention has been given to differences in skill premia across regions. Yet, the dynamics of the skill

* University of Western Ontario Center for International Governance Innovation (CIGI) and National Bureau of Economic Research, email: jwhalley@uwo.ca. ** Beijing Normal University, email: xingchunbing@gmail.com (corresponding author). The authors are grateful to the Ontario Research Fund, for support, and to Shi Li, Terry Sicular, Lance Lochner, Todd Stinebrickner, Chunding Li, Xiaojun Shi, Xiliang Zhao, Yunfei Wang, and seminar participants at the University of Western Ontario, SEBA-GATE 3rd Annual Workshop, Shenyang Agricultural University, the 2012 RUSE China Workshop at Jinan University, Central University of Finance and Economics, and the referee, for helpful comments. Chunbing Xing is also grateful to the National Natural Science Foundation of China (No. 71103019) and the Fundamental Research Funds for the Central Universities for financial support.

premia are central to an understanding of the evolution of China's overall inequality and of inequality in urban China in particular. Estimation of the skill premium over time has been the focus of a significant body of research (see Zhang et al., 2005; Li and Ding, 2003),[1] but how the skill premia have evolved within regions and how this may have affected overall inequality is largely neglected in the literature. Such dynamics also have implications for the mobility of workers with different levels of education.

Using education as a measure of skill, this article draws on data from three urban household surveys to estimate skill premia at the province and/or prefecture (or city) levels in 1995, 2002 and 2007.[2] We find substantial dispersion across regions, but also an increase in skill premia across all regions between 1995 and 2002, while only coastal regions show significant increases in skill premia between 2002 and 2007. We use a fixed effects model to determine which factors account for these increases in skill premia. In the period 1995–2002, institutional change – in the form of enterprise restructuring and privatization – appears to have played a key role in driving up the skill premia in the various regions. In the period 2002–07, by contrast, we find a significant relationship between export activity and increases in skill premia, suggesting that China's accession to the World Trade Organization (WTO) in 2001 and its wider integration into the global economy may have been the dominant influences. Though we also consider the possibility that high migration rates of unskilled labour slow the growth of real wages and drive up skill premia in coastal regions, we find only weak evidence to support this hypothesis.

Investigating changes in the regional distribution of skill premia also provides a deeper understanding of changes in urban wage inequality. Decomposition exercises show that, by 2007, the coastal regions had much wider internal inequality (because of higher skill premia), and that this contributes more to overall urban wage inequality than does inequality in non-coastal regions – a feature that has not yet been documented in the literature. An investigation of the regional distribution of skill premia also has implications for growth. In this article, we view the dispersion of skill premia as a measure of labour misallocation across regions.[3] Wider dispersion indicates greater difference in relative marginal productivity across regions; a reallo-

[1] There have also been estimates of the differential returns to education across other divides. Dong and Bowles (2002), for instance, estimate the returns to education as between public and private employment.

[2] Provinces are the highest-level administrative divisions in China, and prefecture-level cities (hereafter cities) are administrative subdivisions of province-level divisions. Municipalities directly under the central Government (Beijing, Chongqing and Shanghai) are treated as both provinces and cities in our estimation. Tianjin, another municipality, was not covered by the survey and is therefore not included here. In this article, we often use the terms "region" or "regional" to refer generally to these various territorial and administrative subdivisions.

[3] In recent years, a growing literature has emphasized resource misallocation in explaining low economic efficiency (Hsieh and Klenow, 2009). Earlier research focusing on regional inequality and growth considers income differentials across regions and the convergence (or divergence) in income levels in the growth process (Chen and Fleisher, 1996).

cation of labour (through migration) could therefore improve efficiency and promote economic growth.

A more complete picture of urban inequality and the relationship between economic transition and skill premia also has policy implications. First, the sharp increase of skill premia in most regions between 1995 and 2007 suggests that the demand for skilled labour had risen faster than the supply, implying that expansion of education and training programmes could help to reduce skill differentials. As coastal regions have much higher skill premia, which contribute to overall urban wage inequality, skilled labour mobility could help to reduce overall inequality and to realize the growth potential of China's economy. The Hukou system of household registration, which restricts population mobility, should therefore be reformed to become more friendly to educated workers. This policy should be prioritized given the sharp increase in the number of tertiary education graduates that has occurred since China's higher education expansion in the late 1990s. On the demand side, investing in – and offering preferential policies to – low-premium regions may also help to equalize regional skill premia, but such initiatives often involve complicated political processes, including negotiations between the central and local governments and competition among local governments. Indeed, whether skill premia dispersion and inequality can be reduced will depend on local circumstances, technology, and the nature of the policies pursued.

The remainder of this article is organized into five sections. The first reviews the research background and literature on skill premia; and the second describes our data. The third section reports our estimates of skill premia, their regional distribution, and evolution over time. The fourth section investigates the factors underlying regional patterns of skill premia over time and discusses the implications for overall urban wage inequality and potential policy actions. The fifth section briefly concludes.

Why is the regional distribution of skill premia important in China?

The Chinese economy grew rapidly between 1995 and 2007, at an average annual growth rate of 10 per cent, with relatively higher growth in the period 2002–07 (National Bureau of Statistics, 2009, table 2-4). The latter acceleration was partly due to China's deeper integration into the world economy following its accession to the WTO in 2001. High growth and a sharp increase in exports boosted demand for skilled labour in the urban sector. Major changes in the supply side of the labour market included the expansion of higher education, starting from 1999 (Li et al., 2011), and large increases in rural-to-urban migration (Cai, Du and Wang, 2009). But the supply of skilled workers seemed to be outpaced by demand, hence the increasing skill premium (and inequality) that accompanied China's rapid economic growth (Zhang et al., 2005; World Bank, 2009).

China is a large developing country in economic transition, with very different levels of economic development across its various regions. Earlier research has concluded that regional disparity is a major contributor to overall inequality (Gustafsson et al., 2008). The literature, however, has failed to consider that the relative wages of skilled and unskilled labour may be different across regions. Given the considerable effort that has been devoted to estimating skill premia, the natural next step is to extend the analysis to include the regional dimension.

Institutional factors may play a role in causing skill premia differentials between regions. In the late 1990s, many small to medium-sized state-owned enterprises (SOEs) in the urban sector were privatized (Appleton et al., 2002; Solinger, 2002), and many workers were allocated to the private sector. Different regions also had a different firm ownership mix. In 2008, for example, the registered employment share of SOEs was around 30 per cent in most coastal provinces, whereas it was still above 70 per cent in other provinces such as Jiangxi, Guangxi, Shaanxi, Gansu, and Qinghai (National Bureau of Statistics, 2009).[4] Thus, if wage determination mechanisms were significantly different across firm ownership types, with private sector firms and joint ventures sharing a higher skill premium (Meng, 2000; Dong and Bowles, 2002; Xing, 2008; Zhang et al., 2005), skill premia would vary across regions.

Another reason for regional unevenness is varying exposure to trade activity. China's "opening-up" policy was first implemented in the east, leading to rapid export growth and FDI inflows. In 1995, the average share of exports in the GDP of the coastal provinces was 32 per cent, while that of the non-coastal provinces was below 7 per cent.[5] Following its entry into the WTO, China experienced a sharp increase in trade activity over a relatively short period (Wan, Lu and Chen, 2007; Branstetter and Lardy, 2006); and most of the increase occurred in the coastal regions.[6] By 2007, the average export share in the GDP of the coastal provinces had reached 45 per cent, while that of non-coastal provinces was still below 8 per cent. Along with rapid export growth, China's exports were becoming more sophisticated, with resources moving from agri-

[4] These shares are calculated by dividing the number of workers in state-owned units by the total number of registered employees. All numbers are for urban areas (National Bureau of Statistics, 2009, table 4-8). If non-registered employment were taken into account, these SOE shares may turn out to be overestimates.

[5] Coastal provinces include Beijing, Fujian, Guangdong, Hainan, Hebei, Jiangsu, Liaoning, Shandong, Shanghai, Tianjin, and Zhejiang. Non-coastal provinces include Anhui, Gansu, Guangxi, Guizhou, Henan, Heilongjiang, Hubei, Hunan, Jilin, Jiangxi, Inner Mongolia, Ningxia, Qinghai, Shanxi, Shaanxi, Sichuan, Tibet, Xinjiang, Yunnan, and Chongqing. Export shares are first calculated for each province, and then averaged for coastal and non-coastal regions. The shares for 2007 are calculated in the same way.

[6] Most exports from the export growth regions were produced by foreign-invested enterprises, Hong Kong/Macau/Taiwan-invested enterprises, and joint ventures. According to our calculations using the Chinese industrial enterprises database, exports from foreign-invested enterprises accounted for 23 per cent of total exports from firms located in coastal areas in 2002, and their share increased to 35 per cent by 2007. Export growth throughout China shows a similar pattern. Detailed results are available upon request.

culture and textiles into machinery, electronics, and assembly (Schott, 2006; Amiti and Freund, 2008; Wang and Wei, 2008). Deeper integration into the world economy can affect the skill premium through several channels.[7] First, the skill premium may increase if more production of intermediate goods is shifted from developed countries to China, since such manufacturing could be characterized as skilled-labour intensive from China's perspective. Second, the skill premium may increase if capital inflows into China require more skilled labour. More fundamentally, greater openness may induce technological change in the form of increased imports of machinery, office equipment and other capital goods, which increase demand for skilled labour. Third, the adoption of foreign business practices through joint ventures may also affect the skill premium. As trade activity and FDI are regionally concentrated, these effects vary across regions.[8]

These regional patterns partly reflect the policies of the Chinese Government. In the early stages of reform, the central Government offered not only preferential policies, but also more investment to coastal regions to encourage exports and attract FDI. The five Special Economic Zones (SEZs),[9] for example, are all located in coastal regions (Wang and Wei, 2008). In the late 1990s, however, because of the widening regional gap, preferential policies were more often designed for the central and western regions. Many other policies were also location-specific, such as the development of the Pudong New District in Shanghai and the Binhai New District in Tianjin, or the more recent strategy to revitalize the old industrial base of the Northeast. These initiatives have often involved preferential policies on the part of the local and central governments, such as lower income tax rates for foreign-invested enterprises, fewer entry barriers into the finance and service sectors, more favourable treatment in regard to land use permissions, subsidies for industrial upgrading, etc. All of these policies have tended to increase local demand for labour.

However, although labour migration still tends to equalize relative wage gaps among regions, several features of China's labour market have made this process less effective than it otherwise might have been. In particular, the Hukou system, which was originally designed to control rural-to-urban migration in the 1950s by registering household members in designated rural or urban locations, still imposes high moving costs on migrants. Traditionally,

---

[7] Attempts have also been made to relate China's globalization process to inequality. See Zhang and Zhang (2003), Wei and Wu (2003), Wan, Lu and Chen (2007), and Cai, Chen and Zhou (2010). All of these papers use aggregate data and focus on the relationship between globalization and regional disparity.

[8] It is worth mentioning that these forces, combined with ownership restructuring, have probably changed "internal" wage inequality within firms. However, there is little empirical evidence on this, partly because individual-firm matched data are unavailable. Information on companies listed on the Shanghai Stock Exchange sheds light on one aspect of such internal inequality, namely, the pay gap between top executives and ordinary workers. The ratio of average compensation for the top three executives to that of average workers increased significantly, from 4.7 in 2001 to 7.9 in 2010, and the gap was wider in private companies than in SOEs.

[9] The five coastal cities are Shenzhen, Zhuhai, Shantou, Xiamen and Hainan.

one's Hukou status was categorized both by socio-economic eligibility ("agricultural" and "non-agricultural" Hukou) and by registered residential location, i.e. local versus non-local Hukou (Chan and Buckingham, 2008).[10] In the registered location, Hukou status confers specific local benefits, including access to health care, free public education, statutory housing entitlements, and better access to jobs. Permanent migration requires a change of registratered location.[11] Both the process and the number of such moves were tightly controlled by the Government. Temporary migrants, who cannot change their registered location, also needed official approval. People migrating without authorization were vulnerable to round-ups and deportation. Local citizenship benefits were inaccessible to temporary migrants.

Hukou policies have been becoming more flexible since the 1980s. One major change has been the localization of Hukou management, with many local governments having received full powers to determine their own criteria and the number of new permanent Hukou they grant. It has become easier for workers and households to transfer their registrations to other locations – particularly to small to medium-sized cities – and temporary residence permits are being granted more often. Also, it has become possible for some to migrate and get a job without a valid permit. But for such temporary migrants, local public services remain either inaccessible or expensive.

Compared to unskilled workers, skilled workers are more likely to secure local Hukou when they migrate. However, this does not necessarily mean that coastal areas, which have experienced positive demand shocks, have more in-migration of skilled workers, or that the skill premia are lower in those areas. First, the geographic mobility of workers with different skills depends not only on the labour market conditions of their destination areas, but also on the conditions prevailing in their places of origin. Although skilled workers are more likely to obtain urban local Hukou, the number of such moves is strictly controlled in the large coastal cities. For educated workers who cannot secure a local Hukou, the opportunity costs of moving to better-paid cities are probably high, because they typically need to give up a decent and secure job either in the rural non-farm sector or in a small to

[10] The first classification determined entitlement to state-subsidized food grain and other benefits. The second classification conditioned the enjoyment of many rights in a specific locality. One's Hukou status (locality and agricultural vs non-agricultural) is determined by birth, following one's parents' Hukuo status.

[11] Due to significant differences in employment opportunities and welfare and benefit entitlements, there is a strong incentive for rural residents to change their Hukou registration from rural to urban areas. Prior to the late 1990s, such changes also required approval by the State to convert Hukou status from agricultural to non-agricultural. Still today, this can only be done through certain channels and complicated procedures, and these channels generally favour individuals with more skills and/or special achievements. University education has been a major channel for increasing the probability of a favourable Hukou status. Other channels include military service and SOE or government employment (Wu and Treiman, 2004; Fan, 2008), rural residents' land being occupied by urban construction projects (Wong and Huen, 1998), and rural households purchasing urban housing (Deng and Gustafsson, 2006).

medium-sized city.[12] By contrast, large numbers of less educated rural workers migrate for better-paid jobs without obtaining local Hukou (note that the current Hukou system does not prevent such movements). If they do not migrate, these workers are typically engaged in farming jobs with low incomes. In a relevant study, Zhao (1997) finds that in Sichuan province rural residents with relatively high educational levels (full secondary attainment) tend to find jobs in local non-farm industries rather than in cities, mainly because of discrimination and higher living costs in urban areas (especially when compared to a decent, well-paid job and low living costs in rural areas).[13] Indeed, our own evidence from a random sample of the 1 per cent population survey for 2005 suggests that the labour market for skilled workers is far from efficient. Not only is there a large share of skilled workers who do not have the Hukou status of the location of their workplace, but regional wage dispersion is much wider among skilled workers than among unskilled workers.[14]

Second, we argue that the root cause of the increase in the regional dispersion of skill premia lies in regional demand shifts and institutional changes. Labour mobility is an induced reaction of the labour force to regional demand shocks. Even if the geographic mobility of skilled workers tends to reduce the regional dispersion of skill premia, it is unlikely to make the premium lower in high-premium regions, because demand-side factors dominate. Finally, the labour market takes time to adjust, even if skilled workers are responsive to regional demand shifts. In the United States, the impact of demand shocks on labour market outcomes has been shown to take a decade or more to be completely dissipated (Blanchard and Katz, 1992; Bartik, 1991).[15] In China, the Hukou system may further slow down the adjustment process.

Data and summary statistics

We use data from the China Household Income Project (CHIP) surveys for 1995, 2002 and 2007 to estimate the regional dispersion of skill premia over time. CHIP data are known for their high quality and national representativeness. In 1995, 2002 and 2007, the urban surveys covered 11, 12 and 16 provinces or municipalities, respectively, across regions that vary widely in terms of

[12] This is typically the case because non-coastal cities have a higher share of workers working in SOEs.

[13] The pattern of higher migration rates among the low-skilled rural labour force was also observed in the United States in the first half of the twentieth century (Bound and Holzer, 2000).

[14] While higher wage levels (among skilled workers) and higher skill premia in some regions were directly caused by slow adjustment in the training of educated workers relative to the increase in demand, the large *regional dispersion* (both in wage levels and skill premia) is more closely related to the mobility of labour and the functioning of the labour market. Even without new university graduates entering the labour market, the wage levels of skilled workers in high-wage regions will decrease if more existing skilled workers migrate to those regions.

[15] Blanchard and Katz (1992) suggest that the impact of these shocks (in terms of employment rates and wage levels) should be completely dissipated in less than a decade because of population adjustments, while Bartik (1991) suggests somewhat greater persistence.

geographic location and economic development. These surveys were designed to cover households with non-agricultural Hukou registration within the surveyed cities. In practice, however, a small number of migrant households were included as well.[16] In 1995 and 2002, the surveys collected information from Beijing, Shanxi, Liaoning, Jiangsu, Anhui, Henan, Hubei, Guangdong, Sichuan, Yunnan, and Guansu – these are province-level divisions, and Chongqing is separated from Sichuan as a municipality that has been directly controlled by the central Government since 1997. In addition, one municipality (Shanghai) and three provinces (Zhejiang, Fujian and Hunan) joined the 2007 survey. Each province or municipality is treated as a unit, and we use observations within each unit to estimate province-level skill premia. Municipalities and cities within provinces are treated as units when we estimate city-level skill premia. As the CHIP surveys do not follow individuals over time, they do not provide panel data.

We retain information on males aged 22 to 60 and on females aged 22 to 55.[17] We use labour incomes of urban workers, which include regular wages and subsidies and other labour income. The terms "wage" and "income" are used interchangeably and understood to refer to labour income thus defined. All income data are provided at the individual level and are deflated using the province-level consumer price indices (CPIs). The price levels for all provinces are normalized to one in 1995, and subsequent province-specific CPIs are used to calculate the price levels for 2002 and 2007.[18]

Because the sampling process of the CHIP surveys is based on formal residence registration (Hukou), the data include migrants who have obtained local urban Hukou, but exclude most migrant households without formal residence permits. Considering the large number of rural-to-urban migrants and the fact that they are usually less educated and worse-off than local urban workers (Démurger et al., 2009), our data may produce a biased skill premium. By focusing on a sample with urban Hukou, there is less need to consider the monetary value of Hukou. However, this also means that we are unable to use our findings to infer the wage differentials determined by Hukou status.[19]

[16] In 2002 and 2007, around 1.7 per cent of the individuals in the sample had agricultural Hukou; only 0.56 per cent in 2002 and 1.05 per cent in 2007 had non-agricultural Hukou but were registered elsewhere than in the city of their workplace. We do not have such detailed information for 1995, but we conjecture that the number of migrant households was even smaller.

[17] The 22-year threshold is chosen because people who go to university typically finish at that age in China. The age thresholds of 60 for males and 55 for females reflect current arrangements for retirement. Our results, however, are not sensitive to the choice of age thresholds.

[18] As our focus is the relative income of skilled versus unskilled workers in each region, the use of regional or national CPIs will not influence our estimate of the skill premia and their distributions.

[19] We have also used the 1 per cent population survey for 2005 to estimate the returns to education for rural-to-urban migrants who do not have urban Hukou. To save space, we do not report these results here. We find significant variation in skill premia across regions, and the pattern is similar to that reported in this article: on average, coastal cities have higher skill premia than non-coastal provinces. The consistency between these two sets of exercises (those using the CHIP data and those based on the 2005 population survey) indicates that including migrants in our sample would probably produce similar results.

Table 1. Summary statistics (percentages)

Variable	1995	2002	2007
	(1)	(2)	(3)
Age (years)	39.53	41.51	42.30
Female	46.8	45.7	45.7
Years of schooling	10.78	11.27	12.72
Lower secondary school and below	35.8	28.7	22.1
Upper secondary school	24.0	27.9	26.2
Technical school	16.1	11.9	11.3
3-year tertiary	16.0	21.7	25.3
4-year tertiary and above	8.2	9.8	15.0
SOE and government employment	81.4	61.2	53.2
No. of observations	11189	10774	15249

Note: SOE employment includes employment in state enterprises or joint-ownership enterprises in which the State is the majority shareholder (at the central, province or city level).

Table 1 provides summary statistics.[20] Both the average age and education level increased continuously over these years. In 1995, the average age of the urban working population was 39.5, increasing to 41.5 in 2002, and further to 42.3 in 2007. Average years of schooling increased from 10.8 in 1995 to 11.3 in 2002 and 12.7 in 2007. Looking at the different levels of education, a more detailed pattern emerges: the share of the population with tertiary education increased significantly between 2002 and 2007. Changes in the distribution of the labour force between different firm-ownership types reflect the restructuring process that took place in urban China. In the mid-1990s, over 80 per cent of the workforce was employed in the public sector.[21] By 2007, that share had decreased sharply, to 53 per cent, while the number of workers in the private sector increased significantly.

Table 2 reports skilled worker shares (columns 1 to 3), income levels (columns 4 to 6), and inequalities measured by the Gini coefficient (columns 7 to 9) by province. For the purposes of this article, "skilled workers" include all those with a tertiary education degree (three or four years) or above and those with a technical school degree, while the remainder are classified as unskilled workers. On average, the share of skilled workers increased from 40 per cent in 1995 to 43 per cent in 2002 and 52 per cent in 2007. However, there were

[20] We only report the summary statistics for the observations with positive labour income. Including observations without income does not change the results significantly (we do not report these results here).

[21] Public sector employees include government employees and workers in SOEs. Between 1995 and 2002, the shrinking of public sector employment was mainly due to the reduction of employment in SOEs (from 52 per cent in 1995 to 33 per cent in 2002). For 1995 and 2002, wage regressions controlling for a dummy of government or SOE employees produce similar skill premia to those produced by regressions controlling for two dummies denoting government employees and SOE workers. But we cannot distinguish the two types of public sector employment in 2007 so we have put both types of employment into a single category for all three years in this article.

Table 2. Skilled worker shares, income and income inequality in urban China by province, 1995–2007

	Skilled worker share (%)			Average annual income (1995 yuan)			Gini coefficient		
	1995	2002	2007	1995	2002	2007	1995	2002	2007
Province	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Beijing*	51.6	47.7	61.2	8457	12044	20348	0.243	0.348	0.365
Shanxi	43.4	44.0	49.9	4822	8132	12405	0.276	0.363	0.325
Liaoning*	39.2	41.0	48.6	5522	9216	11641	0.267	0.353	0.383
Shanghai*			46.8			24490			0.422
Jiangsu*	32.9	36.4	45.4	6742	10350	18986	0.262	0.367	0.446
Zhejiang*			43.7			21990			0.401
Anhui	34.0	41.8	47.0	4900	8250	12779	0.253	0.346	0.338
Fujian*			51.9			15792			0.372
Henan	38.8	42.2	62.6	4737	7746	11973	0.278	0.326	0.313
Hubei	41.3	51.3	55.3	5866	8532	14140	0.246	0.326	0.358
Hunan			53.0			12830			0.351
Guangdong*	36.3	41.2	52.7	11201	17929	26246	0.307	0.376	0.403
Chongqing	42.8	40.3	48.4	4762	9351	12473	0.232	0.340	0.348
Sichuan	41.6	36.9	51.4	5940	8068	12248	0.258	0.361	0.381
Yunnan	45.6	51.7	52.3	5733	9186	11821	0.202	0.301	0.366
Gansu	37.4	43.1	48.7	4604	7641	9807	0.241	0.344	0.371
Total	**40.2**	**43.4**	**51.6** (52.4)	**6209**	**9772**	**16173** (15522)	**0.296**	**0.373**	**0.413** (0.412)

* Denotes coastal provinces.

Notes: Skilled workers include graduates of technical school, vocational tertiary education (three years), university (four years) or above. Unskilled workers include secondary school graduates and those with degrees below that level. Columns 1–3 calculate the share of skilled workers among those with wage incomes. Wages are deflated using province-level urban CPIs. The price levels for all provinces are normalized to one in 1995. Numbers in parentheses are calculated excluding observations from the newly added provinces covered by the 2007 survey.

wide variations across provinces; for example, the share of skilled workers increased by over 20 per cent between 2002 and 2007 in Henan, but it barely increased at all in Yunnan.

There were also significant increases in income between 1995 and 2007. Average annual wages increased from 6,209 yuan in 1995 to 9,772 yuan in 2002, and further to 16,173 yuan in 2007. The data also indicate that both income levels and income growth were unbalanced across provinces, with coastal regions having higher income levels and growth rates. The Gini coefficients show a significant increase in inequality for every province between 1995 and 2002: on average, the coefficient increased from 0.296 to 0.373. For the period 2002–07, the Gini coefficient for the whole sample increased more modestly, from 0.373 to 0.413, but with significant regional variations. For some hinterland provinces, the Gini coefficients decreased (e.g. Shanxi and Henan), while for coastal provinces, the coefficients increased (e.g. Jiangsu).

The regional distribution of skill premia

The wage levels of skilled and unskilled workers

Table 3 shows how the income gaps between skilled and unskilled workers – a crude measure of skill premia – differ across provinces and how the pattern has evolved over time. The income gaps were moderate in the mid-1990s, except in Guangdong. By 2002, however, the average gap had increased significantly, with some indication that the skilled/unskilled gap was wider in coastal provinces. Between 2002 and 2007, the income gaps were still growing faster in coastal provinces than in non-coastal regions. Thus, skilled workers in coastal regions had higher wages relative to unskilled workers than their counterparts in non-coastal regions. Regional disparity also exists among unskilled workers, but it is not as noticeable as among skilled workers. For example, the Beijing–Shanxi income gap for skilled workers increased sharply from 3,637 yuan in 1995 to 4,224 yuan in 2002, and further to 9,942 yuan in 2007, but the income gap for unskilled workers remained below 3,800 yuan in all three years. Finally, the results reported in table 3 suggest that the widening of income gaps was due mainly to faster income growth among skilled workers, rather than to a decline or slow growth in unskilled workers' incomes.

The above wage gaps may reflect the effects of other factors, including different age and sex distributions, ownership structures, and industry compositions.[22] We control for such effects by estimating the following model:

$$\ln(WAGE) = \beta_0 + \beta_1 * SKILLED + \gamma X + \varepsilon \quad (1)$$

where *SKILLED* is a dummy variable indicating that an individual has tertiary education (three- or four-year post-secondary degree or above) or a technical school degree. Its coefficient reflects the extent to which skilled workers earned more than the unskilled.[23] Vector X includes experience (= age minus years of schooling minus six), experience squared, a sex dummy, an ownership dummy, and industry dummies.

We estimate model (1) by province for each of the three years, and the coefficients for *SKILLED* are reported in table 4. Over the period 1995–2002 (columns 1–2), the skill premia increased sharply across all regions. This is consistent with the existing literature that documents an overall upward trend in returns to education (Liu, Park and Zhao, 2010; Zhang et al., 2005). Less well documented is the wide regional variation in skill premia. In 1995, the highest skill premium occurred in Guangdong (0.399), and the lowest, in Beijing

[22] Non-work rates may also be different across regions: when samples with wage incomes are not selected from the working-age population at random, the skill premia derived from the observed data may be subject to selection bias. These concerns can be addressed by using Heckman's two-step selection model (Heckman, 1979), which gives similar results to OLS; only OLS results are reported.

[23] More rigorously, the skilled earn $100*[\exp(\beta_1)-1]$ per cent more than the unskilled according to model (1); when β_1 is near zero, $\exp(\beta_1)-1 \approx \beta_1$. Even when β_1 is large and $\exp(\beta_1)-1 > \beta_1$, the patterns of the regional distribution of $\exp(\beta_1)-1$ and β_1 will be similar, with $\exp(\beta_1)-1$ showing a wider dispersion. For ease of exposition, we report β_1 directly in the text.

Table 3. Income and income growth among unskilled and skilled workers in urban China by province, 1995–2007 (in yuan)

	Unskilled workers					Skilled workers					Income gap		
	Average annual income			Changes		Average annual income			Changes		Skilled – Unskilled		
	1995	2002	2007	95–02	02–07	1995	2002	2007	95–02	02–07	1995	2002	2007
Province	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Beijing*	7939	10038	14313	2099	4275	8942	14244	24170	5302	9926	1003	4206	9857
Shanxi	4452	6648	10588	2197	3939	5305	10020	14228	4716	4207	853	3372	3640
Liaoning*	4982	7510	9095	2528	1585	6360	11673	14335	5313	2662	1378	4163	5240
Shanghai*			16551					33508					16957
Jiangsu*	6124	8086	12300	1962	4213	8003	14305	27035	6302	12730	1879	6219	14735
Zhejiang*			15351					30531					15180
Anhui	4469	6711	10669	2242	3958	5736	10394	15164	4658	4770	1267	3683	4495
Fujian*			11831					19470					7639
Henan	4214	6352	9391	2139	3039	5564	9657	13516	4093	3859	1350	3305	4125
Hubei	5346	6902	11574	1556	4672	6606	10077	16218	3471	6141	1260	3175	4644
Hunan			9445					15836					6391
Guangdong*	9700	14583	19141	4883	4558	13841	22707	32613	8866	9906	4141	8124	13472
Chongqing	4114	7129	10126	3014	2998	5630	12642	14971	7012	2329	1516	5513	4845
Sichuan	5391	6314	8579	923	2265	6713	11073	15713	4360	4639	1322	4759	7134
Yunnan	5326	7044	8227	1718	1184	6218	11184	15101	4966	3917	892	4140	6874
Gansu	4230	5868	7276	1637	1409	5230	9978	12469	4748	2491	1000	4110	5193
Average	**5621**	**7859**	**11903 (11479)**	**2238**	**4044 (3620)**	**7083**	**12270**	**20172 (19192)**	**5187**	**7902 (6922)**	**1462**	**4411**	**8269 (7713)**

* Denotes coastal provinces.

Notes: Skilled workers include graduates of technical school, vocational tertiary education (three years), university (four years) or above. Unskilled workers include secondary school graduates and those with degrees below that level. Wages are deflated using province-level urban CPIs. The price levels for all provinces are normalized to one in 1995. Numbers in parentheses are calculated excluding observations from the newly added provinces covered by the 2007 survey.

Table 4. Skill premia, return to education, and tertiary education premium in urban China by province, 1995–2007

	Skill premium			Return to years of schooling			Tertiary education premium		
	1995	2002	2007	1995	2002	2007	1995	2002	2007
Province	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Beijing*	0.132	0.249	0.485	0.026	0.059	0.114	0.207	0.414	0.618
Shanxi	0.184	0.340	0.289	0.037	0.059	0.066	0.193	0.315	0.470
Liaoning*	0.319	0.470	0.350	0.048	0.075	0.078	0.333	0.602	0.510
Shanghai*			0.683			0.135			0.895
Jiangsu*	0.170	0.340	0.597	0.034	0.058	0.117	0.057	0.537	0.657
Zhejiang*			0.606			0.114			0.574
Anhui	0.226	0.306	0.244	0.031	0.072	0.053	0.248	0.401	0.345
Fujian*			0.351			0.091			0.442
Henan	0.218	0.263	0.363	0.039	0.056	0.066	0.325	0.445	0.504
Hubei	0.176	0.314	0.326	0.027	0.046	0.080	0.334	0.365	0.499
Hunan			0.340			0.077			0.513
Guangdong*	0.399	0.430	0.466	0.037	0.084	0.117	0.433	0.684	0.700
Chongqing	0.244	0.398	0.354	0.039	0.056	0.066	0.164	0.559	0.587
Sichuan	0.165	0.430	0.440	0.028	0.058	0.089	0.199	0.495	0.640
Yunnan	0.153	0.315	0.480	0.027	0.047	0.090	0.219	0.332	0.566
Gansu	0.277	0.473	0.408	0.039	0.074	0.072	0.367	0.504	0.457
Standard deviation	**0.078**	**0.077**	**0.123 (0.098)**	**0.007**	**0.012**	**0.024 (0.022)**	**0.104**	**0.113**	**0.127 (0.101)**

* Denotes coastal provinces.

Notes: For each province, we ran an OLS regression to get the skill premium and the return to education, controlling for experience, experience squared, sex, industry and firm ownership type. In the first three columns, skilled workers include those with tertiary degrees (three or four years) or above and technical school graduates. Those with secondary school degrees or below are classified as unskilled workers. Numbers in parentheses are calculated excluding the newly added provinces.

(0.132). The second lowest was Yunnan's (0.153) followed by Sichuan's (0.165). In 2002, Beijing remained the province with the lowest skill premium (0.249), while Gansu became the province with the highest (0.473), followed by Liaoning (0.470), Guangdong (0.430), and Sichuan (0.430). Gansu and Sichuan are western provinces and would therefore seem to show no clear relationship between skill premia and economic development. During the period 2002–07 (columns 2–3), there are signs that skill premia stopped rising or even declined in central and western provinces (e.g. Shanxi, Chongqing and Gansu). In the coastal regions, however, the skill premia kept rising.

Returns to education

Dividing the labour force into skilled and unskilled categories is a simplification because the educational expansion of the late 1990s was accompanied by significant composition changes within each group. In the unskilled group, the relative number of secondary school graduates increased significantly, as did

the relative number of tertiary education graduates in the skilled group (see table 1). Estimated skill premia may thus be contaminated by these changes. We therefore estimate the returns to years of schooling and the returns to various levels of education by using two different models, namely:

$$\ln(Wage) = \beta_0 + \beta_1 * SCHOOLING + \gamma X + \varepsilon \quad (2)$$

$$\ln(Wage) = \beta_0 + \sum_i \gamma_i * EDU_i + \gamma X + \varepsilon \quad (3)$$

In model (2) *SCHOOLING* is years of formal schooling, and in model (3) EDU_i are dummies for various education levels. X controls for the same factors as in model (1). The results of models (2) and (3) are reported in columns 4–9 of table 4. Generally, the patterns that emerge are consistent with the results presented above. As regards the returns to years of schooling (columns 4–6), the most important feature is the wide regional variation observed in 2007. While the returns are as high as 10 to 14 per cent in coastal regions, they are well below 10 per cent in non-coastal provinces. The standard deviation was 0.024 in 2007 – i.e. double that of 2002 and more than triple that of 1995 (see last row of table 4).

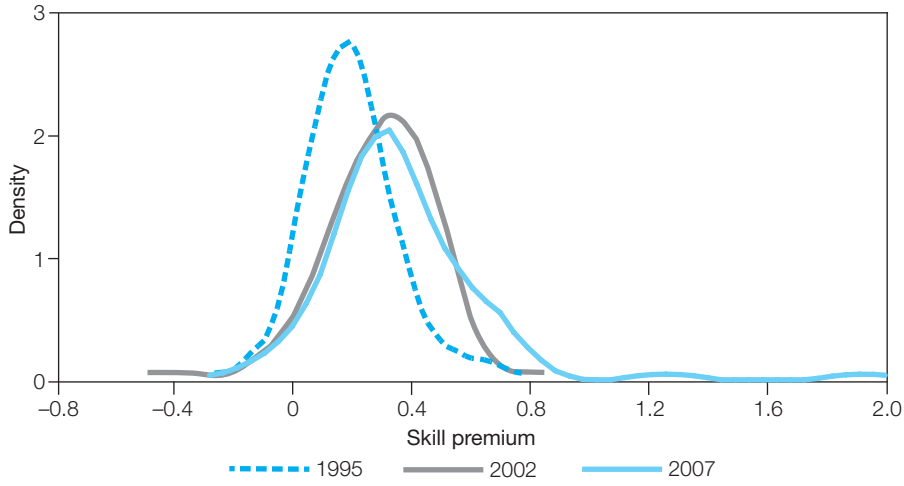
The tertiary education premia show similar patterns, but their dispersion increased only slightly over the period (columns 7–9). Owing to space constraints, the returns to other educational levels are not reported here, though some features are worth noting. First, most of the increases in returns to education are concentrated at higher levels of education, especially tertiary education. Second, coastal regions witnessed rising returns for almost every tertiary education level. Finally, the returns to secondary schooling decreased between 1995 and 2007.

Skill premia at the city level

We estimate wage equations for 62, 61 and 91 cities for 1995, 2002 and 2007, respectively, using the same specification as in model (1). After calculating the skill premia, we estimate their yearly kernel densities non-parametrically, each city being treated as an observation without using city population or employment for weighting. We use the Epanechnikov kernel function with the bandwidth set at 0.08. The distributions are reported in figure 1.[24] Apparently, they are non-degenerate in all three years. The distribution moved to the right and became more dispersed between 1995 and 2002. In the second period (2002–07) it moved slightly to the right. The fatter right-hand "tail" observed in the 2007 distribution is likely explained by the fairly high skill premia of some coastal cities. The regional distribution of returns to years of schooling shows a similar pattern of change over time (not reported here due to space limitations, but available on request). In the following section, we assess the importance of various factors behind the evolution of these city skill premia and returns to schooling.

[24] We have also estimated kernel densities for the distribution of city skill premia for those cities that are common to all three surveys. While only 33 cities remained, and the estimates became less accurate, the regional distribution evolved in a similar pattern. While not reported here, these results are available on request.

Figure 1. Distribution of skill premia at city level



Note: The skill premia are obtained by estimating a wage equation for each city. There are 62, 61, and 91 cities for 1995, 2002, and 2007. The kernel density for each year is estimated using the Epanechnikov kernel function, with the bandwidth set at 0.08, and each city is treated equally without using city population or employment for weighting.

Explanation of results and their implications

Drivers of regional skill premia

In this section, we estimate the following fixed effects model:

$$SKILLPREM_{it} = \beta_0 + \beta_1 * EXPGDP_{it} + \beta_2 * SOE_{it} + \beta_3 * SKILLED_{it} + \gamma X_{it} + u_i + \varepsilon_{it} \quad (4)$$

In this model, subscript i refers to city, and each city is an observation in the estimation; t = 1995, 2002 or 2007, referring to the survey year. *SKILLPREM* is the skill premium or return to years of schooling, as estimated in the preceding section; unlike wages in wage equations, it is not specified in log form. We use the ratio of exports to *GDP* ($EXPGDP_{it}$) to measure the openness of city i at time t. SOE_{it} is the share of the labour force employed in state-owned enterprises or in government. $SKILLED_{it}$ is the share of skilled labour in the labour force. Vector X controls for wage levels and age structures; and u_i is a time-invariant unobservable regional characteristic. The regressions are based on the 33 cities that participated in all three surveys.

The results are reported in table 5. In columns 1 to 3, we use the returns to years of schooling as the dependent variable. Column 1 shows the results when all three years are used. The only coefficient that is significant is for SOE, suggesting that ownership restructuring played a significant role between 1995 and 2007. However, since the effects of some factors may vary over time, columns 2 and 3 report the disaggregated results for the periods 1995–2002 and

Table 5. Explaining the regional variation of returns to education and skill premia

	Dependent variable: Return to years of schooling			Dependent variable: Skill premium		
	1995–2007	1995–2002	2002–07	1995–2007	1995–2002	2002–07
	(1)	(2)	(3)	(4)	(5)	(6)
EXPGDP	0.030	–0.021	0.152**	0.200	0.072	0.917**
	(0.051)	(0.047)	(0.065)	(0.211)	(0.176)	(0.400)
SOE	–0.170***	–0.134**	–0.172*	–0.643***	–0.340	–0.796
	(0.045)	(0.064)	(0.096)	(0.233)	(0.286)	(0.586)
SKILLED	–0.009	0.007	–0.002	–0.030	0.020	0.052
	(0.028)	(0.032)	(0.063)	(0.147)	(0.160)	(0.292)
EXPER11-20	0.048	0.051	–0.055	0.185	0.185	0.463
	(0.064)	(0.050)	(0.163)	(0.301)	(0.268)	(0.606)
EXPER21-30	0.087	0.080	0.042	–0.037	–0.132	–1.763**
	(0.057)	(0.075)	(0.164)	(0.342)	(0.373)	(0.801)
EXPER31+	0.044	0.059	0.166	–0.219	–0.515	–0.752
	(0.051)	(0.073)	(0.168)	(0.282)	(0.359)	(0.736)
MWAGE	–0.001	0.020	–0.037	–0.508	–0.754	–1.244
	(0.070)	(0.117)	(0.183)	(0.430)	(0.451)	(1.041)
Constant	0.179	0.012	0.118	1.022	0.557	0.745
	(0.251)	(0.301)	(0.521)	(1.319)	(1.512)	(2.381)
R^2_within	0.420	0.508	0.289	0.353	0.611	0.187
N	99	66	66	99	66	66

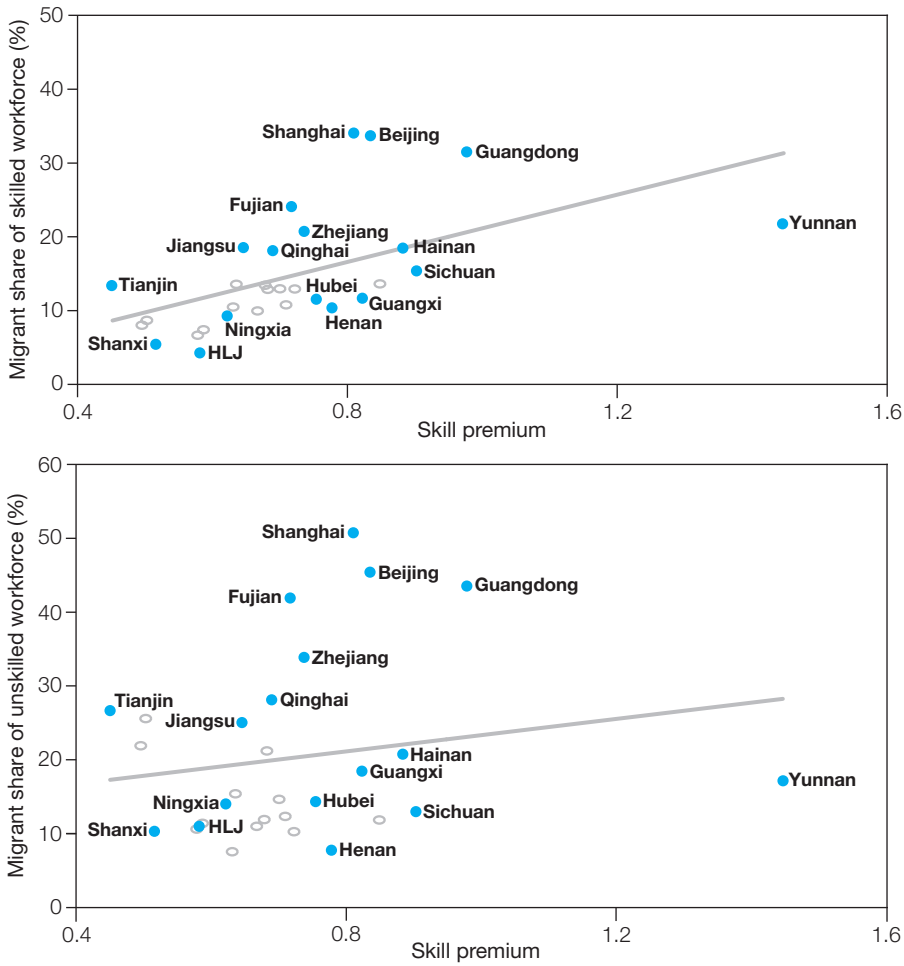
Notes: *EXPGDP* is the ratio of exports to *GDP*; *SOE* is the share of the labour force employed in state-owned enterprises or government. *SKILLED* is the share of skilled labour in the labour force of a city. *EXPER11-20* are the shares of the working population with potential experience ranging from 11 to 20 years; *EXPER21-30* and *EXPER31+* are defined similarly. *MWAGE* is the average wage level. *, ** and *** indicate significance at the 10, 5 and 1 per cent levels, respectively. Standard errors are given in parentheses.

Sources: National Bureau of Statistics (1997–2009) and authors' calculations from CHIP data.

2002–07, respectively. In the first period, export activity did not play a significant role. The coefficient on *EXPGDP* is small (–0.021) and its standard error is relatively large (0.047). For the period 2002–07, however, the coefficient on *EXPGDP* becomes significantly positive: a 10 per cent increase in the export share of GDP was associated with a 1.5 per cent increase in the return to years of schooling. The change in the coefficient on the export variable indicates a structural change after China's entry into the WTO. Indeed, export volumes increased sharply in this period, trade activity became more regionally concentrated, and export products became more sophisticated. These factors increased the demand for skilled labour in coastal regions and caused a wider regional dispersion of the returns to education.

Equally interesting are the coefficients for SOE. Between 1995 and 2002, the coefficient of SOE was significantly negative, which means that the reduction in the relative size of the public sector played a major role in increasing returns to education. This result is consistent with the fact that the private sector already offered higher returns to education than the public sector. Between 2002 and 2007, the coefficient of SOE only became significant at the 10 per cent level, although its absolute value increased. Considering that the SOE shares of

Figure 2. Skill premia and migrant shares of the skilled and unskilled workforces, 2005



Note: We regress log of wage on a skill dummy to get the skill premium for each province, controlling for age, age squared, and sex. Wages are deflated using provincial level urban CPIs. The price levels for all provinces are normalized to one in 1995. Skilled workers are those with a post-secondary degree and with positive wage income. Migrants are those who have left their Hukou registration location and work in another city for more than half a year.

Sources: 1 per cent population survey for 2005 and National Bureau of Statistics (1997–2006).

employment decreased more sharply in the first period (see table 1), ownership restructuring thus played a larger role in 1995–2002 than in the latter period.

Columns 4 to 6 of the table use city skill premia as the dependent variable and lead to similar conclusions. Due to data limitations, we cannot explore all of the factors that may affect regional skill premia. One unexplored hypothesis is that high migration rates of unskilled labour slow the growth of real wages in coastal regions and drive up skill premia there. We use information

from the 1 per cent population survey for 2005 to test this hypothesis by plotting the relationship between skill premia and the migrant shares of the skilled and unskilled workforces in the urban labour market in figure 2.[25] We run a regression of log of wage on a skill dummy for each province to calculate the skill premium, controlling for age, age squared, and sex. In this data set, skilled workers are defined as those with a post-secondary degree, and migrants, as those who have left their Hukou registration location to work in another city for more than six months. Figure 2 shows that the proportions of migrants are higher among unskilled workers than among skilled workers, especially in the coastal provinces. However, there is only a weak positive correlation between the migrant share of the unskilled workforce and skill premium (bottom panel of figure 2), indicating that the inflow of unskilled workers is not a significant factor in increases of coastal skill premia.[26] By contrast, a more significant and larger positive correlation is observed between the migrant share of the skilled workforce and skill premium (top panel of figure 2).[27] That regions with high skill premia (the coastal regions) have larger proportions of migrants in their skilled workforce is consistent with the hypothesis that economic growth is biased toward skilled labour, and that the growth in skilled labour demand is outpacing adjustment in skilled labour supply, either through increased supply of local educated workers or through inter-regional migration.

Skill premia and inequality

One implication of the evolution of regional distributions of skill premia relates to regional inequality. In figure 3, we plot the relationship between skill premia and wage inequality at the province level. In 1995, both skill premia and wage inequalities were low, but between 1995 and 2002, there was a general increase in skill premia across provinces. As a consequence, inequalities within provinces increased dramatically. Between 2002 and 2007, the dispersion of skill premia across provinces also grew, as did inequalities between them. In 2007, the relationship between skill premia and inequalities became more positive and significant. We also ran regressions of province-level Gini coefficients on skill premia in the different years; in all of these regressions, the coefficients on skill premia are positive. For 1995 and 2002, the coefficients are relatively small and insignificant; but in 2007 the coefficient is higher and significant at the 1 per cent level.[28]

[25] The migrant share of (un)skilled workers is calculated using the formula: [number of (un)skilled migrants]/[number of (un)skilled workers in urban labour market].

[26] Regressing provincial skill premia on migrant shares of the unskilled urban workforce results in a coefficient of 0.110 (0.119), and the adjusted R-squared is –0.0052 (Tibet is dropped from this regression).

[27] Regressing provincial skill premia on migrant shares of the skilled urban workforce, we get a coefficient of 0.228 (0.066), and the adjusted R-squared is 0.2730 (Tibet is dropped from this regression).

[28] These coefficients are 0.107 (0.086), 0.100 (0.082), and 0.221 (0.047) for 1995, 2002 and 2007, respectively.

Figure 3. Skill premia and inequality within provinces

Note: The skill premium for each province is estimated according to model (1), using data from CHIP 1995, 2002, and 2007. Regressing Gini coefficients at the province-level against skill premium, the coefficients on skill premium are 0.107 (0.086), 0.100 (0.082) and 0.221 (0.047) for 1995, 2002 and 2007, respectively. The adjusted R-squared are 0.046, 0.041 and 0.582, respectively. The numbers of observations are 12, 12, and 16.

Given the positive correlation between the skill premium and inequality within provinces, we can assess the implications of the evolution of skill premia for inequality. First, as skill premia increased significantly across provinces, so did inequalities within them, and this played an increasingly important role in determining the level of overall urban inequality and changes therein.[29] Second, the distribution of skill premia across provinces indicates that the coastal provinces have much wider internal inequalities. Our exercise shows that inequality within the coastal provinces has increased more than it has in non-coastal provinces, and that such inequality within provinces contributes more to the increase of overall urban wage inequality.[30]

[29] Formally, we decompose overall urban wage inequality into inequality between provinces and inequality within provinces. To guarantee that inequality is decomposable by province, we use an inequality measure of GE(2) (Generalized Entropy Index with sensitivity parameter 2). Such decomposition can be found in Gustafsson et al. (2008). In 1995, the overall and within-province inequalities measured as GE(2) were 0.181 and 0.140, respectively. Between 1995 and 2002, almost all of the increase in overall wage inequality (from 0.181 to 0.284) came from widening inequality within provinces (which increased from 0.140 to 0.243), while inequality between provinces decreased slightly. Again, most of the inequality growth between 2002 and 2007 (from 0.284 to 0.375) is attributable to widening inequality within provinces (from 0.243 to 0.321). Dropping the four provinces added in 2007 did not change this pattern

[30] Between 2002 and 2007, the decomposition exercises for the coastal and non-coastal provinces show that the overall GE(2) increased by 0.034 (= 0.227–0.193) in non-coastal provinces, and by 0.055 (= 0.361–0.306) in coastal provinces. These differential changes are driven mainly by the differential changes in inequality within provinces, namely 0.032 (= 0.223–0.191) and 0.063 (= 0.332–0.269) in non-coastal and coastal provinces, respectively. Again, dropping the four provinces added in 2007 did not change this pattern.

Policy implications

Our results have implications for many policy areas, including education and training, the Hukou system, and the unemployment of university graduates. First, the sharp increase in skill premia in almost all provinces between 1995 and 2007 suggests that education and training programmes can play an important role in reducing inequality by increasing the supply of skilled labour.

Second, the fact that skill premia have not been equalized across provinces indicates that the mobility of skilled labour between provinces is insufficient to meet regional demand shocks. Figure 4 provides further evidence in support of this conclusion: the upper panel shows that migrants account for around one-third of the skilled workers in Beijing, Shanghai and Guangdong, and for over 10 per cent of the skilled workers in 23 provinces; these shares are much smaller than the shares of migrants among unskilled workers, especially in the coastal provinces (see the bottom panel of figure 4). Besides, the large numerical difference between skilled and unskilled workers means that there are obviously far fewer skilled migrants than there are unskilled migrants.[31] Figure 4 also reports the relationship between these shares and the real wages of skilled and unskilled workers. The results suggest that skilled workers are less responsive to income differentials between provinces than unskilled workers. Indeed, while the wages of skilled workers vary more widely across provinces than those of unskilled workers, the province-level proportions of migrants vary less among skilled workers than they do among unskilled workers.[32]

These results show how tertiary education graduates should be allocated under the educational expansion policy, favouring coastal provinces over non-coastal provinces. As the Hukou system still imposes high costs on a large proportion of skilled workers, relaxing the system could facilitate their migration. But might such a policy not widen skill differentials rather than shrink them? This would depend on whether the system is more restrictive of skilled or unskilled labour and how the Hukou system is eased.

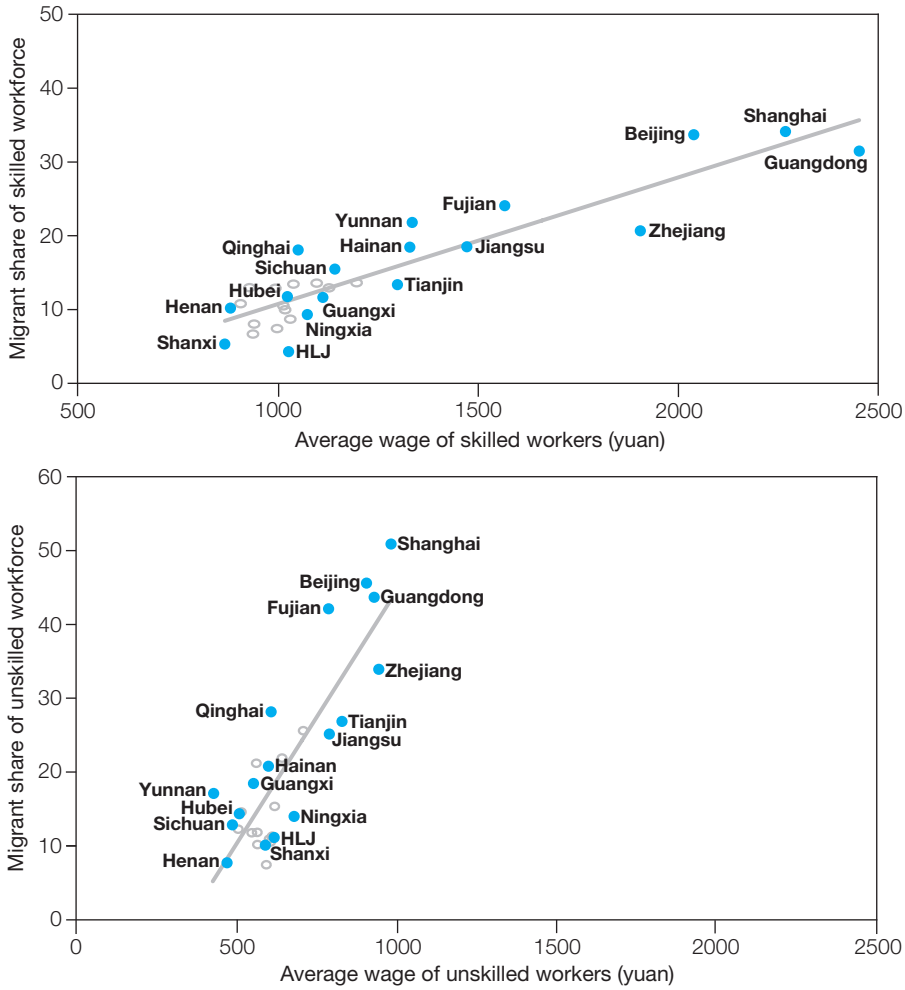
Skilled workers seem to have greater potential for moving than do unskilled workers. As shown in table 3 for 2007, they exhibit larger wage differentials across provinces than do unskilled workers. The wider differentials mainly reflect local wage increases among skilled workers in coastal provinces, suggesting that there is less geographic mobility among skilled workers.[33] Also, as shown in figure 2, the relative number of skilled migrant workers is still small in the urban labour market. Meanwhile, the results reported in table 6 indicate that skilled migrant workers have a stronger preference for permanent hous-

[31] According to our calculation based on the 1 per cent population survey for 2005, the ratio of unskilled to skilled migrants is 5.8:1 in the urban labour market.

[32] Regressing the province-level incomes of skilled workers on the migrant shares of the skilled urban workforce, we get a coefficient of 0.00017 (0.000015), which is much smaller than the results for unskilled workers, 0.00068 (0.00008). After dropping Yunnan province, the coefficients are 0.00017 (0.000014) and 0.00072 (0.00008), respectively. Tibet is dropped from all regressions.

[33] This is consistent with Topel's (1986) findings, which show that the largest local wage adjustments occur among those workers who exhibit the least geographic mobility.

Figure 4. Real wages and migrant shares of the skilled and unskilled workforces



Note: Wages are deflated using province-level urban CPIs. The price levels for all provinces are normalized to one in 1995. Skilled workers are those having degrees higher than high school graduates and with positive wage income. Migrants are those who have left their Hukou registration location and work in another city for more than half a year.

Sources: 1 per cent population survey for 2005 and National Bureau of Statistics (1997–2006).

ing, social security and public services, which are closely related to Hukou status: column 1 shows that they are more likely to purchase permanent housing than rent an apartment or live at construction site dormitories; columns 2 and 3 show that skilled migrants are more willing to change their Hukou registration to their workplaces and to settle down. Relaxing the Hukou system will therefore probably encourage more skilled than unskilled workers to move to high-premium cities, thereby reducing inequality there. The Hukou system should be

Table 6. Migrants' propensity to purchase housing, to settle down and to change Hukou

	1 per cent population survey for 2005	2012 floating population monitoring data	
	purchase permanent housing (yes = 1 / no = 0)	willing to stay over 5 years (yes = 1 / no = 0)	willing to change Hukoulocation (yes = 1 / no = 0)
	(1)	(2)	(3)
skilled	0.122***	0.056***	0.060***
	(0.006)	(0.004)	(0.005)
Pseudo R2	0.274	0.080	0.100
N	76934	132623	132684

Notes: All regressions are run for migrant heads of household, controlling for cubic age, sex, ethnicity, Hukou status, marital status, quadratic log of monthly income, and city dummies. Column 1 also controls for family size, but columns 2 and 3 do not, for lack of data. The *skilled* include individuals with tertiary degrees (three or four years) or above and technical school graduates. Probit models are estimated and the marginal effects are reported.

Source: Column 1 uses the 1 per cent population survey for 2005; columns 2 and 3 use the floating population monitoring data for 2012, compiled by the National Population and Family Planning Commission.

reformed step by step (as it always has been in the past), giving cities room to adjust and allowing the Government to set its priorities in the reform process. Even if our conjecture that the Hukou system is constraining relatively more skilled than unskilled labour does not hold, it is reasonable for the Government to make the Hukou system more friendly to skilled workers first, especially in high-income and high-premium regions. Such reform will not only reduce inequality but would also face less political pressure from urban residents.

Regional development would thus lead to sustained demand for housing and infrastructural investment as larger populations become concentrated in high-income cities. Migrants may experience slower growth in housing costs if the supply of housing is more elastic. At some stage, however, such investment will face constraints determined by the endowments of a specific area and suffer diminishing returns. These constraints and negative externalities also mean that increasing concentrations of workers in high-wage provinces could cause problems related to traffic congestion, pollution and environmental pressures on labour-receiving cities. If skilled workers demand higher compensation for these disamenities, skill premia could remain high in these (urbanizing) provinces. Should this be the case, however, a high skill premium would be associated with less inequality in utility. Moreover, as the labour market becomes more flexible, labour is allocated more efficiently, which is beneficial for growth. According to Au and Henderson (2006), who have estimated the inverted U-shaped function of real output per worker against city scale, China's migration restrictions have resulted in many undersized cities, and the costs of being significantly undersized are high. It follows that encouraging workers – especially skilled workers – to move by reforming Hukou and increasing housing supply will probably induce more returns than costs. Meanwhile, local governments should improve their management capacity to reduce the costs of congestion and pollution.

The high skill premia in some provinces also suggest a role for local governments and employers, including the development of education and training programmes. Take Yunnan as an example: its skill premium increased from 30.7 to 48.3 per cent between 2002 and 2007, but its share of skilled workers remained almost unchanged. In this case, increasing the level of educational attainment and providing a training programme for unskilled workers could reduce the skill premium and, thereby, inequality.

On the demand side, investing in – and offering preferential policies to – low-premium provinces may also help to equalize skill premia across provinces. However, location- or industry-specific policies often involve more complicated political processes; whether this approach can reduce the dispersion of skill premia and inequality depends on local circumstances, technology, the nature of the policies, and labour mobility.

Concluding remarks

This article has used three household surveys (1995, 2002 and 2007) to estimate the levels of skill premia and the changes they have undergone across different provinces and cities in China. Although skill premia increased in nearly all provinces between 1995 and 2002, we do not find any such increase between 2002 and 2007 except in the coastal provinces. Data from the 2007 survey indicate a strong positive relationship between export orientation and skill premia, with the coastal provinces exhibiting much higher skill premia than non-coastal provinces. We interpret the 2002–07 results as reflecting the deepening globalization of China's economy following its accession to the WTO.

These findings also have policy implications. As the employment of skilled workers (university graduates in particular) is an extremely important force for China's urbanization process, the costs of migration and relocation must be reduced in order to sustain high levels of growth and to mitigate inequality. Since labour-sending areas may experience something of a brain drain because of the out-migration of skilled workers, the central Government can play a role in balancing economic development by making fiscal transfers from the well developed to the less developed regions, and by providing quality public education services.

Lastly, in using CHIP data to estimate skill premia, we exclude most of the migrants who do not have local Hukou in the labour market where they work. Investigating the compensation differentials stemming from Hukou status – i.e. the migrant's marginal willingness to pay for the welfare and benefit entitlements associated with the Hukou status of his/her workplace – is beyond the scope of this article, and we leave this to future research.

References

Amiti, Mary; Freund, Caroline. 2008. *The anatomy of China's export growth*. Policy Research Working Paper, No. 4628. Washington, DC, World Bank.

Appleton, Simon; Knight, John; Song, Lina; Xia, Qingjie. 2002. "Labor retrenchment in China: Determinants and consequences", in *China Economic Review*, Vol. 13, No. 2–3, pp. 252–275.

Au, Chun-Chung; Henderson, J. Vernon. 2006. "Are Chinese cities too small?", in *Review of Economic Studies*, Vol. 73, No. 256 (July), pp. 549–576.

Bartik, Timothy J. 1991. *Who benefits from state and local economic development policies?* Kalamazoo, MI, W. E. Upjohn Institute.

Blanchard, Olivier Jean; Katz, Lawrence F. 1992. "Regional evolutions", in *Brookings Papers on Economic Activity*, No. 1, pp. 1–61.

Bound, John; Holzer, Harry J. 2000. "Demand shifts, population adjustments, and labor market outcomes during the 1980s", in *Journal of Labor Economics*, Vol. 18, No. 1, pp. 20–54.

Branstetter, Lee; Lardy, Nicholas. 2006. *China's embrace of globalization*. NBER Working Paper No. 12373. Cambridge, MA, National Bureau of Economic Research.

Cai, Fang; Du, Yang; Wang, Meiyang. 2009. *Migration and labor mobility in China*. Human Development Research Paper, No. 2009/09. New York, NY, UNDP.

Cai, Hongbin; Chen, Yuyu; Zhou, Li-An. 2010. "Income and consumption inequality in urban China: 1992–2003", in *Economic Development and Cultural Change*, Vol. 58, No. 3 (Apr.), pp. 385–413.

Chan, Kam Wing; Buckingham, Will. 2008. "Is China abolishing the *Hukou* system?", in *China Quarterly*, Vol. 195, pp. 582–606.

Chen, Jian; Fleisher, Belton M. 1996. "Regional income inequality and economic growth in China", in *Journal of Comparative Economics*, Vol. 22, No. 2 (Apr.), pp. 141–164.

Démurger, Sylvie; Gurgand, Marc; Li, Shi; Yue, Ximing. 2009. "Migrants as second-class workers in urban China? A decomposition analysis", in *Journal of Comparative Economics*, Vol. 37, No. 4, pp. 610–628.

Deng, Quheng; Gustafsson, Bjorn. 2006. *China's lesser known migrants*. IZA Discussion Paper No. 2152. Bonn, Institute for the Study of Labor (IZA).

Dong, Xiao-yuan; Bowles, Paul. 2002. "Segmentation and discrimination in China's emerging industrial labor market", in *China Economic Review*, Vol. 13, No. 2–3, pp. 170–196.

Fan, C. Cindy. 2008. *China on the move: Migration, the State, and the household*. Abingdon, Routledge.

Gustafsson, Björn; Li, Shi; Sicular, Terry; Yue, Ximing. 2008. "Income inequality and spatial differences in China, 1988, 1995, and 2002", in Björn A. Gustafsson, Shi Li and Terry Sicular (eds): *Inequality and public policy in China*. Cambridge, Cambridge University Press, pp. 35–60.

Heckman, James J. 1979. "Sample selection bias as a specification error", in *Econometrica*, Vol. 47, No. 1 (Jan.), pp. 153–161.

Hsieh, Chang-Tai; Klenow, Peter J. 2009. "Misallocation and manufacturing TFP in China and India", in *Quarterly Journal of Economics*, Vol. 124, No. 4, pp. 1403–1448.

Li, Shi; Ding, Sai. 2003. "Long-term change in private returns to education in urban China", in *Social Sciences in China*, No. 6 (in Chinese), pp. 58–72.

Li, Yao Amber; Whalley, John; Zhang, Shunming; Zhao, Xiliang. 2011. "The higher educational transformation of China and its global implications", in *World Economy*, Vol. 34, No. 4, pp. 516–545.

Liu, Xuejun; Park, Albert; Zhao, Yaohui. 2010. *Explaining rising returns to education in urban China in the 1990s*. IZA Discussion Paper No. 4872. Bonn, Institute for the Study of Labor (IZA).

Meng, Xin. 2000. *Labour market reform in China*. Cambridge, Cambridge University Press.

National Bureau of Statistics. Various years. *China Statistical Yearbook*. Beijing, China Statistics Press.

Schott, Peter K. 2006. *The relative sophistication of Chinese exports*. NBER Working Paper No. 12173. Cambridge, MA, National Bureau of Economic Research.

Solinger, Dorothy J. 2002. "Labor in limbo: Pushed by the plan toward the mirage of the market", in Françoise Mengin and Jean-Louis Rocca (eds): *Politics in China: Moving frontiers*. New York, NY, Palgrave Macmillan, pp. 31–61.

Topel, Robert H. 1986. "Local labor markets", in *Journal of Political Economy*, Vol. 94, No. 3, Part 2, pp. S111–S143.

Wan, Guanghua; Lu, Ming; Chen, Zhao. 2007. "Globalization and regional income inequality: Empirical evidence from within China", in *Review of Income and Wealth*, Vol. 53, No. 1 (Mar.), pp. 35–59.

Wang, Zhi; Wei, Shang-Jin. 2008. *What accounts for the rising sophistication of China's exports?* NBER Working Paper No. 13771. Cambridge, MA, National Bureau of Economic Research.

Wei, Shang-Jin; Wu, Yi. 2003. *Globalization and inequality: Evidence from within China*. CEPR Discussion Paper No. 3088. London, Centre for Economic Policy Research.

Wong, Linda; Huen, Wai-Po. 1998. "Reforming the household registration system: A preliminary glimpse of the Blue Chop Household Registration System in Shanghai and Shenzhen", in *International Migration Review*, Vol. 32, No. 4, pp. 974–994.

World Bank. 2009. *From poor areas to poor people: China's evolving poverty reduction agenda*. Report No. 47349-CN. Washington, DC.

Wu, Xiaogang; Treiman, Donald J. 2004. "The household registration system and social stratification of China: 1955–1996", in *Demography*, Vol. 41, No. 2, pp. 363–384.

Xing, Chunbing. 2008. "Human capital and wage determination in different ownerships, 1989–97", in Wan Guanghua (ed.): *Understanding inequality and poverty in China: Methods and applications*. Houndmills, Palgrave Macmillan, pp. 117–135.

Zhang, Junsen; Zhao, Yaohui; Park, Albert; Song, Xiaoqing. 2005. "Economic returns to schooling in urban China, 1988 to 2001", in *Journal of Comparative Economics*, Vol. 33, No. 4, pp. 730–752.

Zhang, Xiaobo; Zhang, Kevin H. 2003. "How does globalisation affect regional inequality within a developing country? Evidence from China", in *Journal of Development Studies*, Vol. 39, No. 4, pp. 47–67.

Zhao, Y. 1997. "Labor migration and education in rural Sichuan Province" (in Chinese), in *Jingji Yanjiu* (Economic Research Journal), Vol. 2, pp. 37–42.