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MEASURING CHANGES IN COMPETITIVENESS IN CHINESE MANUFACTURING INDUSTRIES ACROSS REGIONS IN 1995-2004: AN UNIT LABOR COST APPROACH[♣]

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ABSTRACT

Using an industry-by-region data set, based on China's *Third Industrial Census* for 1995 and *First Economic Census* for 2004, and covering 28 industries and 30 provinces, this paper examines the trend of labor compensation (ALC), labor productivity (ALP) and unit labor cost (ULC) by manufacturing industry across regions (provinces or groups of provinces). At the aggregate level, it shows that productivity growth was generally faster than that of labor compensation and hence resulted in a significant decline in unit labor cost for all regions in China. Furthermore, compared to more developed regions, less developed regions exhibited even stronger productivity growth relative to compensation, thus leading to a convergence across regions over this period. However, we observe a substantial variation in growth rates and convergence trends across regions for individual industries. Logit regression shows that labor intensive industries are more likely to converge in productivity, compensation and unit labor cost while skill intensive industries tend to increase inequality in unit labor cost. This is confirmed by estimating a growth regression, which shows that in provinces characterized by higher skill levels of the labor force, skill intensive industries experienced faster decline in ULC.

Key words: Labor productivity, average labor compensation, unit labor cost, and regional convergence

JEL Codes: J30

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I. INTRODUCTION

In the past decade, increased competitiveness largely due to low wages made China "the world factory" and the largest receiver of foreign direct investment among developing countries. However, wages are due to rise along with income growth as observed by many news reports and evidenced in some recent studies as well.[1] Hence one may argue that China's cost advantage will erode if the average wage rate in manufacturing industries continues to rise. However, rising wage is only one part of the picture. One cannot deal with competitiveness without looking at changes in labor productivity which has been missing in the current discussion. In the long run, the key to any country's sustainable growth lies in the rise of labor productivity that is attributable to both capital deepening (capital-labor ratio) and total factor productivity improvement. China can still maintain its competitive edge if productivity growth is able to outpace the rising wages. A useful measure of competitiveness therefore need to take into account the change of labor productivity or more precisely the change of unit labor cost, which measures *nominal* labor compensation adjusted by *real* output per worker.

Given China's sheer size and complicated geographical layout, it is characterized by different levels of development and accessibility to foreign direct investment across regions. The literature on income inequality convincingly shows that China's regional income inequality has been rising considerably since the mid-1980s when China's industrial reform began (see, for example, Wan, 2007; Wan, Lu and Chen, 2007).[2] Surprisingly, so far there have been few studies on regional inequality from the production side examining the underlying components of income, including labor productivity and compensation. In this paper we are interested in changes in regional competitiveness in Chinese manufacturing. After all the reallocation of resources across space is not directly driven by gaps in average household income but by differentials in factor costs and regional competitive advantage in general.

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[1] The Institute of Population and Labor Economics at the Chinese Academy of Social Sciences (CASS) and the Development Research Center of the State Council predict a depletion of the rural surplus labor in China in the near future, which will further drive up the wages. (See Cai, 2007). Businessweek (March 27, 2006) cites that corporations and suppliers are beginning to look for more profitable options, including countries such as Vietnam or Indonesia. The Economist (January 11, 2007) notes that pay for factory workers has been rising at "double-digit rates for several years." The New York Times (August 29, 2007) profiles a number of factory managers having difficulty finding workers and dealing with wage rises.

[2] For a recent overview, see the special issue of *The Review of Income and Wealth* on "Inequality and Poverty in China" (March 2007), including contributions by Wan (2007), Wan, Lu Chen (2007) and Tsui (2007). Also refer to "*China's Retreat from Equality: Income Distribution and Economic Transition*" edited by Carl Riskin, Zhao Renwei and Li Shi, for a comprehensive study on income inequality in China.

In this study we follow the standard approach of measuring unit labor cost (ULC) by industry and by province. We exploit the available information from two major industrial censuses, China's *Third Industrial Census* for 1995 (the 1995 Census hereafter) and the *First Economic Census* for 2004 (the 2004 Census hereafter) to examine changes in the levels and growth rates of labor compensation (including wage, welfare and all other non-wage payments to labor) and productivity by industry and by location. This exercise covers 30 provinces and 28 manufacturing industries.

We find that there was indeed rapid increase in average labor compensation over the period 1995-2004, ranging from 2 to 4 times in most industries and provinces. However, there was an even stronger growth in labor productivity across industries and provinces, roughly between 4 and 10 times. This has resulted in a substantial decline in ULC across the board ranging from 20 to 80 percent during this period. We also find that the regional inequality, measured by coefficient of variation, fell significantly for ULC and its two components (ALP and ALC) at least at the aggregate manufacturing level. This implies that even though there may still be sizeable differences in labor productivity and compensation levels among regions, they are now much better aligned than a decade ago, suggesting a significant convergence of regions in labor productivity and compensation and thus ULC. One may reasonably argue that institutional reforms have been doing much to eradicate inefficient activities in wrong industries and at the wrong places. Indeed the literature has now clearly evidenced the huge wipe-out of inefficient state-owned enterprise across the country.[3]

When turning to industry level, we find that while there was an overall decline in ULC for almost all provinces due to the faster increase in labor productivity relative to labor compensation, not all industries exhibit the convergence trend across regions as observed at the aggregate manufacturing level. We therefore apply a Logit regression to investigate whether industries with certain characteristics have a higher probability to converge in ALP, ALC and ULC than those without the characteristics. The estimation results show that labor intensive industries are more likely to converge while skill intensive industries tend to increase inequality in ULC. This leads us to investigate what regional

[3] See, for example, Dougerthy and McGuckin (2002) who show that government decentralization – "federalism" – has played an important role in improving the performance of collective, state-owned and mixed public/private ownership firms. This result is strongly confirmatory of much of the recent theoretical work on transition economies that posits a key role for government in the efficient operation of markets.

characteristics may affect the decline in ULC. By estimating an extended form of growth regression, we find that in provinces characterized by high skill level of the labor force, some skill intensive industries, such as machinery and transportation equipment, experienced significant decline in ULC.

The paper proceeds as follows. In Section II we discuss the database that has been constructed for this study and the issues concerning the asserted consistency of the data for the two benchmark years. Section III examines the main trends in ULC and its two components, labor productivity and compensation, between 1995 and 2004. The convergence pattern of each of the three variables is studied in Section IV, followed by a Logit regression analysis on the "causes" of convergence in Section V. In Section VI, we further substantiate the Logic results by carrying out a growth analysis to identify the factors that may have affected the decline of ULC. Section VII concludes this study.

II. Data Construction

In this paper we use a simple competitiveness measure, which is unit labor cost (ULC) defined as the cost of labor required to produce one unit of output. We prefer this measure which takes account of output and inputs, over comparing only the cost of the inputs. During the economic development, labor compensation is bound to increase in developing economies, thus the cost advantage will easily erode. However, productivity is the source of sustainable economic growth. If only the rising labor cost is more than offset by the increase in labor productivity, firms can still make profit in the long run and the region can still maintain its competitive edge. On the other hand, if the productivity increase cannot keep pace with labor cost, high wages mean that production may become too costly and jeopardize the long-run profitability of businesses

Unit labor cost can be expressed as labor compensation over output, but it is more instructive to observe how ULC is made up of labor compensation per person employed relative to output per employed person. Hence our analysis in this paper focuses primarily on three indicators, average labor compensation (ALC), average labor productivity (ALP), and unit labor cost (ULC). ALC is defined as the ratio of nominal labor compensation (C)[4] to total number of employees (L), while ALP is obtained as a ratio of

[4] Note we are focusing on total labor compensation and not just total wages or earnings. The latter only represent take-home pay measures which provide an incomplete picture of labor costs. Total labor compensation is a more comprehensive measure of labor cost for the employer. In addition to wages and salaries, labor compensation includes payroll taxes paid by the company, including employer contributions

gross value added (Y) to the number of employees. Finally, ULC is the ratio of ALC to ALP or simply the ratio of nominal labor compensation (C) to gross value added (Y).

Each of these indicators can be compared across regions or provinces. They can also be compared at different levels of economic activity, that is, for the whole economy, for industry groups (sectors) or for specific more narrowly defined industries. Hence for a given year, the level of ALC, ALP, and ULC for each individual industry *i* and each province *j* can be expressed as follows: [5]

$$ALC_{ij} = \frac{C_{ij}}{L_{ij}}, \quad ALP_{ij} = \frac{Y_{ij}}{L_{ij}}$$

and $$ULC_{ij} = \frac{ALC_{ij}}{ALP_{ij}} = \frac{C_{ij} / L_{ij}}{Y_{ij} / L_{ij}} = \frac{C_{ij}}{Y_{ij}} \qquad \text{(1a, 1b, 1c)}$$

where $i = 1, 2, \ldots, m$; $j = 1, 2, \ldots, n$, $i \neq j$

Aggregation for each province *j* across industries *i* is as follows:

$$ALC_j = \frac{\sum_i^m C_{ij}}{\sum_i^m L_{ij}}, \; ALP_j = \frac{\sum_i^m Y_{ij}}{\sum_i^m L_{ij}} \text{ and } ULC_j = \frac{ALC_j}{ALP_j} \quad \text{(2a, 2b, 2c)}$$

The third dimension in our study is time, as comparisons can be made at between two points in time or on an annual basis. In this context, it is important to note that while labor compensation is expressed in current prices, the time series for output (gross value added) is deflated with output deflators. Thus, in the calculation of a change in ULC, only the denominator (ALP) is expressed in real terms, while the numerator (ALC) is in nominal terms. This is standard practice in studies on competitiveness as ULC is supposed to measure the nominal cost per unit of real output.[6] Hence the unit labor

to social security schemes, social benefits paid by employers in the form of children's, spouse's, family, education or other allowances in respect of dependants, payments made to workers because of illness, accidental injury, maternity leave, etc. and severance payments (International Labor Office).

[5] Provided that there is only one estimate of employment for each cell, there is by definition no difference between the ratio of total labor compensation to value added and the ratio of average labor compensation to labor productivity.

[6] See, for example, Bureau of Labor Statistics, http://www.bls.gov/lpc/. Naturally, if one would be primarily interested in workers' wealth created per unit of output produced, it would be appropriate to also adjust the wage sum by a cost of living index.

measure represents the current cost of labor per "quantity unit" of real output produced. The deflators are described in more detail in the data description in **Annex A**.

The estimates above are derived for two benchmark years, for which the underlying information on total labor compensation, value added and numbers of employees can be obtained from one and the same source for each year, namely China's *Third Industrial Census* for 1995 and the *First Economic Census* for 2004.[7] These two sources are briefly discussed below. The appendix presents the basic information on ALP, ALC and ULC for 28 industries at all-nation level (see Appendix Table A.1).[8]

First Economic Census 2004

The *First Economic Census of China* was conducted by the National Bureau of Statistics in 2005 with reference to calendar year 2004.[9] The focus of the census was the non-agricultural and comparatively modern sectors of the economy, in particular industry and services. Using the average numbers of employees in 2004 from the Economic Census, there were 80.8 million employees in China's established legal manufacturing enterprises, of whom 56.67 million were in the "manufacturing enterprises of designated size and above". Enterprises of designated size and above are defined as all state-owned enterprises plus non-state-owned enterprises that had sales of 5 million yuan (about 600,000 US dollars) or more. The remaining 24.13 million were in manufacturing enterprises below designated size. Moreover the census includes another 23.8 million of self-employed or people engaged in household-based manufacturing activities.

For 2004, we focus exclusively on the group of 56.67 million employees in enterprises of designated size and above, covering about 70% of total employment in China's established legal manufacturing enterprises. There are several reasons for focusing on the larger plants only, including the difficulties to estimate output and labor compensation for the other two groups. Moreover, there is no information available on a province by industry basis for enterprises other than those at designated size or above. Finally, from

[7] Our analysis in this paper is based on two bench-mark years due to the data availability. It is interesting to have a full time series panel data analysis between these two years to provide a better picture on the dynamics of labor compensation, productivity and unit labor cost and how the convergence trend evolved over the 10-year time period. Such work is under way at The Conference Board.

[8] The industry level detail at provincial level will be made available for research purposes in due time.

[9] The reference time for the Economic Census was December 31st of 2004, and the flow data covered the whole year of 2004 (China NBS, 2005).

the perspective of competitiveness, the interest in the manufacturing firms of designated size and above (beyond 600,000 US$ sales revenue) only seems justified.

Even for enterprises at designated size and above there were no estimates of gross value added and labor compensation that could be directly obtained from the census. An extended table at the national level provided by National Bureau of Statistics contains gross value added and more detailed labor compensation for 30 industries. A comparison between the reported gross value added and the estimated gross value added through income approach in the extended table shows that the labor compensation components are somewhat understated – an issue that we discuss in more detail below. [10]

Even though the *First Economic Census* publishes a separate volume on provincial estimates[11], including the detailed estimates on employment by industry and province, substantial manipulations to the data were necessary in order to estimate gross value added and labor compensation by industry and province. Using the industry-level relationships between the published and extended tables from NBS described above at the national level, we obtained gross value added and labor compensation for 28 industries and 30 provinces.[12] Please refer to the data description in Annex A for detailed explanation.

Third National Industrial Census 1995

The *1995 Third National Industrial Census* consists of three volumes (by industry, region and ownership-type), plus a summary volume. It differs greatly from the 2004 Census in many aspects. The most notable problem is that there has been a change in the definition of the industrial accounting unit. Up to 1998 the major subset of industries for which the

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[10] Income approach gross value added is derived by summing up all labor compensation components together with the total profit, tax paid plus supplementary levies, current year depreciation minus the enterprise income tax. Assuming all components are properly measured, the smaller estimated gross value added than the reported gross value added in the extended table gives us good reason to believe that there are possibly missing components in labor compensation. This is very likely the case in China because a lot of pay in kind is hard to measure and not reported.

[11] NBS, *First Economic Census, Volume II*, Table 1-B-13 for manufacturing designated size and above by province, and Table 1-B-14 to 1-B-42 for manufacturing designated size and above, industry by province.

[12] In fact the 2004 census has 29 industry by province tables. However, the 1995 census discussed below has 28 industries that can be matched but does not include "Manufacture of Artwork and Other Manufacturing" (29) and "Recycling and Disposal of Waste" (30). These two sectors are therefore excluded from our analysis.

industrial statistics provided extensive information was "national independent accounting industrial enterprises at and above township level". Since 1998 this has been replaced by ''all industrial state-owned enterprises (SOEs) with independent accounting system and all industrial non-SOEs with independent accounting system and annual sales revenue in excess of 5 million yuan" (the designated size and above unit). According to Holz and Lin (2001) this change implied that non-SOEs with independent accounting system at or above township level but with sales revenue of no more than 5 million yuan are now excluded from the detailed industrial statistics. On the other hand, village-level enterprises that meet the two requirements are now included (p. 304, footnote 2). Even though it is not possible to make a precise assessment of the difference, it appears that "township level and above" firms covered roughly 60% of gross value of output in 1997, whereas "designated size and above" firms covered 57% of gross value of output in 1998 (Holz and Lin, p. 314, figure 2), which is a sufficiently small difference to assume that these two categories of firms are reasonably comparable. It is worthwhile to note that the manufacturing firms we focus on in this paper, i.e., firms of designated size and above in 2004 and firms of township level and above in 1995 include all foreign firms, state firms and major private firms, which represent the main body of the economy in China.

While the Third National Industrial Census provides complete data on gross value added and labor compensation (at least for wages and the welfare fund)[13], the data on employment by industry and province are essentially missing from the census. This information had to be obtained from the *China Industrial Economic Statistical Yearbook* (CIESY) for 1994, from which we used the industry shares by province to apply to province employment in the census. Please see data description in Annex A for further illustration.

Are we understating the growth of labor compensation?

Because of the two different sources used for 1995 and 2004 we have to carefully assess their consistency. As indicated above, we believe that the accounting units ("township level and above" and "designated size and above") match reasonably well albeit not perfectly. At face value we have no reason to expect any systematic bias in our results from this.

[13] We assume that the other categories of labor compensation were virtually non-existent in 1995.

However, as mentioned above the statistical sources used for this study do not provide a full coverage of the manufacturing sector in China and we can therefore not be certain that the conclusions from this study on enterprises at designated size and above also apply to the manufacturing sector as a whole. A rough comparison of the figures on gross value added and labor compensation from the two censuses with those published in the Input-Output Tables for 1995 and 2002, with a national accounts extrapolation to 2004, suggests that our estimated change in labor compensation for enterprises at designated size and above was much slower than for the manufacturing sector as a whole, while output growth was faster.[14] The obvious concern therefore is of course that we may be understating the trend in labor compensation relative to gross value added and therefore exaggerating the decline in unit labor cost.

In this regard we wish to make a few remarks:

- as firms at designated size and above represent relatively large enterprises, we are missing the smaller enterprises which usually are more labor intensive, hence explaining the larger gap in terms of labor compensation compared to the gap in gross value added
- due to the liberalization of the economy, output and employment outside the "designated size and above" category has probably increased faster. For example, according to a study The Conference Board (Deng et al., 2007), net employment creation in private companies has grown very fast at 9 per cent per year. Many of these companies are start-ups which will not have immediately hit the 5 million yuan revenue level.

While more research is needed, we assume that the rapid decline in unit labor cost is on the whole realistic for the category of "established" firms at designated size and above, on which we are focusing in this study. But the trend is probably somewhat faster than what one would observe for the aggregate manufacturing sector including enterprises below designated size.

III. DESCRIPTIVE RESULTS

[14] Roughly, the coverage of the census-based gross value added for enterprises at designated size and above relative to aggregate manufacturing has increased from around 60 per cent in 1995 to 89 per cent in 2004. In contrast, total labor compensation according to the census relative to the I/O tables has fallen from 88 per cent in 1995 to 84 per cent in 2004.

Figures 1 and 2 are a reflection of our main results which are shown separately along each of the two dimensions (province and industry) in our study. In figure 1 we look at the change in average labor compensation and labor productivity (on the left y-axis) and the decline in unit labor cost (on the right y-axis) for aggregate manufacturing by province between 1995 and 2004. In figure 2 we observe the same variables by manufacturing industry for the whole nation.

The figures show a rapid decline in unit labor cost across the board, both by province as well as by industry. Figure 1 shows that, on average, ULC declined by about 40 per cent between 1995 and 2004. Some provinces show substantially larger declines, but – with the exception of Shanghai – these are all relatively underdeveloped provinces outside the coastal area. While labor compensation grew at a relative comparable rate of 2 to 4 times between 1995 and 2004, labor productivity growth differentials were much bigger (between 4 and 10 times). However, with a few exceptions, the provinces with the fastest decline in unit labor cost are also typically the ones with the most rapid growth in productivity (between 6 and 8 times). Hence on the whole, productivity accounted for more of the variation in unit labor cost between provinces than labor compensation.

Compared to the variation across provinces, figure 2 shows somewhat less variation in ALC, ALP and ULC across industries in particular for ULC (with the exception of petroleum products). On the whole, productivity growth and ULC declines appear fastest in several capital intensive industries, including electric equipment and transportation equipment. In contrast, labor intensive industries, such as sport products, leather and garments, showed the slowest increases in productivity and the least declines in ULC.

Figure 1: Change in Average Labor Compensation (ALC), Labor Productivity (ALP) & Unit Labor Cost (ULC) by Province for Total Manufacturing

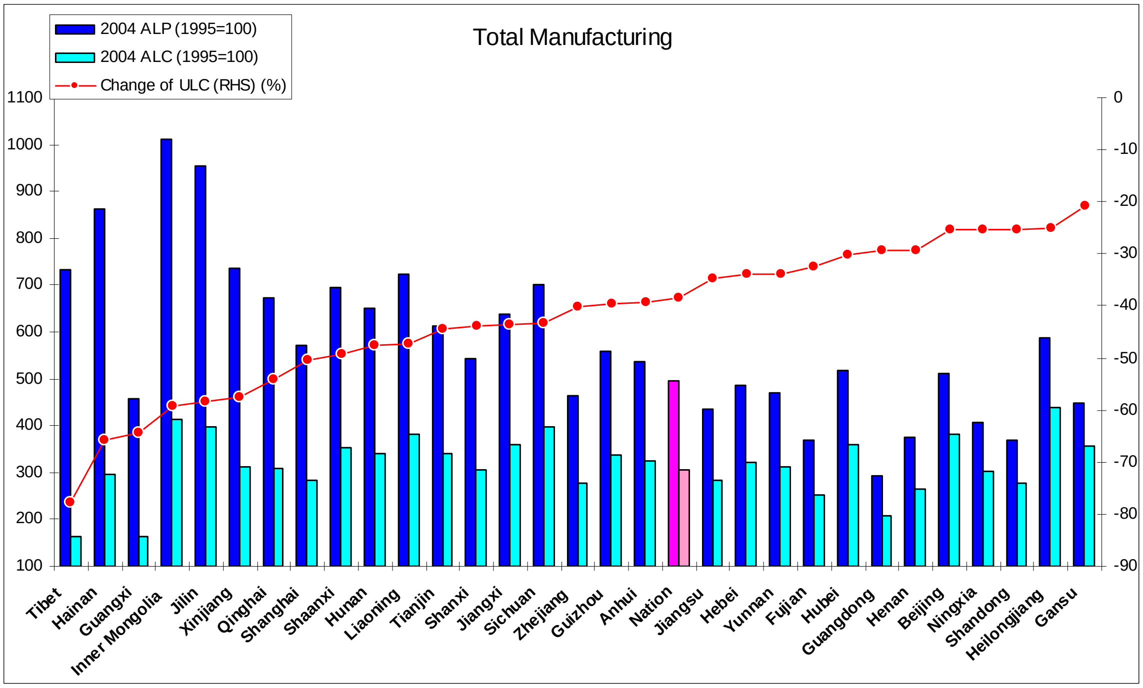
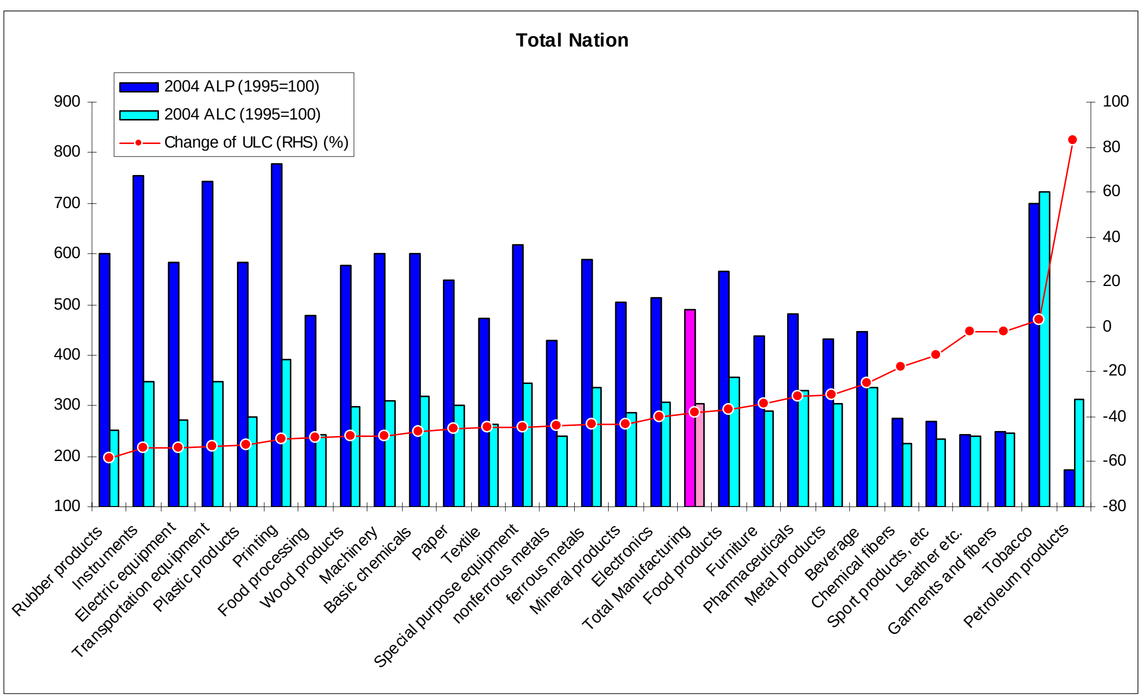


Figure 2: Change in Average Labor Compensation (ALC), Labor Productivity (ALP) & Unit Labor Cost (ULC) by Industry for Whole Nation



The biggest added value of this paper is in the development of a full industry by province panel. In terms of presentation of the results, we combined the 28 industries into eight main industry groups: Food Products; Textile & Clothing; Wood & Paper; Chemicals; Metal Products; Machinery; Transport equipment; and Electronics. Appendix Table A.2 shows how industries were allocated to industry groups. We also grouped the 30 provinces into seven regions which include: Bohai (Beijing and provinces around it), Southeast (including Shanghai and Guangdong), Northeast (represent the traditional industrial region of China), Central, Southwest, Northwest and Tibet (see section 4 and Appendix Table A.2 for a further explanation).

Table 1 shows a matrix of the change in ALC, ALP and ULC by industry group and each of the six regions between 1995 and 2004.[15] It shows that the labor compensation increases were highest in the electronics industry group in the Southwest and Northeast regions. Labor productivity increased fastest in all industry groups in the Northeast region. In contrast productivity growth was slower in the richer provinces in Bohai and the Southeast. Finally, ULC declined most rapidly in the Northeast, Southwest and Northwest regions, and less in the booming regions such as Bohai, the Southeast and the Central region.[16]

Although the picture is not entirely consistent, there is good reason to argue that the trends in ALP, ALC and ULC are at least in part related to traditional convergence trends, with regions that are characterized by low productivity *levels* growing faster in terms of productivity and showing bigger unit labor cost declines than high productivity level regions. This is also clear from Table 2 which – for the first year in our analysis, 1995 – shows relatively low levels of compensation and productivity in the Northeast, Central and Northwest regions, whereas the Bohai and Southeast region showed relatively higher levels.[17]

[15] In this table (as well as in Table 2) we do not separately present the Tibet region, which is very small in terms of its share in total manufacturing (less than 1% of overall manufacturing value added) in China.

[16] The results for electronics in the Southwest are strange, which is related to the very high negative profit that is reported for the electronics industry in Sichuan (incl. Chongqing). Negative profits occur more often in the database, but they rarely offset the positive components that contribute to income-based value added, as is the case here.

[17] The Southwest takes a somewhat intermediate position. This is mainly due to the relatively high productivity level of the Yunnan province which is due to the tobacco processing, accounting for more than 50% of the total gross value added. Also in the Hainan province, productivity came out relatively high (at least in 2004) due to the high productivity level in transportation industry.

Table 1: Change of ALC, ALP & ULC by industry Groups and Regions

Panel A: ALC Index (04/95, 1995=100)

	Bohai	SouthEast	NorthEast	Central	SouthWest	NorthWest	All Nation
Food Products	285.4	317.8	459.3	343.7	353.5	370.7	334.3
Textile & Clothing	238.2	219.7	331.5	241.7	234.6	250.1	255.4
Wood & paper	283.0	232.6	342.6	309.0	263.7	392.2	298.7
Chemicals	274.5	263.5	384.1	296.4	284.3	317.4	297.7
Metal products	361.0	254.1	393.6	335.1	269.9	325.5	313.2
Machinery	297.8	240.4	364.4	299.8	375.1	341.1	304.7
Transport equipment	314.2	297.1	386.5	390.8	308.4	385.9	346.3
Electronics	371.7	257.1	478.9	379.4	434.0	276.2	322.0
Total Manufacturing	302.5	249.8	397.9	320.0	315.6	337.3	304.9

Panel B: ALP Index (04/95, 1995=100)

	Bohai	SouthEast	NorthEast	Central	SouthWest	NorthWest	All Nation
Food Products	412.1	626.2	799.2	509.1	488.5	727.0	531.4
Textile & Clothing	375.7	279.6	678.5	315.8	642.2	410.5	364.4
Wood & paper	486.3	348.1	658.3	557.7	595.2	739.6	499.1
Chemicals	361.7	406.7	584.0	364.9	598.8	440.5	445.0
Metal products	507.0	428.5	835.7	593.2	536.7	605.6	548.9
Machinery	598.8	462.2	818.3	524.9	796.4	755.6	624.1
Transport equipment	617.6	598.4	866.2	747.6	760.9	910.7	742.6
Electronics	662.9	470.2	749.7	1032.1	-97.9	513.4	592.9
Total Manufacturing	439.3	394.9	747.3	504.6	599.4	634.2	494.5

Panel C: ULC Index (04/95, 1995=100)

	Bohai	SouthEast	NorthEast	Central	SouthWest	NorthWest	All Nation
Food Products	69.3	50.7	57.5	67.5	72.4	51.0	62.9
Textile & Clothing	63.4	78.6	48.9	76.5	36.5	60.9	70.1
Wood & paper	58.2	66.8	52.0	55.4	44.3	53.0	59.9
Chemicals	75.9	64.8	65.8	81.2	47.5	72.0	66.9
Metal products	71.2	59.3	47.1	56.5	50.3	53.8	57.1
Machinery	49.7	52.0	44.5	57.1	47.1	45.1	48.8
Transport equipment	50.9	49.6	44.6	52.3	40.5	42.4	46.6
Electronics	56.1	54.7	63.9	36.8	-443.3	53.8	54.3
Total Manufacturing	68.9	63.3	53.2	63.4	52.6	53.2	61.7

Note: Tibet - representing less than 1% of total value added in China - is not separately shown, but included in the total.

Table 2: Relative level of ALC, ALP & ULC by Industry Groups and Regions in 1995, All China=100

Panel A: ALC

	Bohai	SouthEast	NorthEast	Central	SouthWest	NorthWest	All Nation
Food Products	98	135	71	82	113	79	100
Textile & Clothing	90	130	61	75	81	80	100
Wood & paper	103	139	65	77	108	67	100
Chemicals	104	128	84	76	94	88	100
Metal products	88	127	92	87	104	95	100
Machinery	96	136	79	79	84	84	100
Transport equipment	101	133	91	83	100	78	100
Electronics	113	123	59	69	65	92	100
Total Manufacturing	96	129	81	80	96	87	100

Panel B: ALP

	Bohai	SouthEast	NorthEast	Central	SouthWest	NorthWest	All Nation
Food Products	93	106	45	99	178	54	100
Textile & Clothing	99	141	33	77	38	62	100
Wood & paper	123	143	53	84	83	58	100
Chemicals	127	132	85	75	66	69	100
Metal products	110	138	76	86	80	88	100
Machinery	110	152	60	81	66	56	100
Transport equipment	110	167	89	72	75	45	100
Electronics	153	124	50	47	54	74	100
Total Manufacturing	112	132	67	82	91	69	100

Panel C: ULC

	Bohai	SouthEast	NorthEast	Central	SouthWest	NorthWest	All Nation
Food Products	105	127	158	83	63	145	100
Textile & Clothing	91	92	182	97	210	129	100
Wood & paper	84	98	122	92	130	116	100
Chemicals	82	97	98	102	144	127	100
Metal products	80	92	121	101	130	108	100
Machinery	88	89	131	97	128	149	100
Transport equipment	92	79	102	114	134	173	100
Electronics	74	99	117	149	120	124	100
Total Manufacturing	85	98	120	98	106	125	100

Note: Tibet - representing less than 1% of total value added in China - is not separately shown, but included in the total.

IV. CONVERGENCE TRENDS IN COMPENSATION, PRODUCTIVITY AND UNIT LABOR COST

To obtain a better understanding of the degree of convergence that has taken place across regions, we look at the distribution of the comparative levels of ALP, ALC and ULC across provinces and regions in 1995 and 2004. Table 3 shows the coefficients of variation (CV), expressed as the ratio of the standard deviation to the mean for each variable, for major industry groups across the seven regions as defined above in section 3. This is a standard measure of inequality that is useful for the purpose of this study.

When focusing first on aggregate manufacturing, the strong decline in inequality across regions is most strongly established at the level of the seven region grouping. The CVs for all three variables (ALP, ALC and ULC) show a dramatic fall to well below 0.1. Even though the CVs across provinces are considerably higher, picking up more variation due to interregional specialization which is by definition excluded from the seven region grouping, the decline in inequality between 1995 and 2004 is still impressive.[18]

In particular, the huge decline in the CV for ULC to 0.18 on the basis of the provincial grouping, and even to 0.05 when using the seven region grouping, suggests that aggregate unit labor cost levels are now very close between regions. This essentially suggests that provinces (or regions) with high productivity levels relative to the all nation average also have relatively high compensation levels. This aligning of the ALC and ALP levels across provinces (regions) can essentially be ascribed to the transformation from planning towards a market system. As a result inefficient activities which were carried out at the wrong place, given the large differences in gaps for comparative productivity and labor cost levels relative to the national average, have been mostly eradicated during this period.

[18] See Appendix Table A.3 for CV's at the industry level. Here we do not report the coastal-central-western grouping, which is generally seen as too crude to deal adequately with the variation. See, for example, Wan (2007) showing that the three-region distribution of income inequality leaves a very large portion of within-region inequality unexplained.

Table 3: Coefficient of Variation

Coefficient of Variation in 1995

	Average Labor Compensation			Labor Productivity			Unit Labor Cost		
	30 provinces	7 regions	3 regions	30 provinces	7 regions	3 regions	30 provinces	7 regions	3 regions
Food Products	0.384	0.231	0.200	1.185	0.546	0.387	0.381	0.507	0.336
Textile & Clothing	0.385	0.246	0.297	0.523	0.526	0.521	0.489	0.353	0.330
Wood & Paper	0.396	0.299	0.320	0.383	0.357	0.367	0.235	0.172	0.062
Chemicals	2.934	2.219	0.225	0.410	0.390	0.323	3.847	2.431	0.110
Metal products	0.323	0.302	0.151	0.435	0.292	0.242	0.250	0.162	0.103
Machinery	0.340	0.276	0.262	0.476	0.531	0.440	0.338	0.400	0.184
Transport Equipment	0.327	0.218	0.160	0.690	0.420	0.395	0.597	0.297	0.301
Electronics	0.374	0.310	0.316	0.869	0.532	0.553	0.594	0.221	0.257
Total Manufacturing	0.330	0.375	0.214	0.435	0.266	0.244	0.302	0.447	0.028

Coefficient of Variation in 2004

	Average Labor Compensation			Labor Productivity			Unit Labor Cost		
	30 provinces	7 regions	3 regions	30 provinces	7 regions	3 regions	30 provinces	7 regions	3 regions
Food Products	0.400	0.177	0.111	0.672	0.294	0.244	0.278	0.171	0.129
Textile & Clothing	0.256	0.202	0.224	0.466	0.242	0.342	0.910	0.145	0.148
Wood & Paper	0.287	0.342	0.162	0.311	0.174	0.098	0.249	0.239	0.068
Chemicals	0.272	0.141	0.140	0.488	0.390	0.184	0.253	0.218	0.047
Metal products	0.230	0.083	0.064	0.414	0.128	0.146	0.216	0.063	0.128
Machinery	0.249	0.107	0.131	0.399	0.207	0.249	0.254	0.151	0.143
Transport Equipment	0.322	0.294	0.124	0.775	0.482	0.296	0.409	0.365	0.180
Electronics	0.368	0.203	0.134	1.243	0.745	0.753	1.013	-5.993	1.236
Total Manufacturing	0.219	0.078	0.090	0.336	0.094	0.072	0.177	0.052	0.035

We find that the strong decline in the coefficient of variation for aggregate manufacturing is largely but not fully confirmed by the decline in regional inequality for six of the eight major industry groups. With the exception of the wood & paper and transport equipment groups, the CVs for average labor compensation have declined for all other industry groups. For labor productivity, the CV for the chemicals group remained constant, but it increased for the last two industry groups, transport equipment and electronics. Indeed transport equipment also exhibited an increase in CV for unit labor cost. On the whole these results suggest that the relatively capital and skill intensive part of the manufacturing sector has not been contributing much to the overall convergence trend.

Indeed when focusing on the industry level (rather than major industry groups), figures 3a-3c show several industries with CVs for 2004 which are larger than for 1995. For average labor compensation (figure 3a) these include, for example, beverages, tobacco, chemicals and textiles, in addition to transport equipment. Increased regional inequality for labor productivity (figure 3b) is observed, among others, for tobacco, non-ferrous metals, chemicals, in addition to transport equipment and electronics. Figure 3c shows increased inequality for unit labor cost for as many as 10 industries between 1995 and

Figure 3a: Coefficient of Variation for Average Labor Compensation (ALC)

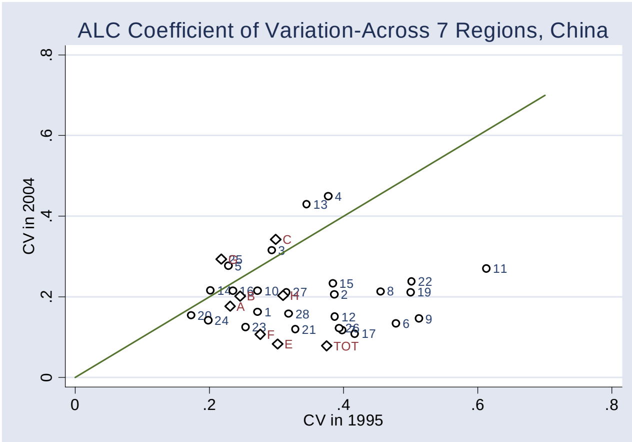


Figure 3b: Coefficient of Variation for Labor Productivity (ALP)

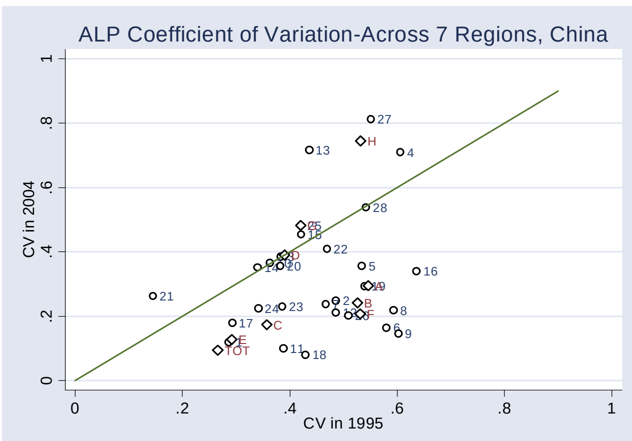
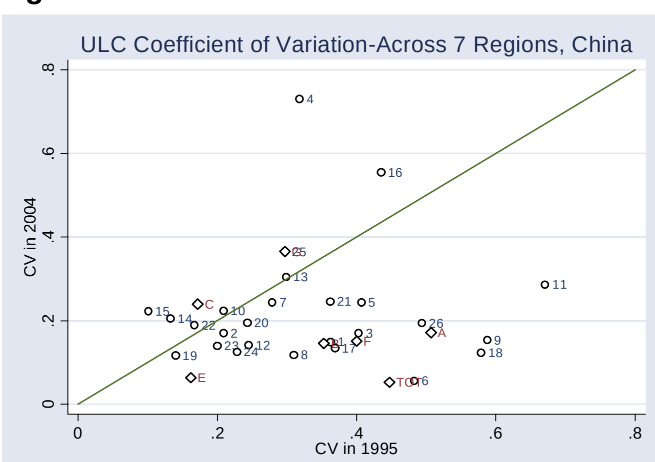


Figure 3c: Coefficient of Variation for Unit Labor Cost (ULC)



Numbers in the above figures indicate 28 industries. Please refer to Appendix Table 2 for the counterparts. Other notations: TOT – total manufacturing; A – food & beverage; B – textile & clothing; C – wood & paper; D – chemicals; E – metal products; F – machinery; G – transportation; H - electronics

2004, including major industries such as chemicals raw materials and fibers and metal products, in addition to transport equipment.

Hence the convergence trend observed for aggregate manufacturing is certainly not ubiquitous across industries. It is also clear from table 3 that inequality at the level of industry groups is much higher than for the aggregate manufacturing sector. This is in the first place a statistical phenomenon, which may be best understood on the basis of a simple example. If a country consists of only two regions (1 and 2) and two industries (A and B), region 1 may have a high level of compensation relative to region 2 in industry A and a relatively low compensation level in industry B. For both industries, the inequality levels would be higher than the average inequality of region 1 to region 2 as the relative inequality levels cancel out.

However, in the second place, the trend towards relatively low levels in inequality of ALC, ALP and ULC at the aggregate level compared to the industry level is also supported by some of the institutional and market reforms that have taken place in China over the past decade. This has allowed regions to specialize in those industries where they have a comparatively high productivity advantage and pay high compensation levels. Standard neoclassical trade theory, however, would predict that these market reforms may also cause an equalization of compensation and productivity levels at industry levels across regions. While this may happen in due time, there is another strand of theory that would predict that greater specialization will attract higher paid resources and cause further divergence rather than convergence at industry level, and perhaps even at the aggregate level.

V. THE CAUSES OF THE CONVERGENCE-DIVERGENCE DICHOTOMY AT INDUSTRY LEVEL

As we observed above that the significant convergence in ALC, ALP and ULC for aggregate manufacturing is not always reflected in similar convergence trends at the industry level, and that the low coefficient of variation for the aggregate manufacturing is in part the result of different specialization trends, the question arises what factors have caused some industries to converge and others to diverge across regions.

To study this we proceeded as follows. First we looked for variables that could have a significant effect on the convergence trend within an industry. From the available data, we constructed the following variables:

1. "State share" defined as the share of state capital and collective capital among total capital hold (source: 2004 Census, 95 N/A)
2. "Firm size" defined as the total gross value added divided by the number of firms, in thousand yuan (source: 2004 & 1995 Censuses)
3. "Labor intensity" measured as the total labor compensation as percentage of total gross value added, i.e., ULC (ULC95 and ULC04 from this study).
4. "Skill level" defined as a categorical variable, with 1 representing a high skill industry and 0 representing a low skill industry. Same measure used in the growth regression in section 6 below (see Kochhar, 2006)
5. "Openness" defined as the export value as percentage of gross value added (source: 2004 & 1995 Censuses).

To systematically analyze the effect of above industry characteristics on convergence and divergence while controlling for the initial level of CV, we applied a logistic regression (Logit) analysis which reveals the "probability" that an industry with a given characteristic will converge or diverge.

For this purpose we converted the ratio of the CV for 2005 over 1995 into a binary variable, taking the value of 1 if the CV ratio is less than 1, indicating convergence, and otherwise 0 indicating divergence. If we take ULC, as an example and denote $P = Prob(CV_{ULC}^{04} / CV_{ULC}^{95} < 1)$, the estimating logit regression takes the following form:

$$logit(P/1-P) = \alpha_0 + \alpha_1 CV_{ULC}^{95} + \alpha_2 X + \varepsilon \qquad (4)$$

with CV_{ULC}^{95} representing the level of the coefficient of variation in 1995 and with X representing one of the categorical variables for an industry (state ownership, firm size, labor intensity, skill intensity or openness). The estimated coefficients from the logit regression are parameters in the above model. As our interest is to know how much the change in the independent variable affects the probability of convergence, i.e., $\partial P / \partial X$. thus the following manipulation is employed:

$$\hat{p} = \frac{e^{\alpha_0 + \alpha_1 CV_{ULC}^{95} + \alpha_2 X}}{(1 + e^{\alpha_0 + \alpha_1 CV_{ULC}^{95} + \alpha_2 X})} \qquad (5)$$

$$\frac{\partial \hat{p}}{\partial X} = \frac{e^{\alpha_0 + \alpha_1 CV_{ULC}^{95} + \alpha_2 X}}{(1 + e^{\alpha_0 + \alpha_1 CV_{ULC}^{95} + \alpha_2 X})^2} \alpha_2 \quad (6)$$

The marginal effect on probability is evaluated at the sample mean for a continuous independent variable and against the reference category for a categorical variable. In the tables below only the marginal effects on probability are listed.

First we estimated the regression with all of the 28 observations, with each observation being the seven regions CV ratio for a particular industry. Due to our small sample size (28 industry observations), we could only use two variables for each regression. In the case of ULC we also carried out diagnostic tests for ULC to identify influential observations. The influential points are determined by their deviation from other normal observations in the graph, and only those that significantly affect regression results are dropped.[19]

Second, as a sensitivity analysis, we did the analysis for the 30 provinces CV ratio as well as the seven region CV ratio. Using the provincial CV ratio as dependent variable generated unsatisfactory results as we did not find any statistically significant relation between convergence and any of the variables. Furthermore the regression results by province appeared very sensitive to the selection of influential points. For these reasons we focused on the logit regressions for the seven region.

The results are summarized in Table 4 (panels a to e). For each dependent variable we report the estimated marginal effect for the 1995 CV ratio and the characterizing variable (for state share and skill we have only one set of observations, whereas for the other

[19] The influential observations are detected by the following diagnostic tests demonstrated in Appendix Table A.4: the standardized Pearson residual which measures the relative deviations between the observed and fitted values, the deviance residual which measures the disagreement between the maxima of the observed and the fitted log likelihood functions; the hat diagonal which measures the leverage of an observation, the chi-square fit statistic which identifies observations with substantial impact on chi-square, the deviance statistic which identifies observations with substantial impact on deviance, and dbeta which provides summary information of influence on parameter estimates of each individual observation. The numbers in this diagnostic test table (Appendix Table A.4) represent the industry code as reported in Appendix Table A.2.

Table 4: Results of Logistic Regression
(Dependent Variable: Between 7 Region CV ratio)

Panel a

	ALC	ALP	ULC	ULC W/O influential obs.
CV 95	0.636	1.049	1.729**	2.152***
State Share 04	-0.457*	-1.467*	-0.870	-0.791
Pseudo R2	0.308	0.214	0.207	0.296
Lstat	82.14%	78.57%	67.86%	66.67%

Panel b

	ALC	ALP	ULC	ULC W/O influential obs.
CV 95	0.728*	2.122*	2.809**	1.922**
Firm Scale 95	-0.000	-0.000	-0.000*	-0.000*
Pseudo R2	0.307	0.252	0.340	0.534
Lstat	75.00%	71.43%	78.57%	81.48%

	ALC	ALP	ULC	ULC W/O influential obs.
CV 95	1.142*	1.574*	2.181*	0 .143**
Firm Scale 04	-0.000	-0.000*	-0.000	-0.000*
Pseudo R2	0.341	0.337	0.280	0.564
Lstat	78.57%	78.57%	75.00%	80.77%

Panel c

	ALC	ALP	ULC	ULC W/O influential obs.
CV 95	0 .490*	1.666*	2.085**	1.595 **
Labor Intensity 95	0.387**	3.371***	2.342 **	1.468 **
Pseudo R2	0.322	0.422	0.330	0.518
Lstat	82.14%	85.71%	75.00%	84.62%

	ALC	ALP	ULC	ULC W/O influential obs.
CV 95	0.507	0.664	1.729*	1.439**
Labor Intensity 04	0.735*	3.957***	2.244*	1.828 *
Pseudo R2	0.283	0.337	0.245	0.409
Lstat	78.57%	78.57%	75.00%	80.77%

Panel d

	ALC	ALP	ULC	ULC W/O influential obs.
CV 95	0.7556*	1.116	1.631 **	1.828 **
Skill	0.076	0.0734	-0.295*	-0.275*
Pseudo R2	0.181	0.061	0.214	0.352
Lstat	82.14%	67.86%	67.86%	73.08%

Panel e

	ALC	ALP	ULC	ULC W/O influential obs.
CV 95	0.649	0.654	1.621 *	1.916 **
Openness 95	0.106	0.342	0.174	0.243
Pseudo R2	0.193	0.144	0.178	0.361
Lstat	71.43%	75.00%	60.71%	68.00%

	ALC	ALP	ULC	ULC W/O influential obs.
CV 95	0.465	0.715	1.690**	1.800**
Openness 04	0.114	0.161	0.026	0.085
Pseudo R2	0.239	0.097	0.145	0.230
Lstat	78.57%	71.43%	64.29%	73.08%

Note:

ALC means the logit regression is run using the CV of ALC, i.e., the dependent variable is the ALC CV ratio between 7 regions, and CV 95 indicates ALC CV 95. Same notation for ALP and ULC.

ULC W/O influential obs. means that the influential observations are excluded from the logit regression.

* significant at 10% level, ** significant at 5% leve, *** significant at 1%* level

State share: state capital and collective capital among total capital hold

Firm Scale: total GVA/number of firms, in thousand

Labor intensity: total labor compensation among total GVA

Skill level: categorical variable, with 1 being high skill industry and 0 being low skill industry. Based on the skill level classification in Africa (Kochhar et al., 2006)

Openness: export value/GVA

variables we have 1995 and 2004 independent characterizing variables). Analogous to R^2 in OLS, a pseudo R^2 is reported, which provides a quick way to describe or compare the fit of the model. However, as it lacks the straightforward explained-variance interpretation of true R^2 in OLS regression, another statistic, Lstat, is used to show the corrected classified rate, i.e., the percentage of the convergence/divergence that can be correctly predicted by the specified model.

The following observations stand out from the analysis:

1. Among all models, the initial level of CV has a positive significant effect on convergence probability. This implies that if the level of CV in 1995 is high, there is more room for convergence making it easier to reduce the regional inequality over the years.

2. Labor intensity (the inverse of capital intensity) significantly affects the convergence no matter whether we use 1995 data or 2004 data, and no matter whether we exclude the influential points for ULC or not. Specifically, at the sample mean, a 1% increase in labor intensity raises the convergence probability for ULC by 1.5% to 2.3%, depending on the year of the data used and the treatment of influential points. The results for ALC are only between 0.4% to 0.7%, but a much stronger and more significant effect exists for ALP, i.e. between a 3.4% and 4% higher convergence probability for a 1% increase in labor intensity. These results imply that industries with a high share of labor compensation in gross value added show a higher probability to converge than capital intensive industries which are more likely to diverge. The latter group of includes industries such as electrical machinery, electronics and transport equipment.

3. Being characterized as a high skill industry significantly reduces the convergence probability for ULC: being a high skill industry has around 30% lower probability to be convergent. This result reinforces the previous result as low skill industries are usually also labor intensive industries and the probability of convergence for these industries are higher than their counterpart. However, in contrast to labor intensity we find no significant result for skills on ALP and ALC convergence.

4. State share and degree of openness do not have statistic significant influence on

convergence probability. Firm scale significantly decreases the convergence probability after excluding the influential points, but the magnitude is small: a thousand yuan more in firm size brings down the convergence probability by 0.00013% and 0.0068% using 2004 and 1995 data respectively.

Obviously this analysis could be further improved if we could make use of more observations in our logit analysis. With 28 industry observations we cannot have more than two independent variables (the 1995 CV and the characterizing variable) in our regression[20]. We also have limited room for dropping influential observations. With more observations we can control the regressions for other characteristics, which might strengthen our result. In future work we will be looking for alternative measures to CV's which may give us a large range of observations.

VI. GROWTH REGRESSION OF UNIT LABOR COST

The above Logit regression results show that capital and skill intensive industries are more likely to diverge, it is interesting to examine whether these industries benefit by locating in provinces characterized by higher skill levels. We use the full industry by province panel and estimate an extended form of the beta-convergence regression commonly used in the economic growth literature in a cross-country analysis to investigate the provincial skill effect on the declining rate of ULC for different industries after controlling for the initial level of ULC.

We focus on the change of ULC because it measures competitiveness, though the same exercise can also be applied to ALP and ALC. Among various characteristics of a province, we focus on the skill level of a province. Skill intensity is widely used to define an industry and a province, especially in China nowadays, because of its economic upgrading from a nation that is characterized by low labor cost and low skill level to a country moving up the industrial value chain and improving the quality of labor as well as productivity through increasing investment in innovation, technology and R&D. The specification takes the following form:

$$Y_{ij} = \alpha_0 + \alpha_1 Z_{ij} + \boldsymbol{\beta} X_j \times \boldsymbol{\phi}_i + \boldsymbol{\phi}_i + \alpha_3 X_j + \varepsilon_{ij} \quad (7)$$

[20] Because logistic regression uses a maximum likelihood to get the estimates of the coefficients, many of desirable properties of maximum likelihood are found as the sample size increases. According to Long (1997, pages 53-54), at least 10 observations are need for each predictor.

$$Y_{ij} = \alpha_0 + \alpha_1 Z_{ij} + \boldsymbol{\beta} X_j \times \boldsymbol{\phi}_i + \boldsymbol{\phi}_i + \boldsymbol{\theta}_j + \varepsilon_{ij} \qquad (8)$$

Where, Y_{ij} is the growth rate (difference of logs) in industry *i* and province *j* for ULC, Z_{ij} is the log of the initial value of ULC, ϕ_i and θ_j are vectors of industry and province dummy variables respectively, capturing the industry and province fixed effects, X_j is a province characteristic variable (province skill intensity in our study). It is derived by weighting the industry level characteristic by its output share (i.e., gross value added share of industry *i* in total manufacturing in an individual province).[21,22]

We expect a significant negative coefficient for the initial value of the ULC, i.e., α_1, to indicate a "catch-up" trend, with regions that are characterized by high ULC levels declining faster in ULC than low ULC level regions. In specification 7 we use province characteristic, X_j,, which allows us to estimate the average effect of province characteristic on the growth rate. However, at the same time it does not capture all province related features. Hence in specification 8 we use industry and province dummies, ϕ_i and θ_j to capture industry and province fixed effects.

The interaction term in specification 7 and 8 above is actually a vector with each of the 28 industries interacting with the provincial skill levels. We are particularly interested in the coefficient vector, $\boldsymbol{\beta}$ of the interaction terms because it tells us whether and how the province characteristic affects the growth rate for a particular industry by looking at the coefficient for the interaction term of a specific industry dummy and province

[21] The industry level skill intensity is a categorical variable, with 1 representing a high skill intensive industry and 0 representing a low skill intensive industry. The classification of high skill and low skill intensive industries follows the industry order listed in Kochhar, 2006. For robustness purpose, we constructed two industry skill level categorical variables: one that classifies the top half of the industries ranked by skill level from high to low according to Kochhar as skilled industry, represented by 1; the other that identifies the top one third of the industries in the skill ranking as skilled industry, represented by 1. Consequently, we derived two types of province skill intensity from the above two industry skill level classifications.

[22] We used three shares: gross value added of 04, gross value added of 95 and the average gross value added share of 95 and 04. For concision, only the results using the gross value added of 04 share are reported in this paper as using other two shares do not affect the overall conclusion we draw from this analysis.

characteristic variable. The answer to this question is of particular interest to business strategists as it provides information on location choice in terms of growth rate. [23] However, the magnitude as well as the statistical significance of the coefficient vector is dependent on the reference group, that is, the choice of the reference group will affect the significance and magnitude of the coefficient vector. To overcome this problem we report normalized coefficients. These normalized coefficients are calculated as the deviations of the estimated province-characteristic premium, β from the gross value added-weighted average coefficient. Weights are the share of each industry output in total output. The weighted average is thus an industry-wide average. The normalized coefficient can be interpreted as the proportional difference of province characteristic *X* in industry *i* relative to the corresponding characteristic's industry-wide weighted average. For simplicity, all interpretations of the normalized coefficients below are relative to the industry weighted average without explicitly stated. This approach is akin to the calculation of the industry wage premium in the labor literature (Haisken-DeNew and Schmidt, 1997). In the results table below, we report the standard errors of the normalized coefficients and *not* the standard errors from the OLS regression.

The results of estimating specification 7 and 8 are reported in Table 5. The provincial skill level in Panel a is derived from a half-half division between high and low skill level industries, and in Panel b the provincial skill level is based on a one-third division between high and low industry levels. The industry code from "ind1" to "ind28" follows the order listed in Appendix Table 2. The first line in Table 5 shows the coefficients of the initial value, α_1 . The significantly negative signs across the board indicate the "catch-up" trend. The reduced regional disparity resulting from the "catch-up" trend conforms to our observed spatial convergence trend at the aggregate manufacturing level (Table 3).[24]

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[23] There is another interpretation of the coefficient vector in specification 7 and 8. From the standpoint of a local government, if the province characteristic is known to the policy maker, the coefficient of interaction terms tells whether and how each of the industry is going to affect the growth rate.

[24] To further verify the convergence trend, we estimate the regression below using the 30 by province observations at the aggregate manufacturing level and find a significantly negative coefficient of the initial level. We also restrict 30 provinces to those with gross value added share more than 1% in the convergence regression below, and the significant negative coefficient signing convergence trend remains. $lnULC_j^t - lnULC_j^{t-1} = \alpha_0 + \alpha_1 lnULC_j^{t-1} + \varepsilon_j$

Table 5: The Effects of Province Characteristics on Individual Industry

	Panel a: Province Skill Level				Panel b: Province High Skill Level			
	Specification 7		Specification 8		Specification 7		Specification 8	
	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error
Zij	-0.763***	(0.049)	-0.825***	(0.059)	-0.759***	(0.049)	-0.825***	(0.058)
ind1_X	0.342	(0.349)	0.393	(0.363)	0.250	(0.336)	0.296	(0.363)
ind2_X	-0.037	(0.329)	-0.034	(0.370)	0.459	(0.356)	0.446	(0.379)
ind3_X	0.526	(0.358)	0.491	(0.412)	0.501*	(0.302)	0.465	(0.356)
ind4_X	0.135	(0.665)	0.255	(0.686)	0.697	(0.755)	0.791	(0.732)
ind5_X	0.309	(0.359)	0.261	(0.327)	0.399	(0.315)	0.341	(0.265)
ind6_X	0.434**	(0.215)	0.395**	(0.195)	0.516**	(0.257)	0.472**	(0.231)
ind7_X	0.771**	(0.391)	0.750**	(0.366)	1.235***	(0.436)	1.205***	(0.422)
ind8_X	-0.050	(0.242)	-0.065	(0.178)	0.089	(0.313)	0.077	(0.219)
ind9_X	-0.699	(0.476)	-0.753*	(0.424)	-0.068	(0.445)	-0.131	(0.393)
ind10_X	0.537	(0.376)	0.556	(0.354)	0.456	(0.428)	0.461	(0.439)
ind11_X	0.203	(0.358)	0.187	(0.349)	0.100	(0.322)	0.071	(0.348)
ind12_X	-0.555	(0.491)	-0.542	(0.411)	-0.326	(0.458)	-0.229	(0.390)
ind13_X	-0.385	(0.555)	-0.483	(0.491)	-0.312	(0.610)	-0.460	(0.607)
ind14_X	-0.147	(0.434)	-0.168	(0.443)	-0.735	(0.535)	-0.768	(0.528)
ind15_X	0.085	(0.287)	0.093	(0.275)	-0.143	(0.351)	-0.186	(0.346)
ind16_X	0.690	(0.649)	0.721	(0.617)	-0.323	(0.913)	-0.178	(0.906)
ind17_X	-0.471	(0.486)	-0.446	(0.518)	-0.513	(0.428)	-0.428	(0.493)
ind18_X	-0.530	(0.359)	-0.489	(0.302)	0.470	(0.538)	0.453	(0.485)
ind19_X	-0.071	(0.241)	-0.050	(0.206)	0.038	(0.260)	0.043	(0.208)
ind20_X	-0.206	(0.540)	-0.244	(0.515)	0.331	(0.504)	0.290	(0.452)
ind21_X	0.852**	(0.391)	0.851**	(0.380)	0.772**	(0.366)	0.755**	(0.338)
ind22_X	-0.273	(0.341)	-0.260	(0.300)	-0.410	(0.447)	-0.416	(0.400)
ind23_X	-0.723***	(0.269)	-0.729***	(0.223)	-0.589**	(0.276)	-0.596**	(0.268)
ind24_X	-0.654*	(0.356)	-0.648**	(0.330)	-0.441	(0.337)	-0.448	(0.279)
ind25_X	-0.901**	(0.390)	-0.942**	(0.369)	-1.092**	(0.486)	-1.196***	(0.455)
ind26_X	-0.278	(0.339)	-0.276	(0.301)	-0.080	(0.414)	-0.101	(0.397)
ind27_X	0.568	(0.662)	0.452	(0.648)	1.251	(1.036)	1.109	(1.024)
ind28_X	-0.133	(0.42)	-0.183	(0.423)	0 .639	(0.629)	0.539	(0.559)
X_pro	-0.231	(0.350)			0.492	(0.530)		
Obs.	794		794		794		794	
R2	0.64		0.68		0.64		0.69	

Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
Dependent variables are the growth rate of ULC, calculated as the log difference of year 2004 and 1995
Zij is the initial log level of the variable
ind(i)_X's are interaction terms of industry dummies with province characteristics
X_pro is province characteristics

On average, provincial skill level does not have a significant effect on the declining rate of ULC. After controlling for the initial level, we find 5 to 6 industries that subject to the individual province skill effect, depending on the specification and the construction of provincial skill level. Among those are both low skill industries (garment and fiber products, leather products, and nonferrous metal) and high skill industries (ordinary machinery, special purpose equipment, and transportation equipment). For those above industries that are significantly affected by province skill characteristic, a general trend emerges: for high skill industries, province skill level positively affects the declining rate of ULC; for low skill industries, on the other hand, the effects go the other direction with the declining rate ULC being negatively affected.

Based on the findings of Logit and growth regression above, we conclude that the strong decline in inequality at the aggregate manufacturing level is mainly contributed by labor intensive industries. Capital and skill intensive industries are more likely to show a divergent trend, especially for ULC. Furthermore, several skill intensive industries, such as ordinary machinery, special purpose equipment and transportation equipment industries, have significantly faster decline in ULC if located in provinces with high skill levels. These observations raise at least two important questions for the future. As capital intensive industries have been contributing to divergence trends, and with these industries becoming more important in the process of modernizing the manufacturing sector, (1) what are the driving forces behind the divergent trend in ALP, ALC and ULC in skill intensive industries and (2) will the aggregate convergence trends continue in the future?

The forces behind the divergence of labor compensation and productivity in skill intensive industries are different from those behind the divergence of unit labor cost. The divergence of labor compensation and productivity in skill intensive industries is in line with New Economic Geography theory, which predicts a divergence trend due to regional agglomeration effect where industries benefit from concentration forces that trigger spillovers, such as access to capital, technology, education, specialized services, etc. As China is gradually shifting towards a skill/capital intensive industrial structural, we expect that the divergence trend will overrule the current convergence trend in labor compensation and productivity.

In case of unit labor cost, the convergence trend at the aggregate manufacturing level is a manifestation of the improved efficiency resulted from market integration as labor compensation and productivity are better aligned across the nation than before. However, 10 out of 28 industries, especially skill/capital intensive industries exhibited divergence trend. Different from labor intensive industries, which are close to a perfect market model, skill/capital intensive industries have high entrance barrier because of high fixed cost and industry specific technology, long term investment return and low mobility of resources such as machine. Because of the above nature of skill/capital/technology intensive industry, the production in such industry should take place in the regions with comparative advantage in skill/capital/technology. However, the Chinese government long considers skill/capital/technology intensive industries as the pillar industries in the national economy and uses various policies to promote these industries in all regions in China, even in regions without adequate supply of capital and technology required in the production. This government intervention distorts the business decision and leads to low efficiency by setting up skill intensive industries in places without adequate supply of the proper capital and technology. The lack of capital and technology restricts the productivity in the firms, while wages are hard to be pushed below the prevailing market level, consequently ULC in those misplaced skill/capital intensive industries is high and is hard to decline over the time. In conclusion, the divergence trend in ULC for skill intensive industries found in our Logit regression is a result of market failure in these industries and is not sustainable in the long run as the market reform deepens. Such postulation is supported by the growth regression results above which shows that ULC declines faster in skill intensive industries located in provinces characterized by high skill levels. With the deepening of the economic reform, Chinese government is gradually reducing its roll in the market economy, we expect that market mechanism will eventually take over the roll in resource distribution across industries and regions, inefficiency will be eradicated and the regional convergence trend will dominate in the end.

VII. CONCLUSION

In this paper we have analyzed a detailed data set for China on labor compensation, labor productivity, and unit labor cost measures by manufacturing industry (28) and province (30) in 1995 and 2004. Our estimates show a rapid decline in ULC as a result of much faster productivity growth relative to labor compensation – across the board (province and industry). In contrast to the more widely available evidence of an increased trend in income inequality in China, we find convergence in compensation, productivity and unit labor cost across provinces and major regions, in particular at the aggregate level. Among other things, we arguer that the rapid convergence in unit labor cost signals an alignment of compensation and productivity, with high levels for both compensation and productivity in one province and low levels for both variables in another province. This alignment of productivity and compensation gaps relative to the national average is due to the transition towards a market economy, which has eradicated inefficient activities where regional productivity and compensation levels relative to the national average are not aligned.

Despite the overall convergence trends, a significant number of industries signaled weak convergence or even divergence trends. Results of a Logit regression prove that capital intensive industries have higher probability to diverge in terms of labor compensation and productivity. Standard neoclassical trade theory would predict that in due time market reforms may cause an equalization of compensation and productivity levels at industry levels across regions. However, another strand of theory would predict that greater regional specialization will attract even more highly paid resources and cause further divergence rather than convergence at industry level, and perhaps even at the aggregate level (Krugman, 1991; Fujita, Krugman and Venables, 1999). Given the evidence that in particular capital intensive and high skill intensive industries show a tendency towards divergence rather than convergence, we hypothesize that the second strand of explanation might carry some value in explaining the divergence trends in labor compensation and productivity. As capital and skill intensive industries may in particular be benefiting from typical concentration forces that trigger spillovers (access to capital, education, specialized services, etc.), the greater importance of these industries over time may reduce the convergence trends at the labor intensive end of the spectrum of industries. It may eventually even reverse the convergence trend and trigger divergence in compensation and productivity. This hypothesis would also make it possible to align our evidence with that of the generally observed trend of greater inequality in income levels. Indeed it will be higher income workers who benefit more from the concentration and specialization effects, and these high income workers will be mainly located in the capital and skill intensive industries. In contrast the labor intensive industries, which have been driving much of the convergence observed in this study, will decline in importance during the process of industrial modernization, and ultimately become less dominant for the aggregate trend.

In addition to the divergence trend in labor compensation and productivity, capital intensive and high skill industries also show a higher probability to diverge in terms of unit labor cost according to the Logit analysis. Different from the divergence trends of labor compensation and productivity, the divergence in unit labor cost does not conform to the market economy. This inefficiency results from market intervention, where Chinese government use preferential policies to encourage the establishment of capital intensive and high skill industries throughout the whole country due to its consideration of such industries as pillar industries in the national economy. The misplacement of these industries in the capital and skill deficient regions restricts the growth of productivity relative to wages, leading to higher unit labor cost compared with regions with advantageous supply of skill and capital. Applying an extended form of growth regression, we confirm not only the convergence trend in unit labor cost at the aggregate level, but also our postulation on the reasons for the divergence trend in unit labor cost for capital intensive and high skill industries. Specifically, after controlling for the initial level, ordinary machinery, special purpose equipment, and transportation equipment show faster decline in unit labor cost by locating in high skill provinces.

The declining unit labor cost between 1995 and 2004, mainly driven by the considerable increase in average labor productivity, relieves the concern that China is losing its competitive edge due to increasing wages to some extent. In the long run, the key to any country's sustainable growth lies in the continuous rise of labor productivity that is attributable to both capital deepening (capital-labor ratio) and total factor productivity improvement. However, if productivity growth relies mostly on an increased capital-labor ratio, it will become costly and inefficient. So the improvement of total factor productivity, which includes innovation, technology, etc., should play a major role in ALP growth in the long term. On the other hand, average labor compensation grew relatively slowly during our study period, partially due to the low bargaining power of labor in China. With the New Employment Contract Law in effect this year, the role of labor unions is emphasized to ensure that the voices of the workers are heard. It consequently brings pressure on wages to rise in the near future. Under such circumstances, it is essential for China to keep the momentum of rapid total factor productivity growth to maintain its competitiveness. Furthermore, to achieve higher economic efficiency, the government should gradually rescind the preferential industry policies and let market allocate resources so that the productivity and labor compensation can become better aligned across regions as well as industries.

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Annex A: Data Description

Our two data sources —*1995 3rd National Industrial Census* and *2004 Economic Census*—do not contain complete estimates of gross value added (Y), labor compensation (C) and employment (L) at the aggregate level as well as at industrial and provincial levels. The table below summarizes the missing estimates. Then we discuss how each of those missing variables is estimated.

	1995			2004		
	By industry at national level	By province at aggregate manufacturing level	Industry by province	By industry at national level	By province at aggregate manufacturing level	Industry by province
Y	Yes	No*	Yes	Yes	No*	No
C	Yes	No*	Yes	Yes	No*	No
L	Yes	No	No	Yes	No*	Yes

*The original tables contain data for these variables, but for comparability purpose (explained below), these numbers are recalculated by summing up the corresponding values in each of the 28 industry by province tables.

1995 employment in 28 industry by province tables

China Industry Economic Statistical Yearbook (CIESY) provided employment data at the level of industry by province. The closest information to the 95 Census is 1994 employment data released in CIESY 1995. Let subscript "*j*" stand for province, [25] "*i*" for industry, we can derive j^{th} region's employment share in China's i^{th} industry in CIESY, i.e., $\frac{L_{ij}^{CIESY}}{\sum_{j=1}^{n} L_{ij}^{CIESY}}$. Use φ to denote this share, it can be used as a proxy to breakdown the provincial employment in China's i^{th} industry in 95 Census, i.e., j^{th} region's employment in China's i^{th} industry:

[25] j = 1,2,…n, where n = 30. There are 31 provinces in 04 Census tables with Chongqing being an independent municipality. In 1995 Chongqing was a city in Sichuan. To make these two years comparable, Chongqing is combined into Sichuan province in 04 Census tables.

$$\varphi = \frac{L_{ij}^{CIESY}}{\sum_{j=1}^{n} L_{ij}^{CIESY}} = \frac{L_{ij}}{\sum_{j=1}^{n} L_{ij}} \quad \Rightarrow \quad L_{ij} = \varphi \sum_{j=1}^{n} L_{ij}$$

<u>2004 gross value added and labor compensation in 28 industry by province tables</u>

There are no estimates of gross value added and labor compensation that could be directly obtained from the 2004 Census. We therefore derived gross value added through "income approach" by summing up the following categories:[26]
wage
welfare payment
total profit
tax paid plus supplementary levies
current year depreciation
minus enterprise income tax;
The summation of the first two components above gives us estimate of labor compensation. [27] From the comparison between the estimated gross value added and the reported gross value added in the extended table at the national level, we know that gross value added estimated through income approach is understated partly due to the unreported components in labor compensation, such as "endowment and medicare insurance", "housing subsidy", etc.. Using the industry-level relationships between the published and extended tables from NBS at the national level, we employ the following approach to estimate gross value added and labor compensation for 28 industry by province tables. Let's use gross value added (Y) as an example.

Let's name the published 2004 data as reduced version (*R*) and the detailed NBS data as full version (*F*). Firstly, let us define the relationship between regional and national aggregate for industry as $Y_{ij} / \sum_{j=1}^{n} Y_{ij}$ .It is in fact the j^{th} region's share in China's i^{th} industry. The same relationship can be calculated using either reduced or full data. It is reasonable to believe that the reduced tables at provincial level are constructed with

[26] NBS, *First Economic Census, Volume II*, Table 1-B-14 to 1-B-42 for manufacturing designated size and above, industry by province.

[27] See a companion study on manufacturing employment and compensation by Banister (2007) for more details.

similar, if not the same, principles. If this is true, the difference between the two sets of data in terms of the relationship $Y_{ij} / \sum_{j}^{n} Y_{ij}$ should be *insignificant*. If we use δ to capture this difference, we then have:

$$\frac{Y_{ij}^{F}}{\sum_{j=1}^{n} Y_{ij}^{F}} = \delta \frac{Y_{ij}^{R}}{\sum_{j=1}^{n} Y_{ij}^{R}} \quad .$$

Now assuming the difference parameter δ= 1, as just discussed, we can estimate the complete Y (i.e. full version) of the *i*[th] industry in the *j*[th] region as follows,

$$Y_{ij}^{F} = \frac{\sum_{j=1}^{n} Y_{ij}^{F}}{\sum_{j=1}^{n} Y_{ij}^{R}} Y_{ij}^{R} .$$

The same approach is used to estimate labor compensation.

The above estimation gives us full set of variables used to derive ALP, ALC and ULC for 28 industry by province tables. These variables, i.e. Y, C and L, are also used to derive the by province table, though both 95 and 04 have published by province tables. The next paragraph explains the reason.

By Province Table

04 Census has 29 industry by province tables while 95 Census has the fully matchable 28 industries, i.e. there are no "Manufacture of Artwork and Other Manufacturing" (29) and "Recycling and Disposal of Waste" (30) in 95 Census as in 04 Census. These two sectors are treated as residue sectors. Because the residue sectors usually contain many unexplainable factors and its share is very small (2% in 95 1% in 04 in terms of gross value added share among total manufacturing), we exclude them from our analysis. The exclusion of the residue sectors affects the by province table at the total manufacturing level as the provincial total Y, C and L no longer equals to the published by province table, which includes all industries in the manufacturing. Thus we recalculate three basic variables in by province table at total manufacturing level as the summation of the 28

industry by province tables, i.e. the numbers in each province in the aggregate by province table is the summation of the numbers in that specific province across 28 industry by province tables. Take employment number in Beijing for example, $L_{Beijing} = \sum_{i=1}^{28} L_{Beijing,i}$.

Time series of productivity and unit labor cost

In addition to the two individual benchmark years, we also computed changes in ALP, ALC and ULC from 1995 to 2004. Here it is important to note that the time series for output and labor productivity need to be adjusted for price changes between 1995 and 2004.

CEIC Database reports PPI's for 12 manufacturing industries and a general manufacturing PPI. All PPI's are based on previous year, i.e. previous year = 100 .Two adjustments were made on the original PPI's. First, set 1995 as base year and calculate 2004 PPI's using the formula below:

Let $PPI^{1995} = 100, PPI^{t} = PPI^{t'} \times \frac{PPI^{t-1}}{100}$, where $PPI^{t'}$ is the reported previous year based PPI.

Second, match the 28 manufacturing industries in our dataset with the 12 industry PPI's. 8 industries do not fall into any of the 12 industry PPI categories. Suppose that these 8 residue industries have the same PPI, this PPI is estimated so that the industry weighted average manufacturing PPI is equal to the reported general manufacturing PPI: 94.47. The weights are calculated as the share of each 28 industry's output value among the total manufacturing output value in year 1995.

$$PPI = \sum_{i=1}^{20} PPI_i \frac{Y_i^{95}}{Y^{95}} + PPI_{residue} \sum_{i=1}^{8} \frac{Y_i^{95}}{Y^{95}}$$

While we have no information on price indices for individual provinces, we applied PPIs by industry at the national level to each of the 30 provinces and derived provincial PPIs as the weighted average of industry PPIs , assuming that price development by industry did not differ between provinces:

$$PPI_j = \sum_{i=1}^{28} PPI_{j,i} \frac{Y_{j,i}^{95}}{Y_j^{95}} \quad \text{j = 1, 2, …, 30}$$

Appendix A.1: Average Labor Compensation (ALC), Labor Productivity (ALP) & Unit Labor Cost (ULC) by Industry at the National Level

	ALC (Nominal Value)			ALP (95 Value)			Current Value	ULC (95 Value)			Current Value
	95	04	04/95	95	04	04/95	04	95	04	04/95	04
Food processing	5033	12200	2.424	20505	97904	4.775	100068	0.245	0.125	0.508	0.122
Food products manufacturing	4541	16194	3.566	13622	77061	5.657	78764	0.333	0.210	0.630	0.206
Beverage manufacturing	5192	17465	3.364	23716	106099	4.474	108445	0.219	0.165	0.752	0.161
Tobacco processing	11192	80797	7.219	190604	1335425	7.006	947484	0.059	0.061	1.030	0.085
Textile industry	4890	12787	2.615	10295	48610	4.722	43275	0.475	0.263	0.554	0.295
Garments and other fiber products	5496	13428	2.443	12832	32037	2.497	33910	0.428	0.419	0.979	0.396
Leather, furs, down and related products	5230	12464	2.383	13297	32416	2.438	34124	0.393	0.385	0.977	0.365
Timber, bamboo, natural fiber & straw products	3785	11257	2.974	9141	52773	5.774	48557	0.414	0.213	0.515	0.232
Furniture manufacturing	4765	13756	2.887	11284	49273	4.367	45337	0.422	0.279	0.661	0.303
Papermaking and paper products	4821	14447	2.997	12790	69998	5.473	67538	0.377	0.206	0.548	0.214
Printing & record medium reproduction	5093	19883	3.904	11289	87774	7.775	62276	0.451	0.227	0.502	0.319
Cultural, educational, and sport products	5643	13222	2.343	12704	34033	2.679	28410	0.444	0.389	0.875	0.465
Petroleum processing and coking products	9368	29353	3.133	70795	121428	1.715	249916	0.132	0.242	1.827	0.117
Chemical raw materials & products	6439	20573	3.195	19542	117535	6.014	109772	0.330	0.175	0.531	0.187
Medical & pharmaceutical products	6511	21563	3.312	22868	109802	4.802	102550	0.285	0.196	0.690	0.210
Chemical fibers manufacturing	8375	18808	2.246	36126	98813	2.735	92287	0.232	0.190	0.821	0.204
Rubber products	6035	15130	2.507	14111	84917	6.018	60249	0.428	0.178	0.417	0.251
Plastic products	5477	15132	2.763	14024	81545	5.815	57856	0.391	0.186	0.475	0.262
Nonmetal mineral products	4742	13564	2.860	11257	56739	5.040	55284	0.421	0.239	0.567	0.245
Smelting & pressing of ferrous metals	8674	29037	3.348	27119	160035	5.901	168352	0.320	0.181	0.567	0.172
Smelting & pressing of nonferrous metals	8732	20919	2.396	24522	105407	4.298	110884	0.356	0.198	0.557	0.189
Metal products	5218	15778	3.024	13549	58656	4.329	61704	0.385	0.269	0.698	0.256
Ordinary machinery manufacturing	6189	19102	3.086	13770	82488	5.990	67628	0.449	0.232	0.515	0.282
Special purpose equipment manufacturing	5952	20423	3.431	12539	77314	6.166	63387	0.475	0.264	0.556	0.322
Transportation equipment manufacturing	7199	24928	3.463	19070	141609	7.426	100471	0.377	0.176	0.466	0.248
Electric equipment and machinery	6694	18124	2.707	19388	113277	5.843	80370	0.345	0.160	0.463	0.226
Electronics and telecommunications	7817	23945	3.063	32506	166995	5.137	118483	0.240	0.143	0.596	0.202
Instruments & stationery machine tools	6281	21720	3.458	12750	96145	7.541	68215	0.493	0.226	0.459	0.318
Total manufactuirng	5949	18043	3.033	17498	85494	4.886	80769	0.340	0.211	0.621	0.223

Table A.2: 8 Industry Categories

Industry Category	Industry	Industry code
Food Products	Food processing	1
	Food products manufacturing	2
	Beverage manufacturing	3
	Tobacco processing	4
Textile & Clothing	Textile industry	5
	Garments and other fiber products	6
	Leather, furs, down and related products	7
Wood & Paper	Timber, bamboo, natural fiber & straw products	8
	Furniture manufacturing	9
	Papermaking and paper products	10
	Printing & record medium reproduction	11
	Cultural, educational, and sport products	12
Chemicals	Petroleum processing and coking products	13
	Chemical raw materials & products	14
	Medical & pharmaceutical products	15
	Chemical fibers manufacturing	16
	Rubber products	17
	Plastic products	18
Metal Products	Nonmetal mineral products	19
	Smelting & pressing of ferrous metals	20
	Smelting & pressing of nonferrous metals	21
	Metal products	22
Machinery	Ordinary machinery manufacturing	23
	Special purpose equipment manufacturing	24
	Electric equipment and machinery	26
Transport Equipment	Transportation equipment manufacturing	25
Electronics	Electronics and telecommunications	27
	Instruments & stationery machine tools	28

Seven region group

7 Regions	Provinces
Bohai	Beijing
	Tianjin
	Hebei
	Shandong
SouthEast	Shanghai
	Jiangsu
	Zhejiang
	Fujian
	Guangdong
NorthEast	Liaoning
	Jilin
	Heilongjiang
Central	Anhui
	Jiangxi
	Henan
	Hubei
	Hunan
SouthWest	Guangxi
	Hainan
	Sichuan
	Guizhou
	Yunnan
NorthWest	Shanxi
	Inner Mongolia
	Shaanxi
	Gansu
	Qinghai
	Ningxia
	Xinjiang
Tibet	Tibet

Table A.3: Coefficient of Variation for Industries and Industry Groups

Coefficient of Variation between 7 Regions

	ALC		ALP		ULC	
	CV95	CV04	CV95	CV04	CV95	CV04
Food processing	0.272	0.163	0.286	0.120	0.363	0.149
Food products manufacturing	0.386	0.206	0.486	0.249	0.209	0.170
Beverage manufacturing	0.293	0.316	0.383	0.385	0.403	0.170
Tobacco processing	0.377	0.450	0.606	0.710	0.318	0.731
Textile industry	0.228	0.277	0.534	0.357	0.407	0.244
Garments and other fiber products	0.478	0.134	0.580	0.165	0.483	0.056
Leather, furs, down and related products	0.398	0.118	0.467	0.238	0.279	0.244
Timber, bamboo, natural fiber & straw products	0.455	0.214	0.593	0.219	0.310	0.118
Furniture manufacturing	0.512	0.146	0.602	0.146	0.588	0.154
Papermaking and paper products	0.272	0.215	0.363	0.366	0.209	0.224
Printing & record medium reproduction	0.613	0.271	0.388	0.100	0.671	0.286
Cultural, educational, and sport products	0.387	0.151	0.486	0.212	0.245	0.142
Petroleum processing and coking products	0.345	0.430	0.436	0.717	0.299	0.305
Chemical raw materials & products	0.202	0.216	0.340	0.352	0.133	0.205
Medical & pharmaceutical products	0.384	0.234	0.421	0.455	0.101	0.223
Chemical fibers manufacturing	0.235	0.215	0.636	0.340	0.435	0.555
Rubber products	0.417	0.109	0.293	0.179	0.369	0.134
Plastic products	2.511	0.148	0.429	0.081	0.579	0.123
Nonmetal mineral products	0.500	0.212	0.539	0.293	0.140	0.117
Smelting & pressing of ferrous metals	0.173	0.155	0.382	0.357	0.243	0.195
Smelting & pressing of nonferrous metals	0.328	0.120	0.145	0.264	0.362	0.246
Metal products	0.501	0.238	0.469	0.410	0.167	0.190
Ordinary machinery manufacturing	0.254	0.125	0.386	0.230	0.200	0.140
Special purpose equipment manufacturing	0.198	0.142	0.341	0.224	0.228	0.125
Transportation equipment manufacturing	0.218	0.294	0.420	0.482	0.297	0.365
Electric equipment and machinery	0.393	0.122	0.509	0.203	0.494	0.194
Electronics and telecommunications	0.315	0.212	0.551	0.812	0.250	6.600
Instruments & stationery machine tools	0.318	0.158	0.542	0.539	0.262	1.964
Total manufactuirng	0.375	0.078	0.266	0.094	0.447	0.052
Food	0.231	0.177	0.546	0.294	0.507	0.171
Textile & clothes	0.246	0.202	0.526	0.242	0.353	0.145
Wood & paper	0.299	0.342	0.357	0.174	0.172	0.239
Chemicals	2.219	0.141	0.390	0.390	2.431	0.218
Metal product	0.302	0.083	0.292	0.128	0.162	0.063
Machine	0.276	0.107	0.531	0.207	0.400	0.151
Transportation	0.218	0.294	0.420	0.482	0.297	0.365
Electronics	0.310	0.203	0.532	0.745	0.221	-5.993

Coefficient of Variation between 30 Provinces

	ALC		ALP		ULC	
	CV95	CV04	CV95	CV04	CV95	CV04
Food processing	0.341	0.234	0.410	0.292	0.348	0.249
Food products manufacturing	0.512	0.401	0.594	0.451	0.329	0.267
Beverage manufacturing	0.509	0.495	0.579	0.453	0.338	0.249
Tobacco processing	0.529	0.623	0.911	0.979	0.602	0.826
Textile industry	0.316	0.311	0.560	0.579	0.544	0.485
Garments and other fiber products	0.943	0.344	0.612	0.359	0.573	0.191
Leather, furs, down and related products	0.500	0.289	0.587	0.505	0.519	0.354
Timber, bamboo, natural fiber & straw products	0.487	0.298	0.633	0.337	0.847	0.207
Furniture manufacturing	0.666	0.267	0.558	0.490	0.731	0.375
Papermaking and paper products	0.420	0.454	0.392	0.431	0.268	0.307
Printing & record medium reproduction	0.470	0.278	0.530	0.434	0.432	0.269
Cultural, educational, and sport products	0.527	0.334	0.760	0.381	0.493	0.353
Petroleum processing and coking products	0.447	0.432	0.738	0.792	1.239	0.523
Chemical raw materials & products	0.372	0.354	0.493	0.844	0.536	0.360
Medical & pharmaceutical products	0.374	0.374	0.449	0.447	0.278	0.233
Chemical fibers manufacturing	0.397	1.053	0.887	2.196	1.283	3.239
Rubber products	0.862	0.239	0.761	0.529	1.308	15.314
Plastic products	4.457	0.269	0.565	0.463	1.372	0.574
Nonmetal mineral products	0.376	0.272	0.488	0.393	0.195	0.221
Smelting & pressing of ferrous metals	0.274	0.436	0.638	0.976	0.419	0.328
Smelting & pressing of nonferrous metals	0.984	0.214	0.504	0.381	0.671	0.291
Metal products	0.422	0.233	0.507	0.602	0.280	0.344
Ordinary machinery manufacturing	0.344	0.274	0.494	0.443	0.306	0.248
Special purpose equipment manufacturing	0.296	0.313	0.435	0.506	0.380	0.585
Transportation equipment manufacturing	0.327	0.322	0.690	0.775	0.597	0.409
Electric equipment and machinery	0.391	0.239	0.494	0.417	0.406	0.349
Electronics and telecommunications	0.396	0.390	1.013	1.024	0.848	1.416
Instruments & stationery machine tools	0.452	0.355	0.681	0.927	0.787	0.488
Total manufactuirng	0.330	0.219	0.435	0.336	0.302	0.177
Food	0.384	0.400	1.185	0.672	0.381	0.278
Textile & clothes	0.385	0.256	0.523	0.466	0.489	0.910
Wood & paper	0.396	0.287	0.383	0.311	0.235	0.249
Chemicals	2.934	0.272	0.410	0.488	3.847	0.253
Metal product	0.323	0.230	0.435	0.414	0.250	0.216
Machine	0.340	0.249	0.476	0.399	0.338	0.254
Transportation	0.327	0.322	0.690	0.775	0.597	0.409
Electronics	0.374	0.368	0.869	1.243	0.594	1.013

Table A.4: Diagnostic Tests for Influential Points in ULC Logit Regression

	Standardized Pearson Residue	Deviance Residue	Hat Diagonal	chi square fit	deviance	dbeta	Influential Points to be dropped
State Share	16	16	4	16	16	16	16
Firm Scale 95	20	20	16	20	20	20, 16	20
Firm Scale 04	16, 20		13, 20	16, 20	16, 20	20	16, 20
Labor Intensity 95	28	28	3, 16	28	16, 25, 28	16, 28	16, 28
Labor Intensity 04	16, 28		4	16, 25, 28	16, 28	16, 28	16, 28
Skill	4		19, 20	4, 16	4, 16	4, 16	4, 16
Openness 95	16		7, 12	16, 19	16, 19, 27	16, 19, 27	16, 19, 27
Openness 04	16		12, 27	16	16	16, 27	16, 27

Numbers indicate industry code, please refer to appendix Table A.2