CESifo Working Papers
www.cesifo.org/wp

Does China Still Have a Labor Cost Advantage?

Janet Ceglowski
Stephen Golub

CESifo Working Paper No. 3579
Category 8: Trade Policy
September 2011

Presented at CESifo Venice Summer Institute, July 2011

CESifo *Working Paper No. 3579*

Does China Still Have a Labor Cost Advantage?

Abstract

In recent years wages in China have been rising and the yuan has appreciated, potentially eroding China's cost advantage in manufactures. This paper explores the evolution of China's relative unit labor costs in manufacturing over 1998-2009. Between 1998 and 2003 China's unit labor costs fell, but since 2003 they have increased both absolutely and relative to US unit labor costs. Much of the rise in China's relative unit labor costs can be traced to a real appreciation of the yuan against the dollar. Despite the recent rise, China's unit labor costs remain low relative to those in most other countries.

JEL-Code: F020, F140, F160, F310, J300.

Keywords: China, labor costs, productivity, international competitiveness, real exchange rate.

Janet Ceglowski
Economics Department
Bryn Mawr College
101 N Merion Ave
Bryn Mawr PA 19010
USA
jceglows@brynmawr.edu

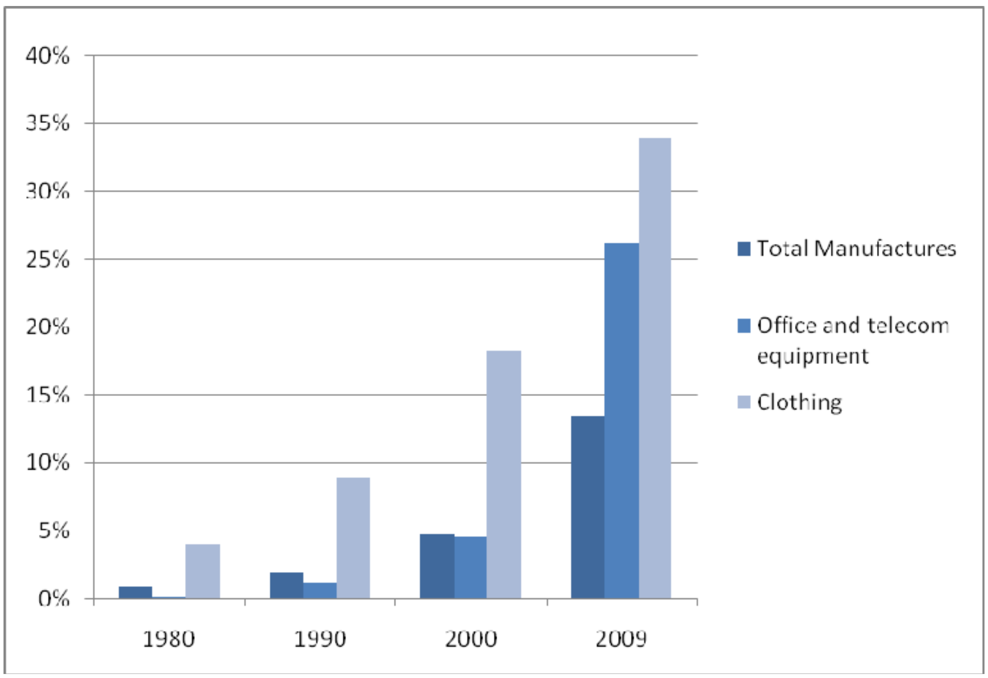
Stephen Golub
Economics Department
Swarthmore College
500 College Ave
Swarthmore PA 19081
USA
sgolub1@swarthmore.edu

August 2011
This is a revised version of a paper prepared for the CESifo conference on "China and the Global Economy Post Crisis" held in Venice, Italy, July 18-19, 2011. We would like to thank the participants at the CESifo conference and the Trico Summer Seminar for helpful comments. We also thank Lingyi Sun for very helpful research assistance.

I. Introduction

China's emergence as a top manufacturing exporter has been meteoric and is one of the most salient features of the current global economy. Over the last decade, its share of world exports of manufactures has almost tripled, rising from under 5 percent in 2000 to 13.5 percent in 2009 (Figure 1). China has become a major supplier of some products, including low-skilled items like textiles and clothing and sophisticated products like office and telecommunications equipment.

Figure 1.
China's share of world manufactured exports, selected products

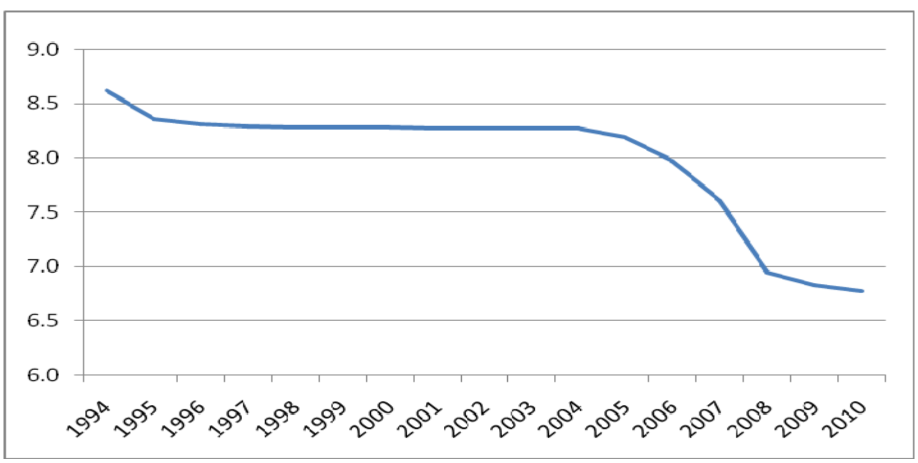


Source: authors' calculations, based on World Trade Organization, http://stat.wto.org/StatisticalProgram/WSDBStatProgramHome.aspx?Language=E

China's export prowess is often attributed to low costs of production, particularly labor costs. In an earlier paper (Ceglowski and Golub, 2007), we investigated this issue and confirmed that, as of 2002, Chinese unit labor costs in manufacturing were low relative to those in a wide range of countries, be they competitors or customers. These low Chinese relative unit labor costs in the early 2000s reflected a combination of low wages, an exchange rate that was undervalued relative to its purchasing power parity for manufactures, and strong productivity growth. That is, Chinese wages were well below Chinese productivity, relative to other countries, when measured in a common currency.

Since around 2007, however, a number of press reports and studies suggest that China's competitiveness has been eroding due to rapidly rising labor costs and gradual currency appreciation. Labor market pressures are evident in recent labor unrest and reports of labor shortages. [1] These pressures, along with recent labor law reforms and large increases in minimum wages, have resulted in rising labor costs in yuan terms. The cost increases have been even larger in dollar terms due to the yuan appreciation. The yuan has appreciated by 18 per cent since the announcement of China's move away from its dollar peg in July 2005, after a decade of a fixed parity of 8.28 RMB per dollar (Figure 2). While these developments represent real pressures on China's relative competitiveness, they paint an incomplete picture for at least two reasons. First, they do not factor in China's recent productivity growth. That is, if productivity is rising in step with wages, unit labor costs are not pushed up. Second, China's relative competitiveness depends on how these developments compare to productivity and wage growth in other countries.

Figure 2.
China's exchange rate (yuan per dollar)



Source: World Bank, *World Development Indicators*

[1] For example, "China's rising wage bill poses risk of relocation," *Financial Times*, February 16, 2011 and "Moving Back to America," *The Economist*, May 14, 2011.

This paper updates our earlier analysis and focuses on recent developments in China's competitive position in manufacturing as measured by relative unit labor costs (RULC). It evaluates China's RULC over time and across a wide range of countries, finding that China's unit labor costs have risen recently relative to those in the US but remain low compared to those in the US and many other countries. It also decomposes the recent increase in China's RULC into changes in 1) relative productivity, 2) relative wages and 3) real exchange movements, and identifies the real appreciation of the yuan against the US dollar as a major contributing factor.

II. Methodology

The approach of this paper follows our earlier paper (Ceglowski and Golub, 2007) in focusing on RULC as a means of assessing China's international competitiveness. [2] A country's international competitiveness in manufacturing depends on its costs of production relative to competitors' costs. RULC focuses on labor costs and labor productivity, excluding other costs of production such as capital, energy, human capital, and infrastructure. This limitation is mitigated insofar as the availability and costs of infrastructure services, energy, physical and human capital, and other inputs influence labor productivity and consequently are reflected in RULC. Also, the relative costs of non-tradable inputs, notably labor, matter more for export competitiveness than the costs of tradable inputs such as capital and energy, which tend to be equalized internationally.[3] Overall, RULCs are widely considered to be useful albeit incomplete indicators of competitiveness.[4]

The Ricardian model of trade provides an analytical foundation for the use of RULC, with an integrated framework for understanding the macro- and microeconomic factors

---

[2] Previous applications of the RULC approach to China and other countries include Turner and Golub (1997), Golub (1999), Mbaye and Golub (2003), and Edwards and Golub (2004), van Ark et al (2009), van Ark et al (2006), and Nowak-Lehmann et al (2007).
[3] Jones (2000) and Golub, Jones and Kierzkowski (2007) emphasize the distinction between tradable and non-tradable inputs in models of global fragmentation of production.
[4] See Turner and Van't Dack (1993), Turner and Golub (1997), and Hinkle and Nsengiyumba (1999) for discussion of the pros and cons of RULC based measures of competitiveness.

determining competitiveness. The role of RULC is illustrated here with a highly condensed version of the Dornbusch, Fischer and Samuelson (1977) (DFS) Ricardian model with a large number of goods.

Let a_i represent the unit labor requirement (the inverse of productivity) for sector i:

$$(1) \qquad a_i = \frac{L_i}{Q_i}$$

where Q is value added and L is labor employment. Marginal productivity and hence a_i are assumed to be constant with respect to variations in L_i.

Let w denote the average labor compensation per worker and e the exchange rate (domestic currency per unit of foreign currency). If labor is the only factor of production (or other factor costs do not differ across countries), average costs of production are equal to unit labor costs (ULC), $a_i w_i$. Expressed in domestic currency, foreign unit labor costs in the same industry are $a_i^* w_i^* e$. International competitiveness in sector i then depends on relative unit labor costs ($RULC$):

$$(2) \qquad RULC_i = \frac{a_i w_i}{a_i^* w_i^* e}.$$

The home country will have a competitive advantage in good i when $RULC_i < 1$, i.e., its unit labor costs are below those of its trading partners.

Alternatively, equation (2) can be written as

$$(3) \qquad RULC_i = \frac{a_i w_i}{a_i^* w_i^* e} = \left(\frac{a_i}{a_i^*}\right)\left(\frac{w_i}{w_i^* e}\right) = \left(\frac{a_i}{a_i^*}\right)\left(\frac{w_i}{w_i^* e_i^{PPP}}\right)\left(\frac{e_i^{PPP}}{e}\right)$$

where e_i^{PPP} denotes the purchasing power parity (PPP) exchange rate for sector i defined as the ratio of the domestic to foreign price levels, i.e., $e_i^{PPP} = \frac{p_i}{p_i^*}$. Substituting the definition of e_i^{PPP} into the middle term of the right-hand side of equation (3) yields:

$$(4) \qquad RULC_i = \left(\frac{a_i}{a_i^*}\right)\left(\frac{w_i / p_i}{w_i^* / p_i^*}\right)\left(\frac{e_i^{PPP}}{e}\right)$$

Equation (4) illustrates the decomposition of relative unit labor costs into relative productivity and relative wages measured in a common currency. More specifically, China's competitiveness vis-à-vis other countries depends on the three terms in (4): 1) labor productivity in China relative to other countries, 2) real labor compensation in China relative to those of other countries[5] or, equivalently, China's relative nominal labor compensation evaluated at e_i^{PPP} and 3) the level of the yuan exchange rate relative to its PPP level. Gains or losses in China's competitive position over time can originate with changes in any of these ratios.

III. Data

We construct annual series for unit labor costs and relative unit labor costs in Chinese manufacturing for 1998-2009, a sample period that begins prior to China's entry into the WTO and its emergence as a major exporter of manufactured goods, and ends in the year for which the latest data are available.[6] Chinese unit labor costs in manufacturing are calculated using available time-series data on Chinese labor compensation, employment, and value added. These underlying time-series data have a number of documented limitations.[7] Given these limitations, two alternative Chinese ULC series are constructed and the results are reported as a range. The first series is based on census of manufacturing data and omits employers' above-wage costs from labor compensation. The second is based on national accounts data and includes measures of

[5] Labor compensation is deflated by producer prices for sector i in equation (4) rather than consumer prices, so it is not an indicator of workers' welfare.
[6] The start date also avoids complications arising from several changes between 1997 and 1998 in the labor and production data reported by the Chinese government.
[7] As explained below, the coverage of some Chinese manufacturing measures is incomplete and changes over the sample period. Moreover, some statistics compiled by the Chinese government are viewed as unreliable by some China scholars; see, for instance, Rawski and Xiao (2001).

both employers' above-wage contributions in labor compensation and wages in non-urban areas.[8] Both measures of ULC are calculated as the ratio of total labor compensation to real value added in manufacturing or, equivalently, average labor compensation to average labor productivity per worker. Each of these two ULC series is then compared to analogous measures for other countries. The main data issues are described below and more details are provided in the appendix.

Chinese ULC based on census definition of value added

The first ULC measure is obtained from UNIDO series for manufacturing employment, wages, and value added. In the case of China, these series derive from annual census data that cover a substantial part of Chinese manufacturing activity and are apt to include the bulk of export-oriented production. The UNIDO compensation data include direct wages and salaries, bonuses, remuneration for time not worked, housing and family allowances, and payments in kind, but do not include employer contributions to social insurance, pension, or insurance plans (UNIDO, 2011b). Total wages for Chinese manufacturing are reported by UNIDO beginning in 2003. As described in detail in the appendix, those reported data are combined with wage data from the Chinese government for earlier years to construct a time series of manufacturing wages for the entire sample period. The latest UNIDO database reports employment and total wages for Chinese manufacturing through 2008 and value added through 2007. We extended the real value added series through 2008 based on UNIDO's (2011c) provisional value of real manufacturing value added for that year.

Chinese ULC based on national accounts definition of value added

[8] Census and national accounts definitions of value added also differ. Most importantly, census measures do not deduct purchased service inputs from sales so census value added tends to exceed national accounts value added.

The second measure uses real value added in manufacturing from the World Bank's *World Development Indicators (WDI)*, which employs a national accounts concept rather than the census-based concept underlying the UNIDO series. To obtain a measure of total manufacturing employment, we combined Chinese data on urban manufacturing employment and a measure of manufacturing employment in township and village enterprises (TVEs) as in Banister (2005a).[9] Labor compensation in manufacturing is constructed by adding total manufacturing earnings in urban units, adjusted for employers' contributions to social insurance, to a measure of total earnings in manufacturing TVEs. The inclusion of TVEs in the employment and compensation series is important because the available data indicate that TVEs account for about two-thirds of employment in manufacturing. As the United States Bureau of Labor Statistics (BLS) (2011) notes, this means that average labor compensation in Chinese manufacturing more closely tracks compensation in TVEs than compensation in urban units. Yet average TVE wages are significantly lower than average wages in urban units. Because of a break in the underlying TVE employment and earnings data in 2007, these two series were adjusted to render them compatible with the earlier data as explained in the appendix. The employment and compensation data are available through 2009. Real manufacturing value added from *WDI* is available through 2007. We extended the real value added series through 2009 based on UNIDO's (2011c) provisional value for 2008 and its estimate for 2009.

Chinese relative unit labor costs

To compare levels of real output and labor compensation across economies, they must be converted to a common currency. These conversions use two different exchange rates. Average labor compensation in local currency terms is converted to dollars at the market exchange rate.

[9] Official Chinese sources ceased publishing figures for total manufacturing employment after 2002. Even before they ceased to be published, Banister (2005a) suggests that the figures reported for total employment appeared to undercount non-urban employment by an increasing amount over time. This possible undercounting is noted also by Szirmai et al (2005), who take a different approach to dealing with it. However, Rawski (2002) reports massive, chronic exaggeration of TVE statistics, including employment data, in the late 1990s.

Average productivity, calculated as real manufacturing value added per employee, is converted to dollars at the PPP exchange rate. The latter PPP rates are conventionally used for international productivity comparisons to eliminate the effects of exchange-rate volatility on measures of real output. Given our focus on labor costs in manufacturing, the ideal PPP exchange rate should be a production-based measure derived from relative prices of manufactured goods. Where available we have used the manufacturing PPP exchange rates from the Groningen Growth and Development Center's International Comparison of Output and Productivity (ICOP) project.

Bilateral measures of Chinese RULC were constructed by pairing each converted series for Chinese manufacturing ULC with converted ULC series for other countries that were constructed from comparable data, ensuring that roughly similar concepts are used in making cross-country comparisons. Specifically, the UNIDO-based Chinese unit labor cost series was compared with unit labor costs in other countries that were derived from the same UNIDO database.[10] The second series for Chinese ULC was paired with ULC measures for the United States and other countries based on data from BLS (2010). The BLS data employ a national accounts-based concept of value added, as well as a measure of labor compensation that includes employer-paid non-wage benefits.

Each of these RULC measures has distinct strengths. The RULC series based on the UNIDO data are apt to include the bulk of China's export-oriented manufacturing. They are also amenable to comparisons with a wide range of countries due to the large number of countries that are included in the UNIDO database. Another advantage is that the Chinese and partner country data are both reported by UNIDO, providing at least some indication of international consistency in the definitions of manufacturing value added, employment, and labor compensation. However, UNIDO documents several changes in the data for China in 2003, which could affect the consistency of the first RULC series over time. Indeed, the UNIDO-based ULC and RULC series for China exhibit more variability than the alternative series. Comparative unit labor costs for

[10] All the UNIDO-based ULC series employ a census concept of value added and exclude employer contributions to social insurance funds from reported labor compensation.

the second measure are available for fewer, primarily industrial countries from the BLS. The second Chinese ULC measure is based on employment and wage data from published Chinese government sources and World Bank data for manufacturing value added; the comparability of these data with the BLS definitions is uncertain. The second RULC series, however, may better account for China's non-urban manufacturing activity and costs, whose importance has increased in recent years due to the considerable growth in manufacturing employment outside of urban areas. It also provides a more comprehensive measure of labor costs that includes an estimate of employers' social insurance contributions.

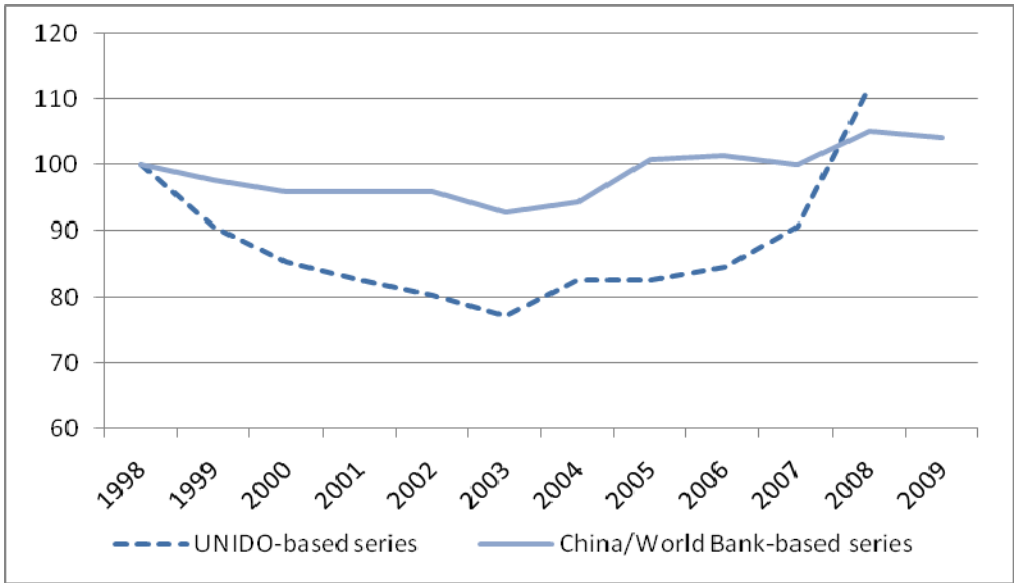
IV. Results

IV.1. China's ULC

We begin by analyzing our two measures of Chinese unit labor costs. Figure 3 displays China's unit labor costs, measured in domestic currency and indexed to 1998. Both series show a drop in China's ULC from 1998 to 2003 and a rise after 2003. By the end of the study period both ULC measures are moderately higher than in 1998, suggesting that labor compensation grew slightly faster than productivity for the period as a whole. The UNIDO-based series, however, shows wider swings, with a large fall in 1998-2003 and an even larger rise in 2003-2008.

Table 1 breaks down the sources of changes in the ULC series over the study period. The UNIDO-based series exhibits larger variations in the growth rates for the two subperiods than the series constructed from the Chinese and World Bank data but both suggest rapid productivity and wage growth. The UNIDO data indicate that productivity shot up by an annual average of 16.7 percent over 1998-2003, outpacing wage growth of 11.5 percent and leading to a drop in unit labor costs. This drop in unit labor costs translated one-for-one to a drop in China's ULC in dollar terms owing to the exchange rate peg. This changed after 2003 as wage growth outstripped productivity, leading to a 7.4 percent annual increase in unit labor costs in domestic currency terms. Unit labor costs rose even faster in dollar terms, reflecting the currency appreciation noted above. The China/World Bank series display a similar pattern with a decline in average annual productivity growth from 11 percent in 1998-2003 to 8.4 percent in 2003-2009 and a small pickup in earnings growth in the second half of the period, from 9.6 percent in 1998-2003 to 10.2 percent in 2003-2009.

Figure 3.
China's unit labor costs in manufacturing
(Index 1998 = 100)



Source: authors' calculations using UNIDO, World Bank and Chinese data.

Table 1 also provides a possible insight into one source of difference in the two ULC series. It shows that for the 2004-2009 period average labor compensation in urban units rose more rapidly than in TVEs, widening the considerable gap between them. Because published TVE employment in manufacturing is significantly higher than manufacturing employment in urban units, average labor compensation in total manufacturing did not rise as quickly as it did in urban units. By comparison, the UNIDO wage data for China imply faster wage growth than published data for urban units, as well as average wages that equal or exceed average wages for urban units.[11]

[11] Table 1 also shows that the rapid growth in nominal wages translated into strongly rising real wages, particularly for urban workers.

Table 1.
China's Unit Labor Costs, 1998-2009
(average annual growth rates in percent)

	1998-2009[a]	1998-2003	2003-2009[a]
Yuan/dollar exchange rate	-1.7	0.0	-3.2
ULC, UNIDO-based series			
Real value added per person	12.6	16.7	8.5
Labor compensation per person			
in yuan	13.7	11.5	16.0
in dollars	15.5	11.5	19.5
Unit labor costs			
in yuan	1.1	-5.2	7.4
in dollars	2.9	-5.2	10.9
ULC, China/World Bank-based series			
Real value added per person	9.6	11.0	8.4
Labor compensation per person			
in yuan			
total	9.9	9.6	10.2
urban units	11.7	11.2	12.1
TVEs			8.2
in dollars	11.7	9.6	13.4
Unit labor costs			
in yuan	0.3	-1.5	1.8
in dollars	2.1	-1.5	5.0
Memo:			
Real wages in yuan[b]			
urban units	10.6	11.5	9.7
TVEs	NA	NA	5.4

a. through 2008 for UNIDO

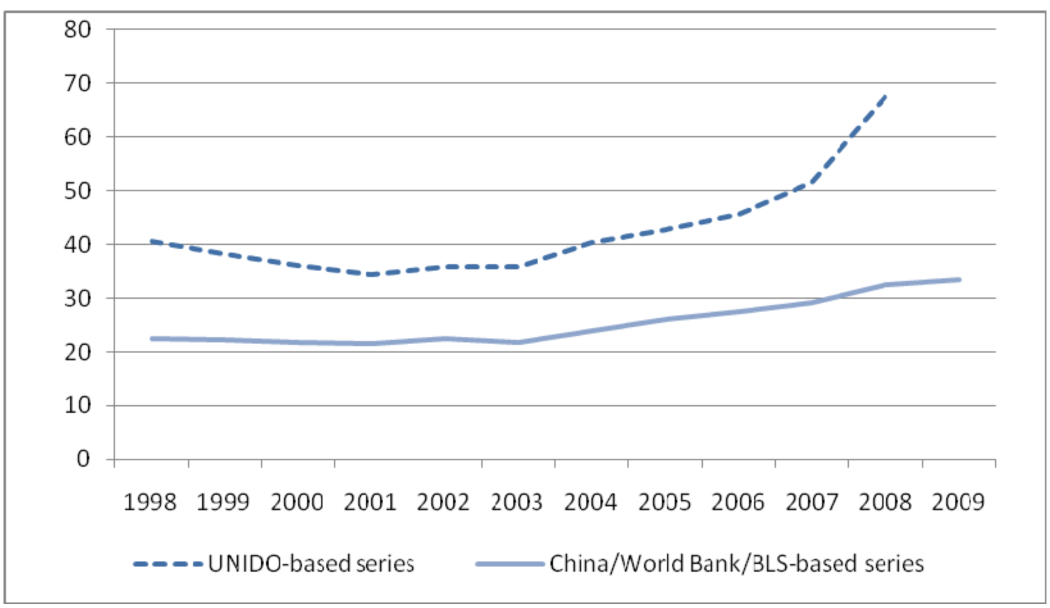
b. deflated by Consumer Price Index

Source: authors' calculations using UNIDO, World Bank and Chinese data.

IV. 2. China's RULC vis-à-vis the United States

Figure 4 presents the two measures of China's bilateral RULC vis-à-vis the United States. The UNIDO-based RULC is consistently higher than the alternative RULC measure, a discrepancy that derives principally from higher Chinese relative labor costs in the UNIDO-based series. Both measures show a rise in China's unit labor costs relative to those in the US beginning in 2003, but the increase is more pronounced in the UNIDO-based series. Table 2 breaks down the changes over time in China's relative unit labor costs into relative productivity and relative labor compensation in dollars. According to both measures, productivity and labor compensation have grown much more rapidly in China than in the United States. Both also show that Chinese relative labor compensation grew less quickly than relative productivity over 1998-2003, but that the situation reversed after 2003, with relative labor compensation growing much faster than productivity.

Figure 4.
China/United States relative unit labor costs in manufacturing
(United States= 100)



Source: authors' calculations using UNIDO, World Bank, BLS, Chinese and ICOP data.

Table 2.
China/US Relative Unit Labor Costs in Dollars, 1998-2009
(average annual growth rates in percent)

	1998-2009[a]	1998-2003	2003-2009[a]
UNIDO-based estimates			
Relative value added per person	6.8	10.1	3.6
Relative labor compensation per person	11.9	7.6	16.2
Relative unit labor costs	5.1	-2.5	12.6
China/World Bank/BLS-based estimates			
Relative value added per person	4.1	4.9	3.5
Relative labor compensation per person	7.7	4.3	10.5
Relative unit labor costs	3.6	-0.6	7.0

a. through 2008 for UNIDO
Source: authors' calculations using UNIDO, World Bank, BLS, Chinese and ICOP data.

Table 3 compares the levels of China's manufacturing productivity, labor compensation, and unit labor costs with their US counterparts in 1998, 2003 and 2008/9. Both measures show that China's relative labor compensation and productivity levels have risen sharply over the decade, but remain small fractions of the US levels. Both series for unit labor costs suggest that Chinese manufacturing remains highly competitive with respect to the United States, with China's ULC between 33 and 68 percent of the US level by the end of the study period.[12] But those values are both significantly higher than in 2003, when they were 22 and 36 percent of the US levels.

There are few existing relative unit labor cost comparisons between China and the US against which to gauge our findings, and even fewer that track recent developments. The most recent level comparisons date to 2002 and are in general accord with our estimates for the early 2000s. In our earlier paper, we found that in 2002 China's unit labor costs were between 27 and

[12] As explained earlier, the China/World Bank ULC measure for China includes an adjustment for a break in the underlying TVE data. Without that adjustment China's RULC in 2009 is 31, a figure that is not directly comparable to the same RULC estimates prior to 2007 due to the break.

43 percent of US unit labor costs, slightly higher than the ratios for 2003 in Table 3. Two studies by van Ark (van Ark et al, 2009 and van Ark et al, 2006) estimate China's unit labor costs to be 21 percent of US unit labor costs in 2002, very similar to the 2003 value we estimate with the China/World Bank/BLS data. Van Ark et al (2006) also report a higher China/US RULC of 46 percent based on an alternative estimate that includes a measure of labor costs outside urban areas. Ferguson and Schularick (2011) show a strong downward trend in their measure of China's RULC over 1998-2008. They provide little discussion of their sources and methods but their productivity measure appears to be based on total output, rather than the value-added measure used here. *The Economist* ("Nominally Cheap," 2010) provides more recent evidence in the form of an index of China's relative unit labor costs, reporting that its "rough and ready" measure shows an increase of almost 50 percent in China's unit labor costs relative to those in the US since 2005, a rise that is consistent with that shown in the UNIDO-based RULC in Figure 4.[13]

Table 3.
China's competitive position
(as a percent of United States levels)

	1998	2003	2009[a]
UNIDO-based estimates			
Relative value added per person	6.1	10.1	12.1
Relative labor compensation per person	2.5	3.6	8.2
Relative unit labor costs	40.6	35.9	67.5
China/World Bank/BLS-based estimates			
Relative value added per person	7.3	9.3	11.5
Relative labor compensation per person	1.6	2.0	3.8
Relative unit labor costs	22.5	21.8	33.2

a. 2008 for UNIDO

Source: authors' calculations using UNIDO, World Bank, BLS, Chinese and ICOP data.

[13] *The Economist* reports that this index is based on Chinese data for urban wages and value added in industry, a concept that extends beyond manufacturing. As explained earlier, urban and TVE manufacturing wages differ in terms of both growth rates and levels.

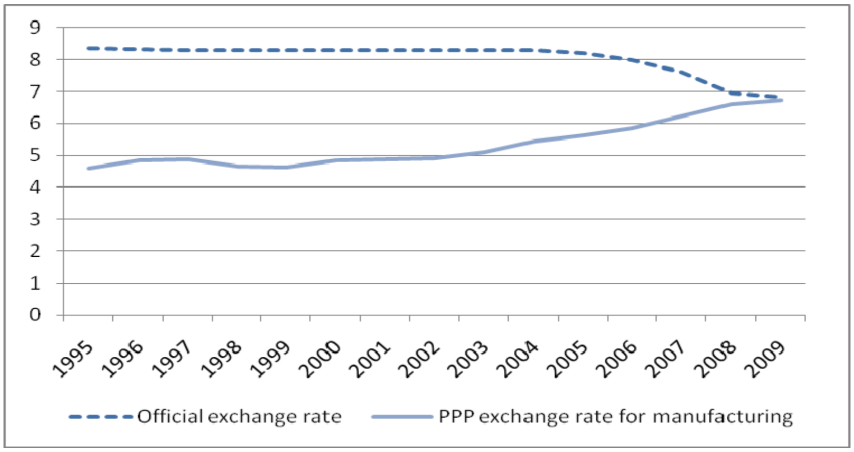
Though not analyses of China's RULC per se, three related studies corroborate the qualitative findings reported here. Chen, Wu, and van Ark (2009) document a decline in China's unit labor costs in manufacturing between 1995 and 2004 based on data from China's first and second economic censuses, consistent with the drop in our ULC series over the first half of the study period. Yang, Chen, and Monarch (2010) find a significant rise in Chinese real wages between 1997 and 2007. Their analysis concludes that, while the growth in China's manufacturing wages has narrowed its advantage over some emerging markets like India and Indonesia, they remain well below manufacturing wages in Japan, Korea, and Singapore. Finally, Banister and Cook (2011) meticulously construct estimates of hourly labor compensation in Chinese manufacturing. They report a 100 percent increase in Chinese hourly compensation, measured in yuan, between 2002 and 2008 and contrast it with the 19 percent increase in US hourly compensation over the same period. Added to the significant yuan appreciation over this period, this growth differential in local-currency labor compensation implies a substantial loss in China's relative wage position over the six year period.

Figure 5 provides further insight into the sources of China's low RULC and its recent rise. Following equation (3), it breaks down the two RULC measures into relative wages and relative productivity, each measured at a common PPP exchange rate, and the deviation of the exchange rate from its PPP level for manufacturing. Figure 5a displays the market exchange rate and the PPP exchange rate, where the latter is based on manufacturing value-added deflators. It shows the official exchange rate and the PPP exchange rate converging by the end of the period as the result of both the nominal appreciation of the yuan and an increase in the PPP exchange rate. The rise in the PPP exchange rate, in turn, reflects larger increases in the manufacturing price deflator in China compared to the United States. In other words, the nominal appreciation and faster inflation in China have led to a substantial real appreciation of the yuan. This real appreciation explains the entire rise in relative unit labor costs since 2003. This can be seen by comparing the increases in relative productivity and relative wages, converted at the PPP exchange rate, in Figures 5b and 5c. To contribute to the recent increase in China's RULC, relative wage growth would have to exceed relative productivity growth. But that is not the case in either figure, implying that the rise in China's RULC since 2003 is due to the rise in $\frac{e^{PPP}}{e}$. It is also worth noting that when both wages and productivity are measured with the PPP exchange rate, China's relative productivity consistently exceeds China's relative wage. As of 2009, therefore, we conclude that China's still-low RULC reflects low domestic-currency real wages relative to productivity, rather than an undervalued currency. According to Figure 5a, China's currency is no longer undervalued relative to the estimated PPP rate for manufacturing.[14]

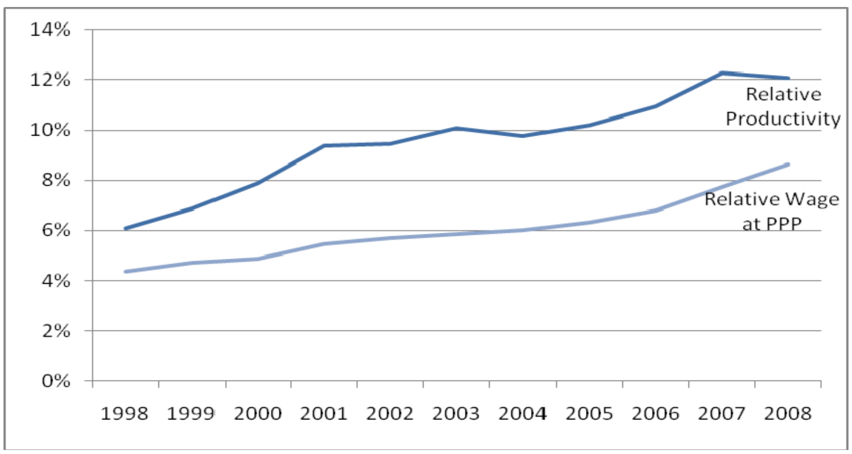
[14] Notably, this finding is predicated on the benchmark PPP exchange rate and price indexes underlying our analysis and may not hold for other PPP benchmarks or price measures.

Figure 5.
Decomposition of China-US relative unit labor cost

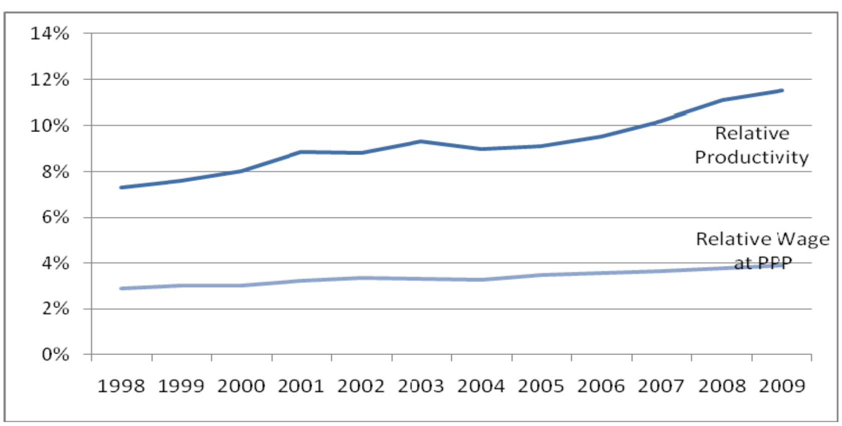
a. Official exchange rate and Purchasing Power Parity (PPP) exchange rate (yuan per dollar)



b. UNIDO relative productivity and wages at PPP exchange rate (percent of US levels)



c. China/WB/BLS relative productivity and wages at PPP exchange rate (percent of US levels)



Source: authors' calculations

IV.3. China's RULC vis-à-vis other countries

Table 4 presents estimates of Chinese relative wages, productivity and unit labor costs against a range of countries for the latest available year. Comparisons are based on China/World Bank/BLS data whenever available. But because BLS data on levels of productivity and labor compensation are not available for most emerging economies, we rely on the UNIDO database for these comparisons. The top half of the table displays the UNIDO-based measures and the bottom half displays the China/World Bank/BLS measures. The cross-country comparisons reveal large variations in China's relative productivity levels. China's manufacturing productivity is well below the productivity levels not only of the European economies, Japan, and the US, but also of a number of middle-income economies including Korea, Taiwan, Singapore, and Chile. Chinese productivity is on a par with that in Malaysia and, by our measures, exceeds productivity in India, Indonesia and Thailand. As also found in Ceglowski and Golub (2007), wage differentials tend to exceed productivity differentials, yielding Chinese RULCs well below 100 for most countries. China's unit labor costs remain especially low relative to European countries because of the large appreciation of the euro in recent years. However, the most recent data indicate that India, Indonesia and Chile have lower unit labor costs than China. The same is likely to be true for the newest low-wage manufacturing exporters in Asia such as Vietnam, Cambodia and Bangladesh, particularly in labor-intensive sectors such as apparel, but recent productivity data are lacking for these countries.[15]

[15] According to the Japan External Trade Organization (2010) in 2009 wages in Guangdong Province were $235 per month, well above the $148 in Jakarta, Indonesia, $100 in Ho Chi Minh City, Vietnam and $47 in Dhaka, Bangladesh. Moreover, there are apt to be significant regional and sectoral differences in unit labor costs within Chinese manufacturing. Indeed, Chen, Wu and van Ark (2009) find that unit labor costs varied across Chinese provinces and industries in 1995 and 2004, and Yang, Chen and Monarch (2010) report substantial provincial and sectoral differences in Chinese wage growth over 1978-2007.

Table 4.
China's productivity, wages, and RULC vis-à-vis selected countries, latest available year (as a percent of comparator country levels)

	Relative productivity	Relative wage	Relative unit labor cost
UNIDO sources			
Brazil (2007)	85.5	40.4	47.3
Chile (2006)	19.2	25.3	131.7
Czech Republic	51.0	30.9	60.7
Hong Kong (2008)	57.3	18.6	32.5
Hungary (2007)	49.7	29.6	59.5
India (2007)	132.1	158.3	119.9
Indonesia (2007)	155.9	223.5	143.3
Malaysia (2007)	105.6	59.3	56.2
Mauritius (2007)	191.8	66.9	34.9
Mexico (2009)	68.1	48.7	71.6
Philippines (2006)	187.2	114.6	61.2
Poland (2006)	46.0	40.9	88.9
Russia (2006)	147.5	82.6	56.0
Singapore (2008)	30.3	13.4	44.1
South Africa (2008)	83.9	30.4	36.2
Thailand (2006)	188.7	166.5	88.2
United States (2008)	12.1	8.2	67.5
China/World Bank/BLS sources			
Belgium (2009)	18.9	3.7	19.7
Germany (2009)	28.3	4.3	15.2
Japan (2008)	17.1	5.3	30.9
United Kingdom (2009)	23.2	4.6	19.6
France (2009)	23.4	4.0	17.2
Italy (2009)	32.7	5.3	16.1
Denmark (2009)	24.7	3.8	15.2
Netherlands (2009)	19.8	3.8	19.0
Sweden (2009)	16.9	4.2	24.8
Korea (2009)	18.9	8.0	42.3
Taiwan (2009)	23.7	16.0	67.5
United States (2009)	11.5	3.8	33.2

Source: authors' calculations using UNIDO, World Bank, BLS, Chinese and ICOP data.

V. Conclusions

This paper provides an update of Chinese manufacturing competitiveness using relative unit labor costs that are carefully constructed from available compensation, employment, and value added data. The limitations of the available data on Chinese labor compensation, value added and employment in manufacturing make precise calculations difficult. As in our earlier paper, we use two alternative measures of RULC, one based on a census concept of manufacturing that draws on a UNIDO database and the other based on a national accounts concept with data from the Chinese government, the World Bank and the BLS. Though these two measures yield different levels of China's relative unit labor costs, they exhibit similar behavior over time: falling relative unit labor costs that reached a low around 2003 but have been on the rise since then. The China/World Bank/BLS measure indicates that China's manufacturing unit labor costs increased from 22 to 33 percent of US unit labor costs between 2003 and 2009, while the UNIDO-based measure shows an increase in China's RULC from 36 to 68 percent between 2003 and 2008.

The paper also investigates the proximate sources of China's RULC and its evolution over the last decade. Both labor compensation and productivity have increased much more rapidly in China than in the United States, with China's productivity increasing from 6-7 percent of the US level in 1998 to 12 percent most recently. Relative Chinese wages have increased at an even greater rate than productivity, although the two data sets yield rather different levels. The UNIDO data suggest that China's wage rates reached about 8 percent of the US level in 2008, up from 2.5 percent in 1998, while the China/World Bank/BLS data indicate that China's relative wage is much lower, at about 4 percent in 2009. A major cause of China's rising RULC is the large real appreciation of the yuan which, in turn, is due to moderate nominal currency appreciation combined with much greater increases in the manufacturing price index in China than in the United States. Nonetheless, the most recent data suggest that China's unit labor costs in manufacturing remain low relative to levels in the US, the EU, Japan, Mexico, Korea, and a number of emerging economies.

Press reports indicate that wage growth in China picked up in 2010 in the face of renewed export growth and widespread labor unrest after slowing in 2009 due to the drop in demand associated with the world recession.[16] Yuan appreciation also continued in 2010, although at a very low rate of 0.9 percent. Further appreciation and wage increases in 2011 and beyond seem likely in view of political and economic pressures emanating both within and outside China. How those affect China's competitive position will depend on productivity developments in China, as well as comparative developments among China's competitors.

[16] See for example, "China Wage Gains Undermine Global Bond Investors as Inflation Accelerates," Bloomberg, February 23, 2011.

Appendix

This appendix describes the sources and construction of the manufacturing value added, employment, compensation, and exchange rate series that form the basis of the Chinese unit labor cost and relative unit labor cost series for total manufacturing. The first ULC series uses a census-based measure of manufacturing production and employment and a narrow measure of labor costs based on direct wages and salaries. The second ULC series is based on a national-accounts measure of value added and estimates of total manufacturing employment. It includes manufacturing activities and costs in TVEs. It also includes a measure of non-wage labor compensation. The inclusion of both non-wage labor costs and TVE manufacturing activities and costs provides a more comprehensive measure of unit labor costs. These ULC series for China are paired with comparable ULC series for other countries to construct relative unit labor cost measures.

Chinese unit labor costs based on a census definition of value added

The first ULC series is calculated from data for manufacturing value added, wages, and employment for China from the 2010 UNIDO INDSTAT database. These three UNIDO series are census data reported by the Chinese authorities. According to UNIDO (2011a), their coverage changes over the sample period. They pertain to industrial enterprises that are state-owned or independent with annual sales of at least 5 million yuan for 1998-2002 and all registered enterprises beginning in 2003. This change has the potential to affect the consistency of the unit labor cost series over time.

We made two adjustments to the reported UNIDO data for China in order to construct a time series for China's ULC. First, UNIDO reports manufacturing value added in nominal terms. We converted this nominal series to real terms by applying the World Bank's implicit value-added deflator for manufacturing from *WDI*. Second, the UNIDO database reports total manufacturing wages for China beginning in 2003, but not for the earlier years in the sample period. The missing data for total manufacturing wages for the period prior to 2003 were estimated in two steps. In the first step a series for average manufacturing wages was constructed by applying the growth rate in average manufacturing wages for urban units reported in the *China Labor Statistics Yearbook* to the average wage implied by the UNIDO total wage and employment series. In the second step this imputed average wage series was multiplied by the reported UNIDO employment data to yield a series for total manufacturing wages for 1998-2002.

Chinese ULC based on a national accounts definition of value added

The second ULC series employs a measure of the manufacturing sector that includes rural enterprises and a more comprehensive measure of labor costs that incorporates employer-funded non-wage compensation. It combines the World Bank's national accounts-based measure of real manufacturing value added from *WDI* with series for manufacturing employment and labor compensation that were constructed from data published by the Chinese government.

Following the method in Banister (2005a), total employment in manufacturing is calculated as the sum of manufacturing employment in urban units[17] and TVE employment in manufacturing. Average employment in urban units is calculated as the ratio of total wages to the average wage in manufacturing urban units, both reported in the *China Labor Statistics Yearbook.* TVE employment in manufacturing is reported separately in the *China Village and Town Enterprise Yearbook* beginning in 2002. Prior to 2002, only TVE employment in industry (which includes mining, utilities, and manufacturing) is reported. In 2002 TVE employment in manufacturing was 92.4 percent of total TVE industry employment. Following Banister (2005a) this ratio was applied to the series for TVE employment in industry to estimate a time series for

[17] Manufacturing employment in urban units includes staff and workers, urban reemployed retirees, foreign employees from other countries and employees from Hong Kong, Macao, and Taiwan in urban manufacturing (Banister 2005a) but excludes rural workers, self-employed urban workers, and urban workers in relatively small privately-owned and –operated enterprises. While the latter two categories of urban workers were included in a broader measure of urban employment until 2002, that measure is no longer reported. For the purposes of consistency, this study uses the narrower manufacturing employment in urban units as the measure of urban manufacturing employment.

TVE employment in manufacturing for the period 1998-2001. It was combined with reported TVE manufacturing employment for 2002-2009 to yield a series for the entire 1998-2009 period. The reported TVE employment data are year-end figures so the year-end data for adjacent years were averaged to yield an annual average employment series.[18] This series was added to average manufacturing employment in urban units to derive a series for total manufacturing employment.[19]

Total labor compensation is constructed as the sum of total compensation in manufacturing urban units and total compensation in manufacturing TVEs. Total wages in manufacturing urban units are reported in the *Labor Statistics Yearbook*. The reported wage data exclude employer contributions to social insurance funds and housing funds. These funds and their contribution rates vary by municipality and the ownership of an enterprise. In particular, the United States Social Security Administration (SSA) (2008) reports that social insurance plans apply to urban enterprises and all state-owned enterprises but, for the most part, do not extend to rural enterprises.[20] A time series of employer contribution rates to social insurance programs was constructed from information reported in SSA's *Social Security Programs Throughout the World*.[21] For China, the reported contribution rates rose from 19 percent of wages in the early part of the sample period to 29 percent most recently.[22] As these rates apply primarily to urban

---

[18] A break in the TVE statistics in 1997 necessitated an alternative means of estimating average TVE employment in 1998. We imputed an average estimate for 1998 TVE employment based on the year-end data for 1998 and 1999 and the average estimate for 1999.

[19] One shortcoming of this series is the possible undercounting of rural migrants working in urban manufacturing plants but registered in rural locales. Banister (2005a) reports that these workers are supposed to be included as on-post staff and workers but their numbers may be underreported by employers.

[20] SSA (2010) reports the gradual introduction of pilot pension plans in some rural areas.

[21] The SSA's *Social Security Programs Throughout the World* is published biennially. In the interim years, the last reported contribution rates were used. In instances where contribution ranges were reported, simple averages were used. The adjustment factor for recent years (29 percent of wages) accords closely with the figure for above-wage benefits (29.12 percent of wages) in Banister (2007), based on data gathered for larger enterprises in the 2004 China Economic Census.

[22] These contribution rates exclude contributions to housing funds and likely exclude some other non-wage labor costs. But they are the only non-wage components of labor costs for which a time series can be constructed.

enterprises, they were used to adjust the urban compensation series but not the TVE compensation series.

Total wages in manufacturing TVEs are reported in the *China Village and Township Enterprise Yearbook* beginning in 2002. Prior to 2002, there are no published series for compensation in manufacturing TVEs. For the earlier years average compensation in TVE manufacturing enterprises in 2002 can be estimated by dividing the reported total compensation by average TVE employment as in Banister (2005b). This yields an average compensation figure of 6927 yuan for TVE manufacturing workers, which equates to 62.1 percent of the average compensation reported for manufacturing workers in urban units in 2002. We applied this ratio to the series for average urban compensation to infer average TVE manufacturing compensation for the years prior to 2002. This average compensation series is multiplied by estimated employment in manufacturing TVEs to yield an estimate of total wages in manufacturing TVEs for 1998-2001, then added to reported total wages for manufacturing TVEs for 2002-2009.

Because of an apparent break in the reporting basis of the TVE data in 2007, an adjustment was made to the underlying TVE employment and compensation series. According to Banister and Cook (2011), self-employed workers were dropped from the reported TVE data beginning in 2007, resulting in a sizable decline in the totals for employment and compensation in 2007. But as Banister and Cook note, the employment totals for manufacturing TVEs rose steadily before and after the break. Therefore, the 2007 TVE employment total was imputed by applying the average of the growth rates in manufacturing TVE employment in 2006 and 2008 (the years immediately before and after the break) to the 2006 TVE employment total. Our adjusted employment series was assumed to grow at the rate of reported manufacturing TVE employment in 2008 and 2009. Labor compensation for manufacturing TVEs was also adjusted by adding an estimate of the total wages of the dropped self-employed workers to the reported TVE compensation for 2007. The average wage of the dropped self-employed workers is likely lower than the average wage for all TVE workers. We assumed that such workers earned 78 percent of the average TVE wage[23] in calculating total earnings for our estimate of self-employed workers and added that to the reported total manufacturing TVE wages for 2007. Our adjusted TVE compensation series was assumed to grow at the rate of reported manufacturing TVE wages in 2008 and 2009.

An alternative method of adjusting the reported wage figures to incorporate above-wage labor costs follows Banister (2005b). She details a 2004 survey of urban manufacturing enterprises, indicating that total labor costs were 1.538 times the average wage in 2002. The latter is consistent with the 2001 data for labor costs in manufacturing reported in ILO (2003), which works out to 1.5 of the average urban wage. Banister (2005b) also reports that non-wage compensation in TVEs varies from 0-16 percent of wage costs. She indicates that reported earnings capture total labor compensation for many TVE manufacturing workers but that a 2001 survey in Nanjing found above-wage earnings equal to 16 percent of wages in very large manufacturing TVEs. She applies constant adjustment factors of 1.538 to average manufacturing urban unit wages and 1.08 (a simple average of the reported range for TVEs) to average manufacturing TVE wages to construct labor compensation measures. Using these constant adjustment factors yields slightly higher estimates of China's relative wages and RULC for each year of the study period. For 2009, for example, this alternative method yields relative wages and an RULC of 4.4 and 38 percent of US levels, respectively, as compared to the values of 3.8 and 33 percent reported in Table 3.

Unit labor costs for other countries

Two main sources of data were used to calculate productivity, labor compensation, and ULC for the other countries in the sample: the BLS (2010) and the UNIDO INDSTAT database. The BLS collects and reports labor compensation and productivity data for a number of primarily

[23] The 78 percent is calculated from census data for 2004, reported in Banister (2007), which indicates that the average annual wage of self-employed and household workers in manufacturing was 6343 yuan, 78 percent of the 8144 yuan average wage in manufacturing enterprises below designated size. For the average TVE wage in 2007, we used the estimate of 10,698 yuan from Banister and Cook (2011).

industrialized countries. The BLS value-added data are based on a national-accounts concept and its compensation series include employers' above-wage labor costs. We used the BLS series to construct RULC for a number of European economies, Japan, Korea, Taiwan, and the United States as shown in Table 4. Because there are no comparable BLS data for most developing countries, we used the UNIDO data to construct ULC and RULC measures in these cases. We also used the UNIDO data to construct alternative ULC and RULC measures for the US. The UNIDO value-added series for these other countries are in nominal terms and were deflated by the *WDI*'s implicit manufacturing value-added deflator to yield measures of real value added. For each partner country, this real value-added measure was combined with UNIDO data for employment and wages to yield a census-based measure of ULC that excludes employers' above-wage labor costs. Recent UNIDO data are missing for some countries and so were estimated. UNIDO data for the United States are missing for 2007 and 2008 and were interpolated using growth rates of the corresponding BLS series. The same procedure was followed for a few other OECD countries using corresponding data from the OECD STAN database. In addition, manufacturing value added deflators were not available for some countries (Hong Kong, Russia); in these cases we used the GDP deflator to deflate nominal manufacturing value added.

Nominal and PPP exchange rates

The average annual exchange rate series that was used to convert Chinese labor compensation to US dollars is from *WDI*. Market exchange rates for the other countries in the sample are from the BLS (2010) or *WDI.* Production-based manufacturing PPP exchange rates were used as the equilibrium exchange rates for productivity comparisons between countries and the calculation of RULCs. These PPP exchange rate values are estimates of the value of the nominal exchange rate that would equate the prices of comparable baskets of manufactured goods for any two given countries. Where available we have used the manufacturing PPP exchange rates from the Groningen Growth and Development Centre's (GGDC) ICOP project. The ICOP price comparisons are unit value ratios that are derived from detailed, comparable data on output volumes and values for specific manufacturing products (van Ark and Timmer, 2001). In the case of China, Szirmai et al (2005) calculate a unit value ratio benchmark for total manufacturing for 1995 for the yuan/dollar. This benchmark PPP exchange rate for 1995 was combined with the US and Chinese value-added deflators for manufacturing to interpolate a series for the PPP exchange rate over the sample period. ICOP benchmark PPP manufacturing exchange rates for other countries in the sample were used to interpolate PPP exchange rate series using the same method.[24] No recent ICOP benchmark rates are available for Brazil, Chile, Hong Kong, Malaysia, Russia, Singapore, Thailand, and Turkey. In these cases, the 2005 benchmark PPP rates for machinery and equipment from the International Comparison Project (ICP) were used.[25]

Relative unit labor costs

RULCs were constructed for each country relative to the US. To construct Chinese RULCs for countries other than the US, the China/US RULC was divided by the RULC for the comparator country relative to the US.

[24] Benchmark PPP exchange rates based on manufacturing unit value ratios from the parenthesized sources were used for all the EU countries in the sample (GGDC), Indonesia, Korea, and Taiwan (Stuivenwold and Timmer, 2003); Japan (Inklaar, Wu and van Ark, 2003); Mexico and Brazil (Mulder, Montout, and Lopes, 2002); South Africa (van Dijk, 2002); and India (Erumban, 2007). With the exception of India, these benchmark values are calculated with respect to the US dollar and were combined with value-added deflators in manufacturing to interpolate a PPP exchange rate series using the method described in the text. Erumban's benchmark exchange rate for India was calculated relative to Germany so it was combined with the benchmark rate for the US and Germany to yield a PPP exchange rate value for the rupee against the US dollar.

[25] ICP data are available from the World Bank at http://databank.worldbank.org/ddp/home.do. The ICP PPPs are expenditure rather than production-based. Machinery and equipment is the closest proxy for aggregate manufacturing.

References

Banister, Judith (2005a) "Manufacturing Employment in China" *Monthly Labor Review*, July.
Banister, Judith (2005b) "Manufacturing Earnings and Compensation in China, *Monthly Labor Review*, August.
Banister, Judith (2007) "Manufacturing in China Today: Employment and Labor Compensation" The Conference Board, *Economics Program Working Paper Series 07-01*, September.
Banister, Judith and George Cook (2011) "China's Employment and Compensation Costs in Manufacturing through 2008" *Monthly Labor Review*, March.
Ceglowski, Janet and Stephen S. Golub (2007), "Just How Low Are China's Labor Costs?" *The World Economy* 30, No. 4, 597-617.
Chen, Vivian, Harry Wu, and Bart van Ark (2009) "More Costly or More Productive? Measuring Changes in Competitiveness in Manufacturing Across Regions in China" *Review of Income and Wealth*, 55, Special Issue 1, 514-537.
China Ministry of Agriculture *China Village and Town Enterprise Yearbook* [in Chinese], 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010 (Beijing, China Agriculture Publishing House).
Edwards, Lawrence and Stephen Golub (2004) "South Africa's International Cost Competitiveness and Exports in Manufacturing," *World Development*, August.
Erumban, Abdul Azeez (2007) "Productivity and Unit Labor Cost in Indian Manufacturing A Comparative Perspective" Groningen Growth and Development Centre Research memorandum GD-96, October.
Ferguson, Niall and Moritz Schularick (2011), "The End of Chimerica," *International Finance* 14(1): 1-26.
Golub, Stephen (1999) *Labor Costs and International Trade* (Washington: American Enterprise Institute).
Golub, Stephen and Chang-Tai Hsieh (2000) "The Classical Theory of Comparative Advantage Revisited," *Review of International Economics*, 8 (2) May: 221-234.
Golub, Stephen , Ronald W. Jones and Henryk Kierzkowski (2007), "Globalization and Country-Specific Services Links," Journal of Economic Policy Reform 10, 63-88.
Groningen Growth and Development Center (GGDC), *ICOP Database 1997 Benchmark*, www.ggdc.net, accessed 20 May 2011.
Hinkle Larry E. and Fabien Nsengiyumba (1999) "External real exchange rates: Purchasing power parity, the Mundell Fleming model, and competitiveness in traded goods" in L. E. Hinkle and P. J. Montiel (eds.), *Exchange Rate Misalignment: Concepts and Measurement* (Washington DC:Oxford University Press).
Inklaar, Robert, Henry Wu and Bart van Ark (2003) "'Losing Ground' Japanese Labour Productivity and Unit Labour Costs in Manufacturing in Comparison to the U.S." Groningen Growth and Development Centre Research Memorandum GD-64, July.
International Labor Office (2003) *Yearbook of Labor Statistics* (Geneva).
Japan External Trade Organization (2010) "The 20th Comparative Survey of Investment Related Costs in 29 Major Cities and Regions in Asia," http://www.jetro.go.jp/vietnam/pdf/5.pdf/
Jones, R. W. (2000). *Globalization and the Theory of Input Trade* (Cambridge: MIT Press).
Mbaye, Aly and Stephen Golub (2003) "Unit Labor Costs, International Competitiveness, and Exports: the Case of Senegal" *Journal of African Economies*, 2, 219-248.
Mulder, Nanno, Sylvie Montout and Luis Peres Lopes (2002) "Brazil and Mexico's Manufacturing Performance in International Perspective, 1970-98" Groningen Growth and Development Centre Research Memorandum GD-52, January.
National Bureau of Statistics, *China Labor Statistics Yearbook* (China).
"Nominally Cheap or Really Dear?" (2010) *The Economist*, November 6.

Nowak-Lehmann, Felicitas, Sebastian Vollmer and Immaculada Martinez-Zarzoso (2007), "Competitiveness—A Comparison of China and Mexico," *CESifo Working Paper* No. 2111, October.
Rawski, Thomas (2003) "Recent Developments in China's Labor Economy" *International Policy Group Working Paper 11* (International Labor Office, Geneva).
Rawski, Thomas and Wei Xiao (2001) "Roundtable on Chinese Economic Statistics: Introduction" *China Economic Review*, 12, 298-302.
Stuivenwold, Edwin and Marcel Timmer (2003) "Manufacturing Performance in Indonesia, South Korea, and Taiwan before and after the Crisis" Groningen Growth and Development Centre Research memorandum GD-63, July.
Szirmai, Adam, Ruoen Ren, and Manyin Bai (2005) "Chinese Manufacturing Performance in Comparative Perspective, 1980-2002" *Economic Growth Center Discussion Paper 920* (Yale University).
Turner, Anthony G. and Stephen S. Golub (1997) "Towards a system of unit labor cost-based competitiveness indicators for advanced, developing and transition countries" *Staff Studies for the World Economic Outlook* (Washington: IMF).
Turner, Philip and J. Van't Dack (1993) "Measuring international price and cost competitiveness" *Bank for International Settlements Economic Paper No. 39*, November.
UNCTAD (2002) "China's Accession to WTO: Managing Integration and Industrialization" *Trade and Development Report 2002*, 141-174 (Geneva).
UNIDO (2011a) *INDSTAT database (Vienna).*
UNIDO (2011b) *INDSTAT2 2010 User's Guide* (Vienna).
UNIDO (2011c) *2010 International Yearbook of Industrial Statistics* (Vienna).
United States Bureau of Labor Statistics (BLS) (2010) *International Comparisons of Manufacturing Productivity and Unit Labor Cost Trends, Underlying Data Tables*, spreadsheet dated December 21, 2010, www.bls.gov, download May 12, 2011.
United States Bureau of Labor Statistics (2011) "Manufacturing in China" http://www.bls.gov, accessed February 4, 2011.
United States Social Security Administration *Social Security Programs Throughout the World Asia and the Pacific*, 2002, 2004, 2006, 2008, 2010 http://www.socialsecurity.gov/policy, accessed 10 May 2011.
United States Social Security Administration *Social Security Programs Throughout the World*, 1989, 1991, 1993, 1995, 1997, 1999 (Washington: Government Printing Office).
van Ark, Bart, Abdul Azeez Erumban, Vivian Chen, and Utsav Kumar (2009) "The Cost Competitiveness of the Manufacturing Sector in China and India: An Industry and Regional Perspective" The Conference Board, *Economics Program Working Paper Series 09-02*, January.
van Ark, Bart, Judith Banister, and Catherine Guillemineau (2006) "Competitive Advantage of 'Low-Wage' Countries Often Exaggerated" The Conference Board, *Executive Action Series 212*, October.
van Ark, Bart and Marcel Timmer (2001) "PPPs and International Productivity Comparisons: Bottlenecks and New Directions" paper prepared for the Joint World Bank-OECD Seminar on Purchasing Power Parities, January 30-February 2, Washington, DC.
van Dijk, Michiel (2002) "South African Manufacturing Performance in International Perspective, 1970-1999" Groningen Growth and Development Centre Research Memorandum GD-58, November.
World Bank, *World Development Indicators online* (Washington*).*
Yang, Dennis Tao, Vivian Chen, and Ryan Monarch (2010) "Rising Wages: Has China Lost Its Global Labor Advantage?" *Pacific Economic Review,* 15(4), 482-504.