

Just How Low are China's Labor Costs? *

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Abstract

This paper provides a new perspective on Chinese international competitiveness in manufacturing using relative unit labor costs. We find that Chinese unit labor costs are about 25-40 percent of US labor costs. They are also low relative to costs in the EU, Japan, Mexico, Korea and most other newly industrializing countries. China's cost advantage derives from large currency devaluations that preceded the establishment of a de facto peg around 1995, and rapid productivity growth in the period since 1995. The recent 2.1 percent revaluation of the yuan is much too small to have a significant effect on China's relative unit labor costs.

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I. Introduction

“China’s emergence as one of the world’s leading export nations is driven by a huge disparity in the cost of producing goods, caused primarily by hourly wages that are a fraction of those in the United States and Western Europe... Typically, a U.S. or Western European factory worker costs an employer \$15 to \$30 per hour. A Chinese factory worker earns the equivalent of less than \$1 per hour.”

-- George Stalk and Dave Young, “How China Gets Our Business”
The Washington Post, 3/7/04

China’s spectacular growth in manufactured exports (Figure 1) has elicited widespread concerns in the United States and other developed countries about deindustrialization and the loss of manufacturing jobs. China’s export success is often attributed to unfairly low wages and an undervalued currency. The concerns about low wages and an undervalued currency are closely related: both result in low Chinese labor costs when expressed in competitors’ currencies. Political pressures for increasing trade barriers on Chinese exports and for a revaluation of China’s currency, the yuan, have intensified in Europe and the United States. In an attempt to defuse these pressures, China revalued its currency by 2.1 percent in July 2005, and altered its exchange-rate-setting policy from pegging to the US dollar to a basket peg. The yuan had been effectively fixed at 8.3 to the dollar since the mid-1990s, following sustained and steep devaluations in the 1980-1994 period (Figure 2). The extent of the undervaluation of the Chinese currency remains highly controversial, however.¹

Much attention is paid to China’s very low wages and pegged exchange rate, but low wages by themselves do not guarantee that a country’s workers are competitive in the

¹ For some recent discussions of China’s exchange rate and international competitiveness, see Funke and Rahn (2005), Adams et al (2004), Bosworth (2004), and Goldstein (2004).

world market for manufactured goods. Labor productivity also matters. This paper attempts to shed some light on these issues through an analysis of China's relative unit labor costs (RULC) in manufacturing. As explained more fully below, unit labor costs are the ratio of wages to labor productivity, and relative unit labor costs reflect currency fluctuations as well as international differences in wages and labor productivity. Relative unit labor costs therefore provide a compact measure of international competitiveness that encapsulates the key sources of the controversy surrounding China's phenomenal export growth. Our objective is to calculate and analyze China's manufacturing wages, productivity and unit labor costs relative to those in the United States, the European Union, Japan, Mexico, and other East Asian developing countries. We provide both a snapshot of China's bilateral RULC vis-à-vis these countries and an historical perspective that traces the evolution of China's RULC since 1980.

Turner and Van't Dack (1993) and Turner and Golub's (1997) surveys of the literature conclude that relative unit labor costs in manufacturing are the best single indicator of competitiveness. Where data are available, Hinkle and Nsengiyumba (1999) also endorse the use of unit labor costs, for analysis of both levels and rates of change of competitiveness. In addition to its clear intuitive appeal, relative unit labor cost is the key relative price in a Ricardian model of trade (Golub and Hsieh 2000). Furthermore, in a world where capital is mobile and production is footloose between countries, it is the relative price of non-tradable *inputs*, notably labor, rather than *outputs* that matters.² As noted above, given the attention focused on Chinese wages, RULC are a very prominent

² See Jones (1980, 2000) for theoretical analyses of globalization and the fragmentation of production pointing to the importance of the distinction between tradable and non-tradable inputs.

candidate for explaining China's booming exports of manufactures. The concept and methodology of this paper are based on previous studies of RULC in various countries by one of the authors (Golub 1999, Mbaye and Golub 2003, Edwards and Golub 2004).

To our knowledge, there have been no previous systematic analyses of Chinese RULC over time. UNCTAD (2002) computes bilateral Chinese RULC vis-à-vis a range of developed and developing countries but the calculations are for a single year, 1998. Cox and Koo (2003) report comparative wage and productivity data for China vis-à-vis the United States and Mexico for 2001 but stop short of unit labor cost comparisons. Szirmai, Ren, and Bai (2005) provide a careful analysis of relative Chinese labor productivity over time, but do not cover relative wages and unit labor costs. Banister (2004) is a detailed study of labor costs in Chinese manufacturing that includes a meticulously-constructed estimate for 2002 but does not contain productivity or unit labor cost estimates.

This paper provides more comprehensive measures of Chinese RULC than in the prior literature. It pays careful attention to data and measurement issues in order to arrive at unit labor cost measures for manufacturing that are comparable across countries. It also provides time series estimates for Chinese RULC over a 23-year period. This time-series perspective is used to trace the evolution of China's competitive position in manufacturing and to analyze the specific developments that have contributed to it. As such, it can provide valuable insights into China's emergence as a manufacturing powerhouse.

II. Methodology

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

$$(1) \quad a_i = \frac{L_i}{VA_i}$$

where VA 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 . 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_i

$$(2) \quad ULC_i = \frac{w_i L_i}{VA_i} = w_i a_i$$

where w is the wage. Expressed in domestic currency, foreign (country j) unit labor costs are $e \cdot w_j \cdot a_j$ where e is the exchange rate between the home and foreign currencies.

Country i 's competitive position vis-à-vis country j depends on its bilateral relative unit labor costs

$$(3) \quad RULC_{ij} = \frac{a_i w_i}{a_j w_j e_{ij}}$$

$RULC_{ij}$ can be decomposed as follows

$$(4) \quad RULC_{ij} = \frac{a_i w_i}{a_j w_j e_{ij}} = \frac{a_i}{a_j} \cdot \frac{w_i}{w_j e_{ij}} = \frac{a_i}{a_j} \cdot \frac{w_i}{w_j PPP_{ij}} \cdot \frac{PPP_{ij}}{e_{ij}}$$

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) China's wages relative to those

of other countries at an equilibrium or PPP exchange rate, and 3) the level of the yuan exchange rate relative to its equilibrium level. Gains or losses in China's competitive position over time can originate with changes in any of these ratios.

III. Data

III.1. General considerations

We construct annual series for unit labor costs and relative unit labor costs in Chinese manufacturing for 1980-2002. The sample period begins near the start of China's shift towards a market economy and ends in the year for which the latest data are available.

To compare levels of real output and labor compensation across economies, they must be converted to a common currency. Productivity is calculated as nominal manufacturing value added per employee, deflated by the manufacturing value-added deflator and converted to US dollars at an equilibrium or purchasing power parity (PPP) exchange rate. Wages are defined as total labor compensation per employee, converted to dollars at the market exchange rate. As is accepted in the literature on international labor productivity and unit labor cost comparisons, PPP exchange rates are used for international productivity comparisons to eliminate the effects of exchange-rate volatility on measures of real output, which should be invariant to such exchange-rate fluctuations. But deviations of exchange rates from PPP do affect relative labor costs, so it is appropriate to use the market exchange rate in converting wages.³ Currency depreciation

³ See Hooper and Larin (1989) for further justification of the use of PPP exchange rates for productivity comparisons but market exchange rates for labor-cost comparisons.

consequently tends to improve international competitiveness by reducing labor costs relative to labor productivity.

Two alternative measures of PPP exchange rates were used: the average real exchange rate over 1980-2002 based on manufacturing value added deflators, and the PPP derived from manufacturing unit values in Szirmai (2005).⁴ As these two methods yielded very similar results, only the RULC based on average real exchange rates are reported in the text.

III.2. Constructing Chinese unit labor costs

Chinese unit labor costs in manufacturing are calculated using data from the United Nations Industrial Development Organization (UNIDO), the World Bank, and published Chinese government documents. The available time-series data on Chinese labor compensation, employment, and value added have some limitations.⁵ Given these limitations, two alternative ULC series are constructed and the results are reported as a range. The first series uses a narrow concept of the manufacturing sector that largely excludes rural and small businesses, is based on census of manufacturing data, and omits employer contributions to social insurance funds from labor compensation. The second uses a more inclusive measure of manufacturing activity that covers rural and smaller enterprises, is based on national accounts data, and includes employer contributions to fringe benefits in labor compensation. Each of these two series, in turn, is then compared

⁴ See the appendix for further details on the computation of the PPP exchange rate.

⁵ As explained below, the coverage of some manufacturing measures is incomplete and changes over the sample period. Other measures, particularly those compiled by the Chinese government, are viewed as unreliable by some China scholars; see, for instance, Rawski and Xiao (2001).

to analogous ULC data for other countries. The main data issues are described here, with more detail provided in the appendix.

Chinese ULC based on narrow definition of manufacturing

The first ULC measure is obtained from UNIDO series for manufacturing employment 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. UNIDO does not report wage and salary data for Chinese manufacturing for the 1980-2002 period, so labor compensation data were obtained from the *China Labor Statistics Yearbook* and *China Statistical Yearbook*, with a definition of manufacturing that corresponds closely to that underlying the UNIDO series. The compensation data include wages and salaries, bonuses, overtime and hardship pay, all kinds of subsidies in cash and in kind including housing, transportation, and meal subsidies, individual income taxes, and employee contributions to social insurance funds, but do not include employer contributions to social insurance or housing funds (Banister 2004).

Chinese ULC based on broader definition of manufacturing

The second, more encompassing definition of the manufacturing sector uses real value added in manufacturing from the World Bank's *World Development Indicators (WDI)*, which employs a national income concept rather than the census-based concept underlying the UNIDO series. These value-added data are significantly higher than the census-based UNIDO series. To obtain a corresponding measure of manufacturing

employment, we aggregated Chinese data on urban manufacturing employment and a measure of manufacturing employment in township and village enterprises (TVEs), as in Banister (2004). Though the *China Labor Statistics Yearbook* reports total manufacturing employment, Banister suggests this total may undercount non-urban employment by an increasing amount over time. Employment in rural manufacturing is collected and reported by a different Chinese government agency than TVE employment, and the data reveal a growing gap between the two measures with reported TVE employment increasingly higher than reported rural employment.⁶ Adding the series for urban and TVE employment yields total employment figures that are considerably larger than the UNIDO data.

Rural workers, including most TVE employees, earn significantly less than urban workers in Chinese manufacturing (Rawski 1999, 2003). For this reason, separate labor compensation series were constructed for urban and TVE manufacturing. As noted above, the wage data reported by the Chinese government exclude employer contributions to social insurance funds and housing funds.⁷ These funds and their contribution rates vary by municipality and the ownership of the enterprise. For instance, the Social Security Administration (SSA) (2005) 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. A time series of employer contribution rates to social insurance programs was constructed from information reported in SSA's *Social Security Programs*

⁶ This possible undercounting is noted also by Szirmai et al (2005), who take a different approach to dealing with it. However Rawski (2003) reports massive, chronic exaggeration of TVE statistics, including employment data, in the late 1990s.

⁷ Li and Zax (2002) also indicate they exclude implicit housing subsidies due to the difficulty in assigning an explicit monetary value.

Throughout the World. For China, the contribution rates range from 3 percent of wages in the early part of the sample period to as high as 35 percent more recently.⁸ Since these rates apply primarily to urban enterprises, they were used to adjust the urban compensation series, but not the TVE compensation series.

III.3. Constructing Chinese relative unit labor costs

Bilateral measures of Chinese RULC were constructed by pairing each series for Chinese manufacturing ULC with ULC series for other countries that were constructed from comparable data, ensuring that roughly similar concepts are used across countries in making comparisons. That is, 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.⁹ In a similar way, the second, broader series for Chinese ULC was paired with ULC for the United States and other countries based on Bureau of Labor Statistics (BLS) data. The BLS data employ a national accounts-based concept of value

⁸ These contribution rates exclude contributions to housing funds. The housing funds are a relatively new development, limited in scope, for which scant data are available. The figure used to adjust the compensation data for 2002 is similar to the “lower-end” adjustment factors used by Banister. She reports the results of a 2004 survey of urban manufacturing enterprises which found that employer contributions to social insurance and housing funds averaged 32 percent of wages in 2002, a figure she uses as a lower-end bound for urban labor costs in 2002. But the same survey reports that total average labor costs were 1.58 times the average wage, Banister’s upper bound for urban wages. 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. As time series for these labor compensation ratios are not available, we rely on the social insurance contribution rates reported in the various issues of *Social Security Programs Throughout the World*.

⁹ For all countries, the UNIDO-based ULC series employ a census concept of value added and exclude employer contributions to social insurance funds from reported labor compensation.

added and employment, as well as a measure of labor compensation that includes employer-paid fringe benefits.

Each of these RULC measures has distinct strengths and shortcomings. The Chinese 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. A downside of the UNIDO data for China is that they contain several changes in their coverage of manufacturing firms. Comparative unit labor costs for the second, broader measure are available for fewer, primarily industrial countries from the BLS. Because the BLS does not report data for Chinese value added, World Bank data were used instead, with uncertain comparability with the BLS definition of value added. However, the broader coverage of the second RULC series provides a more comprehensive measure of relative manufacturing competitiveness. It is also apt to better account for China's non-urban manufacturing activity and costs, whose importance has increased in recent years due to the considerable growth in Chinese manufacturing employment outside of urban areas.

IV. Results

IV.1. Chinese RULC vis-à-vis the United States

Figure 3 shows two RULC series for China, both relative to the United States. The first pairs the UNIDO-based Chinese unit labor cost series with unit labor costs in the United States that are derived from the same UNIDO database. The second series compares the broader measure of Chinese unit labor costs to US costs derived from BLS data on manufacturing value added, labor compensation, and employment. The two series tell a similar story. Both indicate that China's relative unit labor costs fell in the first part of the sample period; the UNIDO-based series shows a drop in China's costs from 74 percent to about 40 percent of US unit labor costs while the second series falls from 38 percent of US costs in 1980 to 27 percent in 2002. In both series these gains in China's competitive position are sustained through the end of the sample period, but they have not widened to any significant degree since the mid-1990s. Still, Chinese labor costs were very low in 2002 even after accounting for productivity differences.

Table 1 breaks down the observed changes in China's unit labor costs into their constituent components for both measures of ULC. The sample period is split at 1995, when the de facto dollar peg appears in the exchange rate series. According to both measures, Chinese labor compensation per worker grew rapidly in local currency terms throughout the 1980-2002 period, at more than 10 percent annually. It substantially outpaced productivity growth prior to 1995. But Chinese productivity growth accelerated in the most recent period, with the average annual growth rate of output per person roughly doubling to 11-12 percent annually, depending on the measure of productivity

used. As a result, China's ULC in yuan terms rose at an annual rate of 5-7.6 percent until 1995 but fell between 1995 and 2002.

Unit labor costs in dollar terms exhibit a similar pattern over 1995-2002, but they display a very different trend than ULC in local currency terms before then. The yuan depreciated by an average of 8 percent a year between 1980 and 1995, leading to an overall fall in unit labor costs, measured in dollar terms, of 1-3 percent a year despite the 5-7 percent annual increase in local-currency unit labor costs. Since 1995 the changes in Chinese unit labor costs measured in dollars have been nearly identical to the changes measured in yuan, reflecting the exchange rate peg.

Table 2 presents a breakdown of changes over time of China's relative unit labor costs measured against the United States in dollar terms. This measure of China's RULC exhibits the same pattern over time as China's dollar-based unit labor cost series. The China/United States RULC declined by 2-4 percent annually between 1980 and 1995. That trend did not continue apace after 1995, despite a substantial rise in the growth rate of China's value added per person relative to that of the United States, reflecting the continued high growth in Chinese labor compensation and the absence of further yuan depreciation.

Table 3 compares the levels of China's manufacturing productivity, labor compensation, and unit labor costs with their US counterparts for the two measures described above for selected years.¹⁰ Both measures show that China's labor compensation and productivity levels have grown but remain small fractions of their US

¹⁰ As is apparent in the table, the principal difference in the two sets of estimates is in the relative wage costs, which are consistently lower in the second series based on the World Bank and BLS data.

counterparts. The range implied by these estimates is in accord with most existing wage and productivity comparisons. Banister (2004) estimates that in 2002 China's hourly labor compensation in manufacturing was 3 percent of US manufacturing labor compensation. Cox and Koo (2003) report a 3.8 percent China/United States ratio for hourly manufacturing wages for 2001 and UNCTAD (2002) estimates Chinese manufacturing wages at 2.1 percent of US manufacturing wages in 1998.¹¹ All of these measures are consistent with the UNIDO-based estimates in Table 3. Zeng (2005) places China's manufacturing productivity in 2000 at less than 5 percent of US labor productivity, lower than the reported range. Szirmai et al (2005) calculate annual estimates of China's relative productivity in manufacturing based on gross output. For the earlier part of the sample period, they report relative productivity of about 5 percent, higher than the estimates in Table 3. However the figures in Table 3 are near the middle of the ranges they estimate beginning in 1995.

Figure 4 provides further insight into the sources of China's low RULC vis-à-vis the United States, using the breakdown of RULC suggested by (4) 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. Two key characteristics are evident in both measures of RULC. First, China experienced very substantial gains in competitiveness prior to 1995 thanks to the depreciation of the nominal exchange rate relative to its PPP

¹¹ Notably, however, UNCTAD's associated estimate of Chinese unit labor costs in manufacturing is 77 percent of US unit labor costs. This is considerably higher than either estimate in Table 2 and is likely to reflect differences in the deflators and exchange rates used to compare real value added in manufacturing.

level.¹² That is, the yuan experienced a real depreciation relative to its equilibrium level of more than 50 percent between 1980 and 1995. Second, when both wages and productivity are measured with the PPP exchange rate in order to control for exchange rate movements, China's relative productivity consistently exceeds China's relative wage. In short, China's low RULC reflect both the sustained depreciation of the yuan prior to 1995 and low wages relative to productivity measured at a constant exchange rate, with this wage-productivity gap widening moderately since 1995.

IV.2. Chinese RULC vis-a-vis other countries

Table 4 presents two sets of estimates of Chinese relative wages, productivity and unit labor costs against selected developed and developing countries for 2002. The first set compares wages, productivity, and unit labor costs based on the UNIDO data for China and each comparator country. The second set pairs the broader measures of the same Chinese series calculated from World Bank and Chinese sources with comparable BLS measures for the United States, Japan, and the EU. For other countries for which no BLS data are available, the second RULC measure is imputed using the UNIDO-based RULC between the United States and each specific comparator country and the broader China/United States RULC.¹³

¹² This shows up in Figure 4 as a fall in the ratio of the PPP exchange rate to the market exchange rate. The two measures of PPP exchange rates yield very similar results in this regard.

¹³ For both sets of RULC estimates, the calculations start by computing the bilateral RULC between each comparator country and the US. For example, the bilateral RULC for Mexico vis-à-vis the United States ($RULC_{M-US}^{UNIDO}$) is calculated from UNIDO data. Bilateral China-Mexico RULC ($RULC_{C-M}^{UNIDO}$) for the narrow definition is then obtained by taking the ratio

The cross-country comparisons reveal sizable differences in relative productivity (Table 4). China’s manufacturing productivity is a fraction of the productivity levels in not only the developed economies but a number of advanced developing economies including Korea, Singapore, and Brazil. Among this group, it ranges from 8 percent to 24 percent of comparator countries’ productivity levels. It is on a par with productivity in Indonesia and, by our measures, exceeds productivity in India. The wage differences are even larger than the productivity differences for most countries; Chinese labor costs are less than 10 percent those of five comparator economies in Table 4. This yields Chinese ULC that are well below those of most other countries. However for most of the countries in the sample, the RULC suggest substantially smaller cost differences than those implied by the relative wage data alone.

According to the broader measure of manufacturing, China’s ULC are the lowest of all the countries shown (Table 4b). China’s RULC vis-à-vis Japan and the EU are similar to its RULC vis-à-vis the United States at 26-30 percent. Against developing countries, China’s RULC vary from 23 percent for Singapore to 88 percent for Brazil, with the others at around 30-40 percent. Using the narrow definition (Table 4a) yields higher Chinese RULC that range from a low of 25 percent for the EU to over 100 percent for Indonesia and Brazil.¹⁴ The high values for China’s RULC vis-à-vis Brazil and Indonesia

$RULC_{C-M}^{UNIDO} = (RULC_{C-US}^{UNIDO}) / (RULC_{M-US}^{UNIDO})$ using UNIDO data for both numerator and denominator. Where no BLS data are available, i.e. for all the developing countries, the broader measure is calculated as $RULC_{C-M}^{BLS} = (RULC_{C-US}^{BLS}) / (RULC_{M-US}^{UNIDO})$. This calculation assumes that the bilateral Mexican-US RULC is equal under the broad and narrow definitions. Therefore the difference between the two calculated Mexico-China RULC in Table 4 derives from the difference between the China-US narrow and broad measures.

¹⁴Table 4a reports Chinese unit labor costs as 42 percent of unit labor costs in the US and Japan. Compared to the 25 percent reported for the EU, this indicates that unit labor

partially reflect very substantial recent currency depreciations for the latter two countries. Nevertheless, even under the narrow definition, Chinese ULC remain much lower than those in the EU and Japan, as well as in newly industrializing countries such as Mexico and Korea.

V. Conclusions

This paper provides a new perspective on Chinese manufacturing competitiveness using relative unit labor costs that are carefully constructed from available compensation, employment, and value added data. Our measures indicate that, as of 2002, Chinese unit labor costs in manufacturing are very low relative to a wide range of other countries. They are about 25-40 percent of the US level and correspondingly low relative to the EU, Japan, Mexico, Korea and most other newly industrializing countries. However the Chinese cost advantage implied by its RULC is, in most cases, substantially smaller than that suggested by a comparison of wages alone.

Our analysis also traces the evolution of China's labor cost advantage in manufacturing over 1980-2002. China's cost competitiveness derives from the large currency devaluations that preceded the establishment of a de facto peg around 1995, as well as rapid productivity gains that have outpaced wage growth in recent years. Since the mid-1990s Chinese relative unit labor costs have stabilized at a low level, reflecting the combined effects of the exchange rate peg and recent productivity growth. The exchange rate peg is therefore not itself the direct cause of China's competitive advantage in manufacturing, but it does prevent adjustments to an apparent disequilibrium as

costs in the EU exceeded unit labor costs in both the US and Japan even in 2002, prior to the weakening of the dollar against the euro in 2003-04.

measured by relative unit labor costs. The recent 2 percent revaluation of the yuan is much too small to have a significant effect on China's relative unit labor costs.

Appendix

This appendix details 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 manufacturing. The first ULC series employs a narrow, census-based measure of manufacturing production and employment, using UNIDO data. It focuses on urban, large-scale manufacturing. The second ULC series uses a broader concept of manufacturing, based on a national accounts measure of value added and total manufacturing employment. Its inclusion of small and rural manufacturing activities and costs provides a more comprehensive measure of unit labor costs. Comparable ULC series are calculated for other countries and combined with the Chinese ULC series to yield relative unit labor cost measures.

Chinese unit labor costs based on narrow definition of manufacturing

This ULC series is calculated from data for manufacturing value added and employment from the UNIDO INSTAT database, and Chinese data for labor compensation. The UNIDO employment and value-added series for Chinese manufacturing are census data reported by the Chinese authorities. Their coverage varies over the sample period of 1980-2002. The value-added data pertain to enterprises with independent accounting systems for the period 1980-1997 and to industrial enterprises that are state-owned or independent with annual sales of at least 5 million yuan for the period 1998-2002.¹⁵ The UNIDO employment data are consistent with these two

¹⁵ Szirmai et al (2005) report that in 1978 enterprises with independent accounting systems accounted for most industrial output and employment but that this coverage has steadily fallen since then due to changes in ownership structure and the limited coverage

reporting bases for the period 1990-2002 but not for the period 1980-1989.¹⁶ Therefore manufacturing staff and workers from the *China Labor Statistics Yearbook* have been used instead of the reported UNIDO employment data for 1980-1989.¹⁷

As noted above, the reporting base for the employment and value-added series changes in 1998. The new base excludes small enterprises and is thus less comprehensive than the old base.¹⁸ Holz and Lin (2001) indicate that this change introduces a discontinuity in the series but that the new reporting base may provide more accurate data, citing concerns about the reliability of statistics collected on small township enterprises that are excluded under the new system. Another break, reported by UNIDO, occurs in 1993 due to the introduction of a new statistical system. These changes have the potential to affect the consistency of the unit labor cost series over time.

UNIDO reports manufacturing value added in nominal terms. This series is converted to real terms by applying the World Bank's implicit value-added deflator for manufacturing from *WDI*. There are large increases in the deflator in the mid-1990s. When it is applied to UNIDO's value-added data, the resulting real value-added series exhibits substantial volatility. This volatility is not apparent in the real value-added series reported by the World Bank. For this reason, the UNIDO value-added data were

of the reported statistics. The change in the reporting base in 1998 excludes small manufacturing enterprises.

¹⁶ For 1980-1989 UNIDO reports formal employment in state-owned enterprises.

¹⁷ Staff and workers refer to formal employees on the payroll of state, collective, and other ownership units for 1980-1997 and formal, on-post employees on the payroll of the same ownership units beginning in 1998. The employment data reported in the *China Labor Statistics Yearbook* are end-year figures. Therefore, the year-end data were averaged to yield an average annual employment series.

¹⁸ Another potential source of discontinuity in the employment series occurs in 1998, when furloughed workers were no longer counted among the employed. This change, along with the narrowing of the reporting base, could account for the substantial drop in the number of manufacturing employees reported by UNIDO in 1998.

smoothed to accord with the World Bank data by applying the growth rate in the real World Bank series to the real value-added series derived from the UNIDO data beginning in 1993.

Compensation data reported in the *China Labor Statistics Yearbook* and *China Statistical Yearbook* were used to construct a series that corresponds to average annual labor compensation in China's urban manufacturing sector. Starting in 1994 the yearbooks report average compensation per worker for urban units, a concept that includes staff and workers, urban reemployed retirees and foreign, Hong Kong, Macao, and Taiwan employees in urban manufacturing (Banister 2004) but excludes self-employed urban workers, urban workers in relatively small privately-owned and – operated enterprises, and rural workers in manufacturing. This series is used as a proxy for average compensation in urban manufacturing. No such series is available prior to 1994 so average compensation for manufacturing staff and workers is used instead.¹⁹

Chinese ULC based on broader definition of manufacturing

This alternative employs a broader measure of the manufacturing sector that includes small and rural enterprises. 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.

¹⁹ This is probably a reasonable substitution as employment data reported in the *China Labor Statistics Yearbook* indicate little difference between staff and workers and urban employment in manufacturing in the early years of the sample period during China's transition to a more market-oriented production system.

Total employment in manufacturing is calculated as the sum of urban manufacturing employment (reported in the *China Labor Statistics Yearbook*) and an estimate of TVE employment in manufacturing, based on the methodology employed by Banister (2004). TVE employment in manufacturing is reported only for 2002; in all other years, 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. Applying this ratio to the series for TVE employment in industry yields an estimated time series for TVE employment in manufacturing. The results were added to the reported total for urban manufacturing employment to derive a series for total manufacturing employment for the entire 1980-2002 period.²⁰

Total labor compensation is constructed as the sum of total urban manufacturing compensation and total compensation in manufacturing TVEs. Total urban manufacturing compensation is the product of urban manufacturing employment and average urban labor compensation. The latter is based on the average urban compensation series detailed above.²¹ It is adjusted to account for employers'

²⁰ One shortcoming of this series is the possible undercounting of rural migrants working in urban manufacturing plants but registered in rural locales. Banister (2004) reports that these workers are supposed to be included as on-post staff and workers but their numbers may be underreported by employers.

²¹ The urban compensation series applies to urban units so it excludes labor costs for self-employed urban manufacturing workers and urban workers in small privately-owned and –operated manufacturing enterprises. By applying it to total urban employment, we are implicitly assuming that it is a reasonable estimate of average compensation for those urban workers operating outside of urban units. In the relative unit labor cost estimates, these data are paired with comparable US data from the BLS. The BLS handles similar data gaps as follows: it does not include compensation data for very small enterprises and assumes that self-employed workers earn the same hourly compensation as the average for wage and salary employees (Banister 2004).

contributions to social insurance funds, as described in the text.²² Total compensation in TVE manufacturing is calculated as the product of our estimate of TVE employment and an imputed series for average labor compensation in manufacturing TVEs. There is no published series of average compensation for TVE manufacturing workers. However Banister (2004) reports total compensation in TVE manufacturing enterprises for 2002, dividing that figure by total year-end TVE manufacturing employment to derive an average compensation figure of 6927 yuan for TVE manufacturing workers in that year. This is 62.11 (62.97) percent of the average compensation reported for manufacturing workers in urban units (staff and workers) for the same year. We applied these two ratios to the series for average urban compensation to infer average TVE manufacturing compensation for the earlier years. This average is multiplied by TVE manufacturing employment and the result is added to total urban manufacturing compensation to arrive at total labor compensation in manufacturing. This total is divided by the sum of urban employment and TVE employment to calculate average compensation per worker.

Unit labor costs for other countries

Two main sources of information were used to calculate productivity, wages, and ULC for the other countries in the sample: the UNIDO INSTAT database and the US BLS. The UNIDO value-added series is in nominal terms and was deflated by the *WDI*'s implicit manufacturing value-added deflator to yield a measure of real value added. For each partner country, this real value-added measure was combined with

²² The adjustment factors are based on contribution rates reported in the SSA's *Social Security Programs Throughout the World*, which 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.

UNIDO data for employment and wages to yield a census-based measure of ULC that excludes employer contributions to fringe benefits. The UNIDO data were used for all countries shown in Table 4a of the text.

A second ULC measure was calculated for those countries for which the BLS collects and reports compensation and productivity data, consisting almost entirely of developed countries. We used the BLS series to construct RULC for the European Union, Japan, and the United States as shown in Table 4b. The BLS value-added data are based on a national-accounts concept and its compensation series include employer-paid fringe benefits. There are no BLS data for developing countries.

Nominal and PPP exchange rates

The average annual exchange rate series that were used to convert labor compensation to US dollars are from *WDI*. Notably, China had multiple exchange rates in the early part of the sample period. The World Bank's exchange rate series for China consists of a weighted average of multiple exchange rates for 1980-1993 and the official exchange rate beginning in 1994 (World Bank 1995).

Two alternative methods of computing equilibrium exchange rates for use in productivity comparisons between countries were tried: 1) the average bilateral real exchange rate over the sample period and 2) the manufacturing PPP based on relative unit value ratios from Smirzai et al (2005). The first method of calculating a benchmark PPP exchange rate can be used for all countries in the sample as it is based on the average value of the real exchange rate vis-à-vis the United States over 1980-2002, using value added deflators in manufacturing as the price index. However it implicitly assumes that

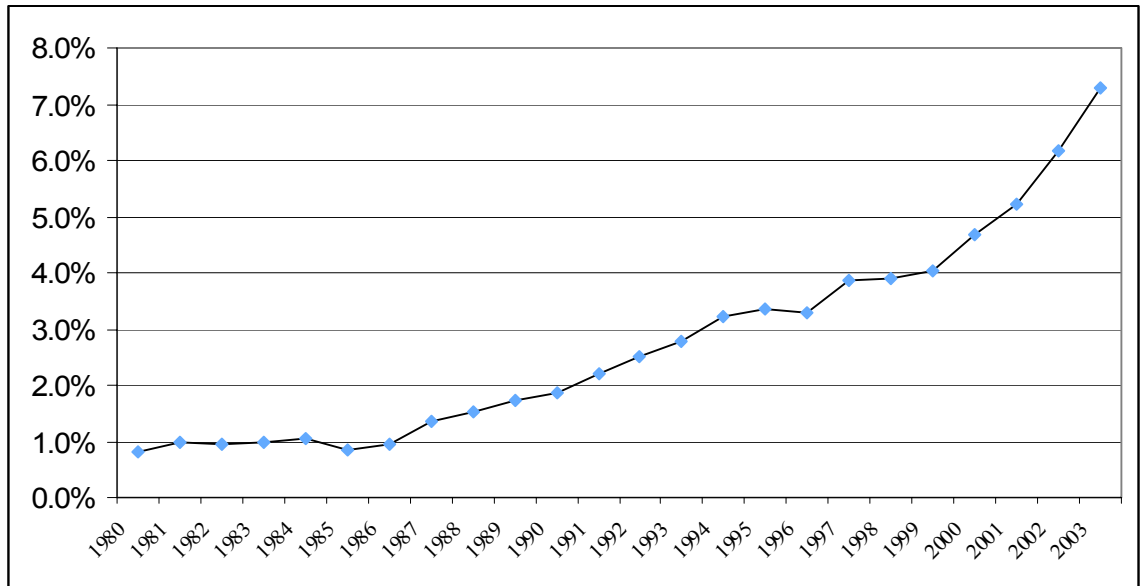
the average value of the real exchange rate over the sample period is a good proxy for its long-run value. This may be questionable, particularly in the case of China because of the government's extensive control over the foreign exchange market and goods market prices, thereby limiting the role of market forces in inducing mean reversion of real exchange rates towards equilibrium. An alternative PPP exchange rate can be derived from ICOP's 1995 unit value ratio benchmark for China and the United States (Szirmai et al, 2005). This is an estimate of the value of the yuan/dollar exchange rate that would equate the prices of comparable baskets of manufactured goods in the two countries. The price comparisons are derived from detailed, comparable data on output volumes and values for specific manufacturing products in China and the United States in 1995. 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 1980-2002. However, because ICOP's 1995 benchmark value (4.6 yuan/dollar) is not substantially different from the value of our PPP exchange rate series in 1995 (5.0 yuan/dollar) the effect on China's relative productivity is minor and it yields marginally lower relative unit labor costs.

References

- Adams, F. Gerard, Byron Gangnes, and Yochanana Schachmurove (2004) "Why is China so Competitive?" *Singapore Management University Economics and Statistics Working Paper 07-2004*, March.
- Banister, Judith (2004) "Manufacturing Employment and Compensation in China," unpublished paper prepared for United States Bureau of Labor Statistics, December (Washington).
- Bosworth, Barry (2004) "Valuing the Renminbi" paper presented at the Tokyo Club Research Meeting, February.
- Cox, W. Michael and Jahyeong Koo (2003) "China: Awakening Giant" *Southwest Economy*, 5, September/October, Federal Reserve Bank of Dallas.
- Edwards, Lawrence and Stephen Golub (2004) "South Africa's International Cost Competitiveness and Exports in Manufacturing," *World Development*, August.
- Funke, Michael and George Rahn (2005) "Just How Undervalued in the Chinese Renminbi?" *World Economy*, 465-489.
- Goldstein, Morris (2004) "Adjusting China's Exchange Rate Policies," (Washington: Institute for International Economics).
- 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.
- 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).
- Holz, Carsten and Yi-min Lin (2001) "The 1997-1998 Break in Industrial Statistics Facts and Appraisal" *China Economic Review*, 12, 303-316.
- Hooper, Peter and K. Larin (1989) "International comparisons of labor costs in manufacturing" *Review of Income and Wealth*, 35, 4, 335-355.
- International Labor Office (2003) *Yearbook of Labor Statistics* (Geneva).
- Jones, Ronald W. (1980) "Comparative and Absolute Advantage," *Swiss Journal of Economics and Statistics* 3: 235-260.
- Jones, R. W. (2000). *Globalization and the Theory of Input Trade* (Cambridge: MIT Press).
- Li, Haizheng and Jeffrey Zax (2002) "Economic Transition and the Labor Market in China" unpublished manuscript,
<http://www.prism.gatech.edu/~hl45/research/lbmkt.pdf>.
- Mbaye, Aly and Stephen Golub (2003) "Unit Labor Costs, International Competitiveness, and Exports: the Case of Senegal" *Journal of African Economies*, 2, 219-248.
- National Bureau of Statistics, *China Labor Statistics Yearbook* (China).
- National Bureau of Statistics, *China Statistical Yearbook* (China).
- Rawski, Thomas (1999) "China: Prospects for Full Employment" *Employment and Training Paper 47* (International Labor Office, Geneva).

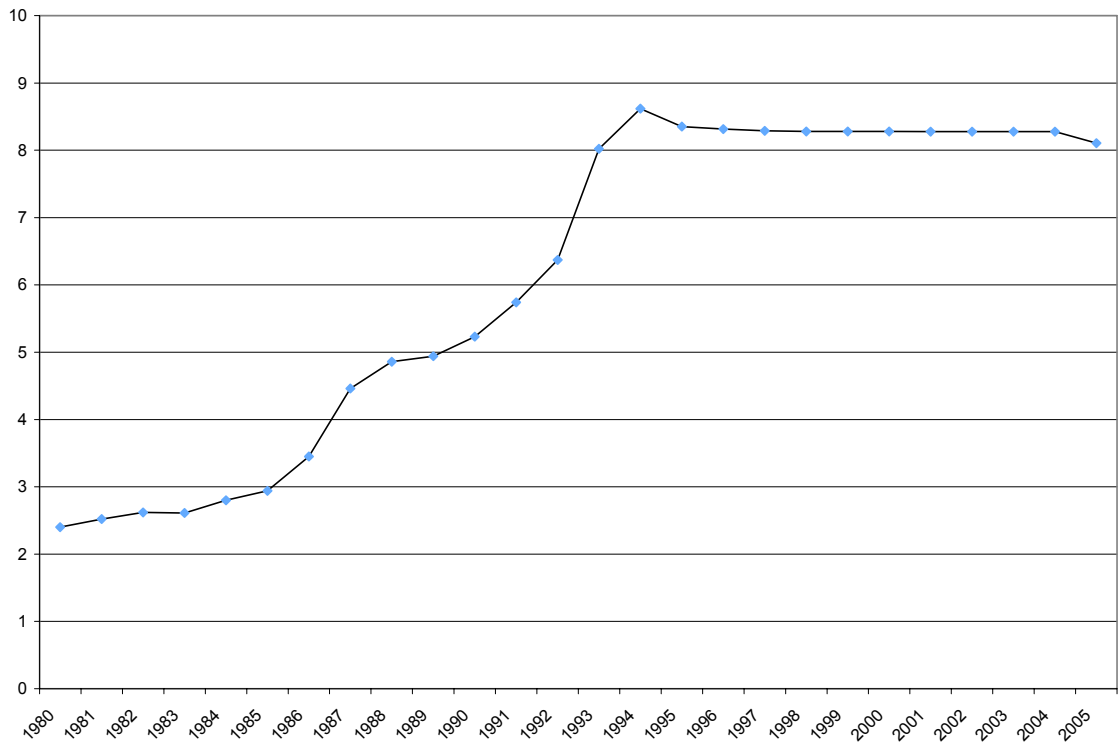
- Rawski, Thomas (2003) "Recent Developments in China's Labor Economy" *International Policy Group Working Paper 11* (International Labor Office, Geneva).
- Rawski, Thomas and Wei Xiao (2001) "Roundtable on Chinese Economic Statistics: Introduction" *China Economic Review*, 12, 298-302.
- Social Security Administration *Social Security Programs Throughout the World Asia and the Pacific*, 2002, 2005.
- Social Security Administration *Social Security Programs Throughout the World*, 1981, 1983, 1985, 1987, 1989, 1991, 1993, 1995, 1997, 1999.
- 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 (2005) *INSTAT database* (Vienna).
- UNIDO, *International Yearbook of Industrial Statistics* (Vienna).
- United States Bureau of Labor Statistics (BLS) (2005), "Underlying Data for Indexes of Output per Hour, Hourly Compensation, and Unit Labor Costs in Manufacturing," unpublished data provided upon request (Washington).
- World Bank (1995) *World Tables* (Washington).
- World Bank, *World Development Indicators online* (Washington).
- Zeng, Douglas (2005) "China's Employment Challenges and Strategies after the WTO Accession" *World Bank Policy Research Working Paper 3522*, February (Washington).

Figure 1.
China's share of world manufactured exports



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

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



Source: World Bank, *World Development Indicators*

Figure 3.
China/United States relative unit labor costs in manufacturing
(United States= 1)

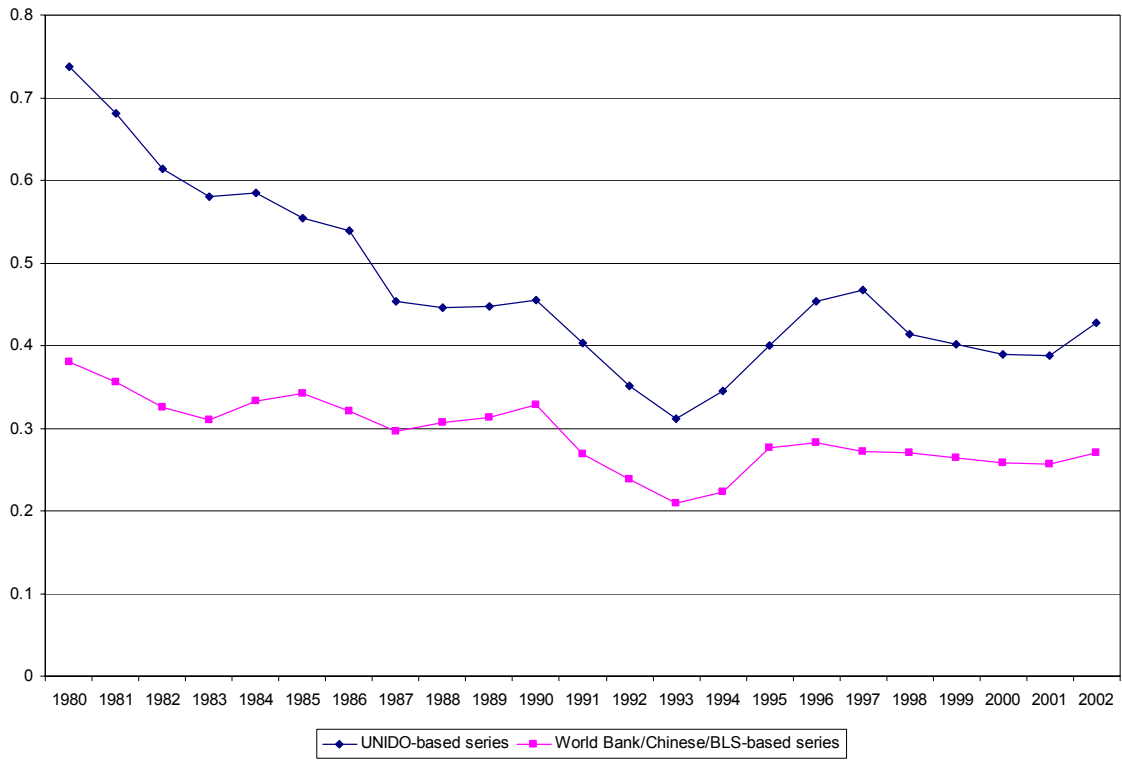
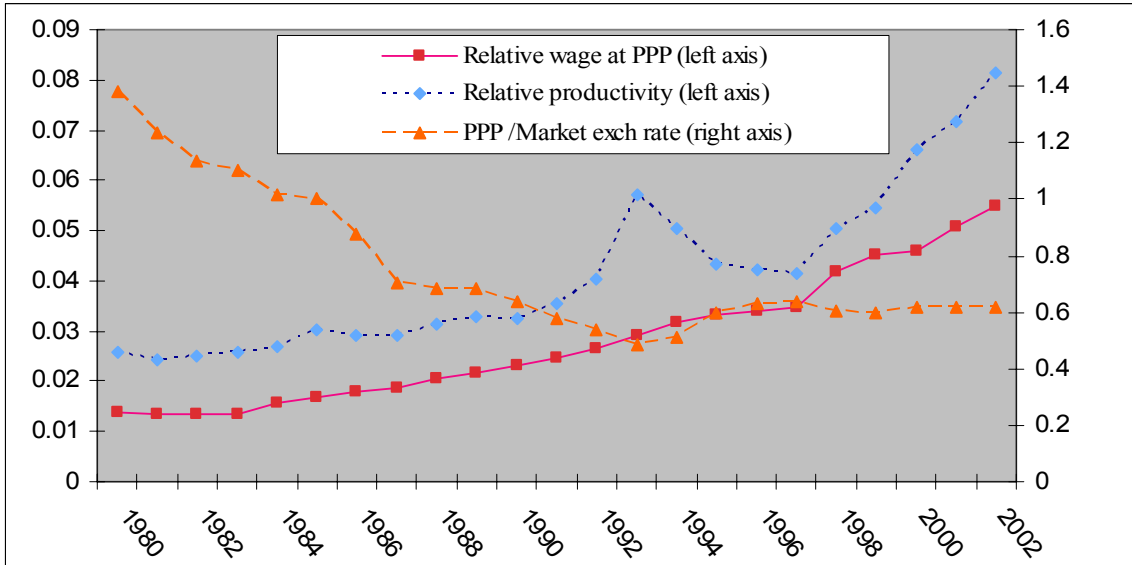


Figure 4. Decomposition of China's RULC vis-à-vis the United States

a. UNIDO-based estimates



b. World Bank/Chinese/BLS-based estimates

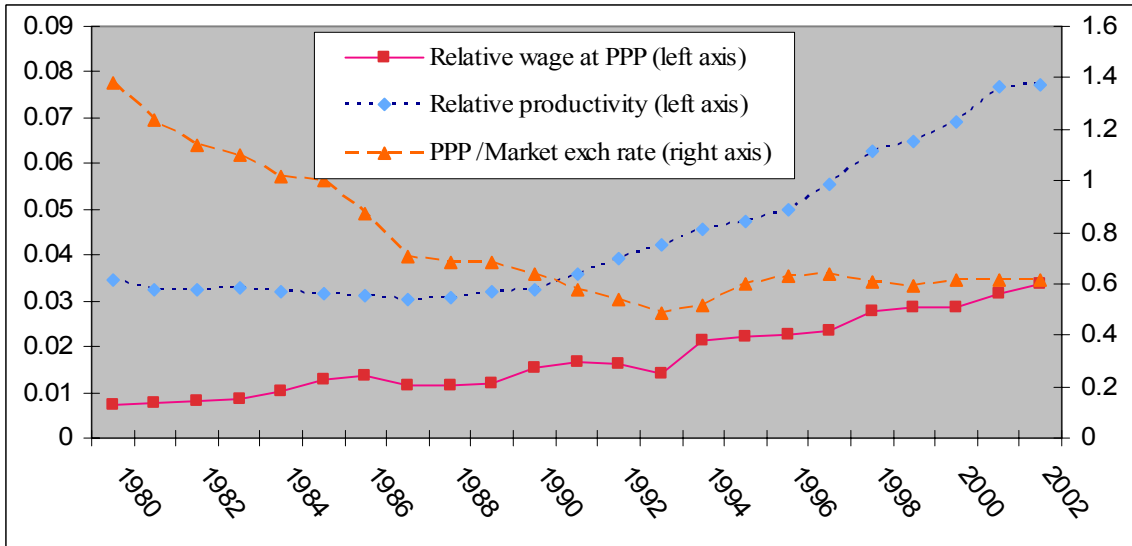


Table 1. China's unit labor costs, 1980-2002
(average annual growth rates in percent)

| | <u>1980-</u> <u>2002</u> | <u>1980-</u> <u>1995</u> | <u>1995-</u> <u>2002</u> |
|---|-----------------------------|-----------------------------|-----------------------------|
| <i>ULC, UNIDO-based series</i> | | | |
| Real value added per person | 9.3 | 7.8 | 12.3 |
| Labor compensation per person | | | |
| in yuan | 12.3 | 12.9 | 10.9 |
| in dollars | 6.6 | 4.6 | 11.0 |
| Unit labor costs | | | |
| in yuan | 3 | 5.0 | -1.4 |
| in dollars | -2.6 | -3.3 | -1.3 |
| <i>ULC, World Bank/Chinese-based series</i> | | | |
| Real value added per person | 7.2 | 5.4 | 11.1 |
| Labor compensation per person | | | |
| in yuan | 12.1 | 13.1 | 9.9 |
| in dollars | 6.4 | 4.8 | 10.0 |
| Unit labor costs | | | |
| in yuan | 4.8 | 7.6 | -1.2 |
| in dollars | -0.8 | -0.7 | -1.0 |
| Yuan/dollar exchange rate | 5.6 | 8.3 | -0.1 |

Table 2.
China/United States relative unit labor costs in dollars, 1980-2002
(average annual growth rates in percent)

| | <u>1980-</u> <u>2002</u> | <u>1980-</u> <u>1995</u> | <u>1995-</u> <u>2002</u> |
|---|-----------------------------|-----------------------------|-----------------------------|
| <i>China/US RULC, UNIDO-based series</i> | | | |
| Relative real value added per person | 5.1 | 4.4 | 6.6 |
| Relative labor compensation per person | 2.6 | 0.3 | 7.6 |
| Relative unit labor costs | -2.5 | -4.1 | 1.0 |
| <i>China/US RULC,</i> <i>World Bank/Chinese/BLS-based series</i> | | | |
| Relative real value added per person | 3.6 | 2.1 | 6.9 |
| Relative labor compensation per person | 2.1 | 0 | 6.6 |
| Relative unit labor costs | -1.6 | -2.1 | -0.3 |

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

| | <u>1980</u> | <u>1985</u> | <u>1990</u> | <u>1995</u> | <u>2000</u> | <u>2002</u> |
|---|-------------|-------------|-------------|-------------|-------------|-------------|
| <i>UNIDO-based estimates</i> | | | | | | |
| Relative labor compensation per person | 1.9 | 1.7 | 1.5 | 2.0 | 2.8 | 3.4 |
| Relative value added per person | 2.6 | 3.0 | 3.2 | 5.0 | 7.2 | 7.9 |
| Relative unit labor costs | 73.7 | 55.4 | 45.5 | 39.9 | 39.0 | 42.8 |
| <i>World Bank/Chinese/BLS-based estimates</i> | | | | | | |
| Relative labor compensation per person | 1.3 | 1.1 | 1.1 | 1.3 | 1.8 | 2.1 |
| Relative value added per person | 3.5 | 3.2 | 3.3 | 4.8 | 6.9 | 7.7 |
| Relative unit labor costs | 38.1 | 34.2 | 32.8 | 27.6 | 25.9 | 27.0 |

Table 4.
Chinese productivity, wages, and RULC vis-à-vis selected countries, 2002
(as a percent of comparator country levels)

a. UNIDO-based estimates (narrow definition of manufacturing)

| | Relative <u>productivity</u> | Relative <u>wage</u> | <u>RULC</u> |
|---------------|---------------------------------|-------------------------|-------------|
| UNIDO | | | |
| United States | 8.1 | 3.4 | 41.6 |
| Japan** | 10.3 | 4.3 | 41.6 |
| EU average# | 14.6 | 3.7 | 25.0 |
| India | 160.3 | 100.3 | 62.6 |
| Indonesia | 107.9 | 118.0 | 109.3 |
| Malaysia** | 43.6 | 27.5 | 62.9 |
| Korea** | 12.2 | 8.6 | 70.2 |
| Singapore** | 17.5 | 6.3 | 35.9 |
| Mexico* | 29.6 | 15.9 | 53.7 |
| Brazil | 23.9 | 32.4 | 135.4 |

b. World Bank/Chinese/BLS-based estimates (broad definition)

| | Relative <u>productivity</u> | Relative <u>wage</u> | <u>RULC</u> |
|---------------|---------------------------------|-------------------------|-------------|
| United States | 7.7 | 2.1 | 27.0 |
| Japan | 8.7 | 2.6 | 30.3 |
| EU average# | 10.7 | 2.8 | 25.8 |
| India | 152.1 | 61.8 | 40.6 |
| Indonesia | 102.4 | 72.6 | 70.9 |
| Malaysia** | 41.4 | 16.9 | 40.8 |
| Korea** | 11.6 | 5.3 | 45.5 |
| Singapore** | 16.6 | 3.9 | 23.3 |
| Mexico* | 28.1 | 9.8 | 34.9 |
| Brazil | 22.7 | 19.9 | 87.8 |

France, Italy, UK, Sweden, Netherlands, Belgium

*2000

**2001.