University of Groningen

Unit labour costs, productivity and international competitiveness

Ark, Bart van; Stuivenwold, Edwin; Ypma, Gerard

Publication date:
2005

Unit Labour Costs, Productivity and International Competitiveness

Bart van Ark, Edwin Stuivenwold and Gerard Ypma

**Unit Labour Costs, Productivity and
International Competitiveness**

Research Memorandum GD-80

Bart van Ark, Edwin Stuivenwold and Gerard Ypma

Groningen Growth and Development Centre
August 2005

Unit Labour Costs, Productivity and International Competitiveness

Bart van Ark, Edwin Stuivenwold and Gerard Ypma

Groningen Growth and Development Centre and The Conference Board

August 2005

Abstract

This paper provides international comparisons of relative *levels* of unit labour costs (ULC) for several OECD countries relative to the United States. The estimates are based on the Total Economy Database and the 60-Industry Database of the Groningen Growth and Development Centre (GGDC), and are also included in the Key Indicators of the Labour Market of the International Labour Office (ILO). The paper discusses the concept of relative ULC measures in comparison to other measures of competitiveness. It presents the main results for manufacturing and total economy measures of ULC, and makes two digressions, firstly by also presenting results for some major manufacturing sectors for a few large European countries and the U.S. and, secondly, by showing some comparable results for developing countries. An important observation from this paper is that relative productivity levels tend to move more or less in tandem with relative labour cost levels so that unit labour cost levels are closer between countries than labour cost levels per se. However, unit labour cost levels are certainly not identical between countries, as there are important deviations due to short term movements in relative prices (related to fluctuation in the nominal exchange rate) and differences in industrial structure. Whereas some of the differences cancel out at the aggregate level, differences in industry and product composition are quite important at a more detailed level.

1. Introduction

The presentation and use of measures of labour productivity and unit labour cost has been a core element of the research programme of the Groningen Growth and Development Centre (GGDC) and The Conference Board. In a range of publications attention has focused on productivity as an important contributor to the improvement in living standards, the creation of better jobs and social development.[1] Since 1999 these measures are also included with the Key Indicators of the Labour Market (KILM) database of the International Labour Office (ILO).[2] Productivity measures are also useful for studies of international competitiveness. Countries with rapid productivity growth rates are better positioned to sell their products and services at lower prices. However, competitiveness is not only determined by productivity, but also by the cost of inputs in the production process. Indeed, a well-known measure of international competitiveness combines labour cost and productivity into a single measure of labour cost per unit output. Unit labour cost (ULC) measures have been widely used for international comparisons of cost competitiveness, but have been mainly compared in terms of ULC trends or real effective exchange rates (REER). The focus of this paper will be on relative *levels* of unit labour costs, which is a rather unique measure not widely used elsewhere.[3]

In section 2, the unit labour cost measure is defined and its usefulness and limitations for a study of competitiveness are discussed. Section 3 provides an international comparison of productivity and unit labour cost for a group of mainly advanced and medium-income countries which are included in the GGDC database. Section 4 provides an extension to a more detailed breakdown of unit labour cost measures by seven major manufacturing industry groups for three large advanced countries (France, Germany and the UK) relative to the U.S.. Section 5 includes a discussion of unit labour cost measures for some major developing countries. Finally, section 6 summarizes the main findings and considers the implications for the creation and remuneration of jobs in advanced and low income countries.

2. Definition of Unit Labour Cost, Applications and Limitations

Unit labour cost (ULC) is defined as the cost of labour required to produce one unit of output in a particular industry, sector or the aggregate economy. ULC indices can be directly compared between countries. For example, the U.S. Bureau of Labor Statistics (BLS) provides international comparisons of manufacturing productivity and unit labour cost trends for 15 advanced countries.[4] The ULC series are expressed both in terms of the national currency basis as well as corrected for changes in the currency exchange rate relative to the US dollar. BLS also constructs a trade-weighted index of the ULC trends for all of the U.S.' major trading partners using weights that take account of both bilateral trade and the relative importance of "third country" markets". The OECD publishes trade-weighted

---

1 See, for example, van Ark and McGuckin (1999), McGuckin and van Ark (2005), van Ark, Duteweerd and Frankema (2004). See also ILO (2004).
2 See, for example, ILO (1999, 2001, 2003).
3 For earlier papers on this issue see, for example, van Ark (1995, 1996) and van Ark and Monnikhof (2000).
4 See BLS website for estimates of Hourly Compensation--International Comparisons and Productivity and Unit Labor Costs--International Comparisons (http://www.bls.gov/fls/home.htm).

ULC indexes for each OECD country using the trading structure relative to 41 trading partners.[5] Some organizations, such as the IMF, publish real effective exchange rates (REER) which are obtained by deflating each country's (trade-) weighted index of the bilateral nominal exchange rate by a similarly weighted index of unit labour costs of other countries relative to unit labour costs at home.[6]

In this paper we focus on a comparison of relative *levels* of unit labour cost, which allows comparisons of cost competitiveness in absolute terms not just in relative terms.[7] Such level comparisons shed light on several key debates in the area of international competitiveness. For example, high wage countries are often concerned about their relatively high level of labour cost in producing particular goods and services compared to low wage countries, in particular to the extent that such lower labour costs are the result of lower taxation, smaller social security payments, lower expenses on high-skilled labour for R&D and innovation and – in some cases – lower labour standards. On the other hand, low wage countries often complain about protectionist tariff and non-tariff measures of high wage countries that hinder exports of goods and services in which low income countries have a comparative advantage. Such protectionist measures not only directly impact exports but also limit technology transfer to developing countries through restricting imports.

The unit labour cost measure is a ratio that is constructed from a numerator reflecting the major cost category in the production process (which is labour compensation) and a denominator reflecting the output from the production process (GDP or value added). Countries with a low level of ULC relative to other countries may be regarded as competitive. In the short run an improvement in cost competitiveness may lead to employment losses in particular industries. But in the longer run countries may be able to gain larger shares of the world market and hence create more jobs.

The meaning of the ULC concept might be even better understood when expressed in terms of the ratio of labour compensation per unit of labour (for example, the wage or the total labour cost per employed person or per hour worked) and the productivity of labour (measured as output per employed person or per hour). It shows that a country can improve its competitiveness either by decreasing its labour cost per person employed or raising the productivity performance. This implies that an economy can apply different strategies to improve competitiveness, for example, by moderating wage growth in order to cut on cost, raise productivity to create more output, or find an appropriate mix of both strategies.

A specific characteristic of unit labour cost measures is that the *numerator*, which reflects the labour cost component of the equation, is typically expressed in nominal terms, whereas the *denominator*, which is output or productivity, is measured in real or volume terms. This implies that, when comparing unit labour cost levels across countries, the level of wages or labour compensation is converted at the official exchange rate: it represents the cost element of the arbitrage across countries. In contrast, output or productivity relates to a *volume* measure as it resembles a *quantity unit* of

---

5 See OECD Economic Outlook. Sources and Methods http://www.oecd.org/eco/sources-and-methods). See also Durand et al. (1998).
6 See IMF, World Economic Outlook, Statistical Appendix
(http://www.imf.org/external/pubs/ft/weo/weorepts.htm). See also Turner and Golub (1997).
7 For a comprehensive overview of price and cost competitiveness measures see, for example, Turner and Van 't Dack (1993).

output. Hence for level comparisons output needs to be converted to a common currency using a purchasing power parity instead of the exchange rate, so that comparative output levels are adjusted for differences in relative prices across countries.

Hence the unit labour measure represents the current cost of labour per "quantity unit" of output produced. For an analysis in terms of comparative levels between countries A and B this implies:[8]

$$ULC^{AB} = [(LC^A/ER^{AB})/LC^B] / (Y^A/PPP^{AB})/Y^A]$$

where ULC stands for unit labour cost, LC for total labour compensation, Y for total output (or value added), ER^{AB} for the official nominal exchange rate between countries A and B and PPP^{AB} for the purchasing power parity for output in country A relative to country B. Dividing labour compensation and output by employment or total hours worked, gives the labour cost per labour unit (lc) and labour productivity (y):

$$ULC^{AB} = [(lc^A/ER^{AB})/lc^B] / (y^A/PPP^{AB})/y^A]$$

Equation (2) can be rewritten to decompose the difference in unit labour cost between country A and country B into three components, i.e., the difference in nominal labour cost per person, the difference in nominal labour productivity (that is unadjusted for differences in price levels) and the differences in relative price levels:

$$\log (ULC^A - ULC^B) = \log (lc^A/ER^{AB} - lc^B) - \log (y^A/ER^{AB} - y^B)$$
$$- \log (ER^{AB} - PPP^{AB})$$

All these components contribute in their own way to differences in cost competitiveness between the two countries, and will be discussed in more detail below.

Unit labour costs are most easily measured and best understood for tradable sectors of the economy, in particular for the manufacturing sector which produces most internationally tradable products. The unit labour cost measure, however, is also useful for analysis at the level of the aggregate economy. However, the precise interpretation of a change in ULC or a difference in ULC levels across countries always depends on the source from which the change originates. For example, an increase in labour costs can result from upward wage pressure or from a slowdown in productivity growth. The upward wage pressure may be largely an external phenomenon triggered by an appreciation of a country's currency, or it may have a domestic cause due to, for example, a shortage on the labour market. A productivity slowdown may be caused, for example, by a rise in the sectoral share of services sector, as seen in many developed (industrialized) countries. Services productivity usually grows more slowly than manufacturing productivity, whereas the development of labour cost

---

[8] In this paper levels are compared for each individual country with the United States only. But countries may be compared between each other through the U.S.. The use of trade-weighted ULC levels indices is an issue for future work. In terms of growth rates, the change in unit labour cost can be written as $\Delta ULC = \Delta LC / [\Delta Y/\Delta P]$ where P stands for the price of output, and the symbol Δ indicates the change over time.

is often less diverse across sectors. But slow productivity growth may also be due to lack of technological progress or slow reforms in product and labour markets. The causes of the changes in unit labour costs, therefore, have important implications for labour and product market policies, technologies and innovation policies as well as foreign trade policies.

Before returning to the more direct use of ULC measures for tradable sectors, it should be stressed that a change in unit labour cost in the non-tradable sector also impacts the tradable sector, in particular when non-tradable products or services are used as an input by the tradable sector. Moreover, many service industries are becoming more tradable themselves, which is an indication that the distinction between tradable and non-tradable sectors of the economy is becoming increasingly anachronistic. An exclusive focus on unit labour cost in the manufacturing industry may therefore be a too restrictive approach to study competitiveness.

Even for tradables, the ULC index should not be interpreted as a comprehensive measure of competitiveness for several reasons. Firstly, ULC measures deal exclusively with the cost of *labour*. Even though labour costs account for the major share of inputs, the cost of capital and intermediate inputs can also be crucial factors for comparisons of cost competitiveness between countries.[9] Secondly, the measure reflects only *cost* competitiveness. In the case of durable consumer and investment goods, for example, competitiveness is also determined by other factors than costs, notably by technological and social capabilities and by demand factors. Improvements in product quality, customization or improved after-sales services are not necessarily reflected in lower ULC. In the literature on competitiveness inspired by Michael Porter, attention is given not only to factor inputs, but also to demand conditions, the presence of local suppliers and clusters, and an environment that encourages investment, innovation and competition.[10] Thirdly, measures of cost competitiveness may be distorted by the effects from, for example, bilateral market access agreements, direct and indirect export subsidies and tariff protection.

Unit labour cost measures also do not have the same coverage as some of the broader composite competitiveness indicators which have gained much popularity in recent years. These broader indicators include measures of economic performance, innovative capacity, structural change, improved living standards and social conditions. Selections of such indicators are taken on board in composite indicators such as, for example, the "World Competitiveness Index" of the International Institute for Management Development (IMD), the "Growth and Business Competitiveness Indexes" of the World Economic Forum (WEF), the "Structural Indicators" of the European Union and the "Human Development Index" of the United Nations. Individual countries, such as Ireland, Japan, the United Kingdom and the United States also developed their own competitiveness indicators. Although such indicators are more comprehensive than the unit labour cost measures used here, the individual components address very different aspects of the competitiveness process and an aggregation into one composite indicator may therefore be very sensitive to the underlying components used in the index.

---

[9] One might argue that with greater international tradability of capital and intermediate inputs, labour input is the key determinant of cost competitiveness as it is much less mobile across countries.
[10] See Porter (1990). See also Fagerberg et al. (2005).

3. Unit Labour Cost Measures in KILM

In KILM the unit labour cost series are based on measures of GDP, value added and labour compensation from the national accounts, in combination with aggregate measures of employment and working hours from the labour force or employment statistics. There are several advantages to using national accounts-based measures instead of measures from, for example, industry statistics, wage cost surveys, etc.. The first advantage is that the national accounts-based measures are comprehensive in terms of their coverage of activities. For example, national accounts are intended to cover all firms in an industry. Secondly, the output and labour compensation measures (and in some cases also the employment and hours measures) are consistently measured in the framework of the national accounts, covering the same activities by industry or sector.[11] This is particularly important for comparisons of *levels* of productivity and labour costs. Thirdly, when based on national accounts, the measures obtained for the manufacturing sector can be directly compared to those for the aggregate economy.

Total labour compensation in the national accounts does not only include gross wages and salaries of employees payable in cash or in kind, but also other costs of labour that are paid by employers, including employers' contributions to social security and pension schemes (whether public or private) including imputed social contributions providing unfunded social benefits. However, an important disadvantage of the national accounts measure of labour compensation is that it refers to employee compensation only. It does not include the compensation of self-employed persons which is by definition part of "other income" in the national accounts, including income on capital, profits, etc.. To obtain a measure of total labour compensation per unit of output, the labour income for self-employed persons is therefore imputed assuming the same labour compensation for a self-employed person as for an employee. This adjustment can of course only be made when the number of self-employed persons is known separately from employees, which is an important constraint determining the number of countries for which such measures can be included.

Figures 1-6 present the comparative measures of labour productivity, labour compensation per hour worked and unit labour cost relative to the U.S. for the manufacturing sector for the period 1980 to 2003. As mentioned before, unit labour cost comparisons in manufacturing have a more straightforward interpretation from the perspective of international competitiveness, because the manufacturing sector mainly consists of goods that are – at least in principle – internationally tradable. These numbers are only available for OECD countries, but include some of the new member states, including the Czech Republic, Hungary, Korea, Mexico and Poland.[12]

Strikingly all charts show that the relative levels of labour productivity exhibit a much greater stability than the series of labour compensation (and, as a result, also of unit labour cost). The reason for this is obvious as the productivity measures are compared in terms of *volume* measures, using a

---

[11] Following one of the key recommendation in the 1993 System of National Accounts, many countries are presently integrating measures of labour input in the framework of national accounts which will further improve the accuracy of unit labour cost measures.

[12] See Section 5 for a more detailed discussion of unit labour cost measures for low income economies outside the OECD area.

specific PPP for manufacturing products.[13] In contrast, labour compensation is expressed in nominal terms, and converted into US$ with the nominal exchange rate. In each chart the index of the nominal exchange rate for each country or country group relative to the US dollar is benchmarked on 1980.[14]

Fig. 1: Average Labour Compensation, Labour Productivity and Unit Labour Cost, Manufacturing, EU-15 (US=100)
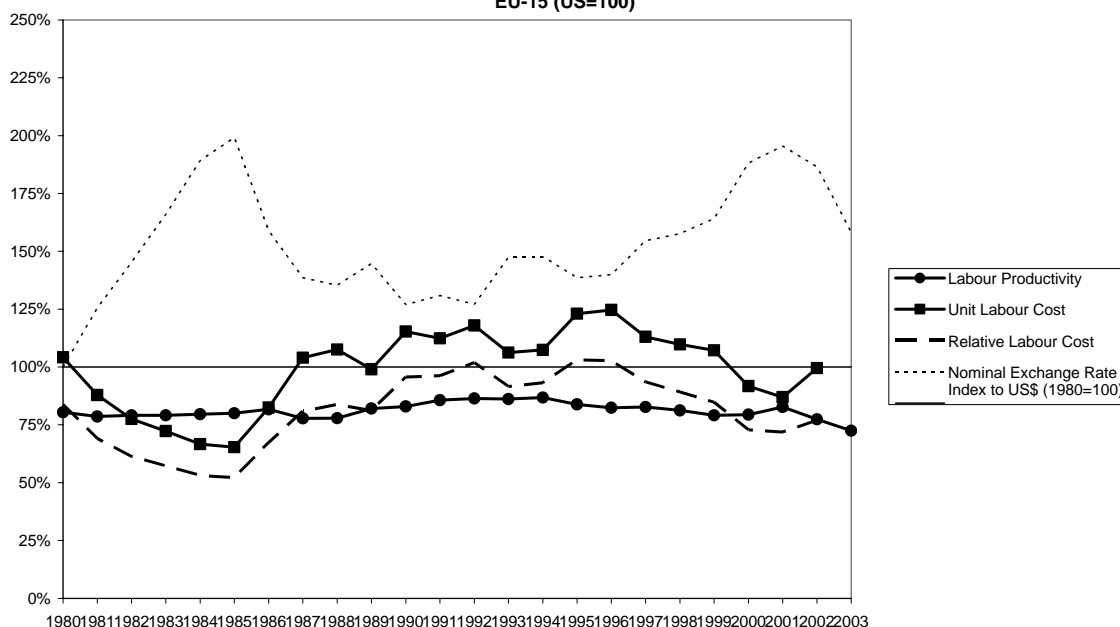
Fig. 2: Average Labour Compensation, Labour Productivity and Unit Labour Cost, Manufacturing, New EU Member States (Czech Republic, Hungary, Poland) (US=100)

---
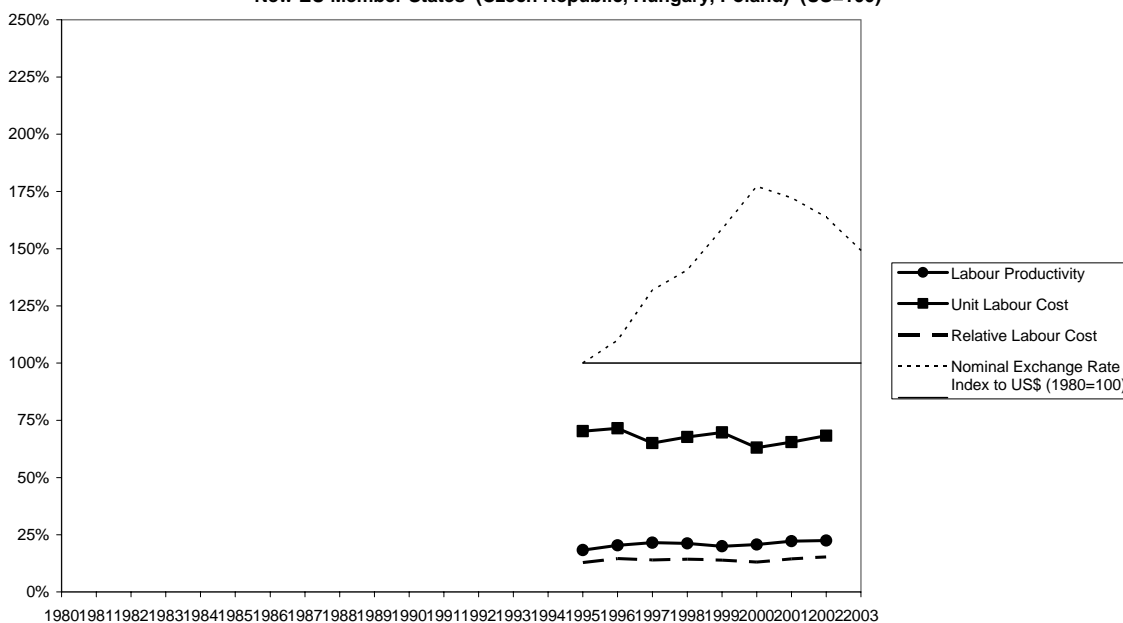
[13] The manufacturing PPPs are for the benchmark year 1997. For more details on the derivation of the PPP for manufacturing products, see Timmer et al. (2005).
[14] For country groups the nominal exchange rate is weighted at the yearly PPP-converted GDP of each country in the group.

Fig. 3: Labour Compensation, Labour Productivity and Unit Labour Cost, Manufacturing, Japan (US=100)
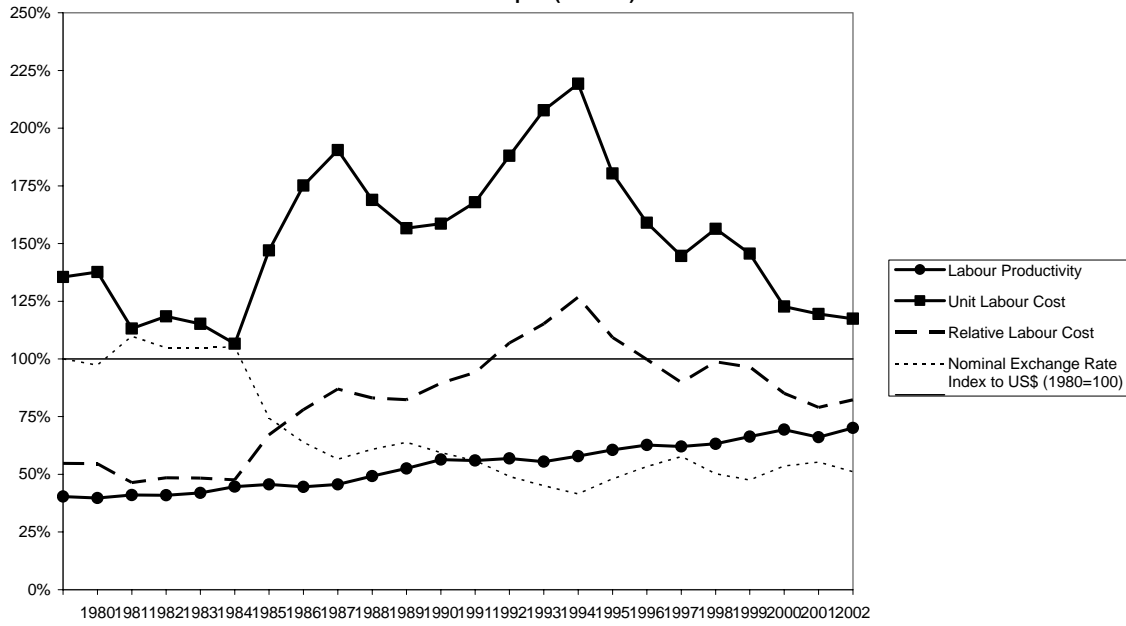
Fig. 4: Average Labour Compensation, Labour Productivity and Unit Labour Cost, Manufacturing (Australia and Canada) (US=100)
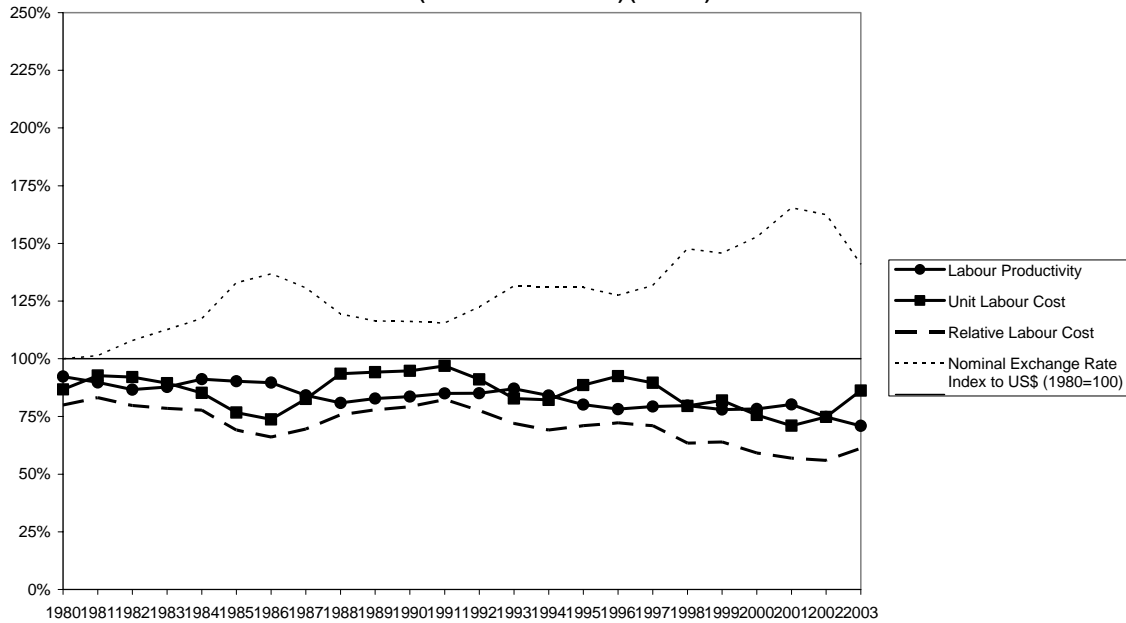
Fig. 5: Average Labour Compensation, Labour Productivity and Unit Labour Cost, Manufacturing Korea (US=100)

Legend:
- ●— Labour Productivity
- ■— Unit Labour Cost
- – – Relative Labour Cost
- ······ Nominal Exchange Rate Index to US$ (1980=100)
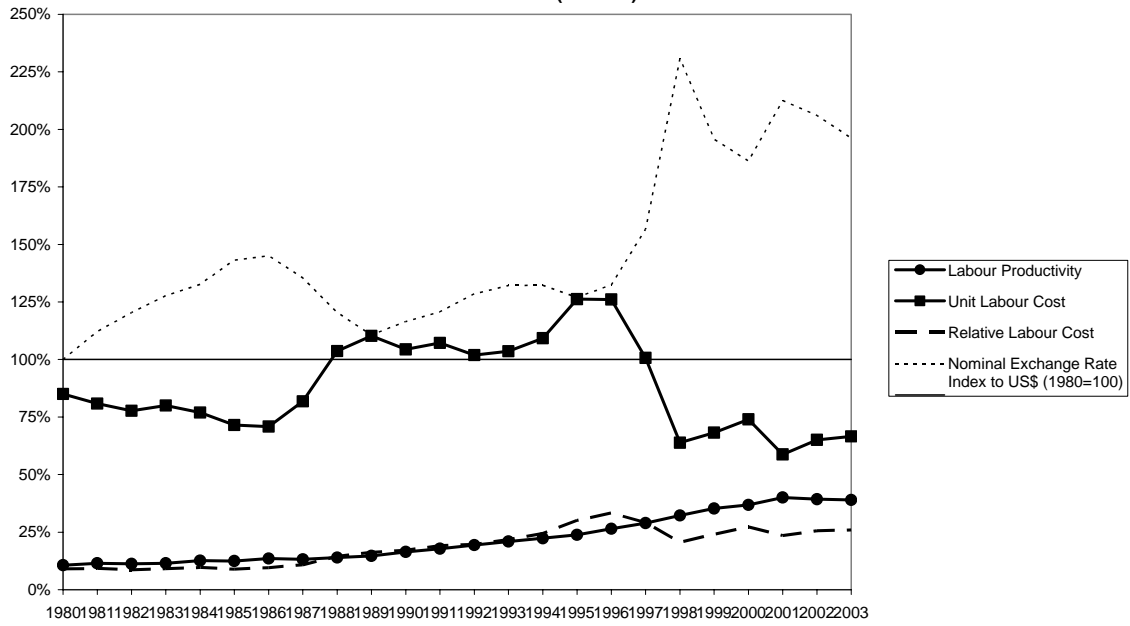
Fig. 6: Labour Compensation, Labour Productivity and Unit Labour Cost, Manufacturing, Mexico (US=100)

Legend:
- ●— Labour Productivity
- ■— Unit Labour Cost
- – – Relative Labour Cost

9
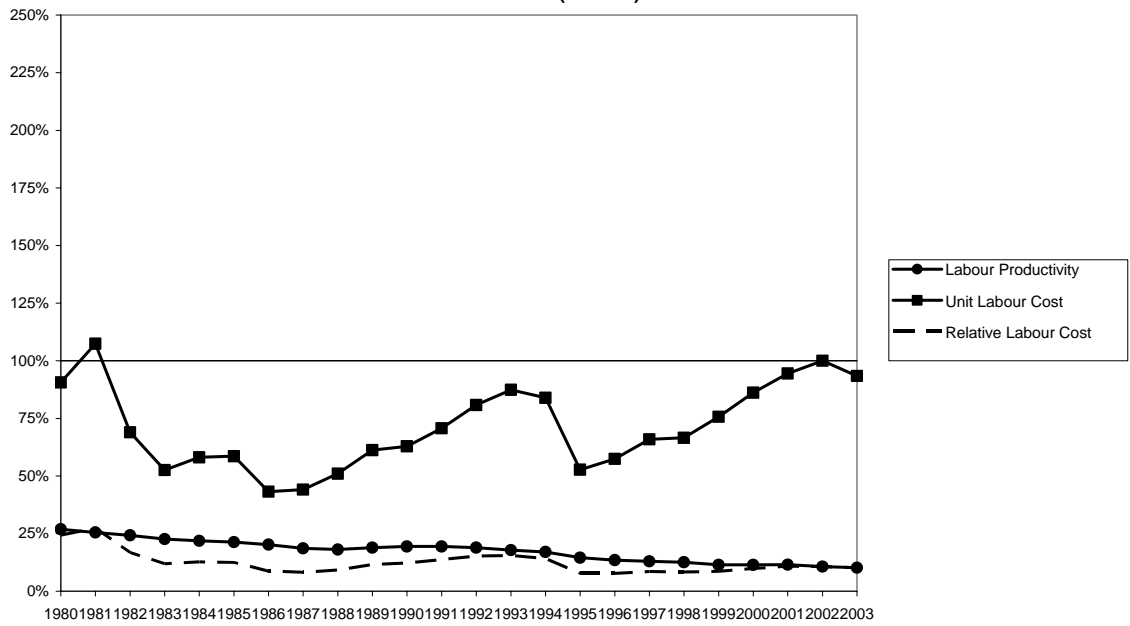
The development of the relative levels of labour compensation is generally strongly related to the nominal exchange rate. For example, the nominal exchange rate of the EU-15 countries in Figure 1, representing the pre-2004 membership of the European Union, shows a strong depreciation of the European currencies to the US dollars during the first half of the 1980s, which goes together with a rapid decline in labour compensation and ULC in EU manufacturing relative to the United States. During the mid 1980s the rapid depreciation of the US dollar, worsened the competitive position of European countries. Despite much higher income taxes and social security contributions, relative labour cost in the EU-15 mostly remained below the U.S. level until the mid 1990s. However, as labour productivity also remained below the U.S. level by between 15 and 20%-points, unit labour cost remained above the U.S. level for most of the period. Hence it was not so much high labour cost, but lower productivity that has threatened the competitive position of the EU-15 until the end of the 1990s.

Since the mid-1990s, and in particular since 2000, the manufacturing productivity gap between EU-15 and the United States has widened. Due to the rather strong depreciation of most European currencies (and since 1999 also the euro) relative to the US dollar, the lower compensation levels in terms US dollars more than offset Europe's lower productivity levels. But since 2001 the combined increase in the EU-U.S. manufacturing productivity gap and the appreciation of the euro, has led to a significant worsening of the unit labour cost position in Europe which was about the same as in the U.S. in 2002.[15]

Figure 2 shows the average comparative performance of three of the ten new member states of the European Union (Czech Republic, Hungary, and Poland). Relative levels of productivity and labour compensation are much lower than in the U.S. and the EU-15. As the comparative wage levels are even lower than comparative productivity levels, the new member states show a significant advantage in terms of ULC levels at approximately 70% of the U.S. level. The depreciation of the currencies of these countries relative to the US dollar has further benefited the competitive position of these countries, but the latter trend has reversed somewhat since 2000.

Figure 3 compares the Japanese performance relative to the U.S. manufacturing sector. Strikingly the manufacturing ULC level in Japan is not only high relative to the U.S., but also in comparison with the EU-15 (Figure 1). Productivity levels in Japanese manufacturing have been considerably lower than in Europe for the whole period. During the early 1990s the ULC gap between Japan and the rest of the advanced world strongly increased as a result of a rise in relative labour cost, which was partly aggravated by an appreciation of the Japanese yen relative to the U.S. dollar. Since the mid-1990s the manufacturing ULC gap has fallen considerably due to a moderation in wage growth in Japan and an improvement in the comparative productivity performance of Japanese manufacturing.

---

15 As all measures presented here are in terms of levels relative to the United States, keeping the U.S. level constant over time, the growth performance of the U.S. itself is hidden from these charts. Figure A1 in the appendix shows that unit labour cost in U.S. manufacturing has only slightly risen by about 10% between 1980 and 2003 (with a peak around 1990), which is the combined result of an increase in nominal labour cost in manufacturing by about 275% and an increase in manufacturing labour productivity of 250%. Hence in most cases the declines in labour cost and productivity of other countries relative to the U.S. do not represent absolute declines but only accelerations or decelerations relative to the U.S. performance in manufacturing.

The estimates in **Figure 4** focus on the comparative performance of two OECD member states which are not part of the European Union, namely Australia and Canada. The average performance of these two countries is much closer to that of the U.S., although unit labour cost levels have remained somewhat below the U.S. level for most of the period.

Figures 5 and 6 show the results for two countries which have only recently become members of the OECD. Both Korea (**Figure 5**) and Mexico (**Figure 6**) started from much lower productivity levels than the U.S., but the two countries exhibited quite different trends. In Korean manufacturing the trends in comparative productivity and relative labour cost levels have moved strongly together. Already by the end of the 1980s, Korea's ULC level in manufacturing had reached the U.S. level, and it moved even beyond the U.S. during the early 1990s. The economic collapse of the Asian economies as a result of the financial crisis led to a strong depreciation of the Korean won, improving its ULC position relative to U.S. manufacturing at the end of the 1990s. Meanwhile Korean manufacturing productivity has continued to catch up with the U.S. level. Although the manufacturing productivity level in Korea remains considerably lower than in the U.S., the gap in productivity has been reduced from 90%-points in 1980 to only 60%-points in 2003.

In Mexico (**Figure 6**), manufacturing labour productivity and labour compensation has continuously deteriorated relative to the U.S.. Comparative productivity levels in manufacturing fell from about 25% of the U.S. level in 1980 to only 10% in 2002. Part of the widening in the productivity gap is due to the rapid acceleration in U.S. productivity growth, but labour productivity in Mexican manufacturing also declined slightly in absolute terms. The unit labour cost level in Mexican manufacturing has remained below the U.S. level virtually throughout the period 1980-2002. But recently it approached the U.S. level very closely as the relative decline in productivity went together with a slight rise in labour cost levels relative to U.S. manufacturing.

As discussed above, productivity, labour compensation and unit labour cost can also be measured for the aggregate economy. **Figures A3 to A8** show the series for the aggregate economy which may be compared to those for manufacturing in figures 1 to 6. On the whole, labour productivity levels relative to the U.S. are higher for the aggregate economy than for manufacturing. This indicates that productivity levels in non-manufacturing industries – in particular in service industries – are generally closer to the U.S. level than in manufacturing. In the EU-15, the gap between manufacturing and non-manufacturing productivity has significantly increased since 1980, as the manufacturing sector stayed at approximately 80% of the U.S. productivity level whereas productivity in the aggregate economy improved more than 90% of the U.S. level in 1995 (although the aggregate productivity level has declined somewhat since 1995). In Japan the differences between manufacturing and non-manufacturing productivity levels relative to the U.S. has declined, as manufacturing has caught up more rapidly with the U.S. than non-manufacturing industries in Japan.[16]

---

16 In this light it is also useful to compare the change in labour productivity, labour compensation and unit labour cost between the aggregate economy and manufacturing. Figure A2 in the appendix shows that unit labour cost for the aggregate U.S. economy has increased much faster (at almost 90% between 1980 and 2002) than in manufacturing (at only 10%). This is mainly due to the much slower

Relative levels of labour compensation for the aggregate economy have also generally been closer to the U.S. level than labour compensation levels in manufacturing. However, there are differences between the various countries or country groups with important implications for the unit labour cost position. For example, manufacturing unit labour cost levels in the EU-15 have increased more relative to the U.S. than those for the aggregate economy. This implies that the manufacturing sector in Europe has become less competitive in terms of labour cost per unit of output compared to the rest of the economy. In contrast the competitiveness position in Japanese manufacturing has improved relative to the rest of the economy. In Korea the ULC level in manufacturing worsened considerably during the early 1990s, but since the financial crisis at the end of the 1990s it recovered faster than for the aggregate the economy. Despite relatively low productivity levels in Mexican manufacturing, the sector is much more competitive relative to the U.S. than the non-tradable sectors of the economy.

In summary, the analysis in this section has shown that even within the group of most advanced countries in the world economy (which are all members of the OECD), there are significant differences between countries and country groups in the comparative performance of labour productivity, labour compensation and unit labour costs. In general there is a greater stability in relative levels of labour productivity than in relatively levels of labour compensation. Still, when taking account of the impact of short term changes in the nominal exchange rates, labour compensation levels tend to move in tandem with productivity levels, so that international differences in unit labour costs are smaller then differences in labour cost and productivity.

Still, there remain significant differences in unit labour cost levels even in a tradable sectors such as manufacturing. In addition to the short term exchange rate movements, such differences may be partly related to differences in industrial structure. The latter issue will be addressed in some more detail in the Section 4. Some of the differences may also be caused by remaining measurement issues. For example, even though the measure of labour compensation in the national accounts is the most comprehensive, including income taxes and social security contributions, the precise administration of such administrative costs may lead to differences between countries. Moreover the imputation of labour cost for self-employed on the basis of compensation of salaried employees can introduce significant errors in the estimation. Such problems may increase when low income countries are included in the comparison, which will be discussed in more detail in Section 5.

4. Unit Labour Cost and Productivity in Manufacturing Branches

The comparisons of productivity and unit labour cost for the aggregate economy and even for a broad sector such as manufacturing, hides important details at industry level. In international trade, some countries will develop comparative advantages in particular industries. When productivity and labour cost levels differ between industries, this may impact the aggregate comparison of unit labour cost even if there are no differences between countries at industry level.

increase in labour productivity in the aggregate U.S. economy (about 50% between 1980 and 2003) compared to manufacturing (an increase of 250% in labour productivity).

A more detailed comparison of ULC within manufacturing requires consistent measures of output, compensation and labour input for individual industries. These are available for a more limited number of countries. By way of illustration, tables 1 to 3 show a breakdown of total manufacturing into seven major industry groups for labour productivity (table 1), labour compensation (table 2) and unit labour cost (table 3) for three major European countries (France, Germany and the UK) relative to the United States from 1980 to 2003.[17]

Table 1 shows that the German and French manufacturing sectors show a substantial erosion of productivity levels relative to the U.S.. Much of the widening of the manufacturing productivity gap between these countries is due to the much smaller share of ICT-producing industries in the European countries. The industries producing products in the area of information technology (IT) hardware and communication (C) equipment have shown by far the faster productivity growth rates, in particular since the 1990s.[18]

In addition to machinery and equipment, German manufacturing also shows a widening of the productivity gap in textiles and chemicals, but an improvement relative to the U.S. in food, beverages and tobacco and "other manufacturing industries". As for the aggregate figures discussed in section 3, the relative levels of wage compensation in **Table 2** are strongly affected by the change in the nominal exchange rate. The depreciation of the euro between 1995 and 2000 has led to a strong decline in relative wage rates across the board. But in 2000 relative labour cost in German textiles was still higher than in the U.S., whereas relative labour cost were lowest by far in the food manufacturing industry. **Table 3** shows that in 2003, German ULC levels were clearly lower than those in the U.S. in food manufacturing, chemicals and other manufacturing, but not in textiles, metal products, and ICT and non-ICT machinery.

The comparative productivity results for the manufacturing sector in France are also quite large, but in all sectors except ICT machinery, the levels are above those in Germany. As for Germany, the improved performance of the food sector and other manufacturing is also found for France, but – in contrast to Germany – French productivity levels in non-ICT machinery improved relative to the U.S. as well. Moreover the widening of the productivity gap in French manufacturing relative to the U.S. since 1995 is not as big as in Germany. With the exception of non-ICT machinery, relative labour costs were also slightly higher in France than in Germany, but the difference was not as big as for productivity. At the aggregate level, labour cost in France stayed just below that of Germany. As a result relative unit labour cost levels in France were at or below the German levels for all sectors (except ICT machinery) and for total manufacturing. Compared to the U.S. ULC levels were higher in France for textiles and ICT machinery.

---

[17] See van Ark (1995, 1996) for similar measures for the period 1970 to 1990.

     [18] It should be stressed that actual comparative levels are affected by the choice of the benchmark PPP, which is 1997 in this study. The relative level might be different if PPPs for, for example, 2002 would be used as the benchmark PPP, because the weights will be different between industries. The further a year is away from the benchmark year, the more likely it is that the relative level is distorted by the weights of the benchmark year. But unlike the actual comparative levels, the change in relative levels will remain unchanged irrespective of the choice of the benchmark PPP.

Table 1: Labour Productivity Levels (Value Added per Hour Worked) by Major Manufacturing branch, 1980-2003, US=100

	1980	1985	1990	1995	2000	2003
Germany						
Food, beverages and tobacco	55.5%	53.0%	60.1%	56.7%	73.2%	70.6%
Textiles, apparel & Leather	77.6%	71.0%	82.8%	78.7%	77.4%	60.1%
Chemicals & allied products	132.4%	100.0%	95.1%	108.2%	114.1%	107.9%
Basic and Fabricated metal products	79.7%	81.2%	86.4%	86.8%	86.3%	84.8%
Machinery and equipment: of which						
ICT-producing	110.0%	147.7%	104.9%	67.7%	74.9%	69.2%
Non-ICT-producing	70.5%	71.7%	73.1%	75.0%	72.8%	65.8%
Other manufacturing	80.0%	78.5%	85.2%	98.6%	108.0%	101.4%
Total Manufacturing	97.0%	92.0%	92.2%	88.8%	80.1%	72.1%
France						
Food, beverages and tobacco	76.4%	62.6%	77.2%	70.3%	84.3%	87.2%
Textiles, apparel & Leather	96.5%	78.7%	80.2%	80.5%	83.2%	77.9%
Chemicals & allied products	211.2%	106.8%	120.9%	147.2%	156.4%	151.4%
Basic and Fabricated metal products	101.4%	116.5%	105.6%	101.9%	100.3%	97.3%
Machinery and equipment: of which						
ICT-producing	176.8%	196.2%	127.7%	85.2%	72.3%	52.7%
Non-ICT-producing	54.5%	61.1%	63.2%	76.5%	89.1%	86.9%
Other manufacturing	71.0%	81.3%	88.2%	98.5%	109.2%	111.8%
Total Manufacturing	99.1%	90.0%	91.8%	94.8%	92.6%	87.9%

Table 1: Continued

	1980	1985	1990	1995	2000	2003
United Kingdom						
Food, beverages and tobacco	55.3%	58.6%	71.3%	68.8%	82.8%	87.2%
Textiles, apparel & Leather	81.1%	65.9%	77.7%	75.3%	73.8%	65.4%
Chemicals & allied products	94.1%	84.7%	90.1%	105.3%	104.3%	96.4%
Basic and Fabricated metal products	29.4%	45.2%	68.3%	62.7%	62.7%	56.9%
Machinery and equipment: of which						
ICT-producing	59.7%	87.7%	77.9%	91.2%	66.3%	88.5%
Non-ICT-producing	37.9%	42.6%	51.8%	57.8%	60.2%	60.9%
Other manufacturing	71.9%	75.5%	100.4%	111.9%	111.3%	114.1%
Total Manufacturing	57.9%	62.6%	74.7%	77.8%	73.2%	71.4%

Note: ICT production relates to Office Machinery, Electronic Valves and Tubes and Telecommunication Equipment

Source: Groningen Growth and Development Centre (http://www.ggdc.net/icop.html)

Table 2: Labour Cost Levels (Labour Cost per Hour Worked) by Major Manufacturing Branch, 1980-2003, US=100

	1980	1985	1990	1995	2000	2003
Germany						
Food, beverages and tobacco	64.0%	36.4%	71.2%	89.3%	54.0%	61.8%
Textiles, apparel & Leather	107.6%	65.4%	130.8%	168.7%	104.3%	118.4%
Chemicals & allied products	110.6%	62.7%	115.8%	139.4%	84.5%	88.6%
Basic and Fabricated metal products	82.7%	52.5%	99.9%	125.0%	81.4%	93.1%
Machinery and equipment: of which						
ICT-producing	126.8%	68.6%	118.5%	144.6%	70.5%	89.1%
Non-ICT-producing	96.7%	54.2%	105.3%	131.5%	86.1%	91.7%
Other manufacturing	94.9%	54.7%	101.5%	131.3%	80.9%	95.7%
Total Manufacturing	96.1%	55.7%	107.1%	132.7%	82.1%	92.9%
France						
Food, beverages and tobacco	88.5%	52.2%	93.9%	104.2%	68.4%	76.3%
Textiles, apparel & Leather	135.8%	82.8%	140.2%	154.3%	98.0%	122.2%
Chemicals & allied products	135.6%	79.8%	133.0%	139.6%	92.5%	104.8%
Basic and Fabricated metal products	98.2%	66.3%	112.3%	120.6%	82.3%	96.5%
Machinery and equipment: of which						
ICT-producing	148.8%	84.7%	141.5%	141.2%	77.9%	102.8%
Non-ICT-producing	103.3%	63.0%	107.8%	113.6%	76.3%	78.8%
Other manufacturing	117.5%	70.9%	119.7%	132.7%	85.1%	103.9%
Total Manufacturing	110.2%	66.6%	113.6%	122.0%	78.7%	89.8%

	1980	1985	1990	1995	2000	2003
United Kingdom						
Food, beverages and tobacco	88.3%	61.7%	112.1%	103.8%	90.7%	105.9%
Textiles, apparel & Leather	82.8%	53.6%	89.8%	93.1%	98.7%	112.7%
Chemicals & allied products	85.5%	52.6%	94.6%	93.2%	91.4%	97.4%
Basic and Fabricated metal products	57.4%	41.1%	67.6%	75.9%	82.2%	92.3%
Machinery and equipment: of which						
ICT-producing	67.6%	43.1%	75.5%	89.8%	71.6%	76.4%
Non-ICT-producing	67.4%	43.6%	76.5%	70.9%	69.7%	73.2%
Other manufacturing	85.9%	58.0%	97.5%	100.8%	99.6%	117.7%
Total Manufacturing	74.5%	49.1%	85.4%	85.4%	82.4%	92.2%

Note: ICT production relates to Office Machinery, Electronic Valves and Tubes and Telecommunication Equipment

Source: Groningen Growth and Development Centre (http://www.ggdc.net/icop.html)

Table 3: Unit Labour Costs by Major Manufacturing Branch, 1980-2003, US=100

	1980	1985	1990	1995	2000	2003
Germany						
Food, beverages and tobacco	115.3%	68.6%	118.5%	157.5%	73.8%	87.5%
Textiles, apparel & Leather	138.7%	92.1%	157.9%	214.3%	134.7%	196.9%
Chemicals & allied products	83.5%	62.7%	121.8%	128.8%	74.0%	82.1%
Basic and Fabricated metal products	103.8%	64.6%	115.5%	144.0%	94.3%	109.7%
Machinery and equipment: of which						
ICT-producing	115.3%	46.5%	113.0%	213.8%	94.1%	128.9%
Non-ICT-producing	137.2%	75.6%	144.1%	175.2%	118.3%	139.3%
Other manufacturing	118.7%	69.7%	119.2%	133.3%	74.9%	94.4%
Total Manufacturing	99.1%	60.5%	116.1%	149.5%	102.5%	128.7%
France						
Food, beverages and tobacco	115.9%	83.4%	121.6%	148.3%	81.1%	87.5%
Textiles, apparel & Leather	140.7%	105.2%	174.8%	191.7%	117.7%	156.9%
Chemicals & allied products	64.2%	74.8%	110.1%	94.8%	59.2%	69.2%
Basic and Fabricated metal products	96.9%	56.9%	106.3%	118.3%	82.1%	99.2%
Machinery and equipment: of which						
ICT-producing	84.2%	43.2%	110.8%	165.7%	107.8%	195.2%
Non-ICT-producing	189.7%	103.1%	170.6%	148.5%	85.6%	90.6%
Other manufacturing	165.6%	87.3%	135.7%	134.8%	78.0%	92.9%
Total Manufacturing	111.2%	74.0%	123.7%	128.6%	85.0%	102.2%

	1980	1985	1990	1995	2000	2003
United Kingdom						
Food, beverages and tobacco	159.7%	105.3%	157.3%	150.8%	109.4%	121.4%
Textiles, apparel & Leather	102.1%	81.4%	115.6%	123.6%	133.7%	172.3%
Chemicals & allied products	90.8%	62.1%	104.9%	88.5%	87.6%	101.1%
Basic and Fabricated metal products	195.3%	90.9%	99.0%	121.1%	131.2%	162.1%
Machinery and equipment: of which						
ICT-producing	113.4%	49.2%	96.9%	98.5%	108.1%	86.3%
Non-ICT-producing	177.7%	102.4%	147.7%	122.8%	115.9%	120.1%
Other manufacturing	119.4%	76.9%	97.2%	90.1%	89.5%	103.1%
Total Manufacturing	128.8%	78.5%	114.3%	109.8%	112.6%	129.1%

Note: ICT production relates to Office Machinery, Electronic Valves and Tubes and Telecommunication Equipment
Source: See Tables 1 and 2

The change in comparative productivity and ULC levels in the UK manufacturing sector relative to the U.S. are in sharp contrast with those for Germany and France. Between 1980 and 1995 UK productivity levels significantly improved in all major manufacturing sectors (except for textiles). Just as in France and Germany, the UK performance weakened relative to that of the U.S. manufacturing sector since 1995, but not as strong as in Germany. Strikingly the productivity performance of the ICT machinery sector was much better by 2003 than in France and Germany. However, with the improvement in comparative productivity levels, labour cost levels also increased rapidly in the UK, partly because the UK pound depreciated less than the euro since the mid 1990s. In 2003, UK wage levels were above those of Germany in food manufacturing, chemicals and other manufacturing. As a result, whereas the UK improvement in productivity relative to the U.S. went together with a decline in unit labour cost levels until the mid 1990s, the stagnation of relative productivity and the rise in nominal wage labour led to a considerable worsening of the ULC position since 1995 and in particular since 2000, except for ICT production.

The upshot of this brief overview of comparative levels of productivity, labour cost and unit labour cost in these four major industrialized countries, is the large diversity in terms of comparative performance. The earlier conclusion that – at the aggregate level – productivity and labour cost basically move in tandem – so that ULC levels are more similar countries – is not confirmed when looking at more detailed industry level. Part of these differences may be due to differences in industrial structure (as is the case, for example, within machinery and equipment), but industry-specific characteristic may also inhibit trade between countries. Finally, measurement issues concerning price indices and PPPs to obtain volume measures may also affect the results at more detailed level.[19]

---

19 See also van Ark (2004).

5. The Unit Labour Cost Position of Developing Countries

The unit labour cost comparisons included in KILM are mainly for advanced countries, which (except for Taiwan) are all members of the OECD. The main reason for this focus on advanced countries is the lack of adequate information on labour compensation from the national accounts of low income countries. Labour compensation measures need to include employers' cost such as social security contributions, etc., which are often not well registered in those countries. In addition, the relatively large share of self-employed persons, even in manufacturing, complicates the analysis of unit labour cost for developing countries. Finally, the lack of detailed industry-level PPPs inhibit the calculation of comparative levels of productivity.

Various national and international organizations, however, have produced studies of unit labour costs in non-OECD countries, including estimates for Central and East European countries (UN Economic Commission for Europe) and for Latin American countries (Inter-American Development Bank). The measures, however, are not always easy to compare in particular because the labour cost measures may or may not include income-related factors such as remuneration for time not worked, bonuses and gratuities, housing allowances and payments in kind.[20]

In recent years, there has been considerable interest in measuring the level of unit labour costs in the manufacturing sector of China, given China's increased share in world trade of manufacturing products. A detailed study commissioned by the Bureau of Labor Statistics has investigated the possibility to construct ULC measures for China, which is one of the major U.S. trading partners not presently included in the BLS database.[21] The study identifies the great difficulty in obtaining estimates for manufacturing employment and labour compensation, in particular outside cities and for the growing private sector of the economy. Despite the substantive statistical uncertainties, some recent studies demonstrate a decline in trade-weighted unit labour cost of China relative to its main competitors between the late 1980s and the mid 1990s, after which the ULC trend in China reverts to a slight increase since 1995. The latter increase is due to the actual rise in unit labour cost in China (in national currency), a decline of unit labour cost of major competitors such as Korea, Taiwan and the U.S., and the growing importance of Taiwan in Chinese trade.[22]

Most studies for developing countries concentrate on trends in (trade-weighted) unit labour costs and real effective exchange rates. One of the few studies that also provide comparative *level* estimates of productivity and unit labour cost is by Golub (1999). The Golub study includes fourteen countries, including the G-5 (France, Germany, Japan, United Kingdom, and United States), seven major Asian countries (India, Indonesia, Korea, Malaysia, Philippines, Singapore and Thailand) and two Latin American countries (Chile and Mexico). Despite the advantage of including several medium income countries, Golub's dataset differs in some respects from the estimates for the

---

20 One may of course argue that such contributions are generally quite low in low-income countries anyway so that the bias would be limited when using only gross salaries received by employees. On the other hand, employers' contributions to social security may often be paid in kind which mostly remains unmeasured anyway. There is also some evidence that bonuses on regular wages are quite frequent in low income countries, for example in China.
21 See Banister (2004).
22 See, for example, Dullien (2005) and Hiumin and Ruoen (2004).

advanced countries in KILM 18. Whereas the latter measures are almost entirely based on national accounts, Golub's measure of labour compensation relates to employee wages, obtained from UNIDO, which does not include employer contributions to social insurance. Golub's estimates are only for manufacturing, and for productivity he does not provide estimates of output per hour worked but only output per person employed. It is also unclear whether the Golub study includes an adjustment for labour compensation of the self-employed. In converting manufacturing productivity to a common currency, Golub makes use of purchasing power parity for producer durables obtained from the Penn World Tables.[23]

Despite these differences, Golub's results may be compared with those for the advanced countries discussed in Section 3. As stressed earlier, Golub also emphasizes that relative levels of unit labour cost are much closer between countries than those of labour productivity and compensation separately, as differences in the relative levels of both indicators more or less offset each other. Still there are differences among countries. By the early 1990s relative unit labour cost level in Malaysia and Thailand had converged to about the same level as those in the U.S., whereas those in the Philippines were at between 70-80% of the U.S. level and those for Indonesia at only 20-30% of the U.S. level. All these Asian countries, however, experienced large depreciations of their currencies during the late 1990s, which might have led to much lower unit labour cost levels. In India, unit labour cost levels were well above those of the U.S. until the end of the 1980s, as relative productivity levels were lower than relative labour cost. This situation changed markedly during the 1990s also in the light of the depreciation of the rupee since the late 1980s.

6. Summary and Conclusions

The main message from this paper is that for an analysis of international competitiveness at least three ingredients are required, namely (1) the nominal labour cost per worker or per hour worked, (2) the output volume per worker or per hour and (3) the ratio of the purchasing power parity for output relative to the nominal exchange rate. An important observation from the comparisons shown here is that relative productivity levels tend to move more or less in tandem with relative labour cost levels so that unit labour cost levels are closer between countries than labour cost levels per se. The competitiveness of a high-wage country is therefore not immediately threatened by lower labour cost elsewhere, as countries with low labour cost are usually also characterized by lower productivity levels. In addition, for example in the case of the EU-15, we found that it was not so much high labour cost, but lower productivity that threatens the competitive position of the region.

However, unit labour cost levels are certainly not identical between countries, as there are important deviations due to short term movements in relative prices (related to fluctuation in the nominal exchange rate) and differences in industrial structure. Whereas some of the differences cancel out at the aggregate level, differences in industry and product composition are quite important at a more detailed level. Due to the high data demands to obtain level comparisons, the analysis in this chapter was largely restricted to OECD countries, but included measures for medium-income

---

[23] See Summers and Heston (1991).

countries like Korea and Mexico. A brief analysis of some complementary evidence for other medium and low-income countries shows that ULC levels also shows a fair amount of variation for a wider range of countries at different income levels. But again both labour cost and productivity are important factors determining cost competitiveness. For example, Korea has shows a rapid improvement in labour productivity relative to the U.S., but its unit labour cost level has been threatened by rapid wage increases during the early 1990s. In contrast, Mexico has shown a deterioration in productivity, but its ULC level has remained much lower than in the U.S became compensation levels have also fallen.

It should be stressed that an exclusive focus on productivity, labour cost and unit labour cost measurement cannot of course fully explain (changes in) trade patterns and differences in economic performance between countries. Firstly, at country level, it is difficult to speak of "competitiveness" as strictly speaking one should always distinguish between industries with and without a comparative advantage relative to other countries. A focus on industry level detail is therefore very important.

Secondly, as indicated in this chapter, competitiveness covers a much range of aspects than just relative cost and productivity, in particular in the longer run. In its broadest interpretation it may include various aspects of economic performance and efficiency, such as improvements in product quality, a firms' capacity to innovate and to adapt consumer preferences, but also the functioning of the macroeconomic, institutional and policy environment, the quality of financial intermediation, the flexibility of factor markets, etc. While competitive gains are primarily realized at the level of individual firms producing goods and services, governments have an important role to play to facilitate this process. In these light policies with regard to a country's trade regime cannot be seen in isolation of other policy measures, such as labour and product market reforms, education and innovation policies.

Despite its limitations, the monitoring of unit labour cost is a useful tool to track a country's competitive performance in the short and medium run – i.e. to take the external sector's temperature and look at the possible cures if unit labour costs go up. The ULC measure is particularly useful when decomposed into the effects of productivity, labour cost and relative price performance. Clearly a decline in unit labour cost achieved through productivity gains has very different implications for the quality and remuneration of jobs than a similar decline which is due to a cut in wages. A too strong emphasis on either the wage or the productivity variable can impact the other variable in such a way that an intended change in unit labour cost may not occur. For example, on the one hand an excessive and long run emphasis on wage moderation may threaten a country's productivity growth rate as it might discourage innovation and investment in human capital. On the other hand, in particular in developing countries, a very strong emphasis on efficiency improvement might cut into the employment base of mainly low-skilled people creating a large pool of low-productivity jobs in the informal sector of the economy, which in turn can threaten the productivity performance of the economy in the long run. Clearly a balanced strategy that leads to the creation of more productive and better paid jobs is the vehicle towards improved competitiveness that can also be sustained in the long run.

Future work in the area of unit labour cost studies should include the extension towards trade-weighted measures and developing countries. A greater emphasis on industry measures in the tradable sector but also on what was traditionally seen as non-tradable industries (such as services) will also require more attention.

References

Ark, B. van (1995), "Manufacturing prices, productivity and labor costs in five economies", *Monthly Labor Review*, July, pp. 56-72.

Ark, B. van (1996) "Productivity and Competitiveness in Manufacturing: A Comparison of Europe, Japan and the United States", in K. Wagner and B. van Ark, eds., *International Productivity Differences. Measurement and Explanations*, Contributions to Economic Analysis, North Holland.

Ark, B. van (2004), "The Measurement of Productivity: What do the Numbers Mean?", in G. Gelauff, L. Klomp, S. Raes and Th. Roelandt, eds., *Fostering Productivity. Patterns, Determinants and Policy Implications*, Contributions to Economic Analysis, Elsevier, pp. 28-61.

Ark, B. van and E.J. Monnikhof (2000), "Productivity and unit labour cost comparisons: a data base", *Employment Paper 2000/5*, International Labour Office, Geneva, 2000.

Ark, B. van and R.H. McGuckin (1999), "International Comparisons of Labor Productivity and Per Capita Income", *Monthly Labor Review*, July.

Ark, B. Van, H. Duteweerd and E. Frankema (2004). "Productivity and Employment Growth: An Empirical Review of Long and Medium Run Evidence", *Research Memorandum GD-71*, Groningen Growth and Development Centre, May (downloadable from http://www.ggdc.net/pub/gd71.pdf)

Banister, J. (2004), "Manufacturing Employment and Compensation in China", Beijing Javelin Investment Consulting Company (http://www.bls.gov/fls/chinareport.pdf).

Dullien, S. (2005), "China's Changing Competitive Position: Lessons from a Unit-Labor- Cost-Based REER," International Trade 0502016, Economics Working Paper Archive at WUSTL, (downloadable from http://econwpa.wustl.edu:80/eps/it/papers/0502/0502016.pdf);

Durand, M., C. Madaschi and F. Terribile (1998), "Trends in OECD Countries' International Competitiveness: The Influence of Emerging Market Economies", *OECD Economics Department Working Papers*, Paris.

Fagerberg, J., M. Knell and M.. Scholec (2005), "The Competitiveness of Nations", paper presented at 10th Year Anniversary DRUID Summer Conference, Aalborg, Denmark, June 27-29th (downloadable from http://www.druid.dk/ocs/viewpaper.php?id=538&cf=3; published in abbreviated format as Chapter 2 of the UNECE, *Economic Survey of Europe*, 2004-2, Chapter 2, http://www.unece.org/ead/pub/042/042c2.pdf)

Golub, S.S. (1999), *Labour Costs and International Trade*, AEI Studies on Understanding Economic Inequality, American Enterprise Institute for Economic Research, Washington D.C..

Hiumin W. and R. Ruoen (2004), "Multilateral Unit Labor Cost-Based Competitiveness Indicator for China", International Seminar on Economic Indicators and Business Cycle: Where do We Stand?, Singapore Department of Statistics and The Conference Board, Singapore, 26-27 May (downloadable from http://www.singstat.gov.sg/conferences/business/ulc.pdf)

ILO (1999), *1999 Key Indicators of the Labour Market*, International Labour Office, Geneva.

ILO (2001), *2001-2002 Key Indicators of the Labour Market*, International Labour Office, Geneva.

ILO (2003), *Key Indicators of the Labour Market, Third Edition*, International Labour Office, Geneva.

ILO (2004), World Employment Report 2004-05. Employment, Productivity and Poverty Reduction, International Labour Office, Geneva.

McGuckin, R.H. and B. van Ark (2005), *Performance 2005: Productivity, Employment and Income in the World's Economies*, Research Report R-1364-05-RR, The Conference Board, New York.

Porter, M. (1990), *The Competitive Advantage of Nations,* The Free Press, New York.

Summers, R. and A. Heston (1991), "The Penn World Table (Mark 5): an expanded set of international comparisons, 1950-1988", *Quarterly Journal of Economics*, 106(2), May, 327-68.

Timmer, M.P., G. Ypma and B. van Ark (2005), 'International comparisons of output and productivity (ICOP): 1997 benchmark', *GGDC Research Memorandum GD-81*, Groningen Growth and Development Centre.

Turner, A.G. and S. Golub (1997), "Towards a System of Multilateral Unit Labor Cost-Based Competitiveness Indicators for Advanced, Developing, and Transition Countries", *IMF Working Papers No. 151*, Washington D.C..

Turner, P. and J. Van 't Dack (1993), "Measuring International Price and Cost Competitiveness", *BIS Economic Papers, No. 39*, Basel, November.

Appendix Figures

Fig. A1: Labour Compensation, Labour Productivity and Unit Labour Cost, Manufacturing, United States (1980=100)
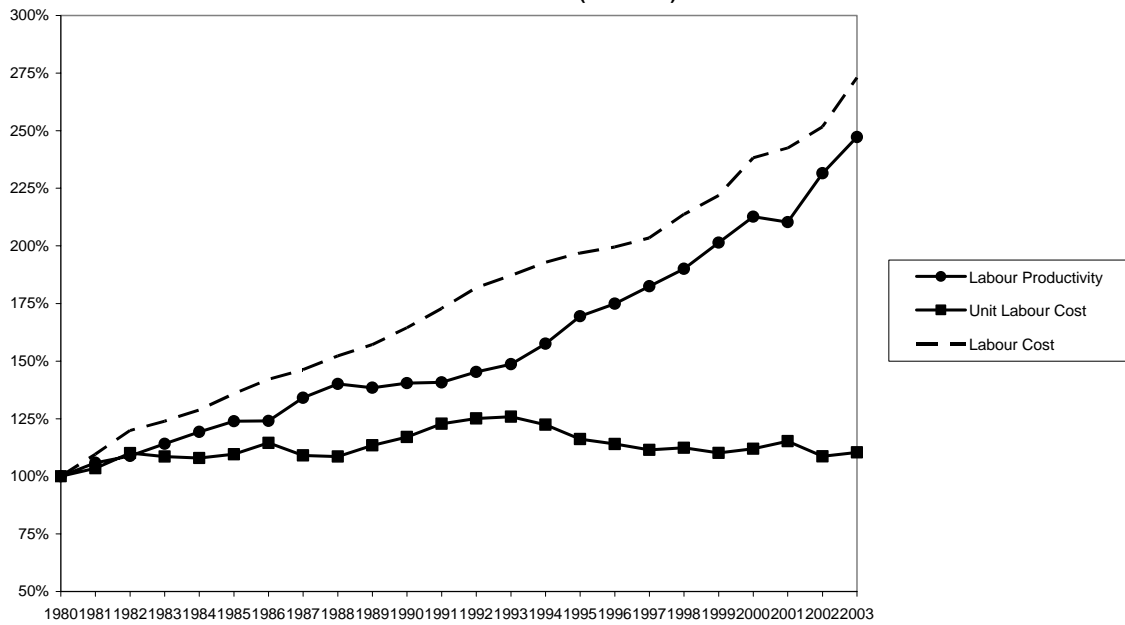

Fig. A2: Labour Compensation, Labour Productivity and Unit Labour Cost, Total Economy, United States (1980=100)
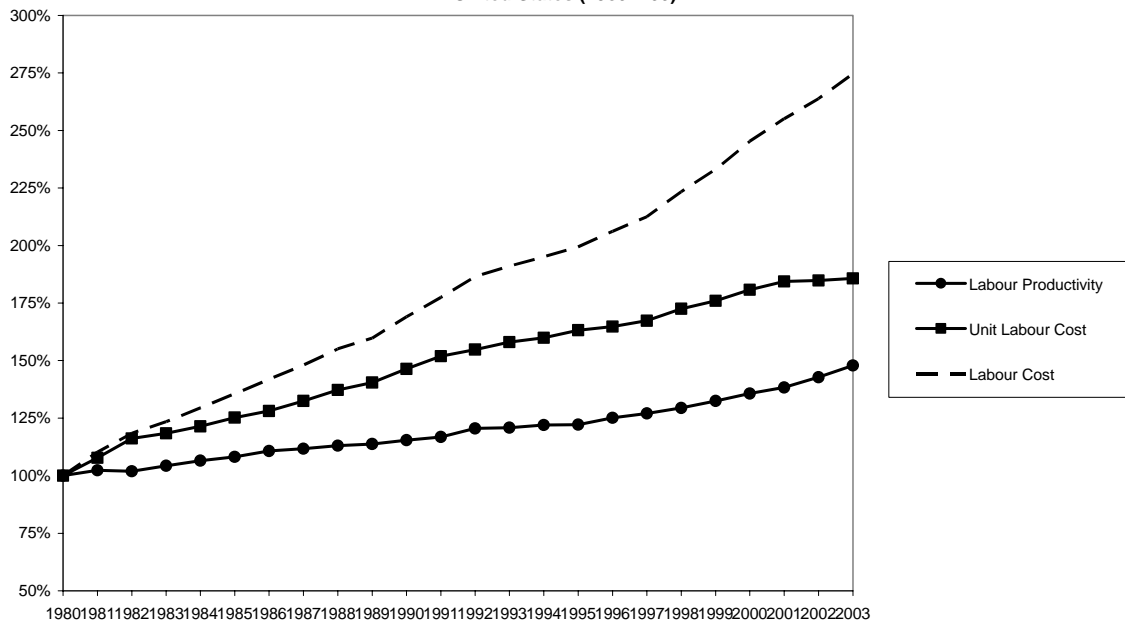
Fig. A3: Average Labour Compensation, Labour Productivity and Unit Labour Cost, Total Economy, EU-15 (US=100)
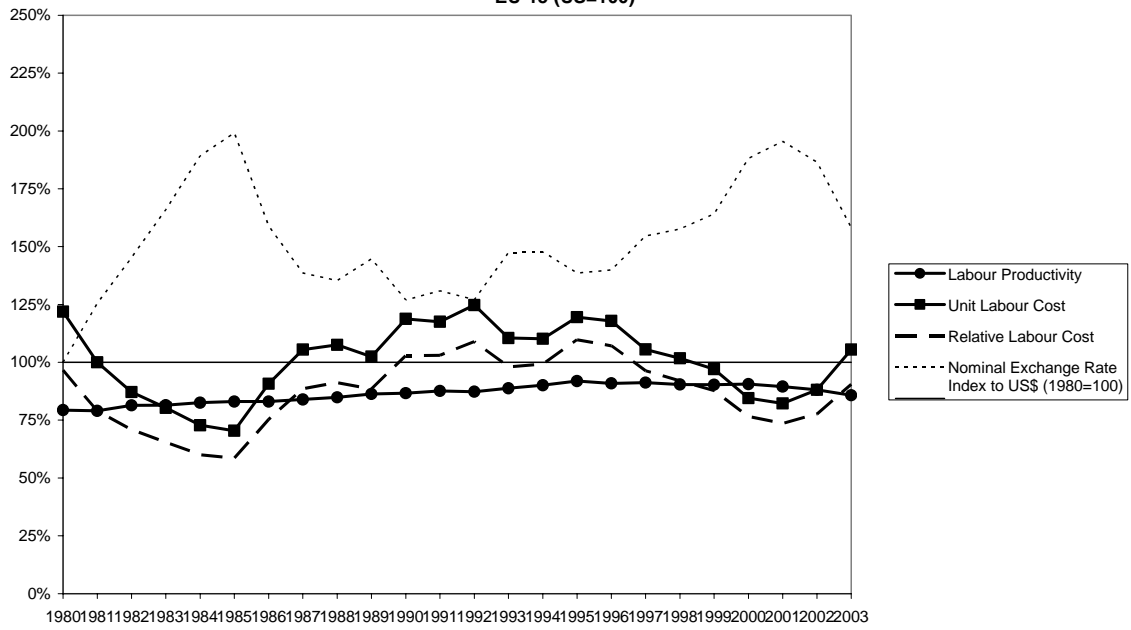

- Labour Productivity
- Unit Labour Cost
- Relative Labour Cost
- Nominal Exchange Rate Index to US$ (1980=100)

Fig. A4: Average Labour Compensation, Labour Productivity and Unit Labour Cost, Total Economy, New EU Member States (Czech Republic, Hungary, Poland, Slovak Republic) (US=100)
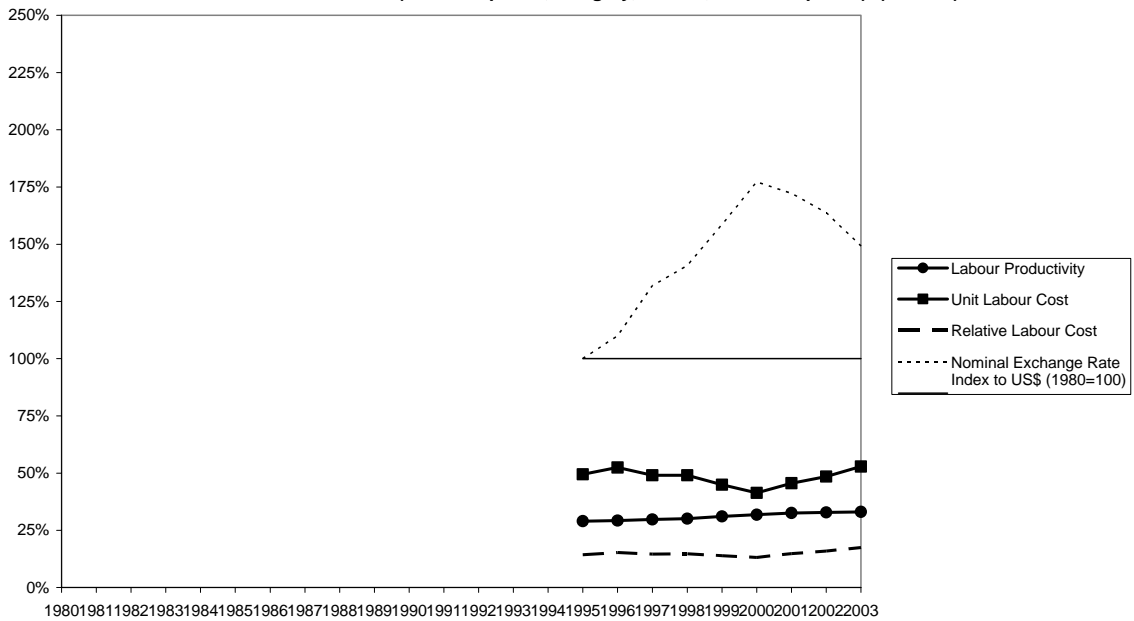

- Labour Productivity
- Unit Labour Cost
- Relative Labour Cost
- Nominal Exchange Rate Index to US$ (1980=100)

14

Fig. A5: Labour Compensation, Labour Productivity and Unit Labour Cost, Total Economy, Japan (US=100)
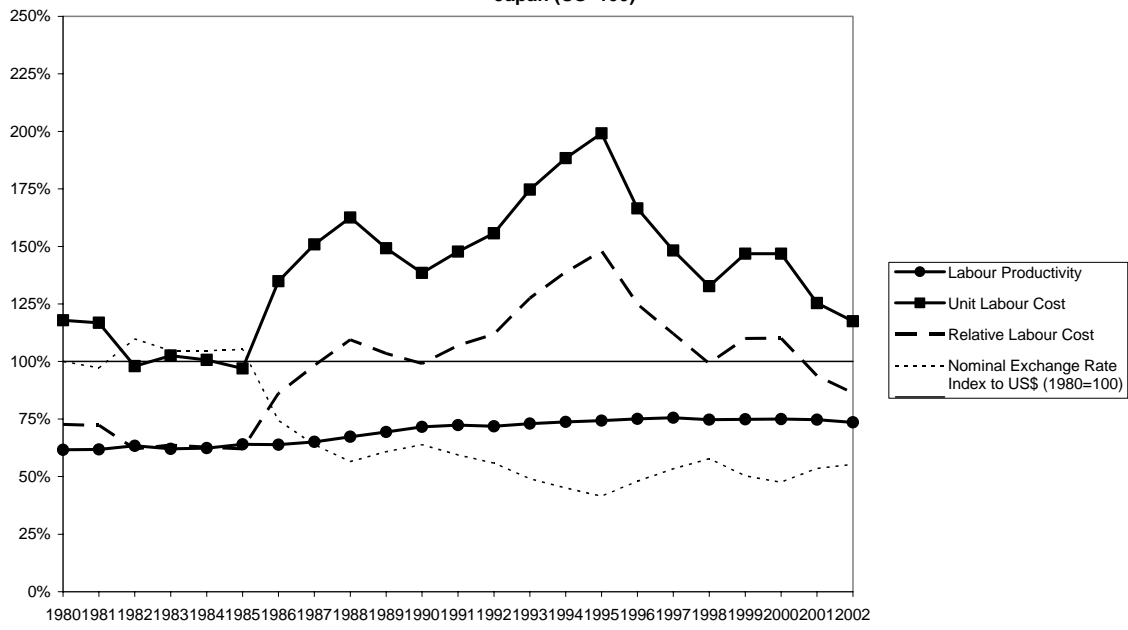

Fig. A6: Average Labour Compensation, Labour Productivity and Unit Labour Cost, Total Economy (Australia, Canada, New Zealand) (US=100)
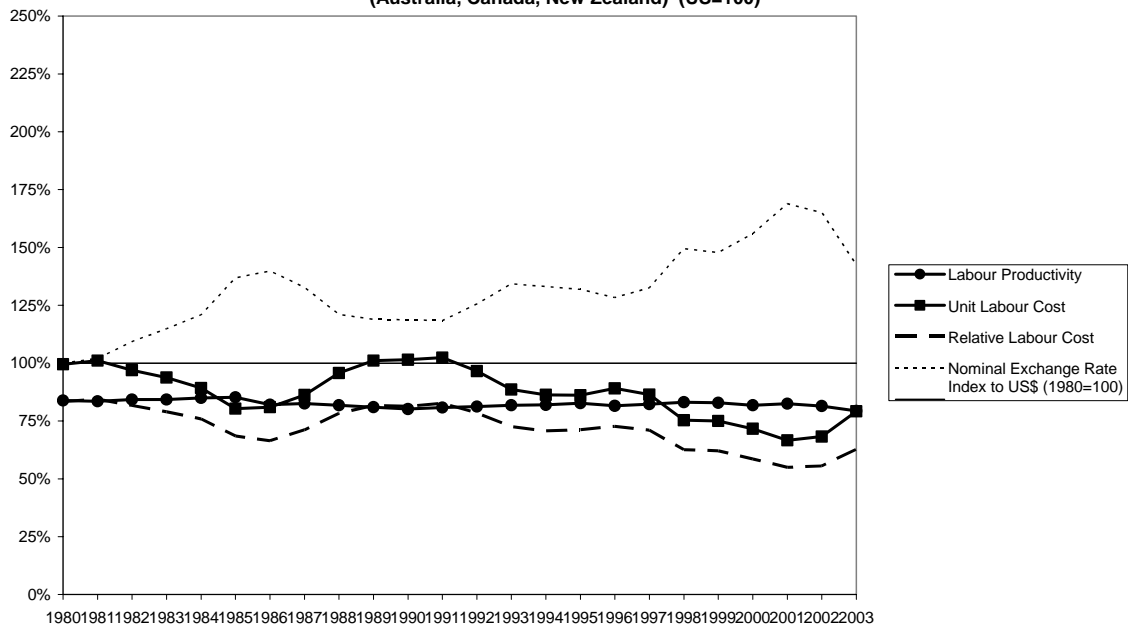

15

Fig. A7: Labour Compensation, Labour Productivity and Unit Labour Cost, Total Economy, Korea (US=100)
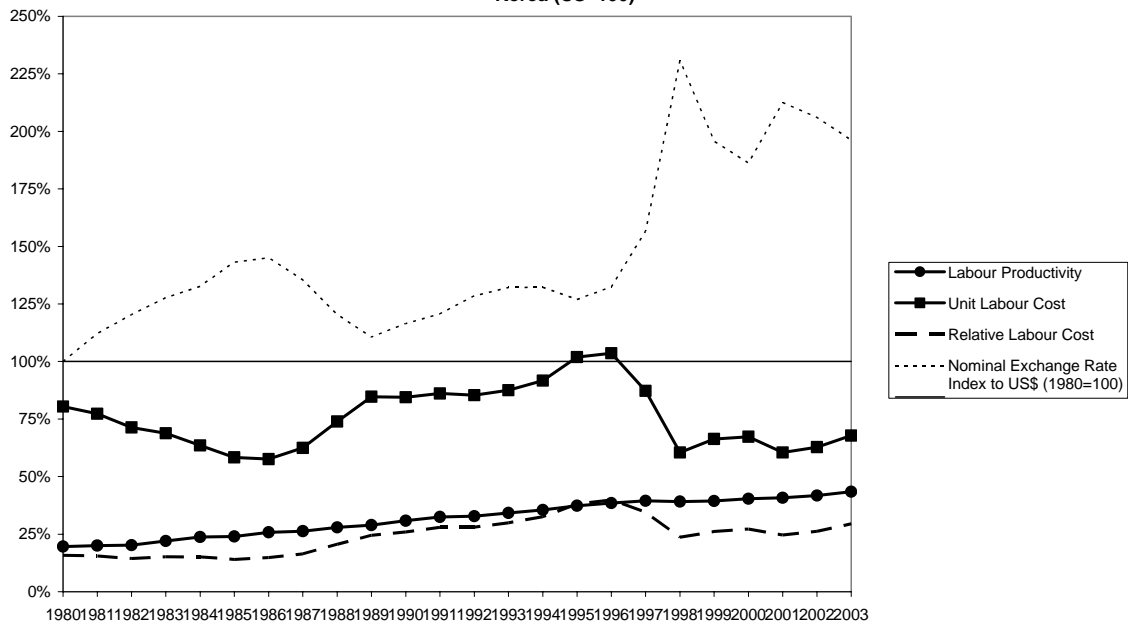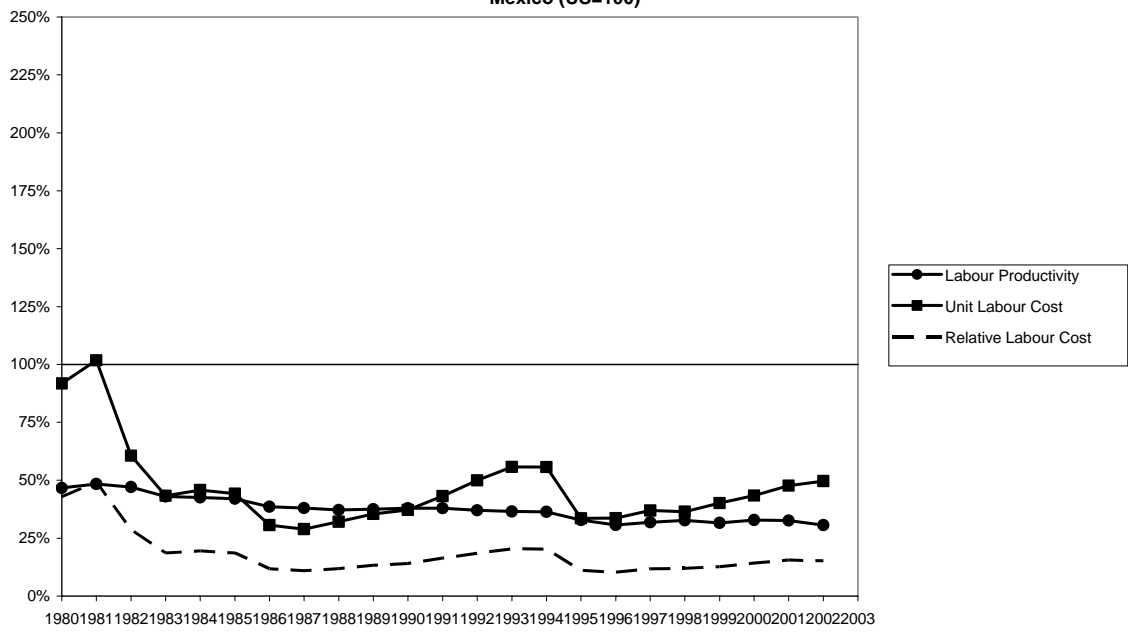

Fig. A8: Labour Compensation, Labour Productivity and Unit Labour Cost, Total Economy, Mexico (US=100)

16

Papers issued in the series of the Groningen Growth and Development Centre

Papers marked * are also available in pdf-format on the internet: http://www.ggdc.net/
Hardcopies of other papers can be ordered (as long as available) from ggdc@eco.rug.nl

536 (GD-1)   Maddison, Angus and Harry van Ooststroom, The International Comparison of Value Added, Productivity and Purchasing Power Parities in Agriculture (1993)

537 (GD-2)   Mulder, Nanno and Angus Maddison, The International Comparison of Performance in Distribution: Value Added, Labour Productivity and PPPs in Mexican and US Wholesale and Retail Trade 1975/7 (1993)

538 (GD-3)*   Szirmai, Adam, Comparative Performance in Indonesian Manufacturing, 1975-90 (1993)

549 (GD-4)   de Jong, Herman J., Prices, Real Value Added and Productivity in Dutch Manufacturing, 1921-1960 (1993)

550 (GD-5)   Beintema, Nienke and Bart van Ark, Comparative Productivity in East and West German Manufacturing before Reunification (1993)

567 (GD-6)*   Maddison, Angus and Bart van Ark, The International Comparison of Real Product and Productivity (1994)

568 (GD-7)   de Jong, Gjalt, An International Comparison of Real Output and Labour Productivity in Manufacturing in Ecuador and the United States, 1980 (1994)

569 (GD-8)   van Ark, Bart and Angus Maddison, An International Comparison of Real Output, Purchasing Power and Labour Productivity in Manufacturing Industries: Brazil, Mexico and the USA in 1975 (1994) (second edition)

570 (GD-9)   Maddison, Angus, Standardised Estimates of Fixed Capital Stock: A Six Country Comparison (1994)

571 (GD-10)* van Ark, Bart and Remco D.J. Kouwenhoven, Productivity in French Manufacturing: An International Comparative Perspective (1994)

572 (GD-11)   Gersbach, Hans and Bart van Ark, Micro Foundations for International Productivity Comparisons (1994)

573 (GD-12)* Albers, Ronald, Adrian Clemens and Peter Groote, Can Growth Theory Contribute to Our Understanding of Nineteenth Century Economic Dynamics (1994)

574 (GD-13)* de Jong, Herman J. and Ronald Albers, Industrial Output and Labour Productivity in the Netherlands, 1913-1929: Some Neglected Issues (1994)

575 (GD-14)   Mulder, Nanno, New Perspectives on Service Output and Productivity: A Comparison of French and US Productivity in Transport, Communications Wholesale and Retail Trade (1994)

576 (GD-15)   Maddison, Angus, Economic Growth and Standards of Living in the Twentieth Century (1994)

577 (GD-16)   Gales, Ben, In Foreign Parts: Free-Standing Companies in the Netherlands around the First World War (1994)

578 (GD-17)   Mulder, Nanno, Output and Productivity in Brazilian Distribution: A Comparative View (1994)

579 (GD-18)   Mulder, Nanno, Transport and Communication in Mexico and the United States: Value Added, Purchasing Power Parities and Productivity (1994)

580 (GD-19)   Mulder, Nanno, Transport and Communications Output and Productivity in Brazil and the USA, 1950-1990 (1995)

581 (GD-20)   Szirmai, Adam and Ren Ruoen, China's Manufacturing Performance in Comparative Perspective, 1980-1992 (1995)

GD-21   Fremdling, Rainer, Anglo-German Rivalry on Coal Markets in France, the Netherlands and Germany, 1850-1913 (December 1995)

GD-22*   Tassenaar, Vincent, Regional Differences in Standard of Living in the Netherlands, 1800-1875, A Study Based on Anthropometric Data (December 1995)

GD-23*   van Ark, Bart, Sectoral Growth Accounting and Structural Change in Postwar Europe (December 1995)

GD-24*   Groote, Peter, Jan Jacobs and Jan Egbert Sturm, Output Responses to Infrastructure in the Netherlands, 1850-1913 (December 1995)

GD-25*   Groote, Peter, Ronald Albers and Herman de Jong, A Standardised Time Series of the Stock of Fixed Capital in the Netherlands, 1900-1995 (May 1996)

GD-26*   van Ark, Bart and Herman de Jong, Accounting for Economic Growth in the Netherlands since 1913 (May 1996)

GD-27*   Maddison, Angus and D.S. Prasada Rao, A Generalized Approach to International Comparisons of Agricultural Output and Productivity (May 1996)

GD-28   van Ark, Bart, Issues in Measurement and International Comparison of Productivity - An Overview (May 1996)

GD-29*   Kouwenhoven, Remco, A Comparison of Soviet and US Industrial Performance, 1928-90 (May 1996)

GD-30   Fremdling, Rainer, Industrial Revolution and Scientific and Technological Progress (December 1996)

GD-31   Timmer, Marcel, On the Reliability of Unit Value Ratios in International Comparisons (December 1996)

GD-32   de Jong, Gjalt, Canada's Post-War Manufacturing Performance: A Comparison with the United States (December 1996)

GD-33   Lindlar, Ludger, "1968" and the German Economy (January 1997)

GD-34   Albers, Ronald, Human Capital and Economic Growth: Operationalising Growth Theory, with Special Reference to The Netherlands in the 19th Century (June 1997)

GD-35*   Brinkman, Henk-Jan, J.W. Drukker and Brigitte Slot, GDP per Capita and the Biological Standard of Living in Contemporary Developing Countries (June 1997)

GD-36   de Jong, Herman, and Antoon Soete, Comparative Productivity and Structural Change in Belgian and Dutch Manufacturing, 1937-1987 (June 1997)

GD-37   Timmer, M.P., and A. Szirmai, Growth and Divergence in Manufacturing Performance in South and East Asia (June 1997)

GD-38*   van Ark, B., and J. de Haan, The Delta-Model Revisited: Recent Trends in the Structural Performance of the Dutch Economy (December 1997)

GD-39*   van der Eng, P., Economics Benefits from Colonial Assets: The Case of the Netherlands and Indonesia, 1870-1958 (June 1998)

GD-40*   Timmer, Marcel P., Catch Up Patterns in Newly Industrializing Countries. An International Comparison of Manufacturing Productivity in Taiwan, 1961-1993 (July 1998)

GD-41*   Ark, Bart van, Economic Growth and Labour Productivity in Europe: Half a Century of East-West Comparisons (October 1999)

GD-42*   Smits, Jan Pieter, Herman de Jong and Bart van Ark, Three Phases of Dutch Economic Growth and Technological Change, 1815-1997 (October 1999)

GD-43*   Fremdling, Rainer, Historical Precedents of Global Markets (October 1999)

GD-44*   Ark, Bart van, Lourens Broersma and Gjalt de Jong, Innovation in Services. Overview of Data Sources and Analytical Structures (October 1999)

GD-45*   Broersma, Lourens and Robert McGuckin, The Impact of Computers on Productivity in the Trade Sector: Explorations with Dutch Microdata (October 1999, Revised version June 2000)

GD-46*   Sleifer, Jaap, Separated Unity: The East and West German Industrial Sector in 1936 (November 1999)

GD-47*   Rao, D.S. Prasada and Marcel Timmer, Multilateralisation of Manufacturing Sector Comparisons: Issues, Methods and Empirical Results (July 2000)

GD-48*   Vikström, Peter, Long term Patterns in Swedish Growth and Structural Change, 1870-1990 (July 2001)

GD-49*   Wu, Harry X., Comparative labour productivity performance in Chinese manufacturing, 1952-1997: An ICOP PPP Approach (July 2001)

GD-50*   Monnikhof, Erik and Bart van Ark, New Estimates of Labour Productivity in the Manufacturing Sectors of Czech Republic, Hungary and Poland, 1996 (January 2002)

GD-51*   van Ark, Bart, Robert Inklaar and Marcel Timmer, The Canada-US Manufacturing Gap Revisited: New ICOP Results (January 2002)

GD-52*   Mulder, Nanno, Sylvie Montout and Luis Peres Lopes, Brazil and Mexico's Manufacturing Performance in International Perspective, 1970-98 (January 2002)

GD-53*   Szirmai, Adam, Francis Yamfwa and Chibwe Lwamba, Zambian Manufacturing Performance in Comparative Perspective (January 2002)

GD-54*   Fremdling, Rainer, European Railways 1825-2001, an Overview (August 2002)

GD-55*   Fremdling, Rainer, Foreign Trade-Transfer-Adaptation: The British Iron Making Technology on the Continent (Belgium and France) (August 2002)

GD-56*   van Ark, Bart, Johanna Melka, Nanno Mulder, Marcel Timmer and Gerard Ypma, ICT Investments and Growth Accounts for the European Union 1980-2000 (September 2002)

GD-57*   Sleifer, Jaap, A Benchmark Comparison of East and West German Industrial Labour Productivity in 1954 (October 2002)

GD-58*   van Dijk, Michiel, South African Manufacturing Performance in International Perspective, 1970-1999 (November 2002)

GD-59*   Szirmai, A., M. Prins and W. Schulte, Tanzanian Manufacturing Performance in Comparative Perspective (November 2002)

GD-60*   van Ark, Bart, Robert Inklaar and Robert McGuckin, "Changing Gear" Productivity, ICT and Services: Europe and the United States (December 2002)

GD-61*   Los, Bart and Timmer, Marcel, The 'Appropriate Technology' Explanation of Productivity Growth Differentials: An Empirical Approach (April 2003)

GD-62*   Hill, Robert J., Constructing Price Indexes Across Space and Time: The Case of the European Union (May 2003)

GD-63*   Stuivenwold, Edwin and Marcel P. Timmer, Manufacturing Performance in Indonesia, South Korea and Taiwan before and after the Crisis; An International Perspective, 1980-2000 (July 2003)

GD-64*   Inklaar, Robert, Harry Wu and Bart van Ark, "Losing Ground", Japanese Labour Productivity and Unit Labour Cost in Manufacturing in Comparison to the U.S. (July 2003)

GD-65*   van Mulligen, Peter-Hein, Alternative Price Indices for Computers in the Netherlands using Scanner Data (July 2003)

GD-66*   van Ark, Bart, The Productivity Problem of the Dutch Economy: Implications for Economic and Social Policies and Business Strategy (September 2003)

GD-67*   Timmer, Marcel, Gerard Ypma and Bart van Ark, IT in the European Union, Driving Productivity Divergence?

GD-68*   Inklaar, Robert, Mary O'Mahony and Marcel P. Timmer, ICT and Europe's Productivity Performance, Industry-level Growth Accounts Comparisons with the United States (December 2003)

GD-69*   van Ark, Bart and Marcin Piatkowski, Productivity, Innnovation and ICT in Old and New Europe (March 2004)

GD-70*   Dietzenbacher, Erik, Alex Hoen, Bart Los and Jan Meist, International Convergence and Divergence of Material Input Structures: An Industry-level Perspective (April 2004)

GD-71*   van Ark, Bart, Ewout Frankema and Hedwig Duteweerd, Productivity and Employment Growth: An Empirical Review of Long and Medium Run Evidence (May 2004)

GD-72*   Edquist, Harald, The Swedish ICT Miracle: Myth or Reality? (May 2004)

GD-73*   Hill, Robert and Marcel Timmer, Standard Errors as Weights in Multilateral Price Indices (November 2004)

GD-74*   Inklaar, Robert, Cyclical productivity in Europe and the United States, Evaluating the evidence on returns to scale and input utilization (April 2005)

GD-75*   van Ark, Bart, Does the European Union Need to Revive Productivity Growth? (April 2005)

GD-76*   Timmer, Marcel and Robert Inklaar, Productivity Differentials in the US and EU Distributive Trade Sector: Statistical Myth or Reality? (April 2005)

GD-77*   Fremdling, Rainer, The German Industrial Census of 1936: Statistics as Preparation for the War (August 2005)

GD-78*   McGuckin, Robert and Bart van Ark, Productivity and Participation: An International Comparison (August 2005)

GD-79*   Inklaar, Robert and Bart van Ark, Catching Up or Getting Stuck? Europe's Troubles to Exploit ICT's Productivity Potential (August 2005)

Groningen Growth and Development Centre Research Monographs

Monographs marked * are also available in pdf-format on the internet: http://www.ggdc.net/

No. 1*   van Ark, Bart, International Comparisons of Output and Productivity: Manufacturing Productivity Performance of Ten Countries from 1950 to 1990 (1993) (http://www.eco.rug.nl/GGDC/ThesisArk.html)

No. 2   Pilat, Dirk, The Economics of Catch-Up: The Experience of Japan and Korea (1993)

No. 3   Hofman, André, Latin American Economic Development. A Causal Analysis in Historical Perspective (1998)

No. 4   Mulder, Nanno, The Economic Performance of the Service Sector in Brazil, exico and the United States (1999)

No. 5*   Smits, Jan-Pieter, Edwin Horlings and Jan Luiten van Zanden, Dutch GNP and Its Components, 1800-1913 (2000) (http://www.eco.rug.nl/GGDC/PUB/dutchgnp.pdf)