The cost competitiveness of European industry in the globalisation era - Empirical evidence on the basis of relative unit labour costs (ULC) at sectoral level

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Abstract

This study gathered and constructed estimates of unit labour costs (ULCs) and real effective exchange rates (REERs) in unit labour cost terms at the 1-digit NACE level for selected broad sectors and at the 2-digit NACE level for manufacturing industries. It used OECD and Eurostat data for the developed countries, and gathered data directly from the statistical offices of Brazil, China, India and Russia so as to include these countries in the analysis. Key findings were: (1) widening the range of countries considered as competitors results in a higher estimate of the scale of the deterioration in EU competitiveness in the past decade; (2) nominal exchange rate movements were very important for driving the improved REERs in Brazil and India, but in China falling ULCs were the dominant factor; (3) while trends in REERs are relevant to trade performance, there is no simple relationship between the two; in some sectors non-ULC factors are clearly important; (4) there is some evidence of convergence of productivity in key manufacturing sectors in new Member States since they joined the EU; (5) there is some evidence of a Balassa-Samuelson effect in new Member States, whereby ULCs in less-traded sectors rise faster than in manufacturing.

Keywords: Unit labour costs, real effective exchange rate, competitiveness, manufacturing, services, European Union, EU15, EU12, Brazil, China, India, Russia, European integration, globalization.

JEL codes: F15, F16, J30

Contents

Executive Summary

Method

This study has developed a database of estimates of unit labour costs (ULCs) and real effective exchange rates (REERs; nominal exchange rates deflated by relative ULCs and weighted for the importance of each trading partner to a country's trade) at the 2-digit NACE level for manufacturing industries. It has relied upon OECD and Eurostat data for the developed countries, and has supplemented this with data gathered directly from the statistical offices of Brazil, China, India and Russia in order to include these countries in the analysis. Data for broad groups of service sectors have also been developed for comparison.

Findings

General findings for trends in REER and the competitiveness of EU Member States

For some countries, the *impact of macroeconomic changes* is felt across most sectors. This is true for the southern European eurozone members, where the loss of competitiveness is seen across all sectors. It is also true of countries outside of the eurozone whose currency movements have a common impact across sectors (Sweden, the UK and the USA).

When the range of trading partners in the calculation of REERs is *broadened to include low cost competitors*, the effect is, as expected, to make the trend in REERs among the EU countries worse. The largest impact is the inclusion of China, imports from which have risen very sharply in some sectors (including, but not limited to, sectors in which low labour costs are traditionally a source of comparative advantage such as wearing apparel and textiles).

The macroeconomic finding noted in Section 3.2 that there is no simple, consistent relationship between *trends in the trade balance and trends in REERs* is also borne out at the level of individual sectors. There is no common theme that improvements in ULC competitiveness are associated with an improved trade performance, or vice versa. There are examples consistent with this pattern, and there are counter-examples. In some cases, the examples of an improved trade balance despite a deterioration in ULC competitiveness seem consistent with known strengths in terms of quality. We cite some econometric evidence for the factors explaining extra-EU export performance in support of this finding.

While labour costs by no means dominate the cost structure of manufacturing subsectors, they remain more important for the competitiveness of different geographical locations than this statistic might suggest, because they are *an important cost element which varies between those locations*. Another important element for some manufacturing industries whose cost varies greatly across countries is energy costs.

Intra-European comparison in manufacturing sectors

For the intra-European comparison of ULCs and REERs we considered seven countries, representing either old or new Member States of the EU. France, Germany, Italy and Spain represented the old Member States, while the Czech Republic, Hungary and Slovakia represented the new ones.

We observed high increases in productivity and gross value added for the new Member States, suggesting a process of convergence. In several cases increases in nominal compensations exceeded the increases in productivity so that there was a deterioration in labour cost competitiveness. In general, new Member States had more volatile developments than the old ones, which signifies restructuring processes in the new EU economies.

Motor vehicles was one of the sectors that had the largest increases in productivity and production. Slovakia in particular saw very large increases. Smaller increases were seen in Hungary, but even so it is dependent on motor vehicles: Audi, Opel, Suzuki and Visteon make 90% of the Hungarian automotive industry and the exports of Audi, Opel ansd Suzuki make 17% of all Hungarian exports.[1]

As expected, currency movements had important influences on REERs for new Member States outside of the eurozone. The Czech and the Slovak currencies experienced an appreciation which weakened their cost competitiveness.

Intra-European comparison in service sectors

For the intra-European comparison in service sectors, we considered the same seven Member States and found some differences compared with manufacturing sectors. Unit labour costs in the broad service sectors covered in Chapter 6 tended to grow faster in new Member States, and particularly in financial and business services sectors, reflecting stronger growth in nominal compensation (which was not offset by stronger growth in productivity). Transportation, storage and communication was the only broad service sector in which employment in the new Member States fell, despite the fact that GVA grew faster than in old Member States in all except Slovakia. However convergence towards the productivity levels of the old Member States was not as strong as in the manufacturing sectors.

[1] Hungarian Investment and Trade Development Agency, ITD Hangary

Comparison between emerging economies and the EU

In Chapter 7, we compared the trends of unit labour costs and real effective exchange rates in all manufacturing sectors of three important emerging economies, Brazil, China and India with a European average of 16 Member States. The REERs trends of the selected BRIC countries moved in the opposite direction to those of the European average, and in general the BRIC countries saw a fall in REERs.

The trends in unit labour costs were different to those in real effective exchange rates. China was the only country in which ULCs fell. The countries' competitiveness was generally improved by depreciation against European currencies. We found some empirical evidence for the relation between developments in real effective exchange rates and developments in trade balances. Improvements in cost competitiveness for the emerging economies went along with a growing trade surplus, but this was not so evident for the European average, supporting the earlier finding that in most sectors the trade performance of the higher-cost European countries depends less on cost competitiveness.

1 Background

This study has developed a database of estimates of unit labour costs (ULCs) and real effective exchange rates (REERs; nominal exchange rates deflated by relative ULCs and weighted for the importance of each trading partner to a country's trade) at the 2-digit NACE level for manufacturing industries. It has relied upon OECD and Eurostat data for the developed countries, and has supplemented this with data gathered directly from the statistical offices of Brazil, China, India and Russia in order to include these countries in the analysis. Data for broad groups of service sectors have also been developed for comparison.

Chapter 2 presents a brief literature review on the relevance of ULCs as a measure of competitiveness. Chapter 3 notes the macroeconomic (all-manufacturing) trends in the data.

The scope for analysis of the database is potentially large. In the remaining chapters of this report we present results along a number of different lines of enquiry. Chapter 4 presents selected results on a country-by-country basis, and draws out some common themes. Chapter 5 uses the database to compare outcomes for a selection of new and old Member States to detect evidence of convergence in performance of the new MS. Chapter 6 summarises the results for service sectors. Chapter 7 presents results for Brazil, China and India[2]. Chapter 8 draws conclusions from the analysis.

The appendices describe the methods and data sources and also compare the results for ULCs and REERs for all-manufacturing with those available from the OECD and ECB.

[2] Russia was excluded from the calculation of REERs because the database only included data from 2003.

2 Literature review

The literature review for the study comprised two elements:

- a review of methods for constructing unit labour costs, effective exchange rates and real effective exchange rates
- issues arising from economic theory with respect to the relevance of unit labour costs as a measure of competitiveness

The results of the review of methods are presented in Appendix A:. This chapter presents a brief discussion of the theoretical issues associated with the use of unit labour costs as a measure of competitiveness.

2.1 The relevance of unit labour costs as a measure of competitiveness

Prices and costs as measures of competitiveness

Turner and Van 't Dack (1993)[3] review various possible alternatives for the measures of relative prices or costs that can be used to calculate REERs for the purpose of measuring competitiveness. They note that relative *export prices* suffer from the weakness that market pressures will tend to limit observed difference in these prices, and that firms may for some time continue to supply at prices that do not reflect their underlying cost position. A second weakness is that observed export prices are usually measured as unit values, which change depending on the composition of a country's exports. Since exports are by no means homogeneous even at the 2-digit level, this effect undermines the usefulness of relative unit export values as a measure of competitiveness: a country moving from specialisation in lower quality to higher quality products would show a rise in its unit export values, but this need not imply any loss of competitiveness.

Turner and Van 't Dack note that other price measures (consumer or producer prices) also suffer drawbacks as measures of competitiveness. Consumer prices are not a good proxy for tradables, and in the context of the present study there are no relevant consumer prices for intermediate goods. Producer prices are more relevant, but they relate to gross (turnover) value: in a country/industry with substantial imported inputs, producer prices are not a good measure of the cost of the value added in the country, which is the relevant concept for competitiveness.

Turner and Van 't Dack draw attention to the breakdown of the various elements of costs (bought-in goods, some of which are imported and some of which are produced

[3] Turner and Van 't Dack (1993) pp26-34.

domestically), bought-in services (of which the non-traded share is typically higher than for goods), labour and capital. In addition, we can consider domestic tax and regulatory systems. From the perspective of competitiveness, we are interested in those costs (prices, and the productivity with which the resource is used) that differ from one country to another. Thus, the cost of bought-in goods that are highly traded (for example commodities) is unlikely to differ much one country to another unless there are important barriers to imports. The cost of energy may vary, because of differences in taxation or subsidies, in regulatory practices and in environmental measures (for example, the EU-ETS, or measures to promote adoption of higher-cost low-carbon technologies, notably in power generation). The cost of bought-in services is likely to vary more substantially between countries, both because of their smaller exposure to trade and also because of differences in their organisation and productivity (which in turn reflects low tradability). The cost of capital may differ across countries, particularly where the firms involved are not large enough to access international capital markets. However, the importance of the cost of capital to competitiveness is greater in industries with large economies of scale in which multinational enterprises predominate. In such industries, characterised by substantial capital with a long life, what may matter more (because it varies more across countries) than the cost of capital is the assurance of stability in other key costs, so that priority is given (for example) to the regulatory environment or long-term energy supply contracts. Finally, to the extent that innovation is important to competitiveness, and to the extent that this is transferred only slowly or imperfectly across space, the presence of a strong research base or cluster of highly innovative firms gives a country a competitive advantage which is not readily measured in terms of the cost of inputs[4]. Allen and Whitley (1994) provide empirical evidence for the importance of innovation (represented by cumulative investment) to UK trade performance, and Cambridge Econometrics' E3ME multi-country, multi-sectoral model of the EU similarly finds a similar measure that represents innovation/technical progress generally to be significant in explaining trade flows.[5]

Clearly, a focus on labour costs neglects all these other elements of costs, some of which may show important cross-country differences. However, labour costs do account for a substantial element of non-traded inputs to production. The use of unit labour costs adjusts for differences in the productivity of labour, but because productivity is pro-cyclical it introduces a cause of variation in the indicator that does not reflect underlying competitiveness, and this is particularly important for countries with an economic cycle that is different in timing or scale. But Turner and Van 't Dack note that the most important conceptal problem with unit labour costs is that productivity is endogenous and responds to changes in the cost of labour. Consequently, a country facing a sharp increase in wages might see its firms respond by minimising the use of labour and exiting sectors most exposed to labour-cost competition, so the observed outcome would be an increase in productivity which mitigates and obscures the rising cost of labour, resulting in only (say) a modest increase in unit labour costs. Similarly wage rates are affected by productivity. A country which invests to make its educational system more effective will produce a more highly qualified and productive labour supply which will also earn higher

[4] See van Ark et al (2005) p11 for a further discussion of the non-labour influences on competitiveness.

[5] See the treatment of export and import functions in the E3ME manual, http://www.camecon.com/Libraries/Downloadable_Files/E3ME_Manual.sflb.ashx.

wages. The net result may not be any marked change in its unit labour costs, but in a broader sense (reflecting the standard of living of its workers) its competitiveness would have improved[6].

Precisely because ULCs reflect the outcome of the wider economic process, European Commission (2009) makes the case that *sectoral* ULC are more relevant than a whole-economy measure for assessing changes in competitiveness:

> 'Since all sectors within an economy compete for workers in the same labour market, wages in each sector will reflect the average level of productivity in the economy. If there is a sector where we have a comparative advantage, we should expect wages to grow more slowly than productivity, hence lowering ULC. As a consequence, sectoral ULC may point to comparative advantages and disadvantages vis-à-vis our trade partners without looking at trade flows.'[7]

Ca'Zorzi M. and Schnatz B. (2007) undertake an empirical examination of six alternative measures of cost/price competitiveness (including ULC for manufacturing industry and for the whole economy) for the euro area, by testing the impact of using each of the six in euro area export equations (with no sectoral disaggregation), but they do not find that any one measure outperforms the others.

2.2 Trends expected on the basis of economic theory

The principal relevant theory is the Balassa-Samuelson effect[8], which is conveniently summarised in Box 4.2 of OECD (2010a)[9].

> 'The Balassa-Samuelson effect arises because the growth of productivity differs among sectors, while wages tend to be less differentiated. Typically, productivity growth is faster in the traded goods sector than in the non-traded goods sector. To the extent that the faster productivity growth in the traded goods sector pushes up wages in all sectors, the prices of non-traded goods relative to those of traded goods will rise so leading to a rise in the overall price index. Given that the growth of productivity is typically faster in developing countries which are catching-up to developed countries, this effeect implies that, other things being equal, the real exchange rate of the former will tend to rise over time.'

This suggests that we would expect to see the following trends in ULCs and ULC-based REERs:

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[6] See, for example, Chapter 4 'Training, education and productivity' in European Commission (2009) *European Competitiveness Report 2009*, SEC(2009)1657 final, Enterprise and Industry Directorate-General. http://ec.europa.eu/enterprise/newsroom/cf/_getdocument.cfm?doc_id=5715

[7] European Commission (2009), Box 1.3, 'Labour costs and comparative advantage', p29.

[8] Balassa (B.) (1964): "The purchasing power parity: A reappraisal", *Journal of Political Economy*, vol 72, issue 6, pp. 584-596; Samuelson (P.) (1964): "Theoretical notes on trade problems", *The Review of Economic and Statistics*, vol 46, No. 2.

[9] OECD (2010a) *OECD Economic Outlook*, Volume 2010/1, May, Paris: OECD, p225.

- in all countries, ULCs rise faster in less traded sectors (notably among services, but potentially also among manufacturing sectors in which trade is less important), as labour costs per worker/hour worked rise at broadly similar rates across sectors while real productivity growth is faster in more traded sectors
- for the same reason, in all countries REERs in less traded sectors rise relative to those in more traded sectors
- these effects are stronger in those countries with lower productivity levels which are seeing fast productivity growth and catch-up with the richer countries
- when aggregated to the whole economy level, REERs in the countries that are catching up rise relative to those in the richer countries

However, European Commission (2011b) cites research that finds that find a Balssa-Samuelson effect for new Member States of only 1% per year, on average[10], and so if these effects exist at all in the data it is likely that they will be most apparent when comparing countries with larger differences in GDP per capita than exists within the EU.

[10] European Commission (2011b), p5.

3 Macroeconomic trends in unit labour costs, REERs and trade[11]

The main focus of the study has been to examine the trends in sub-sectors of manufacturing that underlie macroeconomic outcomes, but we begin by summarising briefly here the trends in key indicators of competitiveness and performance at a macroeconomic (i.e. all-manufacturing) level in order to provide a context for the sub-sector analysis.

3.1 Convergence and non-convergence in the eurozone

3.1.1 Unit labour costs

Figure 3.1 shows the trend in (own-currency) unit labour costs in four Member States whose experience can be described broadly as one of convergence from the mid-1990s and especially since the launch of the euro. For comparison, an average for a grouping of 10 EU Member States[12] is also shown. France and, to a lesser extent, Germany showed a sharper increase in ULCs than Austria and the Netherlands until the late 1980s / early 1990s, but a broadly similar trends thereafter. The inclusion of other countries in the EU10 average results in a still sharper increase in ULCs in the pre-euro period.

Figure 3.2 shows the equivalent indices for four Member States whose experience has not been one of convergence. Greece, Portugal, Spain and Italy saw (in that order) a sharper increase in ULCs than the EU10 average (in which Italy is included, but not the other three countries) prior to the mid-1990s. In the euro period, when the implications for competitiveness represented by that trend could not be offset by a depreciation in each country's currency against (say) the deutschemark, ULCs continued to increase more rapidly than the EU10 average.

[11] The results presented here use the results of the data analysis carried out for this project. Comparisons of our macroeconomic results with those published by the OECD and ECB are shown in Appendix B:.

[12] EU10 comprises Austria, Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Sweden and the UK.

Figure 3.1: Trends in unit labour costs among 'convergent' countries

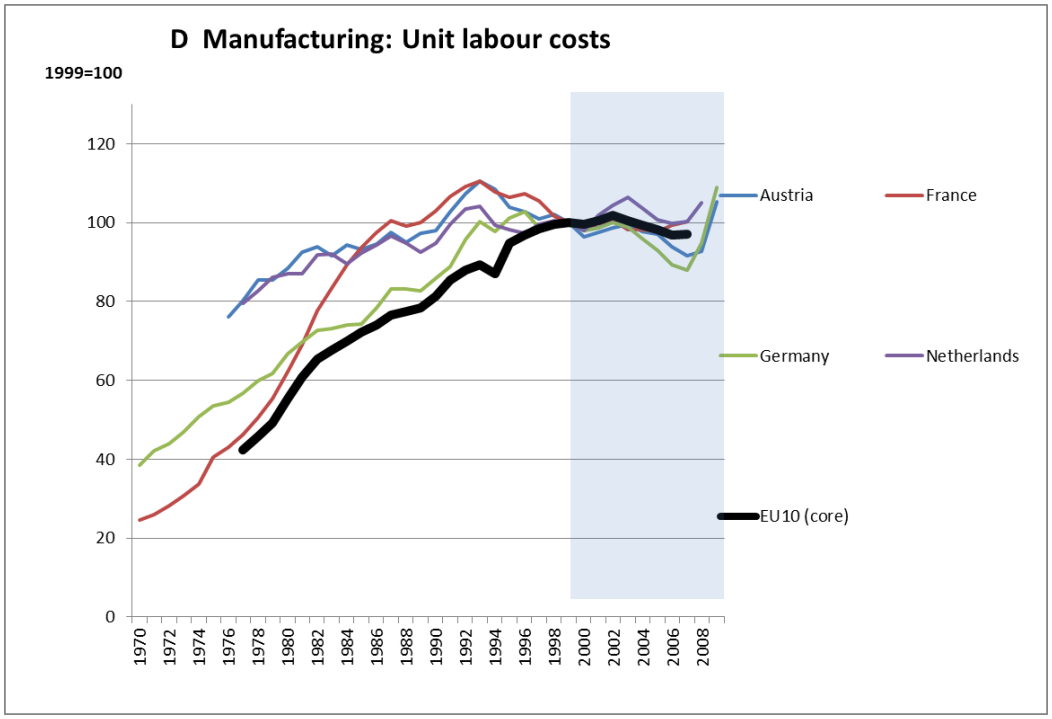
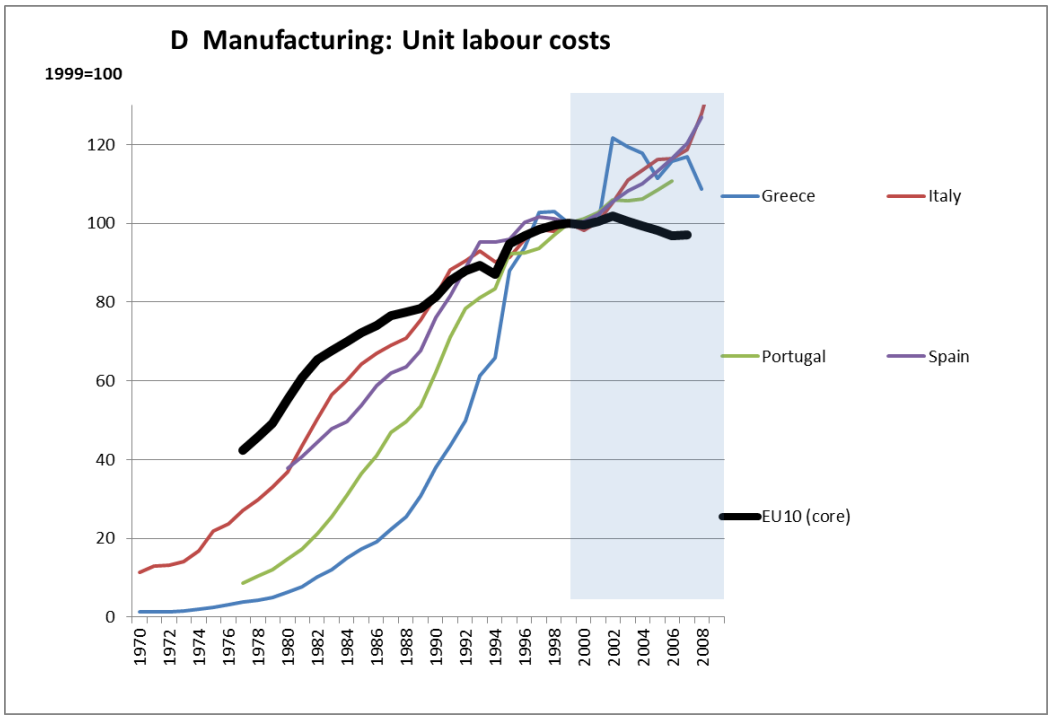


Figure 3.2: Trends in unit labour costs among 'non-convergent' countries



3.1.2 Real effective exchange rates

The REERs presented in Figure 3.3 and Figure 3.4 adjust ULCs to a common currency and compare each country's own ULC against those of a basket of trading partners, where the weights reflect the importance of each partner in the country's trade.

Figure 3.3 shows that Germany experienced an appreciation in its REER (i.e. a loss of labour cost-competiveness) over the decade from the mid-1980s to the mid-1990s, while the other three 'convergent' countries saw broadly no change. Towards the end of the 1990s this group saw a depreciation in their REERs (which reflected an appreciation of the US dollar). Since the launch of the euro they have seen similar trends, with Netherlands experiencing an appreciation in line with the EU10 average and Germany experiencing some depreciation.

Figure 3.3: Trends in real effective exchange rates among 'convergent' countries

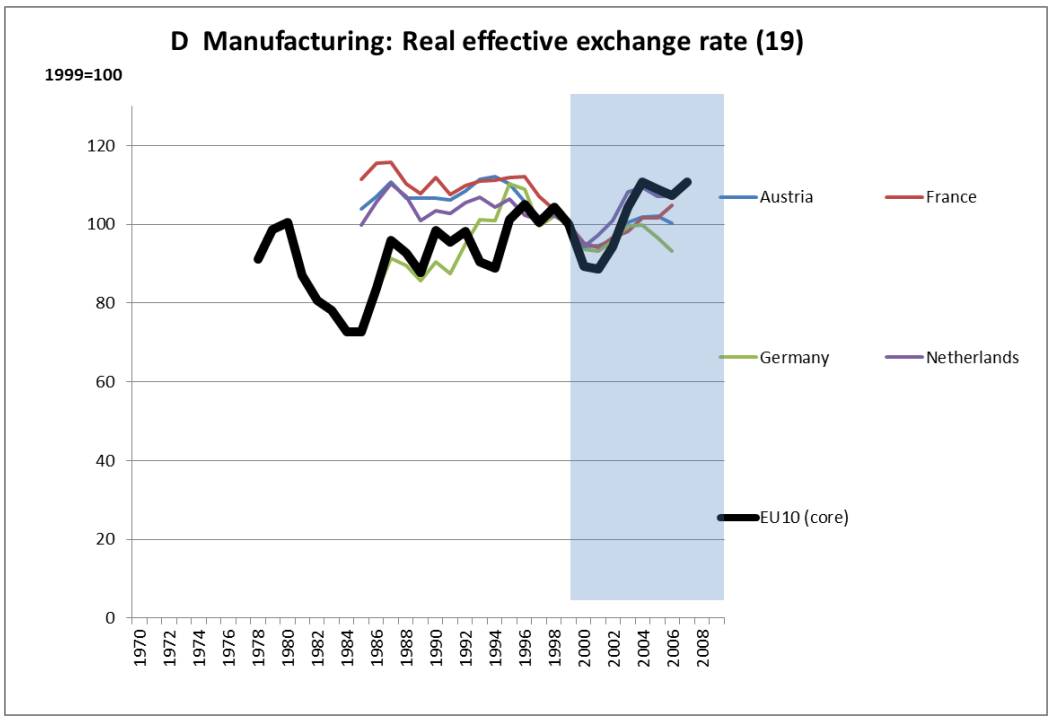
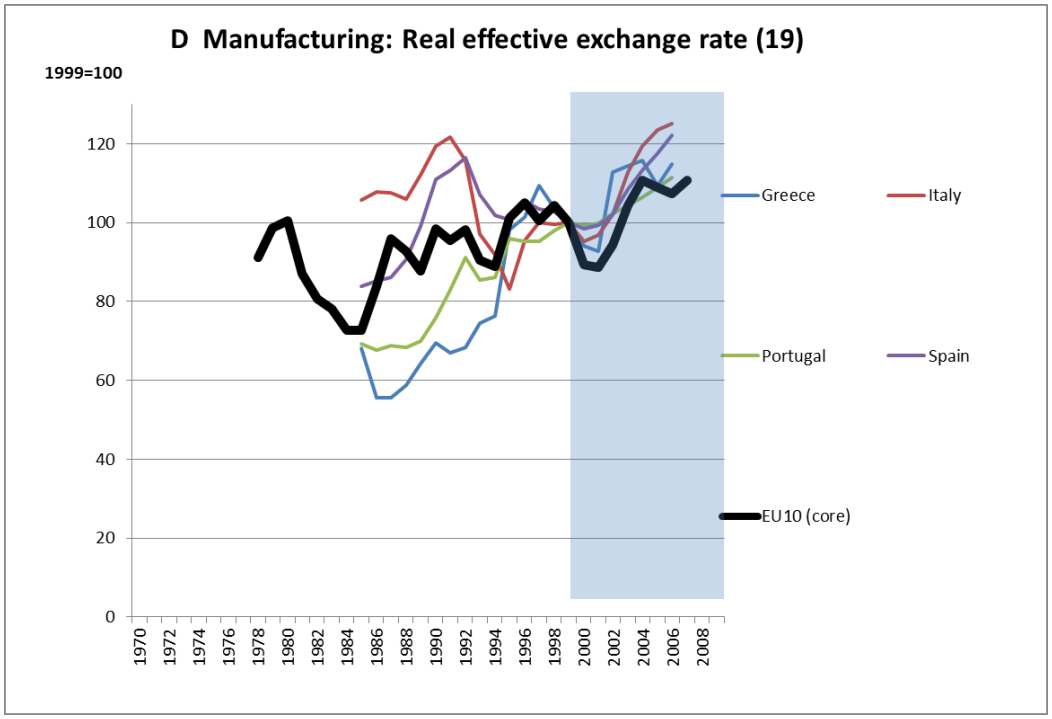


Figure 3.4 shows that, prior to the launch of the euro, currency depreciation allowed Italy and Spain to experience a depreciation in REERs, whereas the currency depreciation experience by Greece and Portugal was not large enough to offset fully the impact of higher ULC inflation. Since the launch of the euro, all have experienced a faster appreciation in REER than the EU10 average (which itself appreciated, driven particularly by a depreciation of the US dollar).

Figure 3.4: Trends in real effective exchange rates among 'non-convergent' countries



3.2 REERs and trade performance

Table 3.1 summarises the trends in the past decade for movements in the manufacturing balance of trade[13] and the REERs[14] based on comparative unit labour costs. Clearly, the trade balance is affected not only by cost competitiveness but also by quality competitiveness and the relative growth rates of domestic spending, and the table shows that there is no simple, consistent relationship between trends in the trade balance and trends in REERs. However, certain suggestive patterns are evident:

- a strong improvement in trade balance and reduction in REERs in Brazil and China
- an improvement in the trade balance of some core eurozone members, not associated with a reduction in REERs (Austria, Germany and the Netherlands)
- an increase in the REER of several new Member States, but a division among
  - those that achieved an improved balance of trade (Hungary) or at least no trend deterioration (the Czech Republic)
  - those that saw a deterioration in trade balance (Estonia, Latvia and Lithuania)
- a deterioration of the trade balance associated with an increase in REERs for southern EU Member States (Greece, Portugal, Spain)
- a deterioration, sometimes modest, in the trade balance for some core eurozone members associated with a higher REER (Denmark, Belgium, Italy)

[13] The manufacturing balance of trade is derived by aggregating the sectoral balances derived from the UN COMTRADE data. In most cases the trends identified correspond to those available from the OECD goods trade balances, but there are some exceptions.

[14] In the case of a few countries there is insufficient data to calculate REERs, in which case a judgement has been made as to the likely trend in REER given the trend in ULCs.

- trends in the trade balance of non-eurozone high-income EU Member States broadly consistent with the trend in their REERs (Sweden: improving; UK: deteriorating)

Table 3.1: Trends in manufacturing trade balance and real effective exchange rates, 1998-2008

		Trends in REER		
		Lower	**No trend**	**Higher**
Balance of trade	**Improving**	Brazil China	Germany	Austria Hungary Netherlands
	No trend	India Japan Poland	Finland USA	Czech Republic Ireland Italy
	Deteriorating	Slovakia Sweden	France Slovenia	Belgium Denmark Estonia Latvia Lithuania Romania Greece Portugal Spain UK

4 Analysis of trends for selected countries

This section reviews the trends in (ULC-based) real effective exchange rates by sector in each country. In each case the analysis focuses on the contribution of different subsectors to the all-manufacturing trend.

4.1 Common themes

While the picture is quite mixed, certain key themes emerge. For some countries, the *impact of macroeconomic changes* is felt across most sectors. This is true for the southern European eurozone members, where the loss of competitiveness is seen across all sectors. It is also true of countries outside of the eurozone whose currency movements have a common impact across sectors (Sweden, the UK and the USA).

4.1.1 The range of competitors considered in the REER

The focus in this chapter is on long-term trends in REERs, and so we focus on the REER(19) measure. However, this omits the most important low-cost competitors because of lack of data. For example, it excludes countries on the edge of Europe; similarly (with respect to the US) it exclude Mexico; and it excludes countries in the Far East. A key example of the potential importance of this is in wearing apparel, where a common trend across most Member States is the heavy loss of jobs and sharp deterioration in the trade deficit. In northern Member States this is mostly associated with an apparent improvement in ULC competitiveness (falling REER(19). To examine this issue more closely, Figure 4.1 compares the trends in narrow (REER(19) and broad (REER(30)) real effective exchange rates in Germany for wearing apparel (and, as context, also for all-manufacturing). The chart shows that the *inclusion of a broader range of competitors* (notably China) produces a less favourable outcome for the REER. But it also shows that the trend depreciation in Germany's wearing apparel REER remains, albeit at a less rapid rate.

For individual Member States, the weight of trade with other EU partners remains important: in the case of Germany, its labour cost-competitiveness is improving against southern European Member States. If we focus on groups of EU countries and exclude the internal trade among them from the calculation of REERs, the impact of extra-EU competition becomes more apparent, as Figure 4.2 shows. The figure shows the much sharper loss of competitiveness when the range of trading partners) is broadened (the latter indicator also has a broader group of EU countries, but the main effect is the extension of trading partners).

Figure 4.1: Comparing narrow and broad REERs for Germany

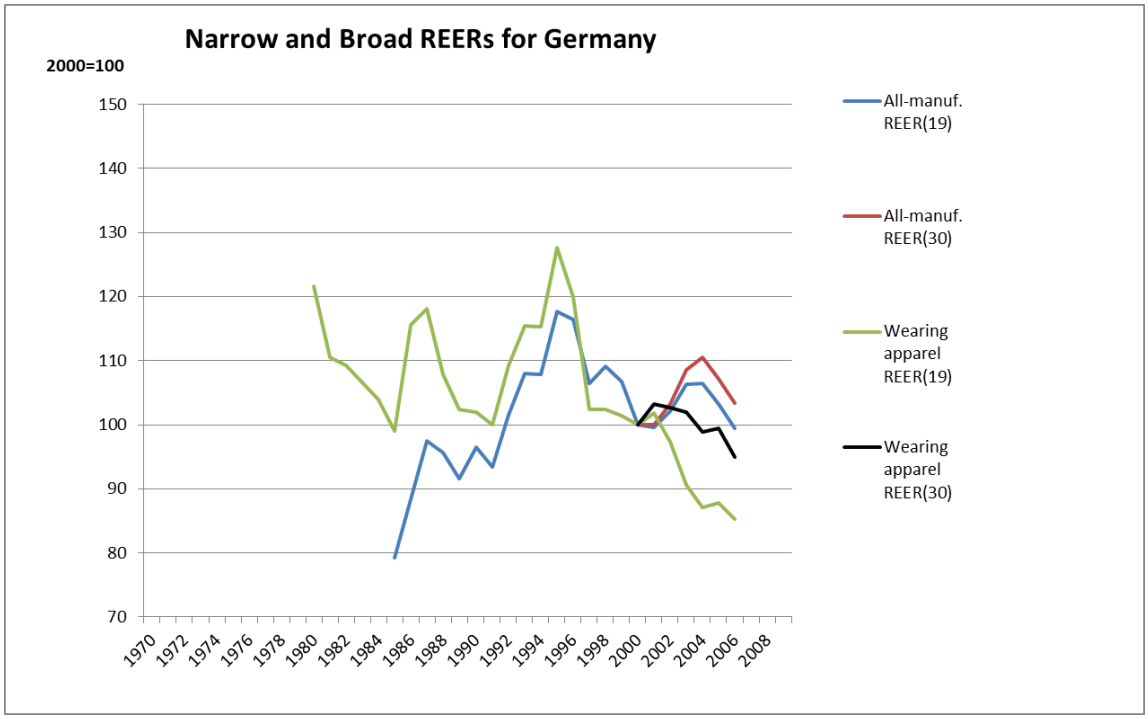
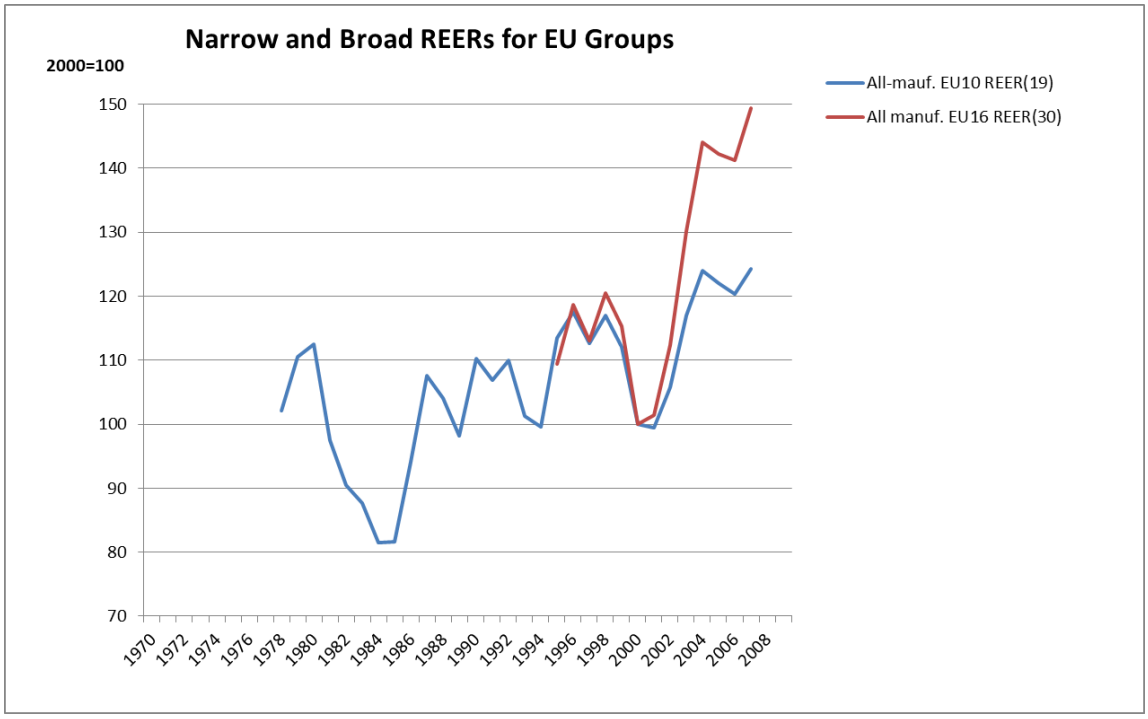


Figure 4.2: Comparing narrow and broad REERs for EU groups



This highlights the importance of knowing the proportion of trade in each sector that is accounted for by the countries covered in the REER comparison. Table 4.1 shows this

proportion for EU10 external trade with the partners included in the REER(19) measure, and for EU16 external trade with the partners included in the REER(30) measure.

Table 4.1: Trade with selected competitors as a share of all trade, by manufacturing sub-sector

%

	EU10				EU16					
	REER(19) partners				REER(30) partners					
	Exports		Imports		Exports		Imports		Exports To China	Imports From China
	1997	2007	1997	2007	1997	2007	1997	2007	2007	2007
15 Food and beverages	38.5	43.8	22.4	23.2	34.6	43.8	24.5	27.1	2.1	3.7
16 Tobacco	21.0	60.1	15.0	32.0	17.1	40.5	14.8	32.6	0.4	0.0
17 Textiles	33.7	31.0	27.4	21.0	38.1	41.8	39.5	52.1	4.6	23.0
18 Wearing apparel	42.6	41.2	14.7	6.8	43.0	38.9	36.4	51.2	2.1	36.5
19 Leather etc	41.6	33.5	24.8	13.6	48.8	48.2	49.3	61.1	6.3	36.7
20 Wood	37.1	37.7	29.7	17.9	35.6	40.9	43.2	48.1	3.6	16.1
21 Paper	31.1	29.9	48.1	35.9	29.9	35.0	57.0	64.7	6.7	21.1
22 Publishing	30.0	30.0	48.8	34.0	32.8	34.9	54.7	66.2	5.4	29.4
23 Coke, petroleum, etc	35.4	47.1	27.3	23.4	38.4	49.1	30.0	26.4	2.3	1.7
24 Chemicals	38.5	41.3	38.5	38.8	39.1	45.7	40.6	42.5	4.1	5.3
25 Rubber and plastics	34.4	31.7	42.6	39.1	32.7	38.8	45.2	55.9	7.2	13.5
26 Other non-met. mineral	35.7	34.0	39.1	33.6	37.5	40.5	45.1	59.0	4.2	24.3
27 Basic metals	38.7	32.9	25.2	24.0	39.9	43.8	26.9	36.6	8.3	11.4
28 Fabricated metal products	34.8	31.4	29.0	23.2	41.5	44.0	35.9	43.7	7.4	16.5
29 Machinery and equipment	38.3	34.6	51.7	35.2	42.8	45.4	57.4	62.3	8.5	24.0
30 Office machinery	43.2	33.6	50.1	19.4	43.4	38.8	56.1	58.8	3.7	38.3
31 Electrical machinery	36.3	35.0	50.1	34.7	38.5	44.3	55.4	61.2	7.9	22.9
32 Communication equipment	29.1	29.5	50.8	33.7	33.3	39.1	56.5	65.7	8.8	28.0
33 Instruments	36.3	34.6	46.6	35.1	43.2	45.7	53.6	57.1	7.5	19.0
34 Motor vehicles	47.8	45.8	59.0	51.3	43.3	47.2	54.1	58.9	5.2	5.0
35 Other transport eq	49.4	42.5	53.8	57.0	52.3	51.2	55.8	70.8	8.4	9.3
36 Furniture and other	37.0	34.5	31.0	19.7	42.4	44.9	49.5	58.4	5.3	33.4
37 Recycling	37.6	32.1	25.3	23.8	38.8	43.1	27.9	36.9	7.9	12.0
D Manufacturing	38.5	37.7	40.6	32.0	40.6	44.9	46.6	52.0	6.2	17.6

EU10 (core): Austria, Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Sweden, UK

Competitors for EU10 (core): Greece, Portugal, Spain, Canada, Japan, Norway, South Korea, USA

EU16: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Netherlands, Slovakia, Slovenia, Spain, Sweden, UK

Competitors for EU16: Estonia, Lithuania, Portugal, Romania, Canada, Iceland, Japan, Norway, South Korea, USA, Brazil, India, China

Source: UN COMTRADE.

The table shows, firstly, the impact on the coverage of trade that results from broadening the selection of trading partners (the figures are generally higher in the columns headed 'REER(30) trading partners' than those in 'REER(19) trading partners'). But the more

important point is that, for some sectors, the difference is very large and has become much more important in the past decade. The most extreme example is wearing apparel, where the share of EU10 imports accounted for by the REER(19) trading partners fell from 15% in 1997 to just 7% in 2007, whereas the share of of EU16 imports accounted for by the REER(30) partners rose from 36% in 1997 to 51% in 2007.

The dominant effect in the change in trade shares has been the growth of trade with (and especially imports from) China. The size of these shares of trade with EU16 in 2007 is shown in the final columns of the table.

4.1.2 Differences in the price sensitivity of trade across countries and sectors

The macroeconomic finding noted in Section 3.2 that there is no simple, consistent relationship between *trends in the trade balance and trends in REERs* is also borne out at the level of individual sectors. There is no common theme that improvements in ULC competitiveness are associated with an improved trade performance, or vice versa. There are examples consistent with this pattern, and there are counter-examples. In some cases, the examples of an improved trade balance despite a deterioration in ULC competitiveness seem consistent with known strengths in terms of quality. Examples include electrical machinery, instruments and motor vehicles in Germany, 'other' transport equipment (which includes aerospace) in France, the UK and the USA, and chemicals (which includes pharmaceuticals) in the UK and the USA.

Relative costs are not the only determinant of trade performance. For example, a country that is undergoing a period of unusually strong growth in domestic spending will typically experience a deterioration in its trade balance across a number of sectors. A fuller analysis would therefore take account of a wider range of factors influencing a country's exports and imports in order to assess the importance of relative costs. While it was beyond the scope of the present study to undertake such an analysis, Table 4.2 compares the size of relative price elasticities for extra-EU exports and imports for Germany and Spain. It is immediately obvious that the elasticities for the exports of German manufacturing sectors are generally much lower than for those in Spain, supporting the interpretation that the competitiveness of German firms is more associated with quality than price, compared to those in Spain.

Table 4.2: Comparison of size export price elasticities for manufacturing sectors in Germany and Spain

	Extra-EU export price elasticity	
	Germany	Spain
5 Food, Drink & Tob.	low	low
6 Text., Cloth. & Leath	low	very high
7 Wood & Paper	very high	very high
8 Printing & Publishing	medium	medium
9 Manuf. Fuels	low	very high
10 Pharmaceuticals	low	low
11 Chemicals nes	low	medium
12 Rubber & Plastics	low	low
13 Non-Met. Min. Prods.	low	very high
14 Basic Metals	low	very high
15 Metal Goods	low	very high
16 Mech. Engineering	low	high
17 Electronics	medium	very high
18 Elec. Eng. & Instrum.	low	high
19 Motor Vehicles	low	high
20 Oth. Transp. Equip.	low	low
21 Manuf. nes	low	medium

The sensitivity is measured by the relative price elasticity for extra EU exports estimated in Cambridge Econometrics E3ME model. The categories are assigned as follows:
"very high" = greater than 0.9 in absolute magnitude
"high" = 0.6 to 0.9 in absolute magnitude
"medium" = 0.3 to 0.6 in absolute magnitude
"low" = less than 0.3 in absolute magnitude

4.1.3 The importance of labour costs in each sector's cost structure

It was noted in the literature review that ULCs may be a misleading indicator of competitiveness in cases (industries) where labour costs are a small element of total costs. This needs some qualification. If we are concerned with a comparison of the cost-competitiveness of different geographical locations, what matters is the cost elements that vary between those locations. For example, metal-bearing raw materials represent a substantial proportion of total costs in the metal-refining sector, but because these raw materials are typically available at broadly the same cost in competing locations (because they are purchased from a global market), this large element of overall costs does not represent a key factor in the competitiveness of alternative locations. Another substantial cost element in this (capital-intensive) sector is the depreciation of capital, but again if the cost of capital to the multinational enterprises that dominate this sector does not differ across investment locations then it, too, is not a factor that will influence the choice of investment site or the profitability of operation in different locations. In contrast, another important element is energy costs, and these costs differ substantially (because markets are fragmented and because of the influence of regulation and other forms of policy intervention) across locations, making them a significant factor in the competitiveness of alternative locations for energy-intensive sectors.

Labour costs (and their component elements of wages and labour productivity) clearly differ across locations, and so even where their share in a sector's overall costs is by no means dominant (which is the case in all manufacturing industries), in most sectors they remain a more relevant factor in cost-competitiveness than that statistic might suggest. Furthermore, to the extent that an industry uses bought-in goods and services that are less than perfectly tradable internationally, the embodied labour costs of domestically-produced inputs are also an influence on competitiveness.

Table 4.3 Compensation of employees as a proportion of output by selected country and sector, 2007

					%
	Germany	France	Spain	UK	Average of four countries
D Manufacturing	19.6	16.3	15.1	23.9	18.9
G-H Trade, hotels and restaurants	35.2	31.8	23.7	32.6	30.1
I Trans., storage and comms.	22.1	28.1	17.9	29.9	25.2
J-K Fin. & bus. services	25.1	27.8	28.4	28.2	27.3
15 Food and beverages	15.0	13.3	12.0	22.7	15.5
16 Tobacco	21.1	17.4	26.2	18.0	20.1
17 Textiles	22.6	21.1	22.1	33.3	24.4
18 Wearing apparel	17.6	19.6	21.0	31.2	21.3
19 Leather etc	18.1	26.9	19.0	23.8	21.2
20 Wood	17.0	19.5	18.4	26.7	19.5
21 Paper	17.5	16.5	15.3	23.2	18.1
22 Publishing	20.8	28.2	24.7	32.8	26.6
23 Coke, petroleum etc	2.7	2.6	1.8	9.9	3.8
24 Chemicals	18.3	11.5	14.7	18.0	16.0
25 Rubber and plastics	22.7	23.4	20.0	29.5	23.8
26 Other non-met. mineral	22.4	21.1	17.3	26.2	21.2
27 Basic metals	12.5	10.6	9.5	14.3	11.8
28 Fabricated metal products	24.9	27.4	21.6	33.9	26.4
29 Machinery and equipment	24.6	23.4	21.9	28.6	24.7
30 Office machinery	18.3	12.3	22.5	20.8	18.9
31 Electrical machinery	25.9	22.7	14.3	27.3	23.9
32 Communication equipment	20.1	19.9	13.0	22.4	19.9
33 Instruments	29.7	28.7	24.4	30.8	29.4
34 Motor vehicles	17.5	10.3	11.0	16.9	15.3
35 Other transport eq.	23.3	11.9	20.2	26.6	19.1
36 Furniture and other	24.5	22.1	25.5	25.3	24.4
37 Recycling	12.0	12.8	7.1	-	10.5

Source: Eurostat use tables at purchasers prices

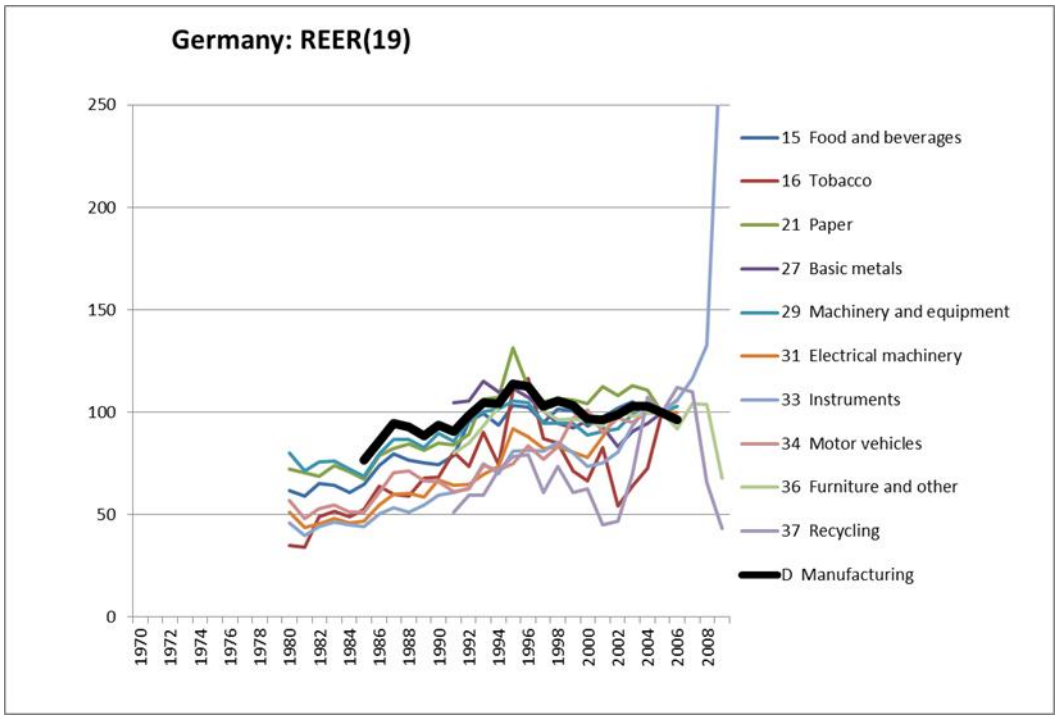
(http://epp.eurostat.ec.europa.eu/portal/page/portal/esa95_supply_use_input_tables/data/workbooks).

Notwithstanding these caveats, it is of interest to be aware of the differences in the share of labour costs (compensation of employees) in production (output at basic prices) across manufacturing sectors, and these are shown in Table 4.3, together with some comparisons with service sectors. The table highlights the smaller shares of labour costs in capital-intensive industries, notably coke, petroleum etc., but also basic metals, food processing, motor vehicles, chemicals and paper. On this measure, the most labour-intensive manufacturing industries are instruments, fabricated metal products and publishing. As expected, the service sectors have high shares of labour costs.

4.2 Country results

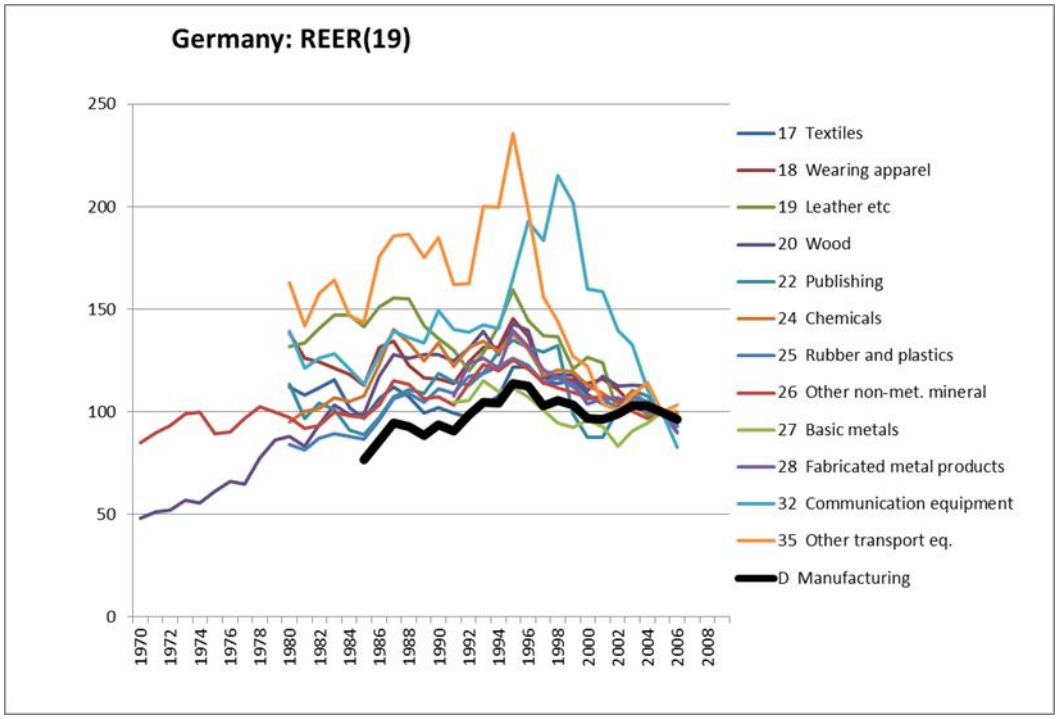
4.2.1 Germany

Figure 4.3: Sectors whose ULC competitiveness is worsening relative to the manufacturing average (or similar to that average)



Trends in these sectors are generally quite similar to the manufacturing average for Germany. The sectors which have seen a particular deterioration in ULC competitiveness are electrical machinery, motor vehicles and instruments. All of these have, nevertheless, seen an improvement in their trade balance, suggesting that the measured deterioration actually reflects a move towards quality which is not captured in the volume measure of GVA.

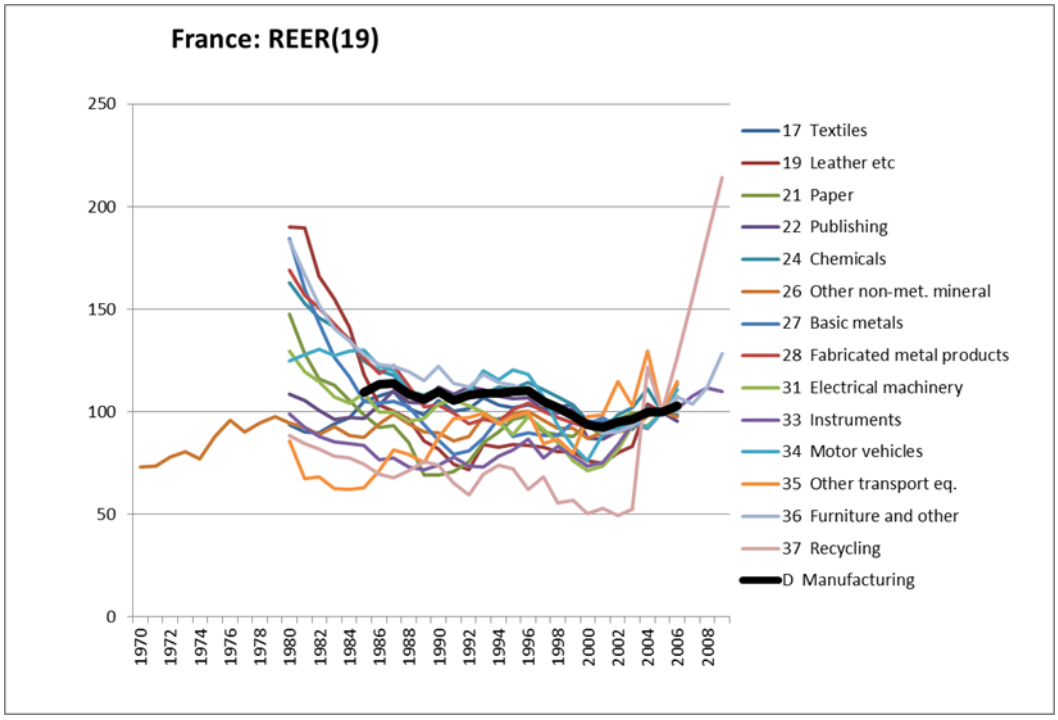
Figure 4.4: Sectors whose ULC competitiveness is improving relative to the manufacturing average



Some of the sectors that have seen an improvement in ULC competitiveness are 'traditional' sectors in which price competitiveness is generally important: textiles, wearing apparel and leather etc. The improvement in ULC competitiveness was associated with a sharp reduction in employment and fast increases in productivity. This suggests that price competition effects were associated with restructuring. Germany's balance of trade in textiles saw a shift from deficit to surplus over the past 20 years, while the deficits in wearing apparel and leather etc were sustained (but did not deteriorate further).

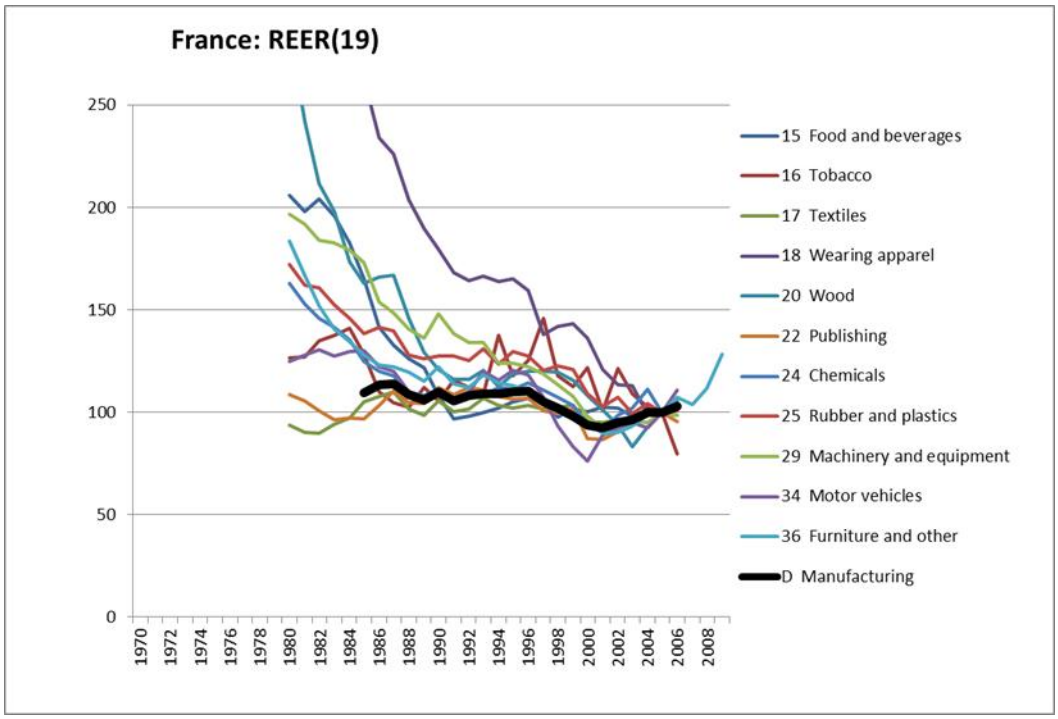
4.2.2 France

Figure 4.5: Sectors whose ULC competitiveness is worsening relative to the manufacturing average (or similar to that average)



The sectors whose ULC competitiveness deteriorated most were instruments and other transport equipment (which includes aerospace). Instruments saw a marked deterioration in its trade balance, but other transport equipment saw a marked improvement.

Figure 4.6: Sectors whose ULC competitiveness is improving relative to the manufacturing average

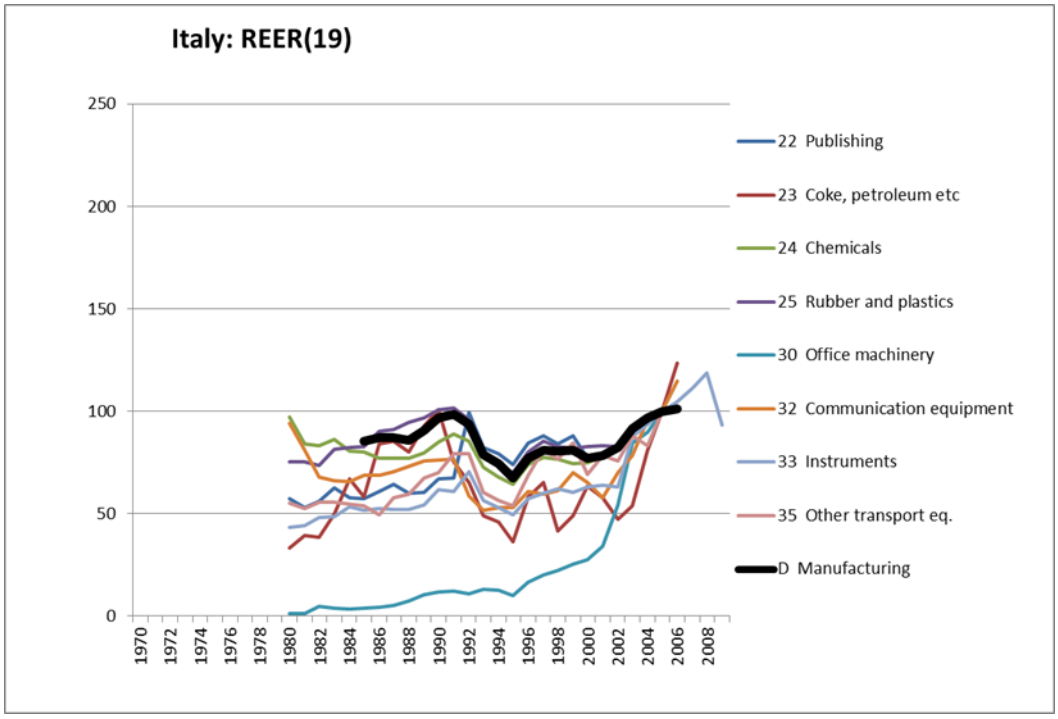


As in Germany, wearing apparel in France has seen a large improvement in ULC competitiveness, while the trade balance has deteriorated sharply and employment has fallen heavily, consistent with restructuring driven by globalisation. Machinery and equipment has seen a similar outcome in terms of a deterioration in the trade balance despite an improvement in ULC competitiveness, but the loss of employment has been in line with manufacturing as a whole.

In contrast, food and beverages has seen a marked improvement in ULC competitiveness associated with a strong improvement in the trade balance and modestly increasing employment.

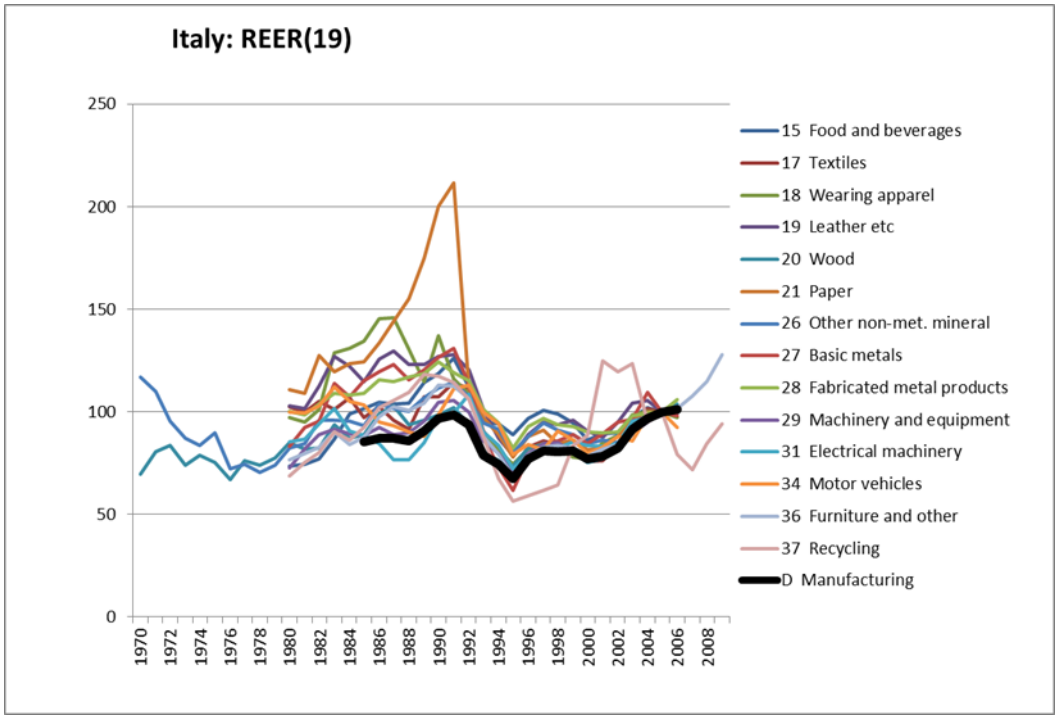
4.2.3 Italy

Figure 4.7: Sectors whose ULC competitiveness is worsening relative to the manufacturing average (or similar to that average)



The sectors seeing the worst deterioration in ULC competitiveness in Italy (excluding office machinery where data are generally difficult to interpret) are instruments and communications equipment. The trade balance in instruments has improved and employment has been broadly flat (better than for manufacturing as a whole), while the trade balance in communications equipment has deteriorated and employment has fallen more sharply than manufacturing as a whole.

Figure 4.8: Sectors whose ULC competitiveness is improving relative to the manufacturing average



The outcomes for textiles, wearing apparel and leather have been rather different in Italy than in Germany and France. These sectors initially saw an improvement in ULC competitiveness (to the mid-1990s) but thereafter the trend was similar to manufacturing as a whole (a deterioration, during the euro era). Despite this latter deterioration, Italy's trade performance has been strong in textiles and leather; the surplus in wearing apparel has fallen away. But in all three sectors there has been a sharper reduction in employment than in manufacturing as a whole.

Basic metals and fabricated metal products also saw an improvement in ULC competitiveness to the mid-1990s and some deterioration thereafter. In basic metals the trade balance has deteriorated and employment has fallen at about the same rate as in manufacturing as a whole. In fabricated metal products, the trade surplus has been maintained and employment has increased.

4.2.4 Belgium

Figure 4.9: Sectors whose ULC competitiveness is worsening relative to the manufacturing average (or similar to that average)

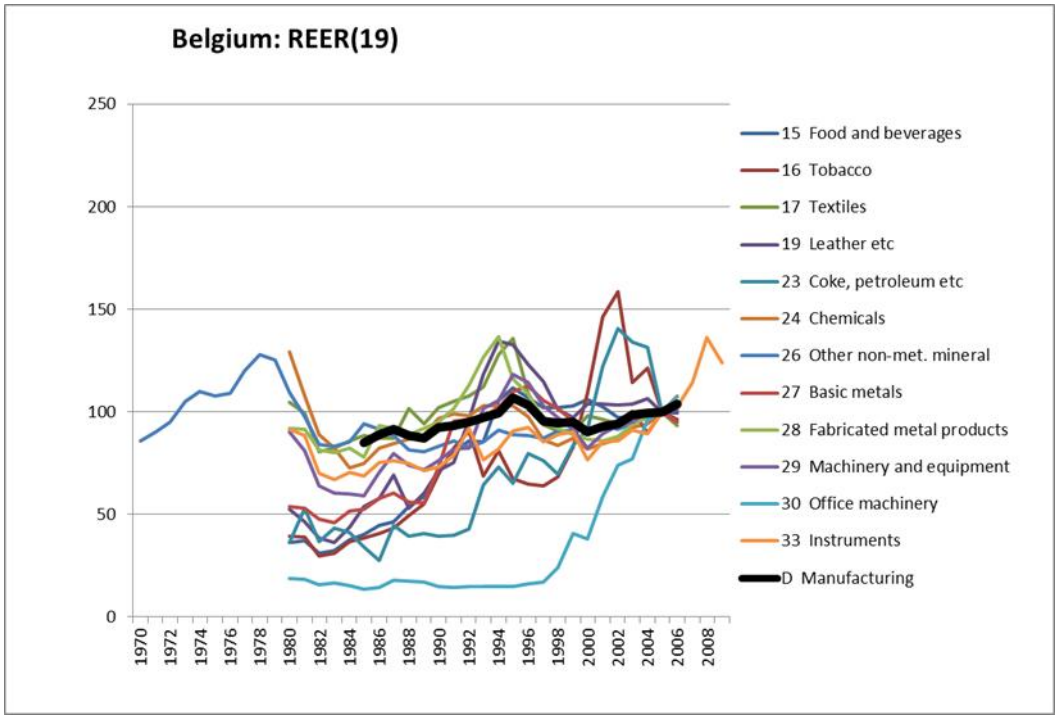
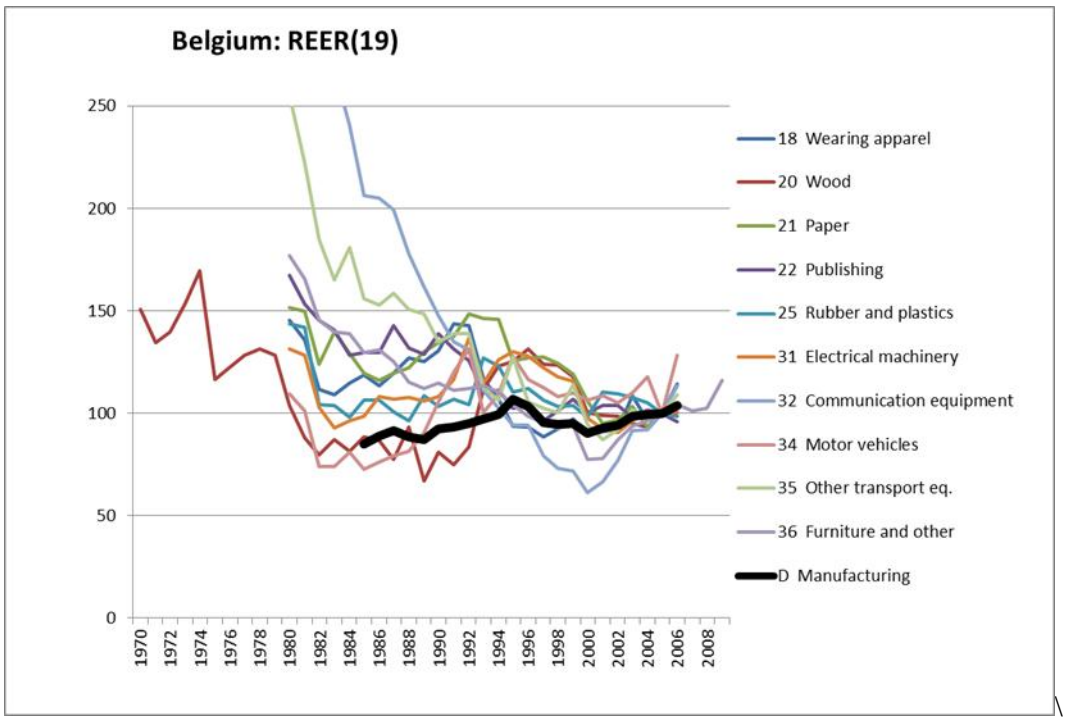


Figure 4.10: Sectors whose ULC competitiveness is improving relative to the manufacturing average



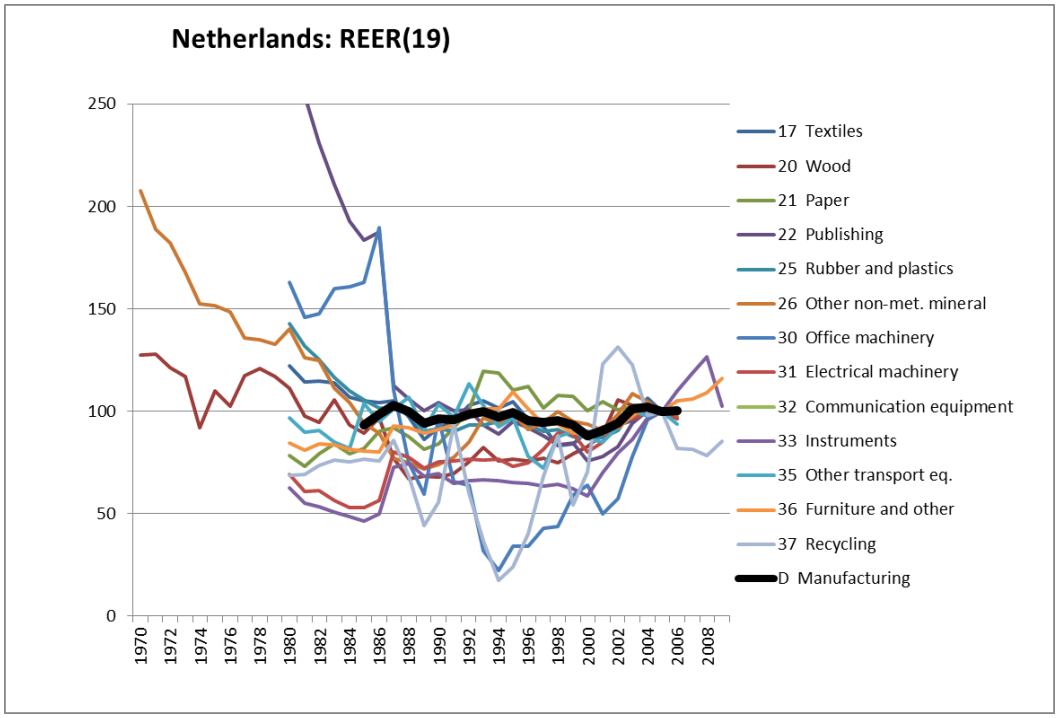
Basic metals, instruments and machinery and equipment have all seen a relatively fast deterioration in ULC competitiveness. The trade deficits in instruments and machinery

and equipment have deteriorated further, while reductions in employment have not been as sharp as in manufacturing as a whole. The trade surplus in basic metals has been broadly stable, and job losses here were heavy in the two decades up to 2000 but the rate of decline since then has been broadly in line with manufacturing as a whole.

Belgium has seen a similar trend in wearing apparel as the other northern European eurozone members: an improvement in ULC competitiveness together with a sharp deterioration in the trade deficit and a sharp reduction in employment. Both electrical machinery and other transport equipment have seen a deteriorating trade deficit despite an improvement in ULC competitiveness, but the rate of job loss has been broadly similar to that in manufacturing as a whole.

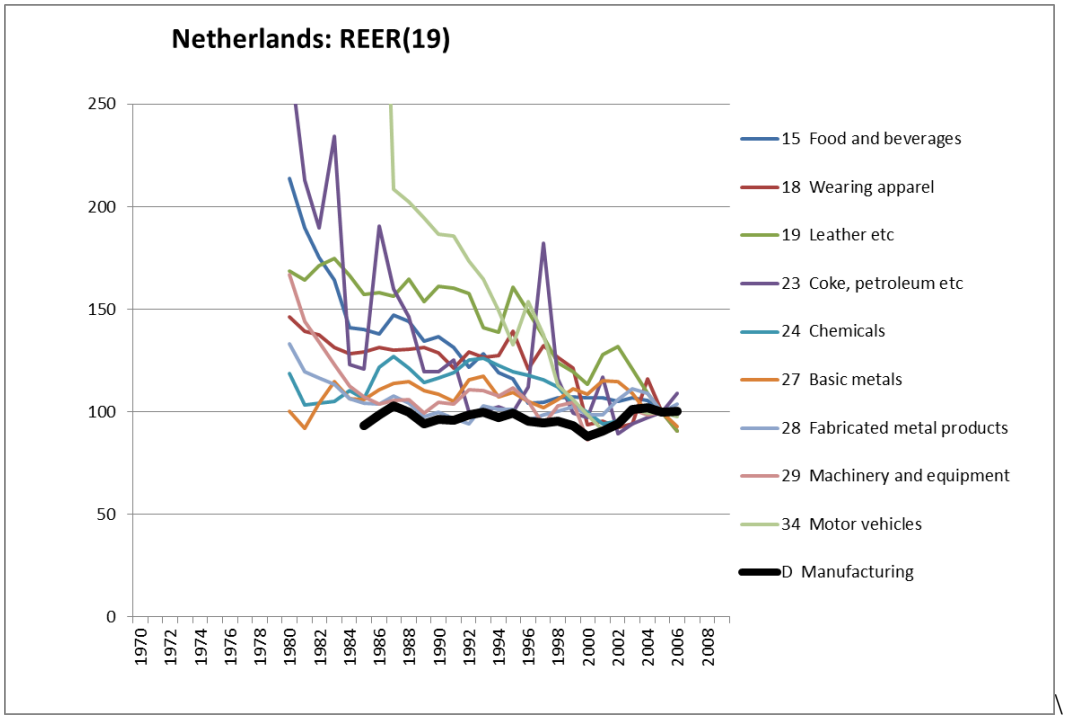
4.2.5 Netherlands

Figure 4.11: Sectors whose ULC competitiveness is worsening relative to the manufacturing average (or similar to that average)



In the Netherlands, instruments and electrical machinery have both seen a marked deterioration in ULC competitiveness. This has been associated with a deteriorating trade performance and faster rate of job loss in these sectors than in manufacturing as a whole.

Figure 4.12: Sectors whose ULC competitiveness is improving relative to the manufacturing average



The Netherlands has seen a similar trend in wearing apparel as the other northern European eurozone members: an improvement in ULC competitiveness together with a sharp deterioration in the trade deficit and a sharp reduction in employment.

Motor vehicles, food and beverages and chemicals have all seen an improvement in their ULC competitiveness. The trade deficit in motor vehicles saw some improvement in the past decade, while the trade surpluses in food and beverages and chemicals have strengthened, consistent with the improved ULC competitiveness.

4.2.6 Austria

Figure 4.13: Sectors whose ULC competitiveness is worsening relative to the manufacturing average (or similar to that average)

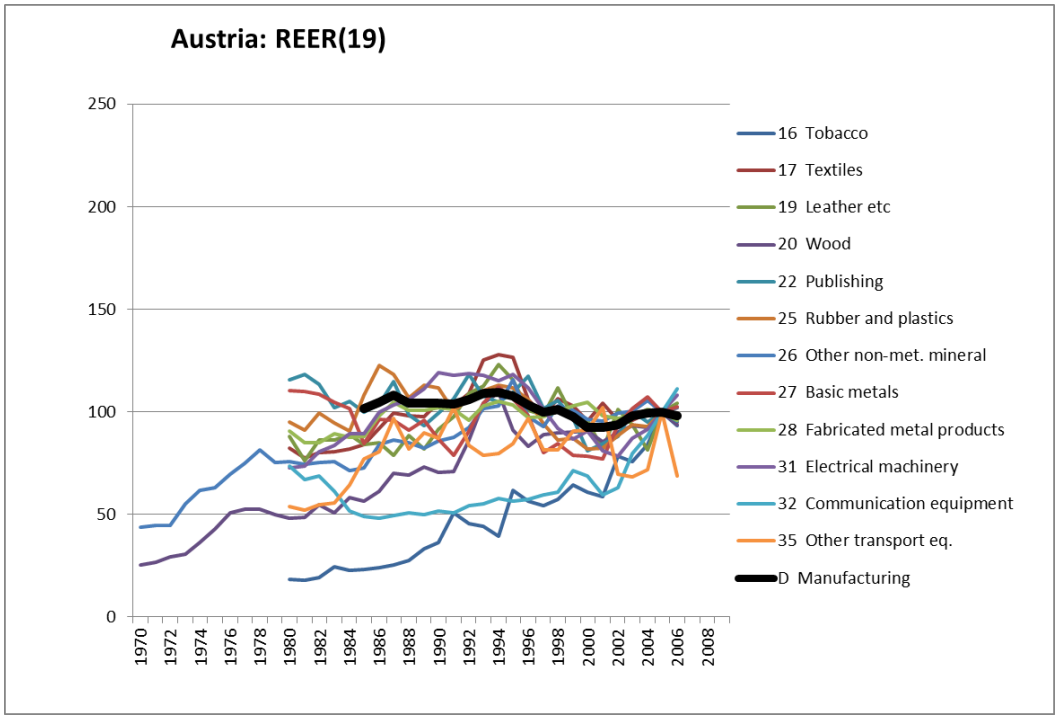
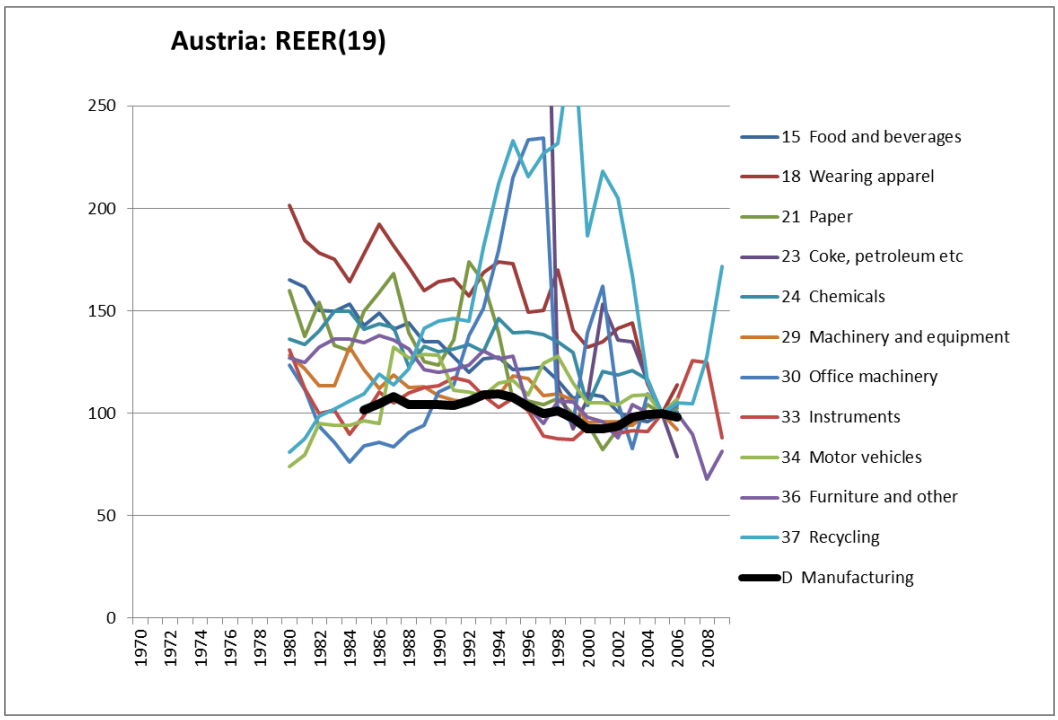


Figure 4.14: Sectors whose ULC competitiveness is improving relative to the manufacturing average



In Austria, both wood and other non-metallic mineral products have seen a deterioration in ULC competitiveness, an improvement in the trade surplus and a rate of decline in

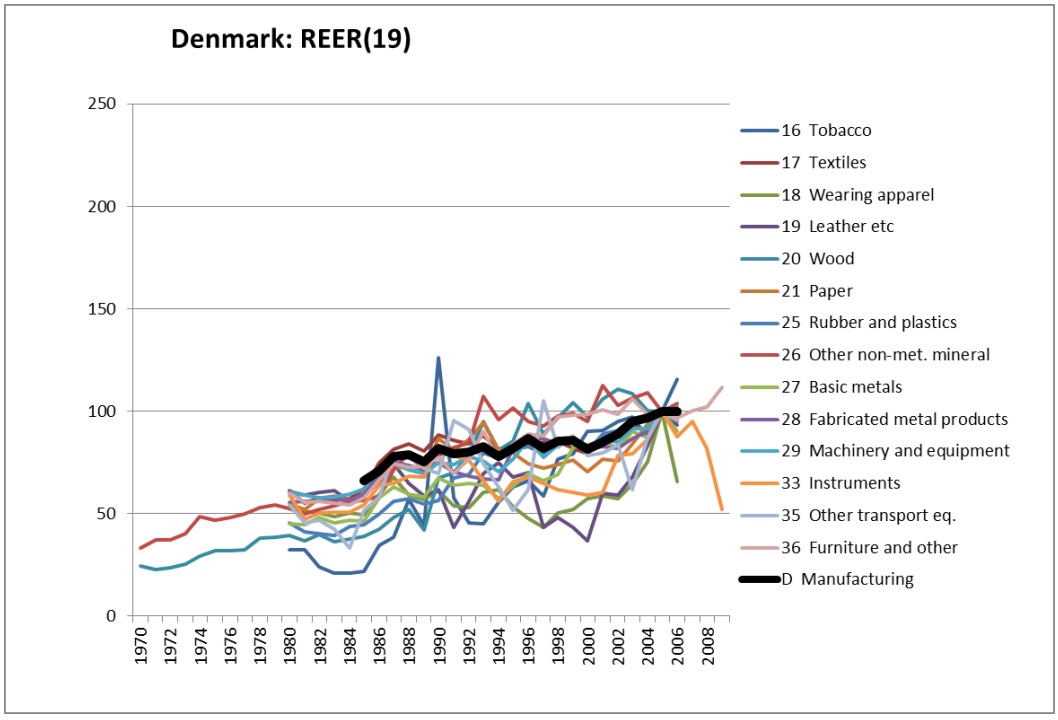
employment no faster than in manufacturing as a whole, suggesting an offer based on quality.

Austria has seen the same trend in wearing apparel as the other northern European eurozone members: an improvement in ULC competitiveness together with a sharp deterioration in the trade deficit and a sharp reduction in employment.

Food and beverages and chemicals have seen a marked improvement in ULC competitiveness, an improvement in the trade balance and a similar rate of employment as in manufacturing as a whole.

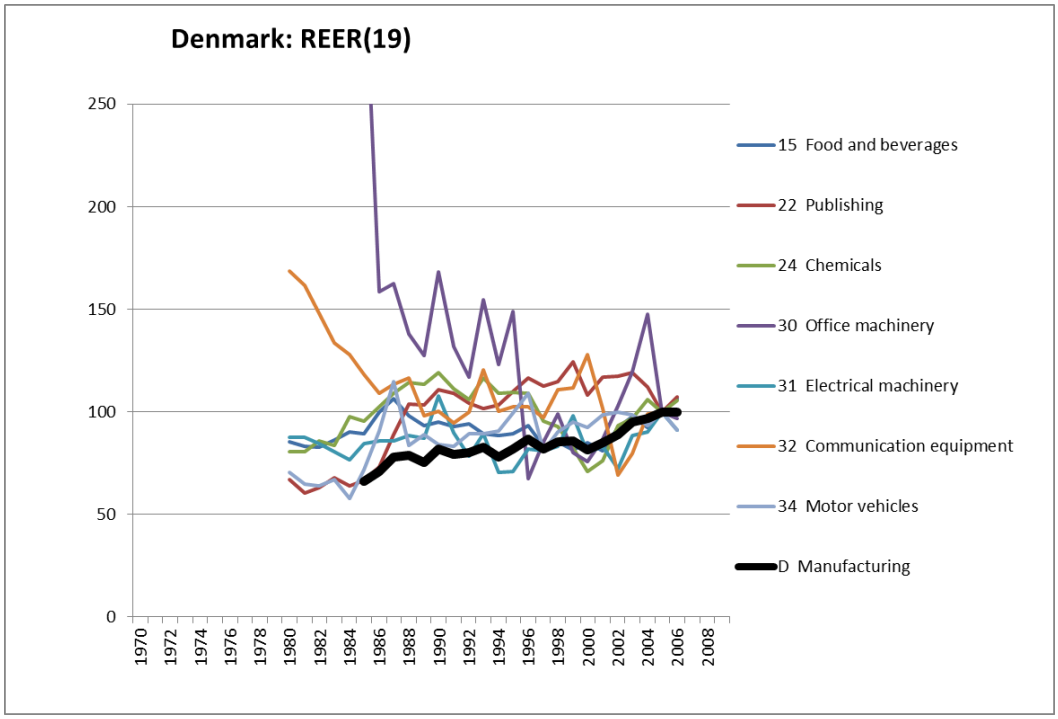
4.2.7 Denmark

Figure 4.15: Sectors whose ULC competitiveness is worsening relative to the manufacturing average (or similar to that average)



Denmark differs from most of the other northern European Member States in that here wearing apparel (and leather etc) saw a deterioration in ULC competitiveness. In other respects the experience of these industries was similar, however: a sharp deterioration in the trade balance and large job losses. One interpretation would be that its industry did not respond as vigorously to the impact of globalisation. Other sectors that showed a marked loss of ULC competitiveness were wood and basic metals. These both saw a sharp deterioration in their trade deficit, but while basic metals also saw large job losses, employment in wood was broadly flat in the decade prior to the recession.

Figure 4.16: Sectors whose ULC competitiveness is improving relative to the manufacturing average



Food and beverages and chemicals saw an improvement in the ULC competitiveness and this was consistent with an improved trade performance. Office machinery and communication equipment saw an improvement in ULC competitiveness but a deterioration in trade performance.

4.2.8 UK

Figure 4.17: Sectors whose ULC competitiveness is worsening relative to the manufacturing average (or similar to that average)

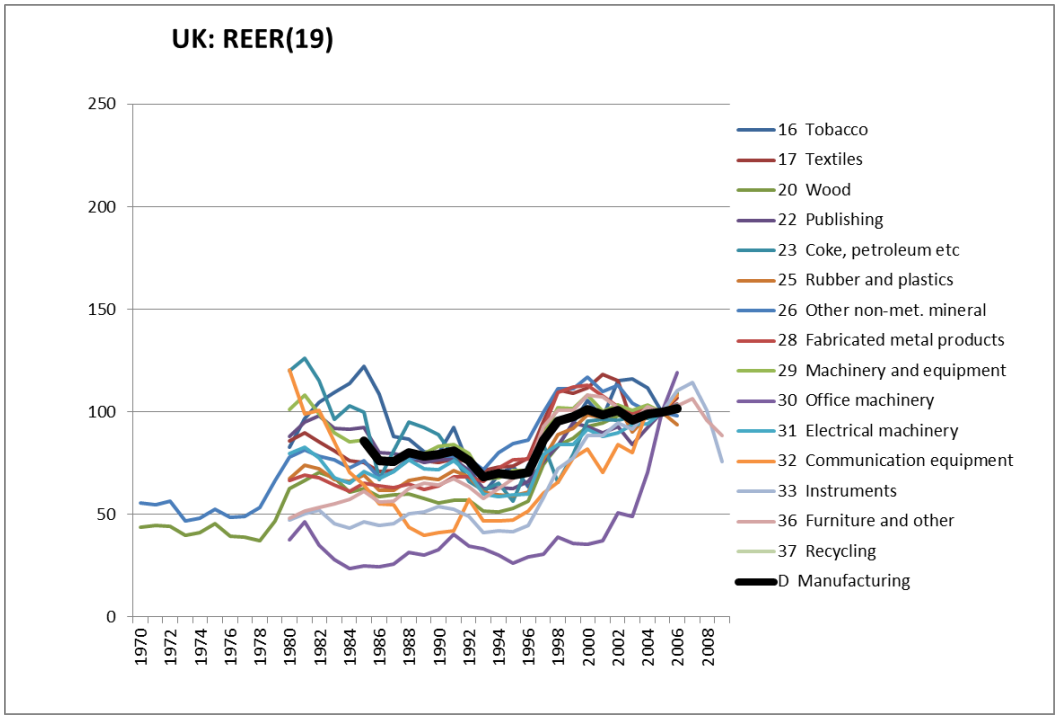
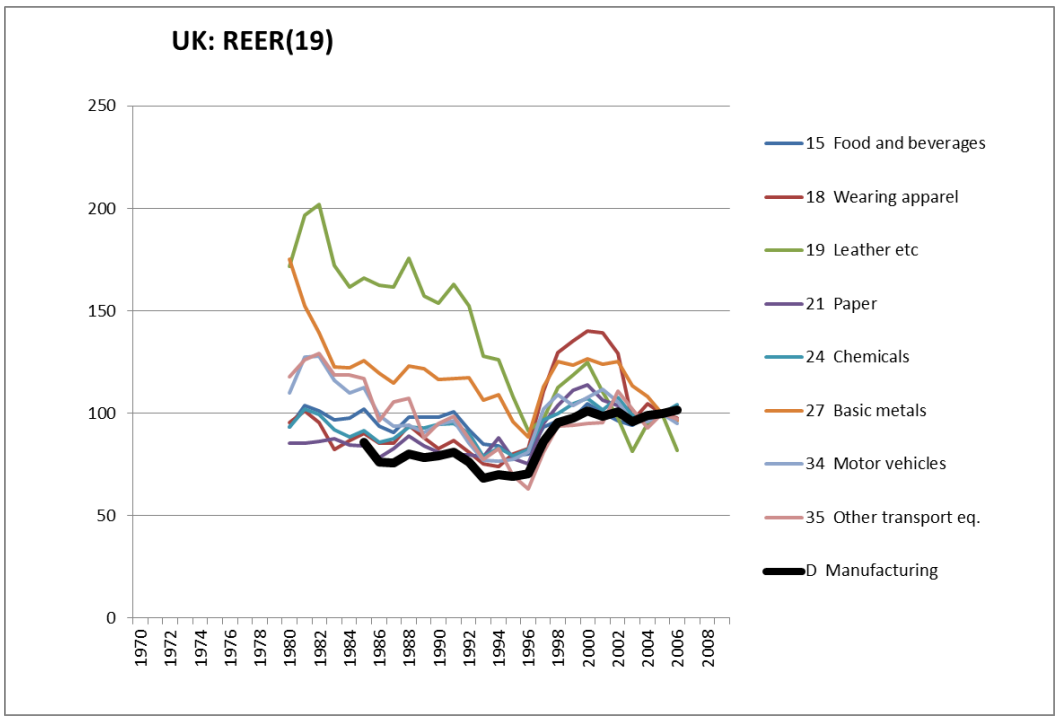


Figure 4.18: Sectors whose ULC competitiveness is improving relative to the manufacturing average



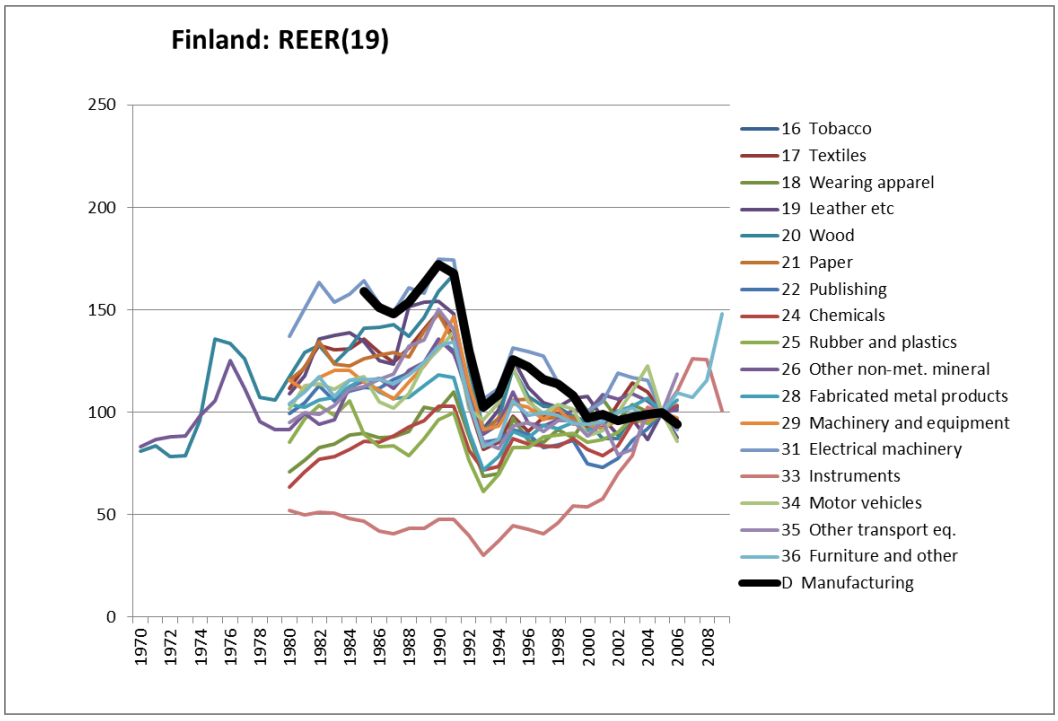
The ULC competitiveness of most sectors in the UK is heavily affected by movements in sterling against the euro, and in particular the strong level of sterling for much of the

decade prior to the recession. Sectors that saw a stronger than average deterioration in ULC competitiveness include wood, rubber and plastics, fabricated metal products, machinery and equipment and instruments. All saw a deterioration in their trade performance, but their job losses were not worse than the average for manufacturing as a whole and in some cases (wood and rubber and plastics) were better.

The UK saw something of the trend evident elsewhere in northern Europe in wearing apparel: an improvement in ULC competitiveness but a sharp deterioration in trade performance and very heavy job losses. Prior to the surge in sterling at the end of the 1990s both chemicals (which includes pharmaceuticals) and other transport equipment (which includes aerospace) also saw an improvement in ULC competitiveness, but this was partly reversed from the late 1990s onwards. Both saw an improvement in their trade balance.

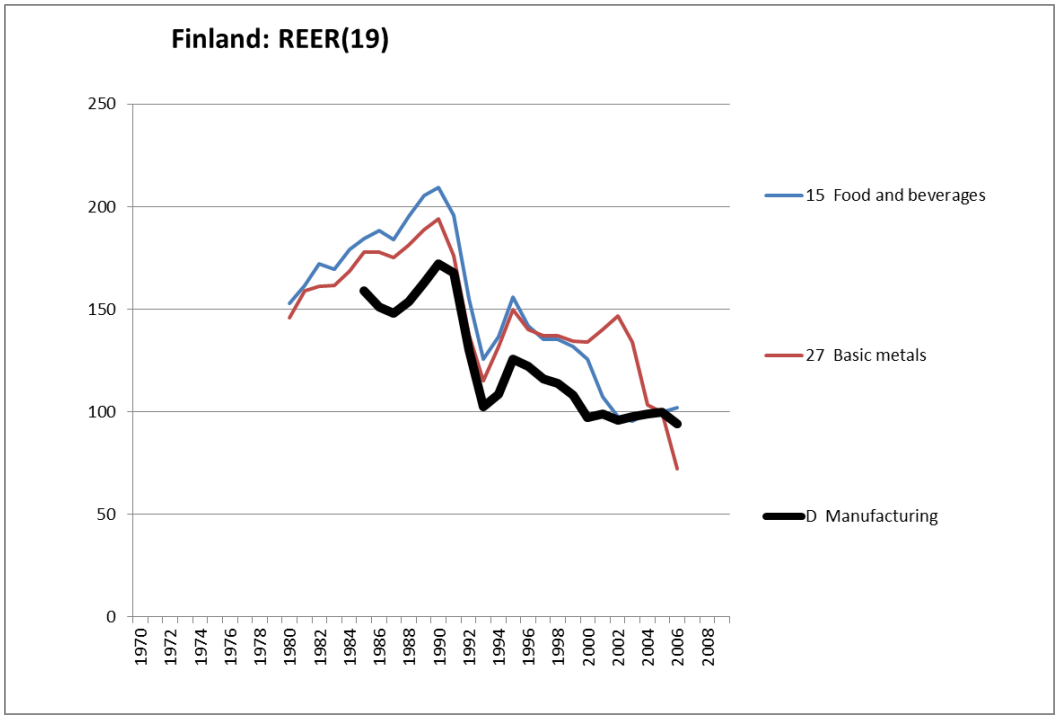
4.2.9 Finland

Figure 4.19: Sectors whose ULC competitiveness is worsening relative to the manufacturing average (or similar to that average)



Unlike most other northern European Member States, Finland saw a deterioration in ULC competitiveness in wearing apparel. In common with other countries it saw a sharp deterioration in the trade balance and sharp losses in employment. Chemicals and rubber and plastics saw a deterioration in ULC competitiveness in marked contrast to the all-manufacturing trend. This was not reflected in any marked deterioration in their trade deficits or in any markedly different trend in employment compared with the all-manufacturing average. Wood and paper saw broadly no change in ULC competitiveness from the mid-1990s onwards, but saw the largest improvement in trade surplus; this was associated with heavier shedding of jobs in these sectors.

Figure 4.20: Sectors whose ULC competitiveness is improving relative to the manufacturing average



Among the sectors for which data are less erratic, Finland saw an improvement in ULC competitiveness in food and beverages and basic metals. The trade deficit in food and beverages deteriorated, whereas the trade surplus in basic metals increased. Employment fell more rapidly in food and beverages up to the late 1990s; subsequent falls were in line with the all-manufacturing average. Finland recorded a sharp improvement in ULC competitiveness in communications equipment and, until recently, a sharp increase in the trade surplus. The surge in employment in this sector in the 1990s has given way to declines in the past decade.

4.2.10 Sweden

Figure 4.21: Sectors whose ULC competitiveness is worsening relative to the manufacturing average (or similar to that average)

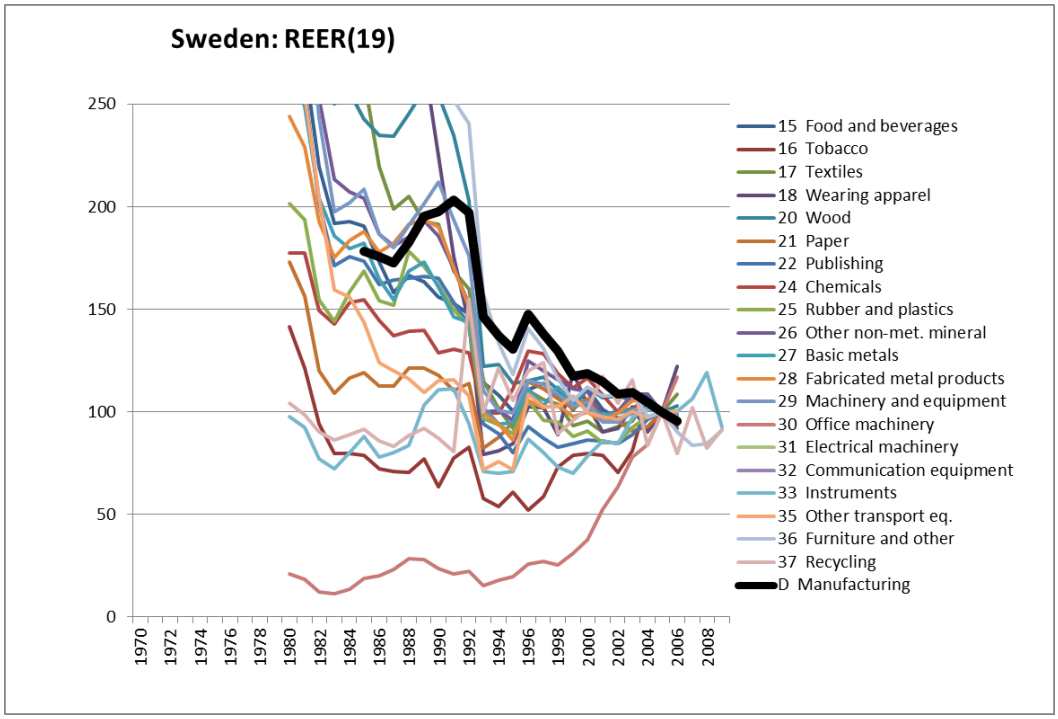
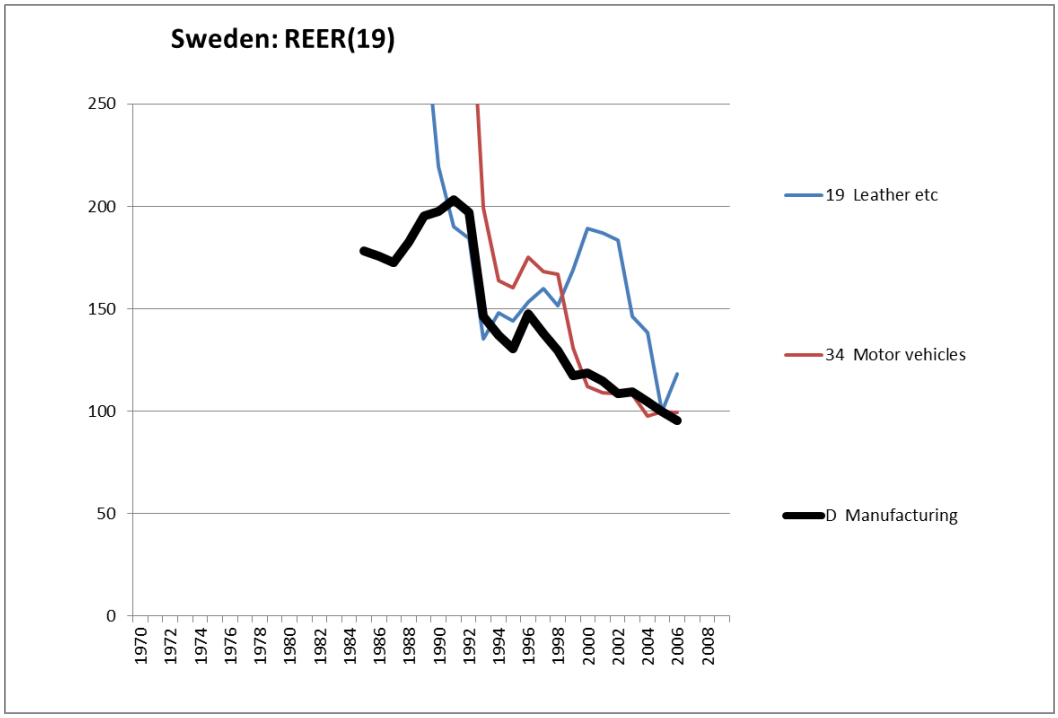


Figure 4.22: Sectors whose ULC competitiveness is improving relative to the manufacturing average



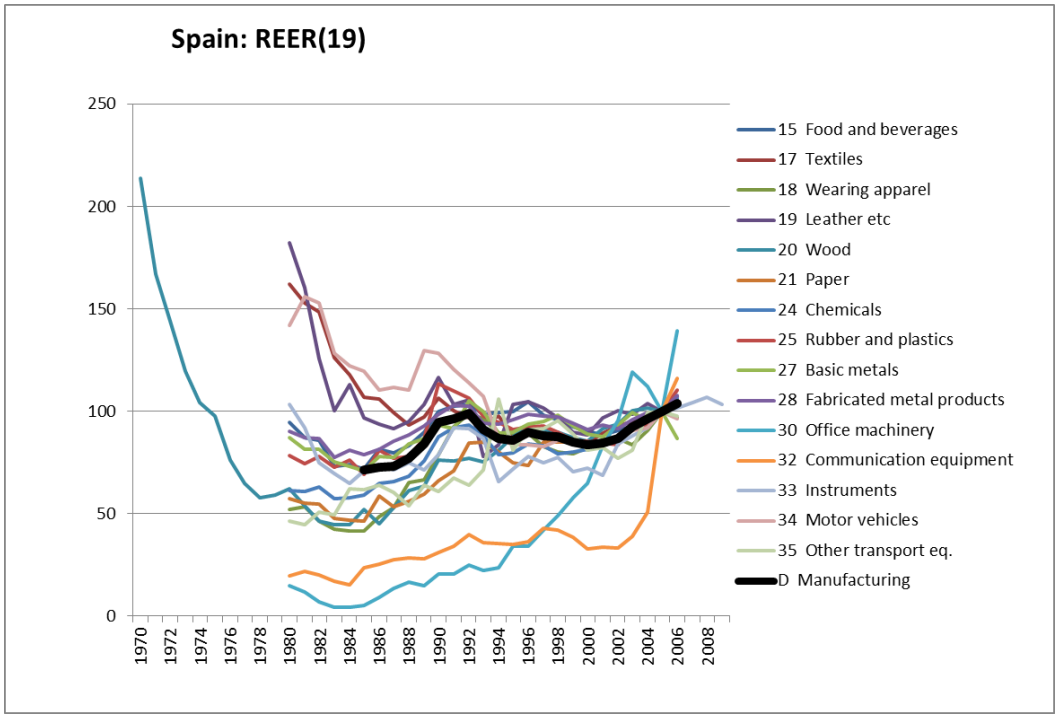
The ULC competitiveness of most sectors in Sweden reflects the macroeconomic trends, notably the effect of changes in the exchange rate. Paper saw a much more modest improvement in ULC competitiveness than the all-manufacturing average (to which the trend for wood was much closer), but as in Finland these sectors saw the strongest

improvement in trade surplus. Machinery and equipment saw a similar, if less pronounced trend. Of these sectors, only paper saw a more pronounced loss of jobs than the manufacturing average.

Like most other northern European Member States, Sweden saw an improvement in ULC competitiveness in wearing apparel (at least until the last decade), a sharp deterioration in the trade balance and a rapid rate of job loss. Over the long term Sweden saw a more marked improvement in the ULC competitiveness of its motor vehicles sector (although only at the same rate as the all-manufacturing average in the last decade). It saw a steady improvement in its trade surplus and increases in employment in this sector prior to the recession

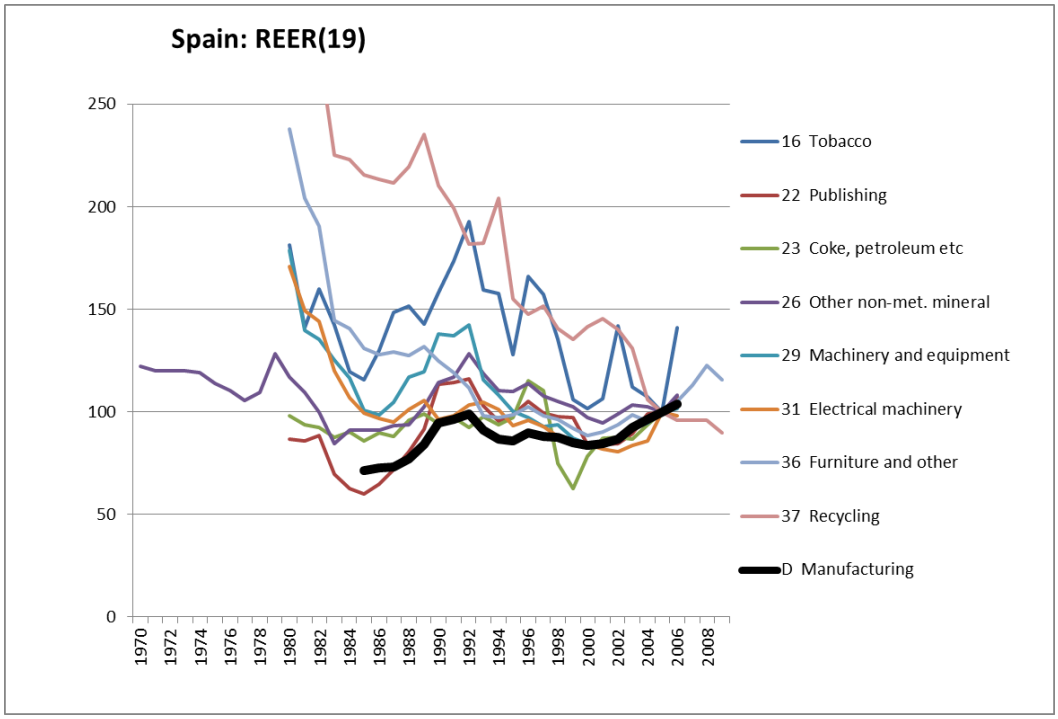
4.2.11 Spain

Figure 4.23: Sectors whose ULC competitiveness is worsening relative to the manufacturing average (or similar to that average)



Most sectors in Spain saw a deterioration in ULC competitiveness broadly in line with the macroeconomic trend. There was a particularly marked deterioration in wearing apparel, wood, paper and other transport equipment. The trade balance deteriorated in all these sectors, although job losses only occurred in wearing apparel.

Figure 4.24: Sectors whose ULC competitiveness is improving relative to the manufacturing average



Spain saw an improvement in ULC competitiveness up to 2000 in machinery and equipment and electrical machinery, and employment rose broadly in line with the manufacturing average, while the trade balance deteriorated. The only sectors that saw an improvement in the trade balance were food and beverages and other non-metallic mineral products, both of which saw an improvement in ULC competitiveness and growth in employment stronger than the manufacturing average.

4.2.12 Portugal

Figure 4.25: Sectors whose ULC competitiveness is worsening relative to the manufacturing average (or similar to that average)

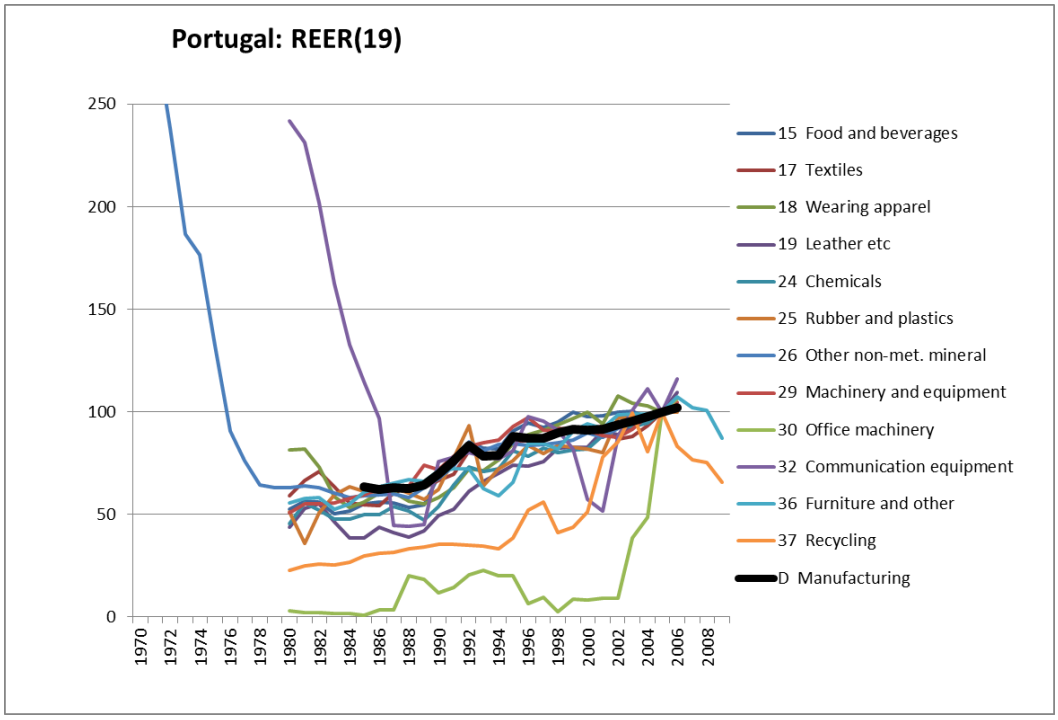
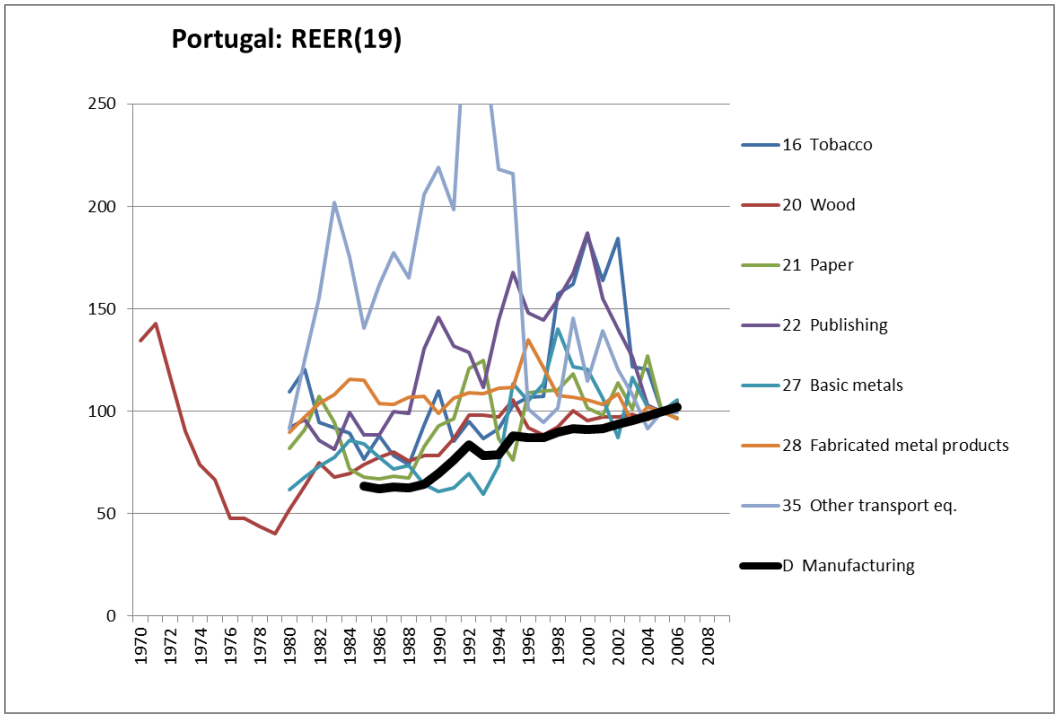


Figure 4.26: Sectors whose ULC competitiveness is improving relative to the manufacturing average



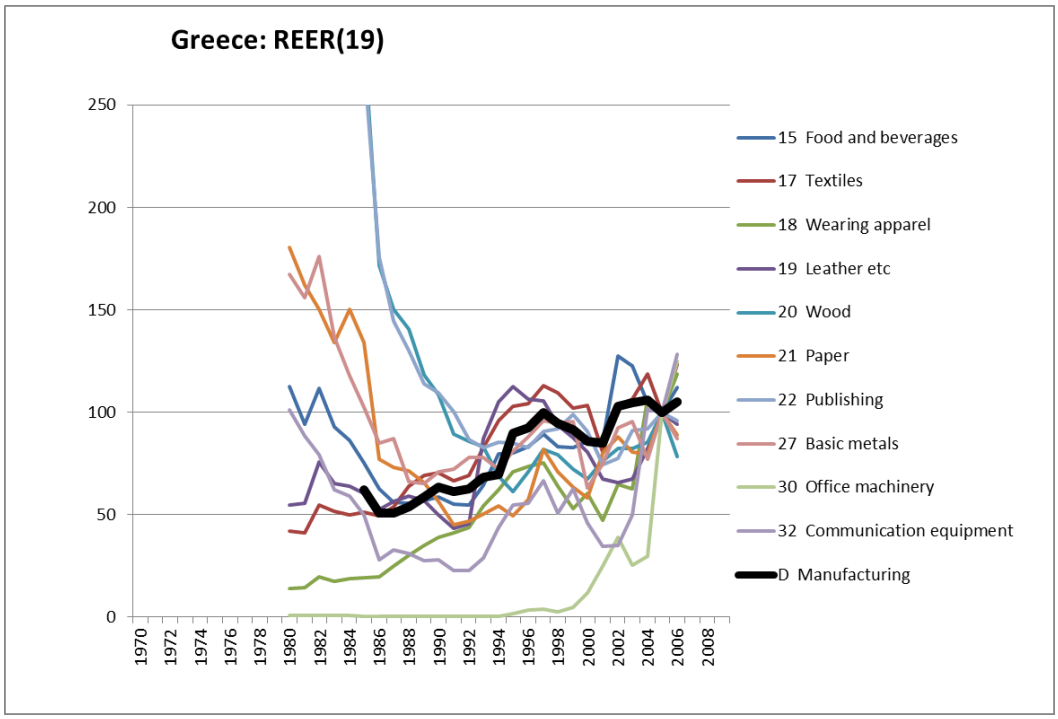
Most sectors in Portugal saw a deterioration in ULC competitiveness broadly in line with the macroeconomic trend. Apart from office machinery and recycling, where data are less reliable, the sectors that saw a particularly marked deterioration were wearing

apparel, leather etc, food and beverages and chemicals. Portugal's trade surplus in wearing apparel has fallen back since the late 1990s, but its trade surplus in leather etc has been broadly maintained. Employment in both sectors has fallen more sharply than the manufacturing average. Food and beverages and chemicals both saw a marked deterioration in the trade deficit, but employment in these sectors fell more slowly than the manufacturing average.

Apart from the sectors where data is quite erratic, the sectors that saw a less marked deterioration in ULC competitiveness were wood, paper and fabricated metal products (the latter showing a slight improvement). Wood and paper maintained or improved their trade surplus, but fabricated metal products saw its deficit worsen from the mid-1990s. Wood saw employment fall broadly in line with the manufacturing average, whereas the other two sectors did not see as sharp a fall.

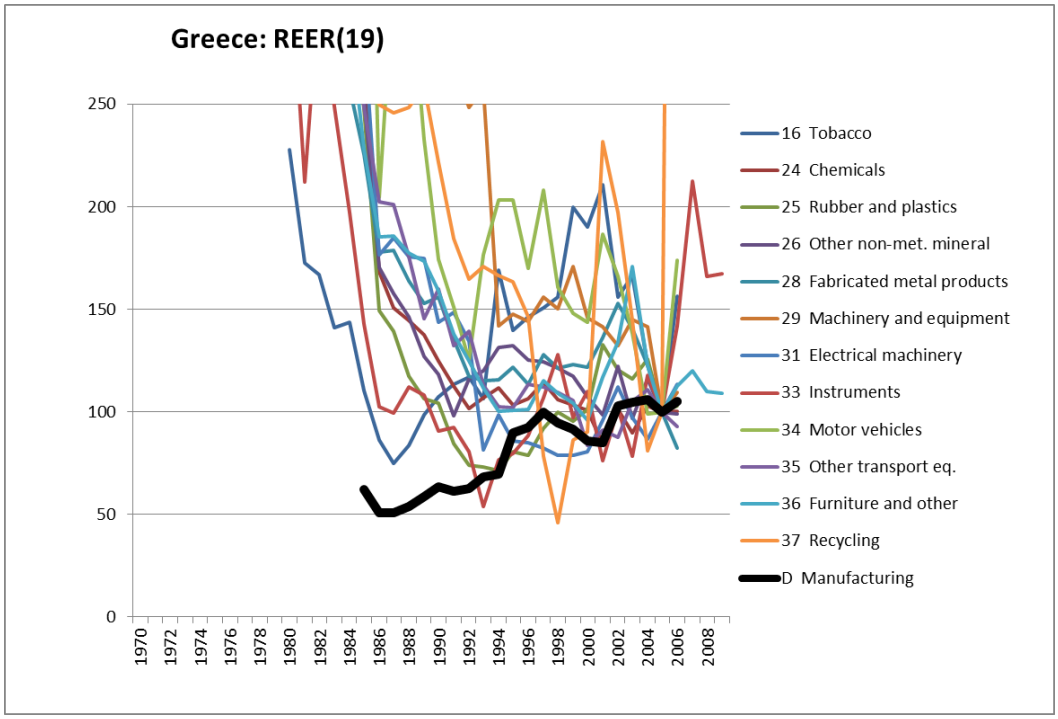
4.2.13 Greece

Figure 4.27: Sectors whose ULC competitiveness is worsening relative to the manufacturing average (or similar to that average)



All manufacturing sub-sectors in Greece saw a deterioration in their trade balance from the mid-1990s. Apart from sectors where data are erratic, most sectors saw a deterioration in their ULC competitiveness. The most pronounced deterioration was in wearing apparel, where the trade surplus of the 1980s and 1990s moved into deficit in the 2000s, and the sector has seen a heavy loss of employment since the early 1990s.

Figure 4.28: Sectors whose ULC competitiveness is improving relative to the manufacturing average



Most of the sectors in Greece that appear to have seen some improvement in ULC competitiveness are subject to erratic data. There are some sectors which saw an improvement prior to the late 1990s but then came into line with the deterioration seen in the all-manufacturing average. This may reflect the influence of participation in the eurozone, but the data do not appear to be very reliable.

4.2.14 USA

Figure 4.29: Sectors whose ULC competitiveness is worsening relative to the manufacturing average (or similar to that average)

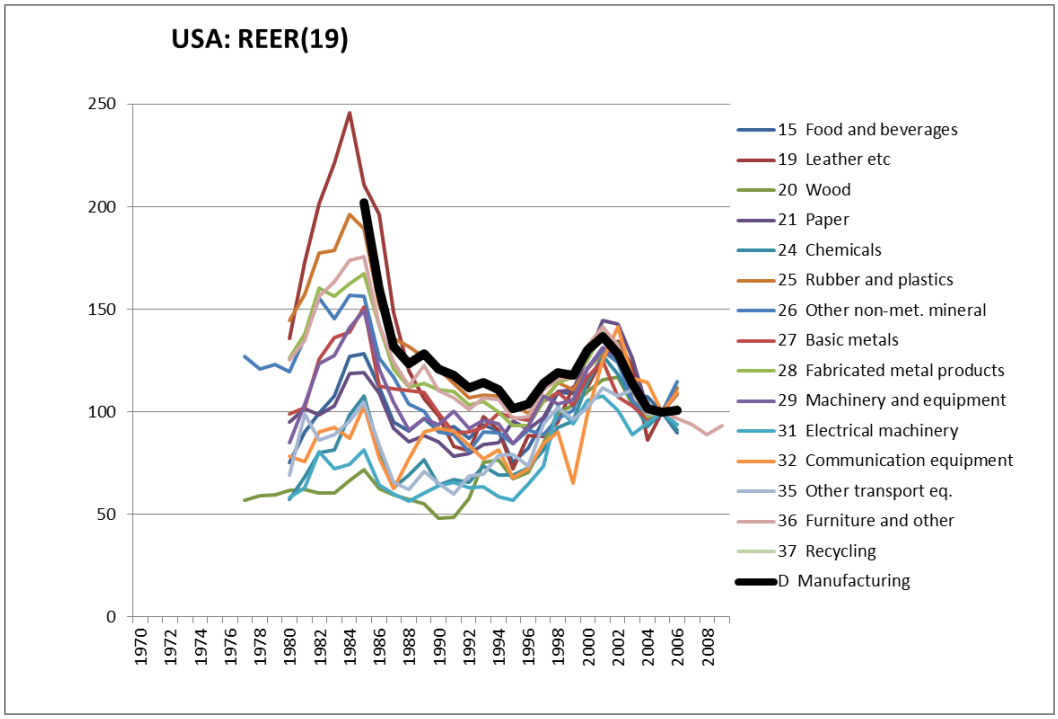
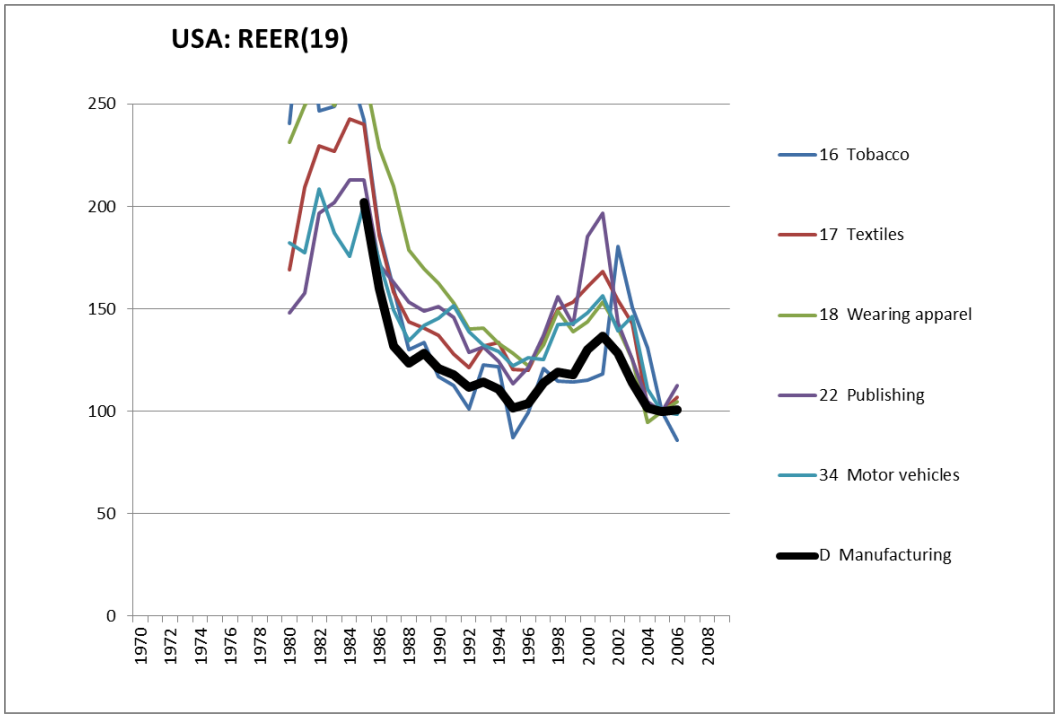


Figure 4.30: Sectors whose ULC competitiveness is improving relative to the manufacturing average



Movements in the ULC competitiveness of sectors in the USA reflect the macroeconomic influences, notably movements in the dollar exchange rate. Sectors that saw a more marked deterioration include some 'basic' sectors, such as food and beverages, wood,

paper and chemicals, but also machinery and equipment and other transport equipment. Chemicals (which includes pharmaceuticals) and other transport equipment nevertheless saw a marked improvement in their trade balance (in contrast to all other manufacturing subsectors).

Sectors in which the US saw a more marked improvement in ULC competitiveness include wearing apparel, textiles and motor vehicles, but it should be noted that the countries included in the REER exclude Mexico. All saw a deterioration in their trade deficit, especially wearing apparel and motor vehicles. The REER indicators for instruments and office machinery suggest very large improvements in ULC competitiveness (larger than is plausible) and reflect difficulties in the data.

5 Analysis of trends in manufacturing unit labour costs in old and new Member States of the European Union

5.1 Intra EU development of unit labour costs in manufacturing

This section compares the relative development of competitiveness in new and old Member States of the EU. We therefore compare the development of REERs and ULCs as well as the drivers of ULC for seven selected Member States of the EU. France, Germany, Italy and Spain represent the old Member States, while the Czech Republic, Hungary and Slovakia (which entered the EU in 2004) represent the new Member States. In order to understand structural changes in competitiveness, we focus on the pre-crisis period up to 2007. The blue boxes in the figures cover the crisis period. To give focus on relative developments of different countries, all figures in the following sections represent relative developments over time, and the base year is set to 2000 = 100. The choice of trading partners in REER indicators shown here is the REER (30) group.

Figure 5.1: Real effective exchange rates in manufacturing in selected Member States

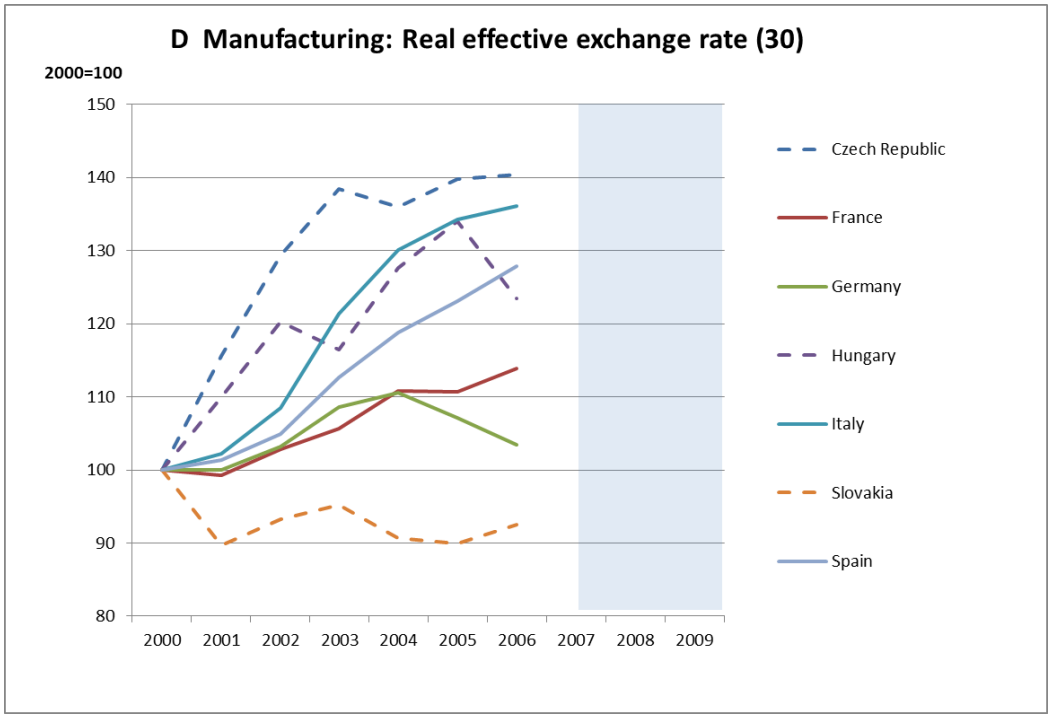


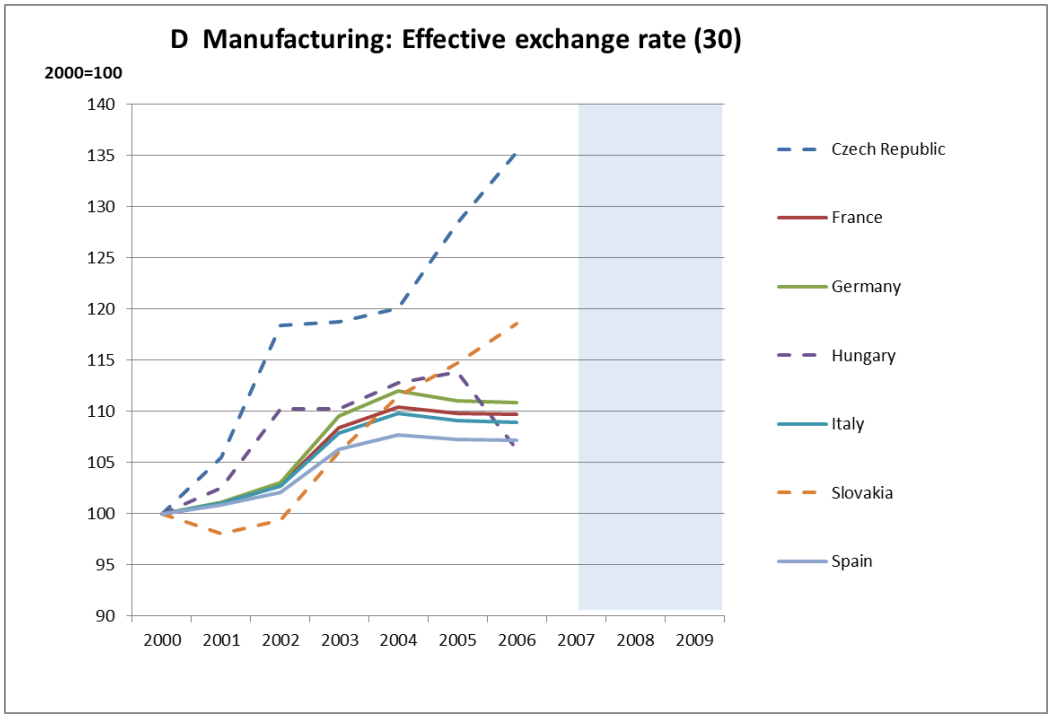
Figure 5.1 shows the trend in REERs for all manufacturing sectors. Old Member States are represented by solid lines, while new Member States are represented by dashed lines. There is no clear difference between both groups with regard to a general upward or downward trend. REERs for the Czech Republic and Hungary rose by 40% and 25% respectively, while Slovakia's REER fell by nearly 10%. REERs for France, Italy and Spain grew steadily, whereas Germany's upward trend until 2004 was followed by a downward trend, so that the REER level in 2006 was very close to that of 2000.

In the following we decompose the REERs into nominal effective exchange rates (EERs) and unit labour costs. The relation is given by the following equation:

Real effective exchange rates	=	Trade-weighted relative unit labour costs	*	Nominal effective exchange rates

The trade-weighted relative ULCs are given by the product of the weighted ratios of domestic unit labour costs to foreign unit labour costs with respect to every foreign country that is included in the statistic. The EERs are defined as the product of the weighted nominal exchange rates for every foreign country (units of foreign currency per unit of domestic currency). The weights take into account the importance of a foreign country as a trade partner. The exact calculation of these aggregates is explained in more detail in Appendix A:. The EERs of the seven representative countries are shown in Figure 5.2.

Figure 5.2: Effective exchange rates in manufacturing in selected Member States

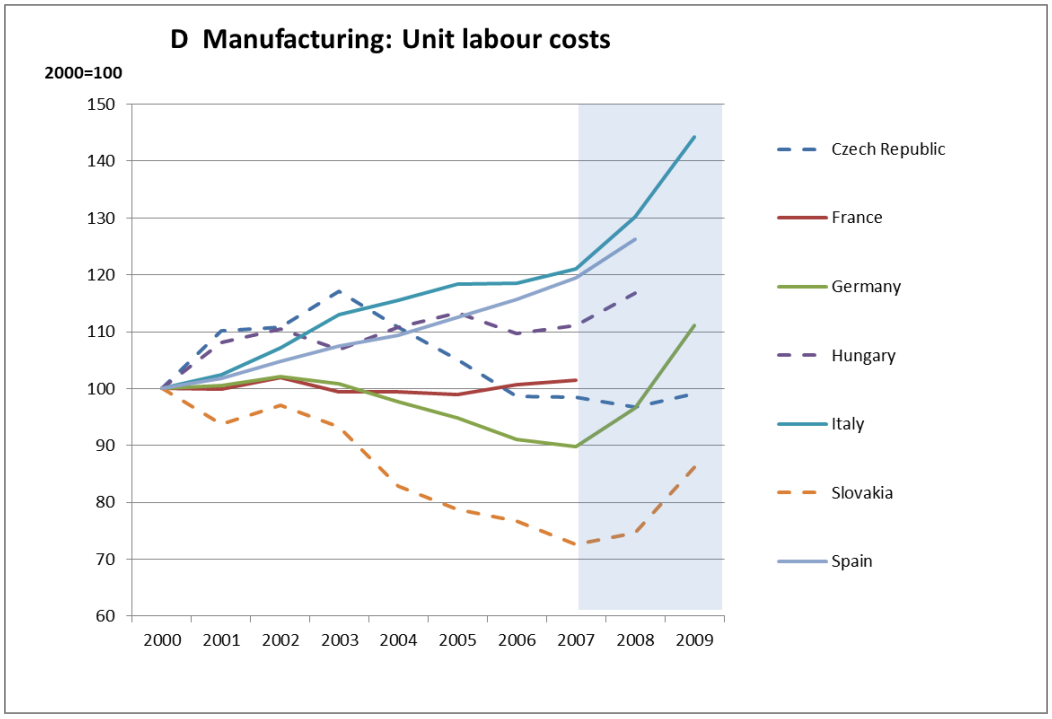


We observe an upward trend in nominal effective exchange rates for all countries. The trend is stronger for new Member States, most of all for the Czech Republic with a shift of nearly 40%. The developments in old Member States are not surprisingly almost

identical (since they are all in the eurozone, the differences only arise because of different weights for trading partners). Their EERs rose by approximately 8% to 10%.

Given that changes in nominal effective exchange rates could hardly account for the more heterogeneous trends in real effective exchange rates, at least for old Member States, we focus on (own-currency) ULCs as the explanatory factor. Figure 5.3 shows the relative development of unit labour costs.

Figure 5.3: Unit labour costs in manufacturing in selected Member States



ULCs in Italy and Spain rose by 20%, in Hungary by 10%. In France they remained constant, while in the Czech Republic, an upward trend was followed by a downward trend, so that the pre-crisis level was very similar to the level of 2000. In Germany ULCs declined by 10% and in Slovakia by more than 25 %. The only apparent difference between the two groups of countries is that the developments in new Member States are more volatile compared to the rather smooth developments in old Member States. That corresponds to the developments in REERs. Indeed, the changes in REERs seem to be driven more by ULCs than by changes in nominal exchange rates.

Differences between the two country groups are evident when unit labour costs are decomposed into the two components, labour compensation and labour productivity:

Unit labour costs	=	Labour costs per worker	/	Gross value added per worker

Figure 5.4 shows the relative development of nominal compensation per job (numerator). Nominal labour costs rose in every country, partly due to inflation. Here, a clear difference between the two country groups is the substantially faster growth in the

new Member States. Unless offset by faster labour productivity growth, this would lead to a deterioration of the new Member States' cost competitiveness.

Figure 5.4: Nominal compensation per job in manufacturing in selected Member States

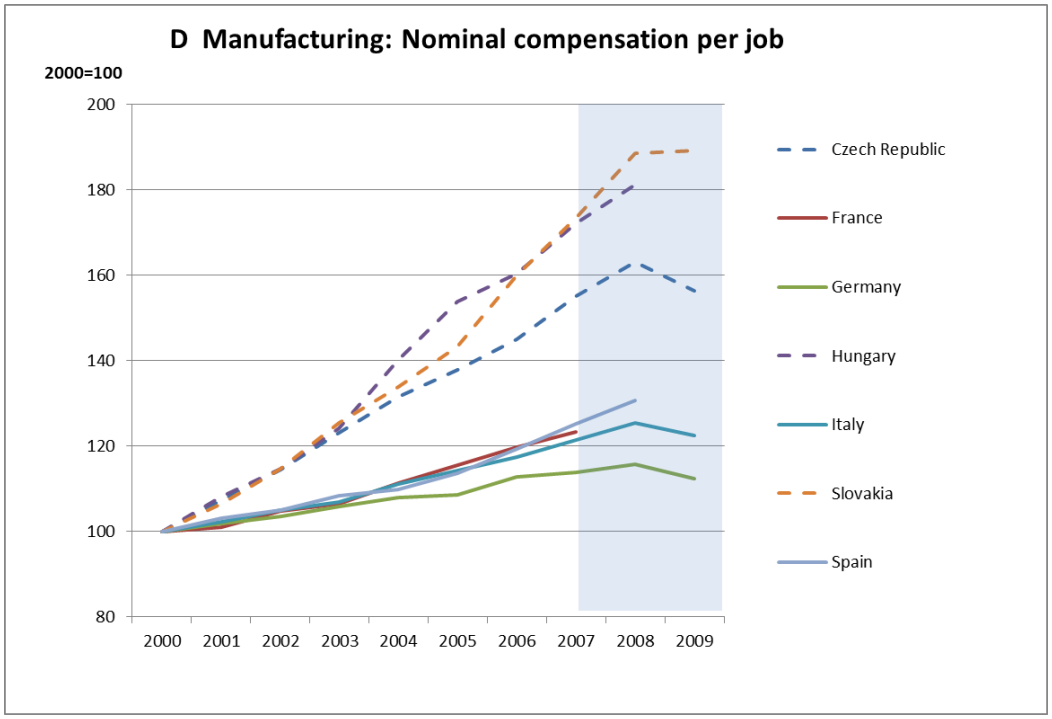
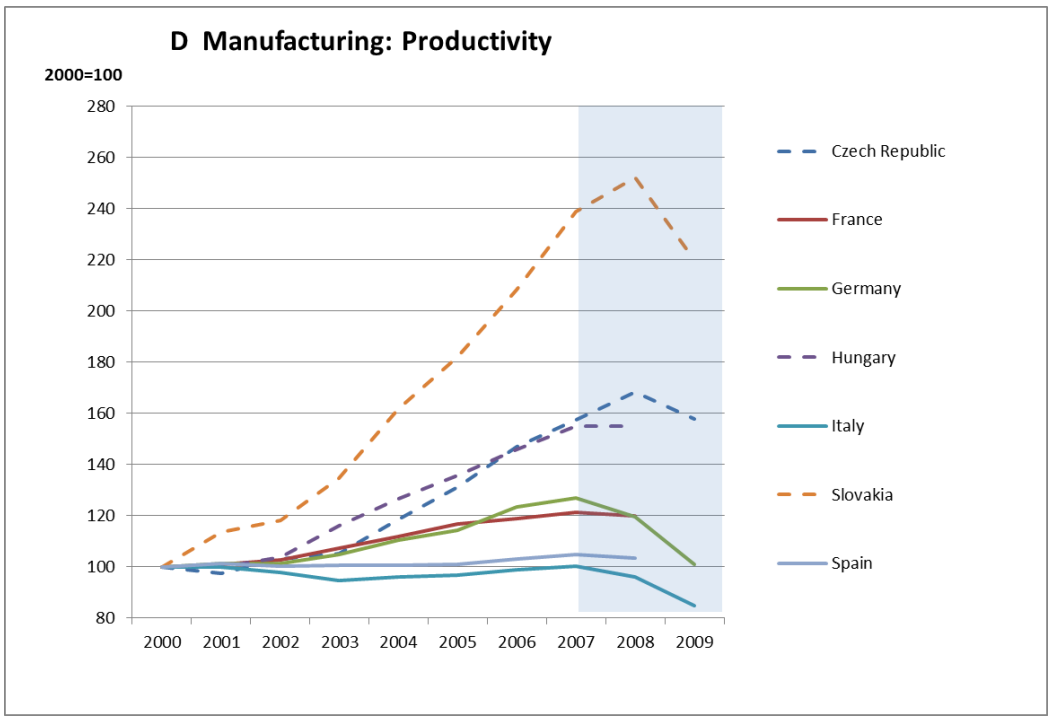


Figure 5.5: Average labour productivity in manufacturing in selected Member States



The second component of unit labour costs is labour productivity (the denominator), depicted in Figure 5.5. We see that productivity growth in the new Member States was also stronger than in the old Member States. In Slovakia and the Czech Republic productivity growth was sufficiently fast to outweigh the impact of faster growth in average wages (nominal compensation per job), but not in Hungary. The fact that both components show fast growth may explain the higher volatility of ULCs in new Member States compared to the old ones.

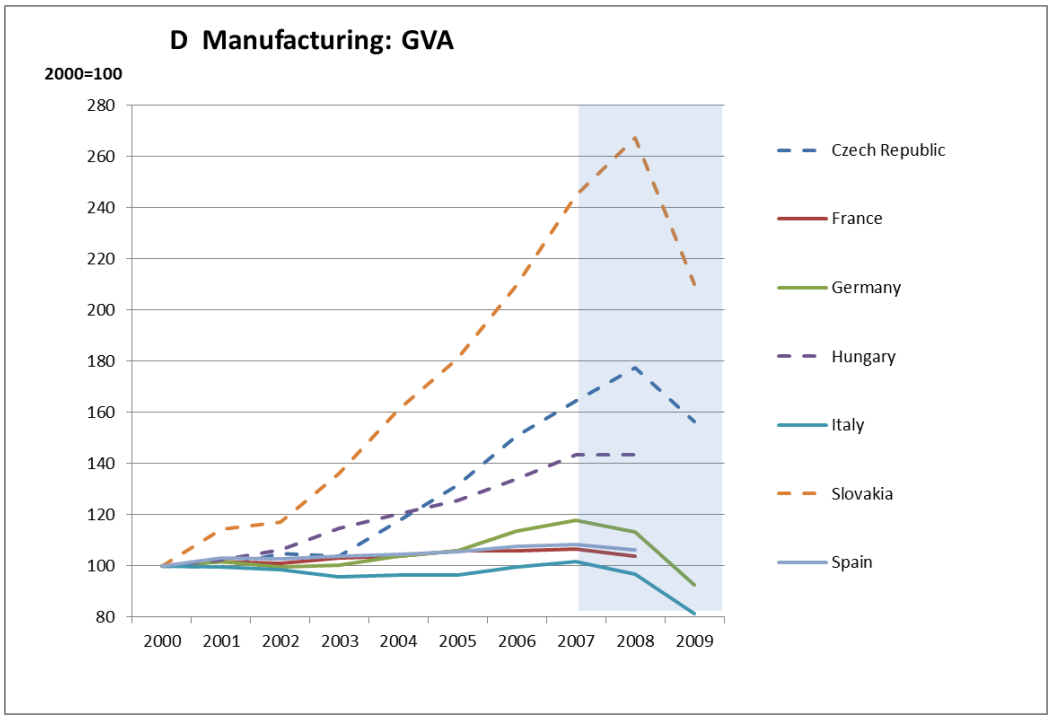
In the group of old Member States, Germany had the slowest growth in nominal labour compensation (+10%) and achieved the fastest growth in labour productivity (+25%). In France, both labour costs and productivity rose by about 20 %. In Italy and Spain the labour costs also rose by 20 %, but the labour productivity remained constant. That explains the deterioration in relative labour cost competitiveness observed in Figure 5.3.

A rise in labour productivity measured at the industry level can have several reasons. For a further interpretation we decompose labour productivity into its components, gross value added (numerator) and employment (denominator):

Labour productivity	=	Gross value added	/	Employment

As can be seen in Figure 5.6, the much faster growth of gross value added in the new Member States represents another difference between the two country groups. As was the case for labour productivity, the highest growth in gross value added was in Slovakia, about 150%.

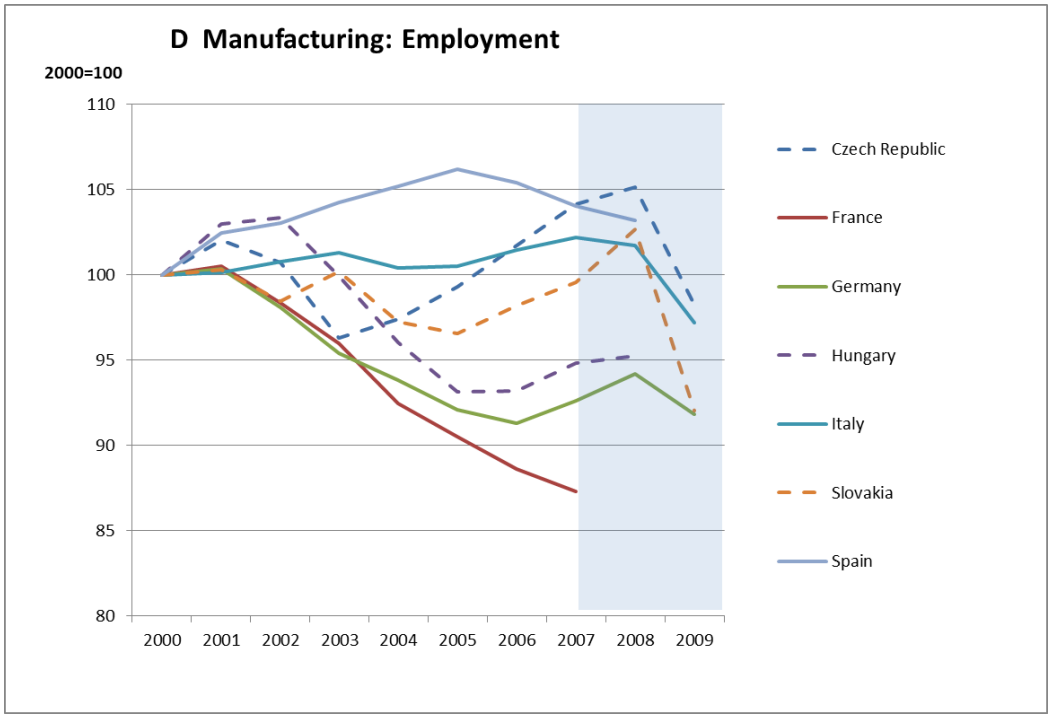
Figure 5.6: Gross value added in manufacturing in selected Member States



GVA rose by approximately 70% and 45% respectively in the Czech Republic and Hungary, while old Member States had much slower growth rates. Germany performed the best with growth of nearly 20%. There was a weak downward trend in Spain's GVA until 2006, followed by an upward trend. The pre-crisis level in 2007 equals the base year level of 2000. France and Italy had small positive GVA growth rates.

The trends in employment shown in Figure 5.7 show no clear difference between the two country groups. For an interpretation of the relative developments, the individual countries have to be considered.

Figure 5.7: Employment in manufacturing in selected Member States



In Slovakia and the Czech Republic GVA grew fast, while employment was roughly constant with a slight upward trend since their accession to the EU. This could be an indication of successful restructuring of manufacturing industries. GVA also grew relatively fast in Hungary but employment was falling at the same time. The productivity gains in Hungary may be driven by unproductive firms that left the market because of a lack of competitiveness. The moderate growth of GVA in Germany and France went along with reductions in employment. One interpretation is that work done by low skilled labour is relocated from these countries as a consequence of the high level of labour costs. In the case of Italy, the neutral development of productivity is reflected in the likewise neutral developments of GVA and employment.

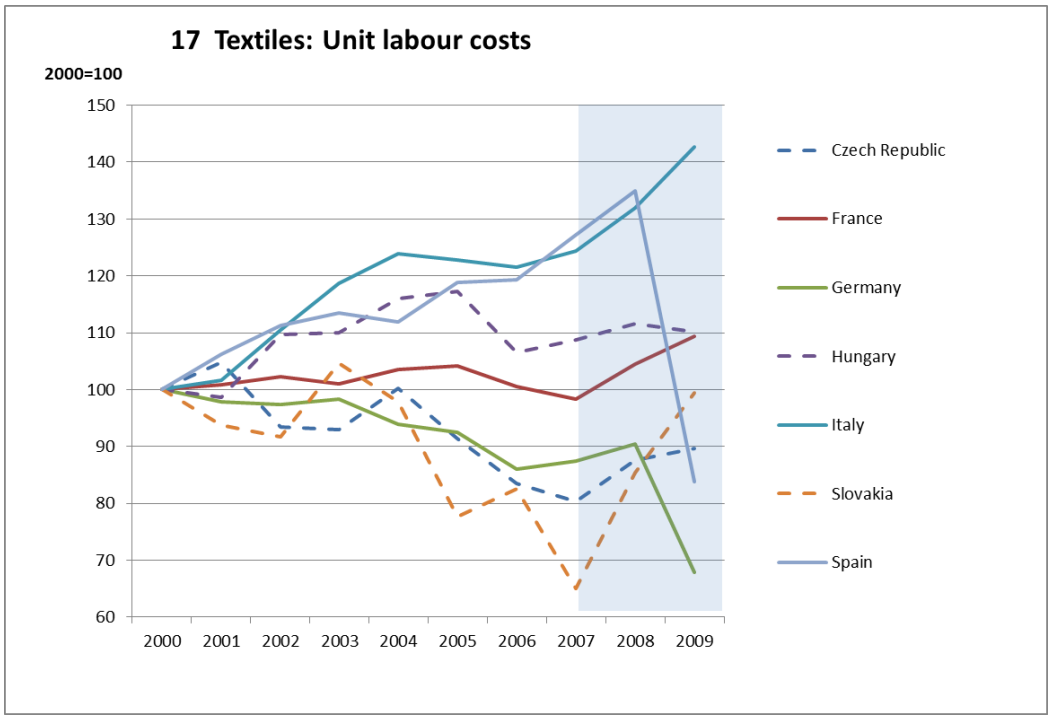
5.2 Trends in unit labour costs and employment by industry

For the same set of countries as in the section above, this section compares the trends in ULCs in four important industries, namely manufacture of textiles (17), of chemicals and chemical products (24), manufacture of electrical machinery (31) and manufacture of motor vehicles, trailers and semi-trailers (34).

5.2.1 Textiles

In textiles, we observe no clear difference between old and new Member States. In both groups there are examples of increasing and decreasing ULCs. The ULCs of Italy and Spain rose by about 25%, while in France they remained constant and in Germany they fell by more than 10%. In the group of new Member States the ULCs of Hungary rose by almost 10% and the ULCs of the Czech Republic and Slovakia fell by 20% and 35% respectively. Again, changes in the new Member States tend to be somewhat more volatile.

Figure 5.8: Unit labour costs in textiles in selected Member States



Using the same methodology as before, we decompose unit labour costs into its drivers. Productivity trends are shown in Figure 5.9. Slovakia, the country that achieved the greatest reduction in ULCs, had the highest productivity gains: an increase of about 140%. Productivity in the Czech Republic rose by 90%. The developments in Germany and France are similar: productivity rose by approximately 25%. In Spain we observe a slight increase while Italy's productivity slightly decreased. In Hungary productivity fell by more than 10%.

Figure 5.9: Average labour productivity in textiles in selected Member States

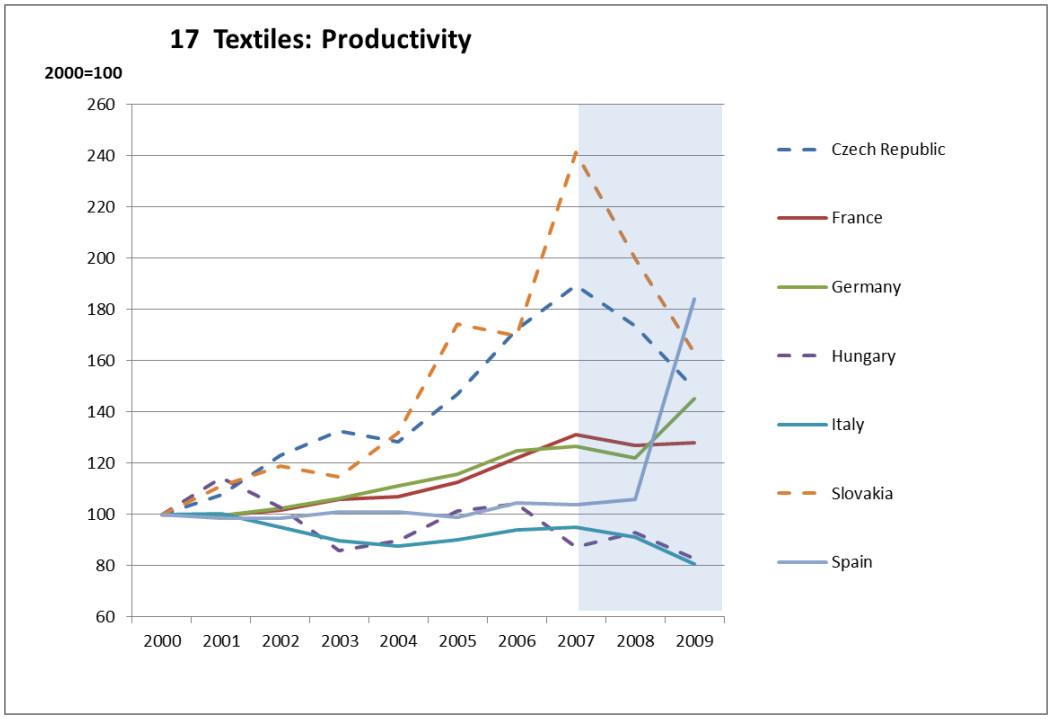
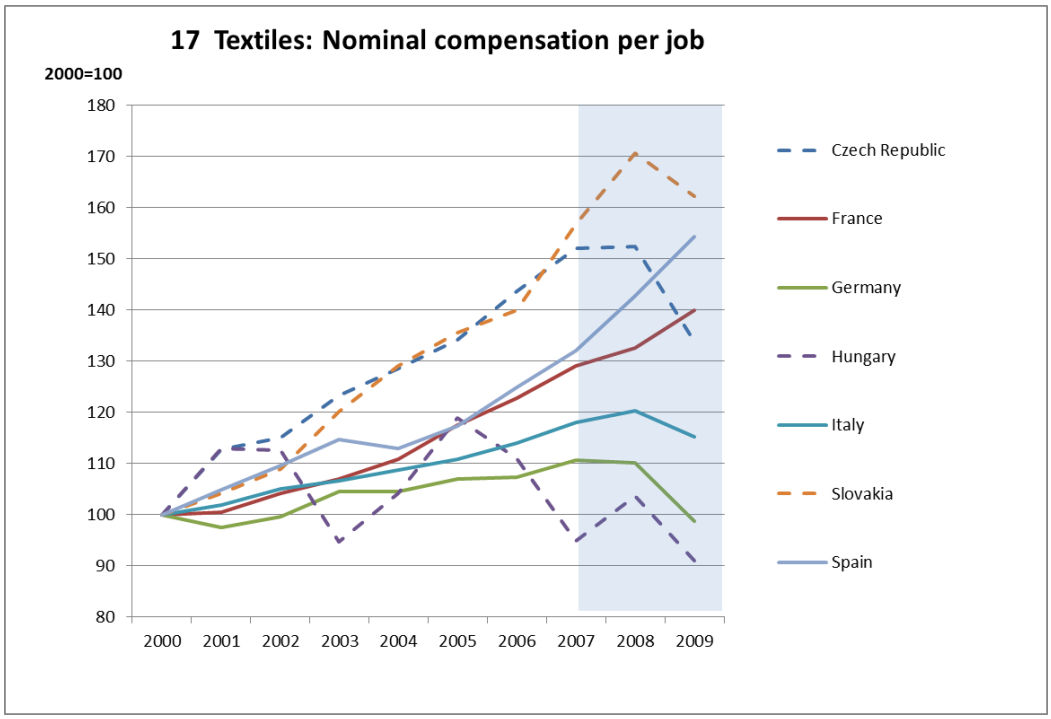


Figure 5.10: Nominal compensation per job in textiles in selected Member States



Nominal compensation per job rose in every country apart from Hungary, where the pre-crisis level was equal to the base year level. Whereas France and Germany had similar developments in productivity, the slower increase in nominal compensation per job in Germany explains the difference in the ULC trends. In France, the increase in productivity was outpaced by a fast increase in nominal compensation.

Figure 5.11: Employment in textiles in selected Member States

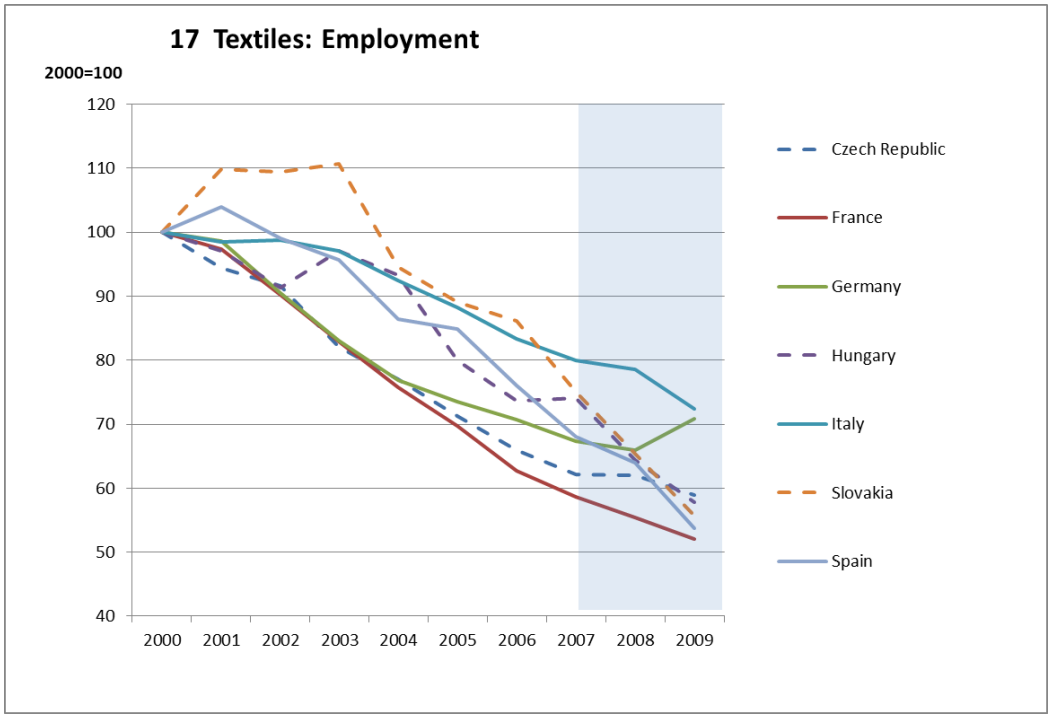


Figure 5.11 shows the changes in employment in textiles: in every country under consideration employment fell rapidly. Except for the Czech Republic and Slovakia, GVA also fell. Outsourcing of production to low-wage countries in the globalisation era explains these developments.

5.2.2 Chemicals and Chemical Products

As in textiles, in chemicals there are no clear, systematic differences in ULC performance since 2000 between old and new Member States. ULCs fell (until 2008) in the Czech Republic, Slovakia, France and Germany while in Italy and Hungary they rose. Both trends are shown in Figure 5.12.

Figure 5.13 shows that Spain is the only country where employment in this sector rose, and that trend came to a halt in 2005. It came about not because of a strong performance in output (Figure 5.14) but because of a weak performance in productivity (Figure 5.15).

Figure 5.12: Unit labour costs in chemicals in selected Member States

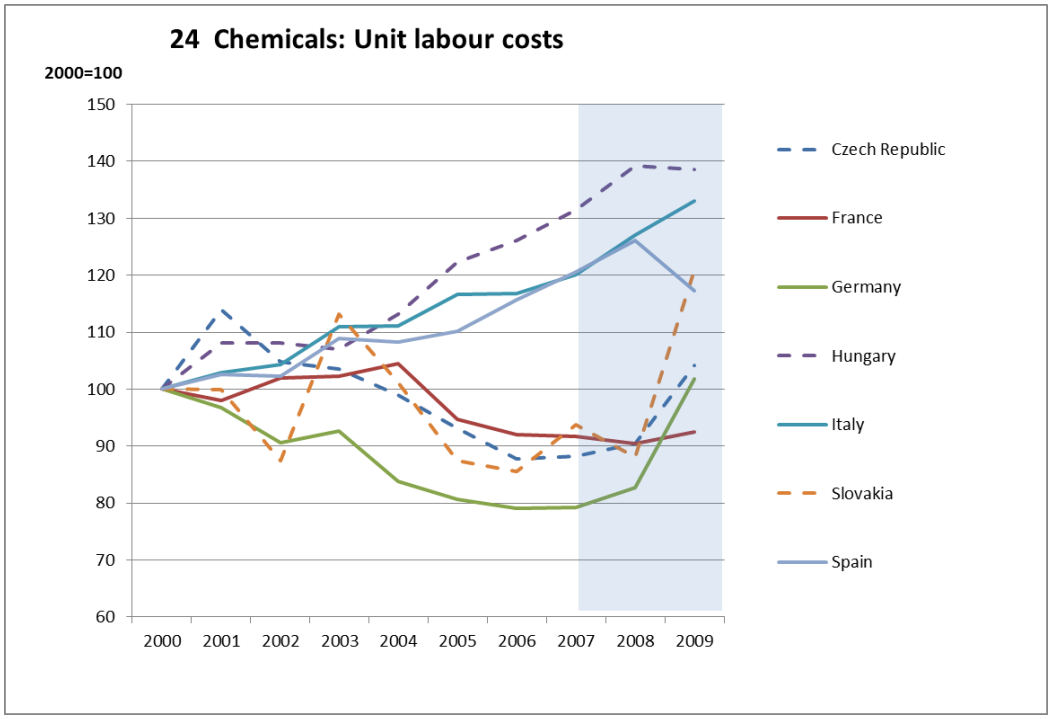


Figure 5.13: Employment in chemicals in selected Member States

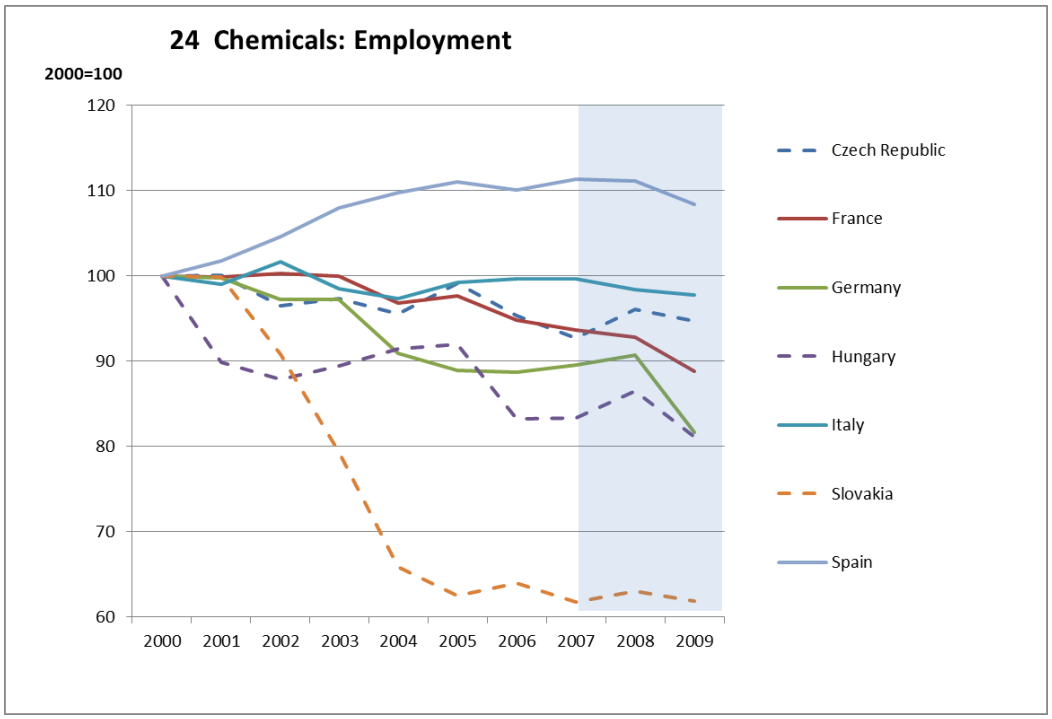
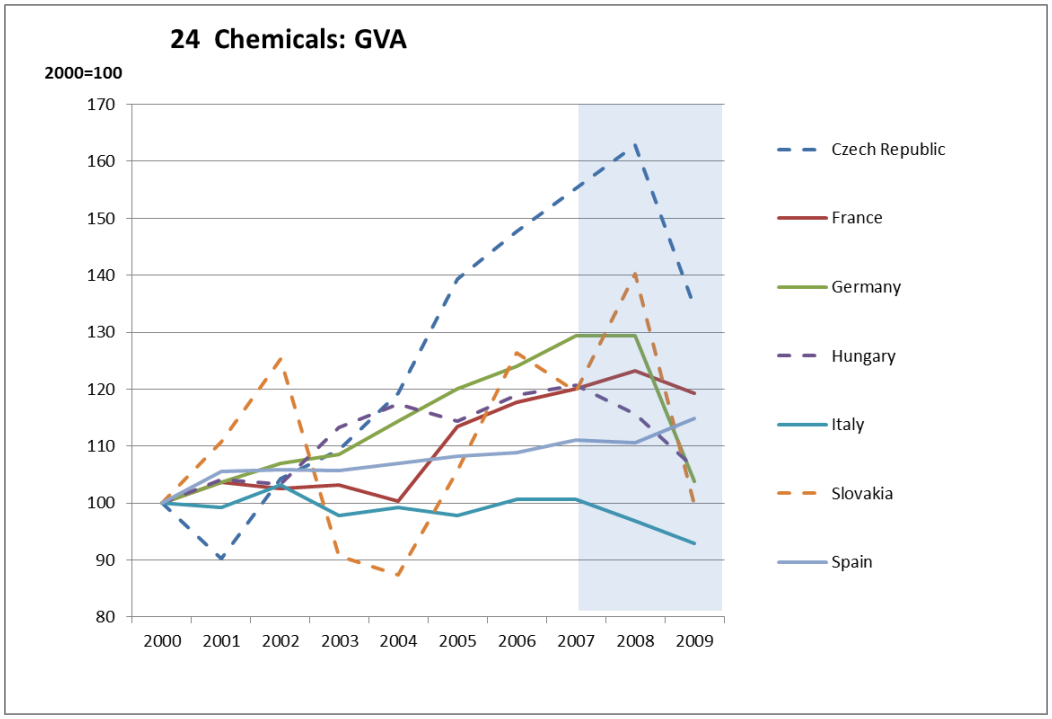


Figure 5.14: Gross value added in chemicals in selected Member States



The weakest growth in GVA was in Italy. The Czech Republic had the highest growth in GVA, of almost 60%. The two trends, decreasing employment and increasing gross value added seem to reflect higher capital productivity and an increase in capital inputs, since most countries saw quite substantial increases in labour productivity as shown in Figure 5.15.

There was a clear difference in labour productivity trends in chemicals between old and new Member States. New Member States generally had higher increases, especially Slovakia where labour productivity doubled and the Czech Republic where it increased by about 70%. Labour productivity growth was slower in Germany and France, and much slower in Spain and Italy. This pattern would be consistent with modernisation of the sector in the new Member States and some catch-up of productivity. Employment in the new Member States fell during this period and, in the case of Slovakia, at quite a fast rate.

Similarly, nominal compensation per job rose more rapidly in new Member States than in the old. Hungary had the highest increase, of nearly 90% followed by Slovakia and the Czech Republic. Hence, in the group of new Member States, the relatively good performance in terms of ULCs in Slovakia and the Czech Republic came about because the (strong) increase in nominal compensation per job was outpaced by strong productivity growth. In the group of old Member States, modest growth in average wages in Germany (which was characteristic of most manufacturing sectors) and relatively (among old Member States) strong productivity growth drove the good performance in ULCs.

Figure 5.15: Average labour productivity in chemicals in selected Member States

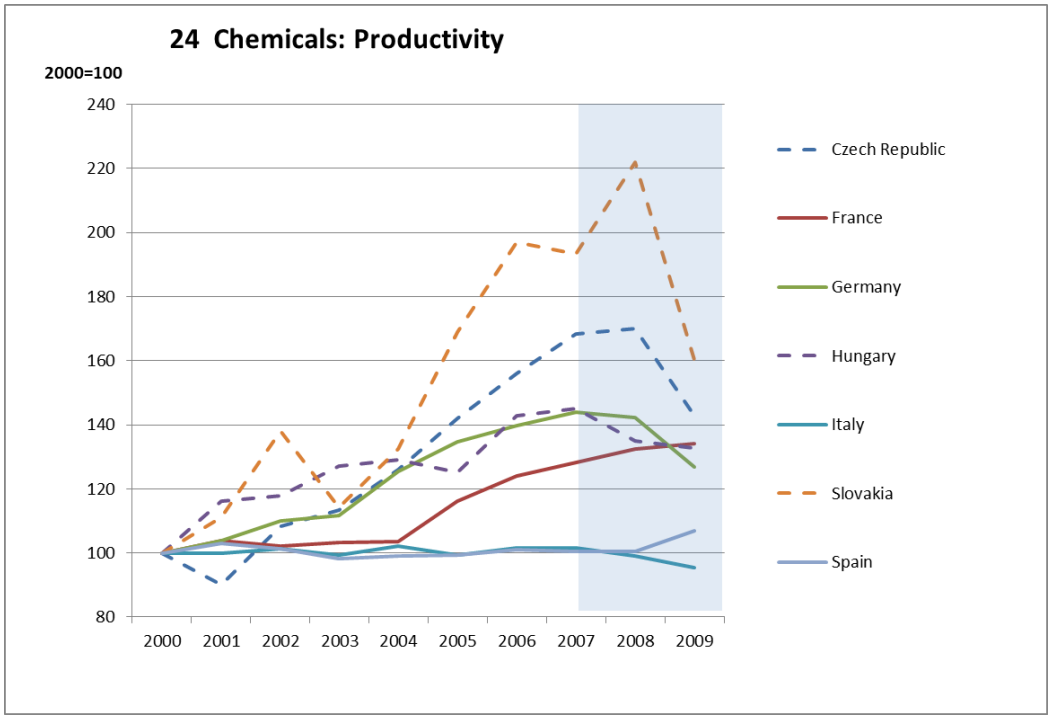
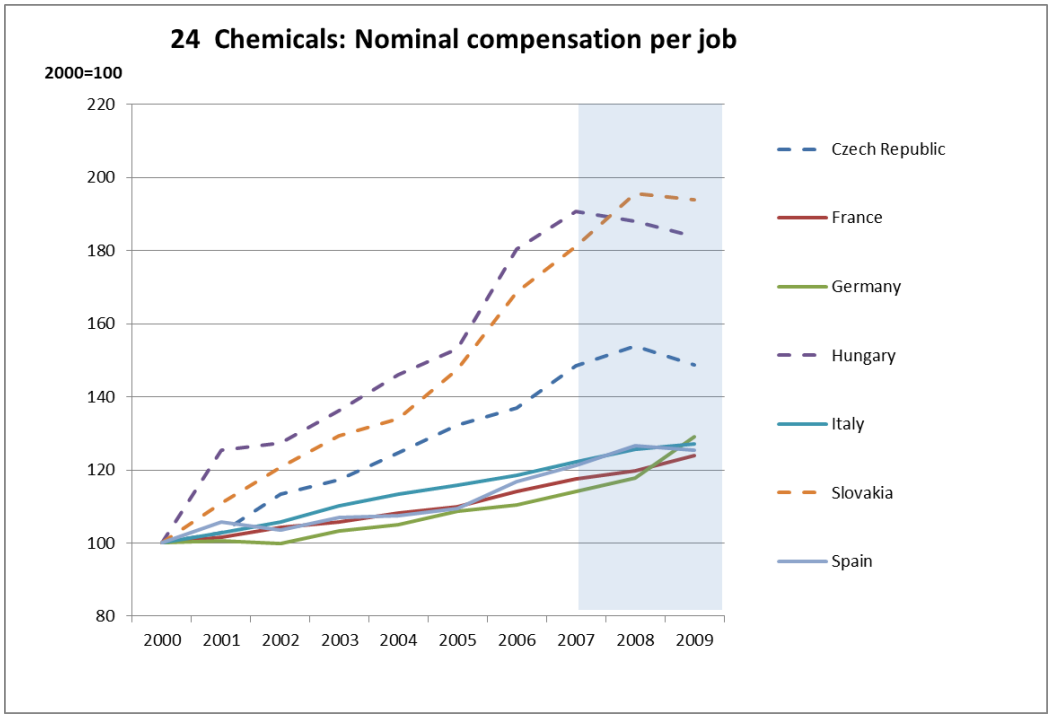


Figure 5.16: Nominal compensation per job in chemicals in selected Member States



5.2.3 Electrical machinery

In electrical machinery, Figure 5.17 shows that ULCs in old Member States generally increased (most strongly in France, and to a lesser extent in Italy and Spain). The increase in ULCs in Germany over 2000-02 was subsequently reversed. The Czech Republic and Slovakia saw a short and very rapid increase over 2000-02 followed by a decline. Hungary saw a particularly marked reduction in ULCs.

Figure 5.17: Unit labour costs in electrical machinery in selected Member States

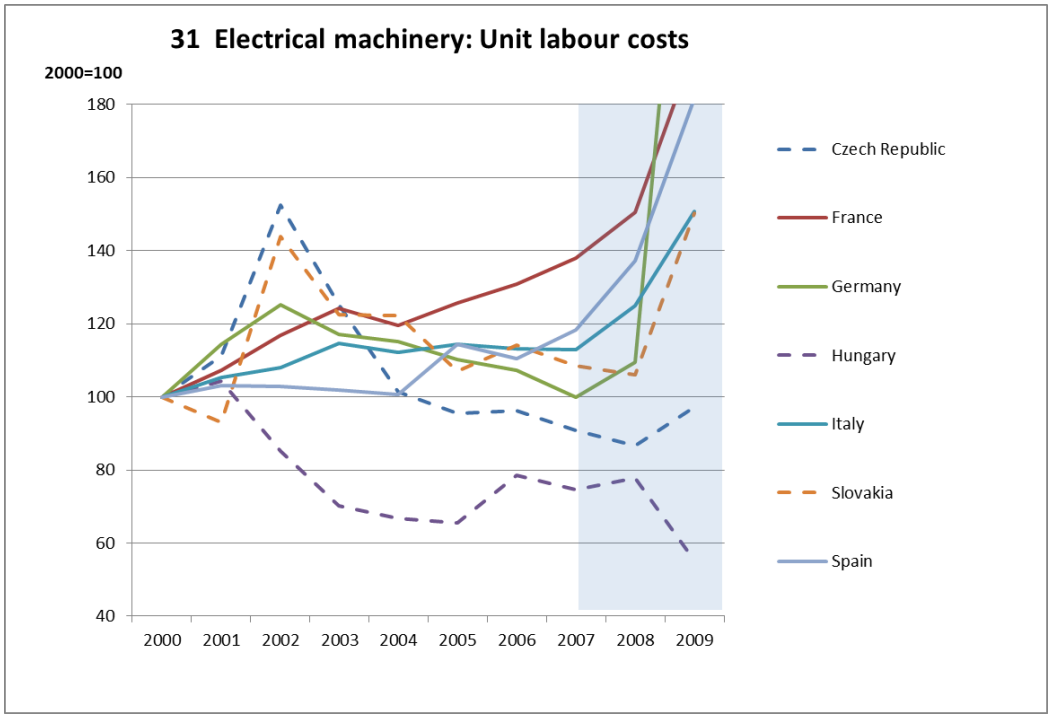


Figure 5.18 shows that productivity growth in electrical machinery was strong in all three new Member States. Average labour productivity in France fell, which was a key driver of its strong rise in ULCs. Even so France saw the largest fall in employment, as shown in Figure 5.19, because GVA fell throughout this period. Despite their relatively strong productivity growth, employment outcomes were generally better in the new Member States, although less so in Hungary. Italy's relatively strong employment growth reflected relatively strong GVA growth.

While strong productivity growth in the new Member States may have reflected modernisation and restructuring, the fact that employment generally increased (unlike the case of chemicals) suggests that in this industry the new Member States were successful in gaining market share, reflected in strong GVA growth. This was reflected in improved trade surpluses, particularly in the Czech Republic and Hungary.

Figure 5.18: Average labour productivity in electrical machinery in selected Member States

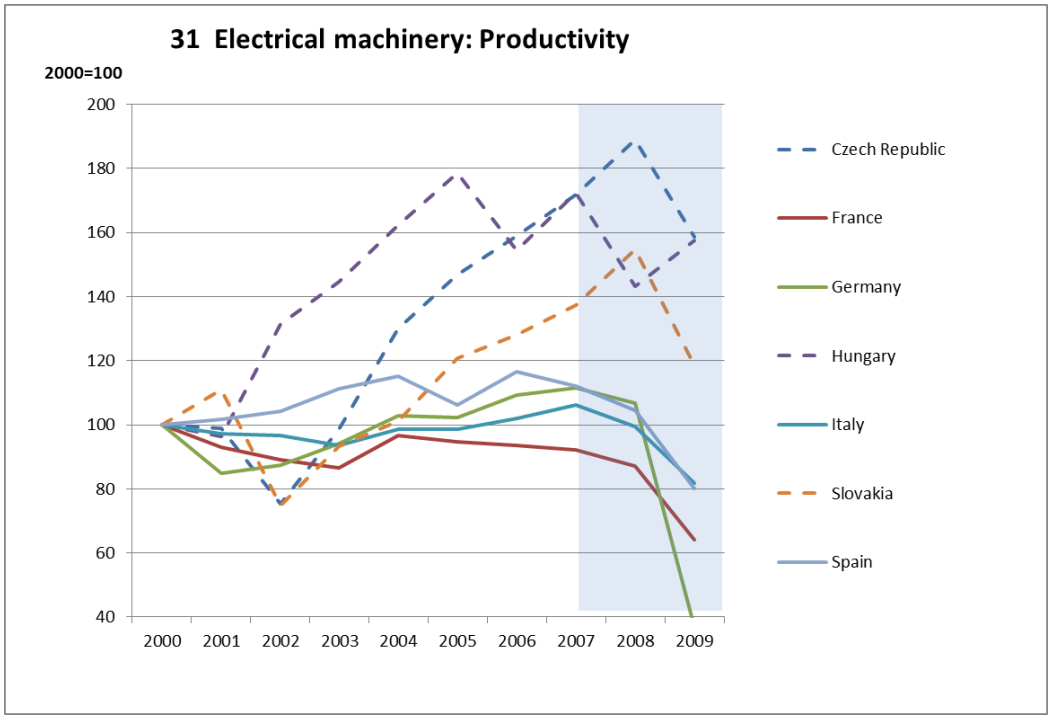


Figure 5.19: Employment in electrical machinery in selected Member States

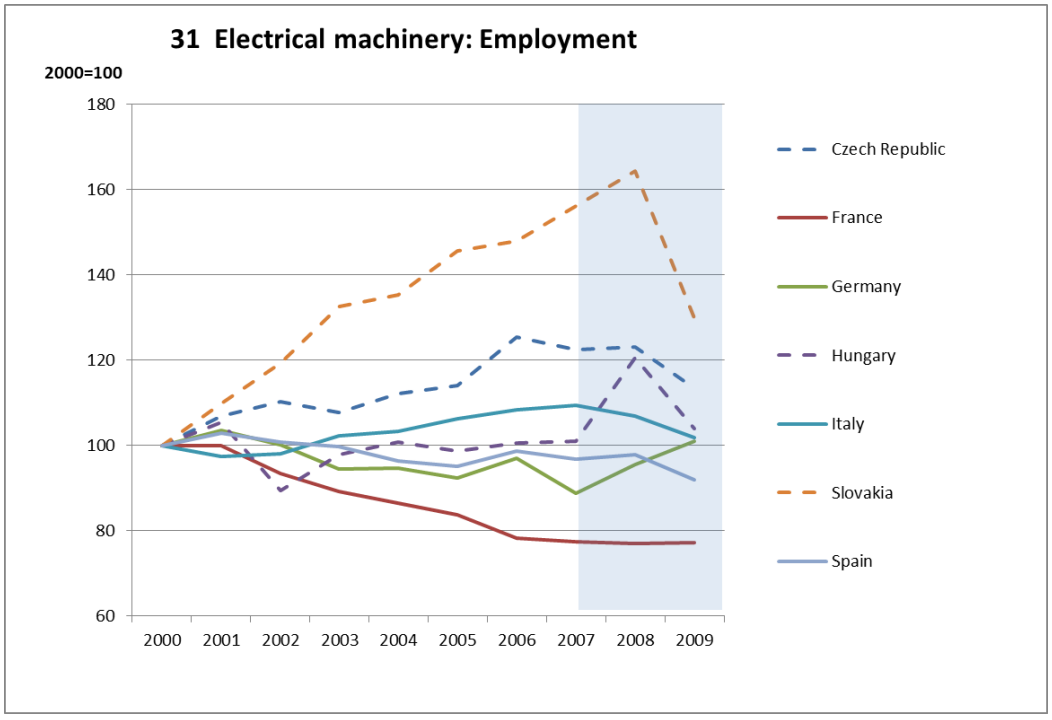
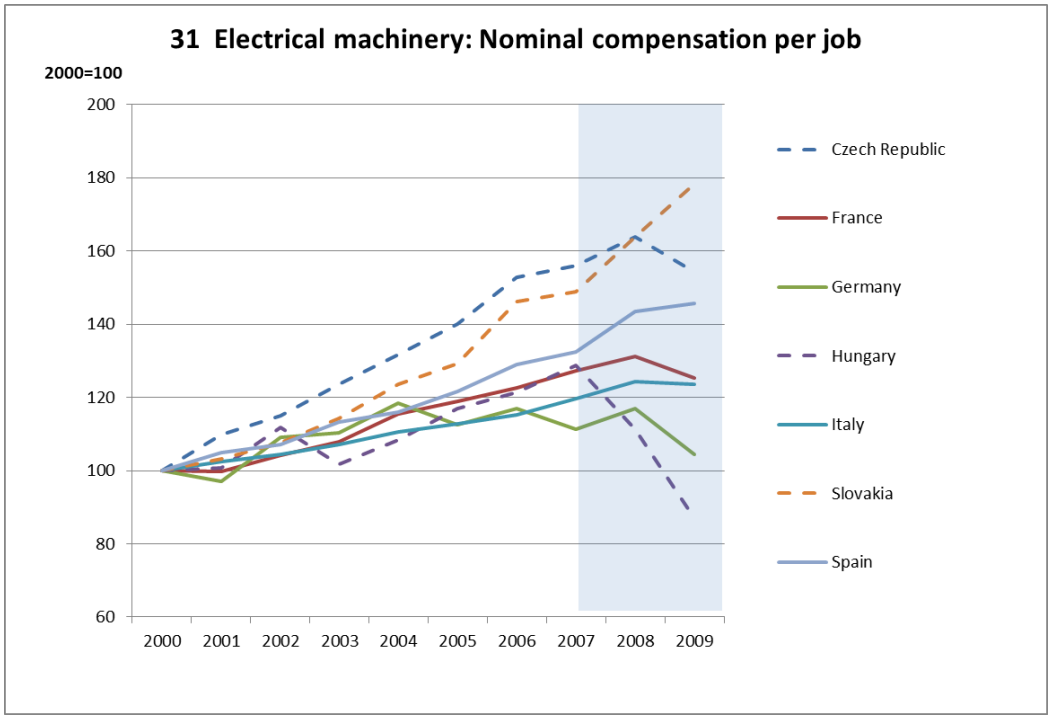


Figure 5.20: Nominal compensation per job in electrical machinery in selected Member States



Strong productivity growth in the new Member States supported strong increases in average wages in the Czech Republic and Slovakia, as shown in Figure 5.20. The increase in Hungary was slower and broadly in line with the increases in old Member States.

5.2.4 Motor vehicles

Figure 5.21 shows that there were very marked differences in trends in ULCs among the three new Member States. While the Czech Republic and Slovakia saw a substantial reduction in ULCs, Hungary saw a very large increase. Among the old Member States, Germany saw a reduction in ULCs almost as rapid as those in the Czech Republic and Slovakia, whereas France saw a relatively rapid increase.

Figure 5.22 and Figure 5.23 show that the large increase in Hungary's ULCs reflected a large increase in nominal compensation per job and only modest productivity growth. But Hungary saw a marked improvement in its motor vehicles trade balance in this period (as did the Czech Republic and, to a lesser extent, Slovakia). This raises the question as to whether GVA growth, and hence productivity growth, is understated in Hungary's data.

In the group of old Member States, Germany had the highest increase in productivity. The productivity of labour in France more or less remained constant, while Italy and Spain had slight increases. Increases in nominal compensation per job were broadly similar among the old Member States (slowest in Italy). Germany's superior performance in ULCs, driven by productivity, was reflected in its improving trade surplus, whereas the other three countries saw a deterioration. But employment trends were similar in the old

Member States, as the impact of stronger GVA growth in Germany was offset by stronger productivity growth.

Figure 5.21: Unit labour costs in motor vehicles in selected Member States

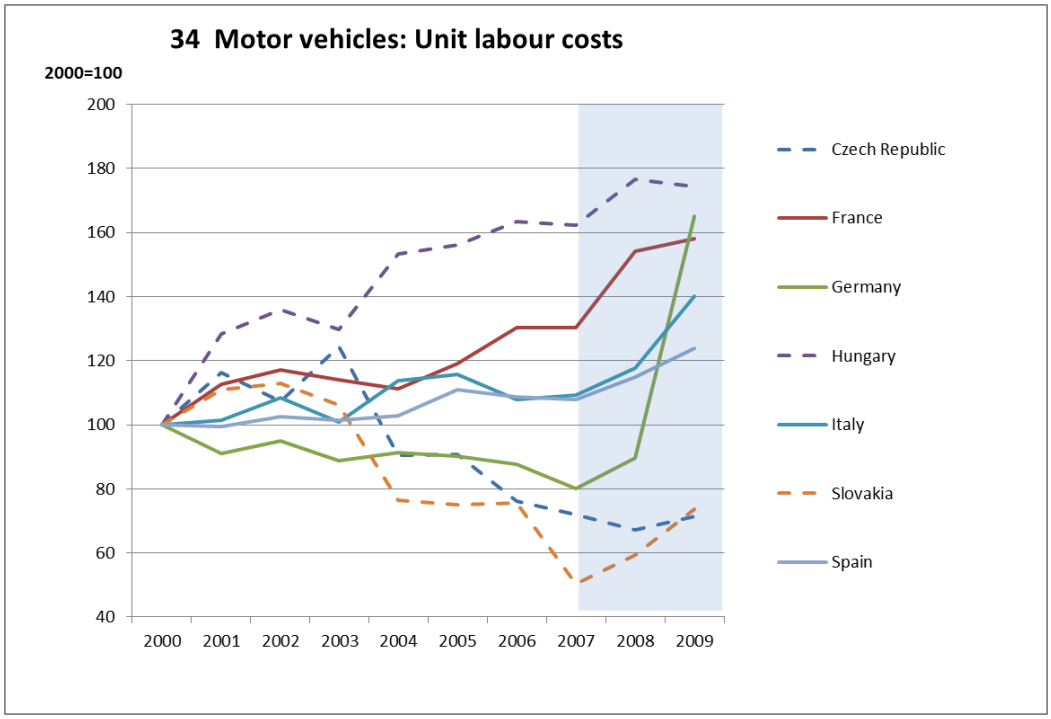


Figure 5.22: Average labour productivity in motor vehicles in selected Member States

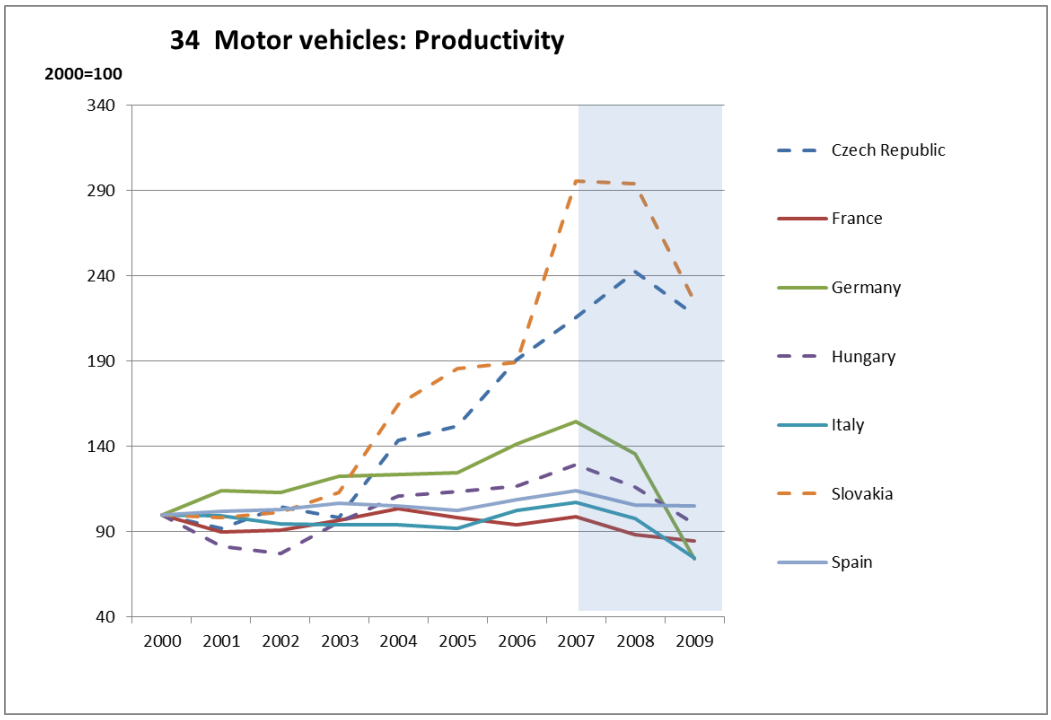


Figure 5.23: Nominal compensation per job in motor vehicles in selected Member States

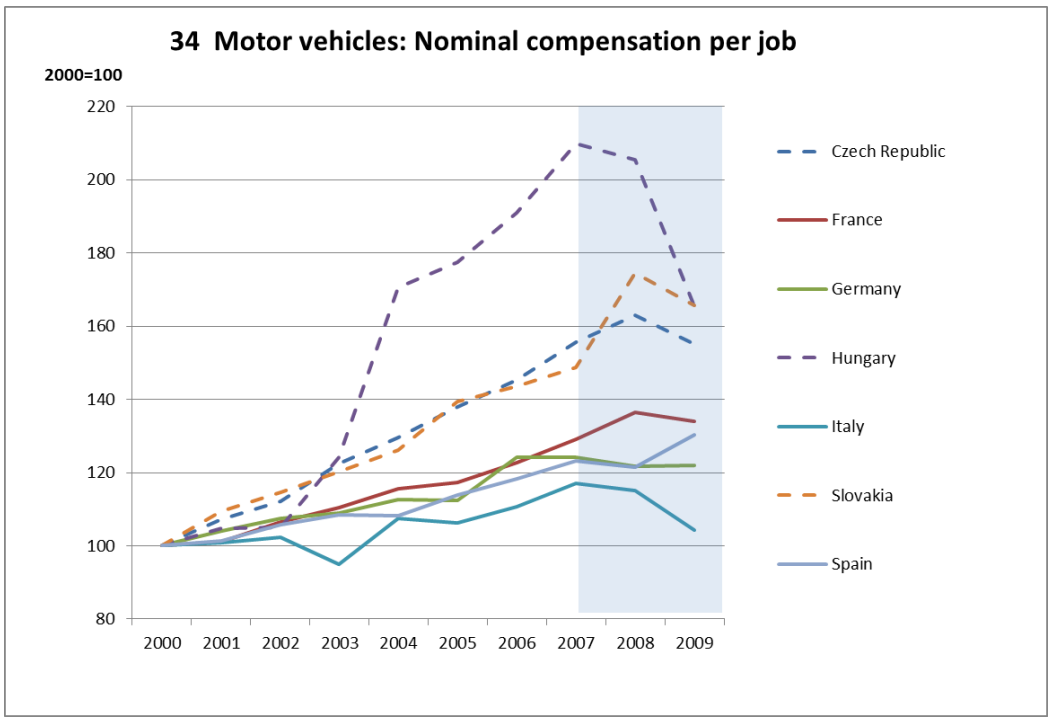
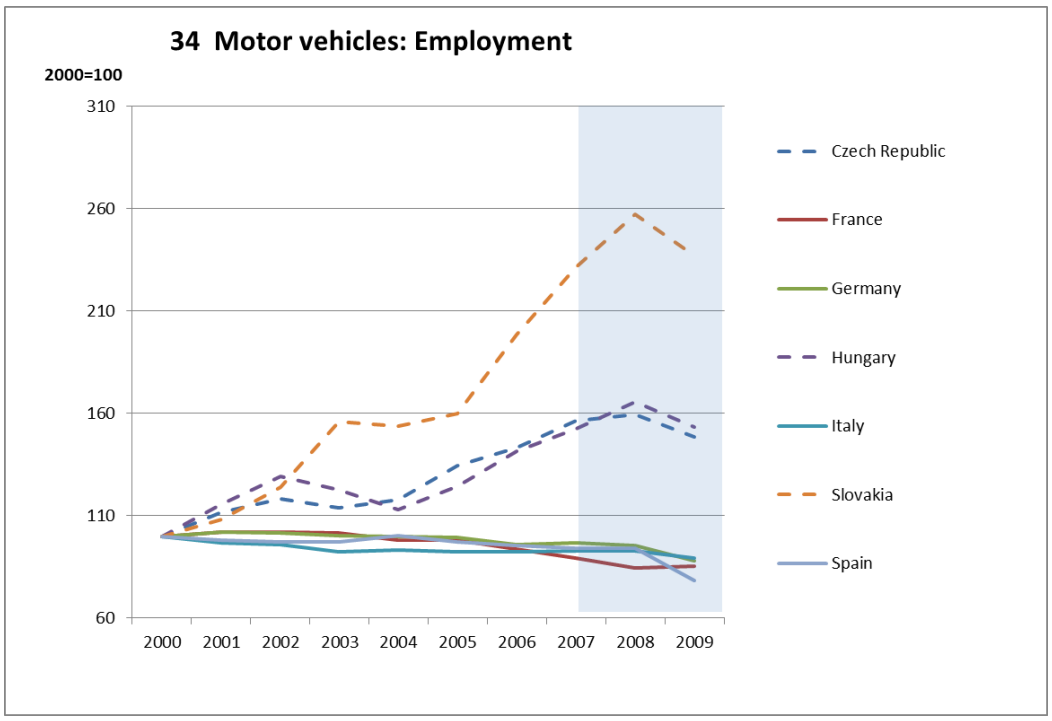


Figure 5.24: Employment in motor vehicles in selected Member States



To conclude, looking at single sectors, clear differences in trends between old and new Member States are rare. At least regarding some indicators, a catching up process can be identified, especially in terms of productivity and to some extent also in GVA. Fast increases in average wages are generally (although not always) paid for by faster increases in productivity, so that improvements in labour cost competitiveness are sustained. In some cases the catching up is reflected in sufficiently strong growth in GVA, driven by an improved trade balance, for employment to increase. As we mentioned above, all of the figures represent relative developments and so they allow no conclusions about absolute differences in cost competiveness. In any case, old Member States of the EU usually have higher levels of productivity and production than new Member States.

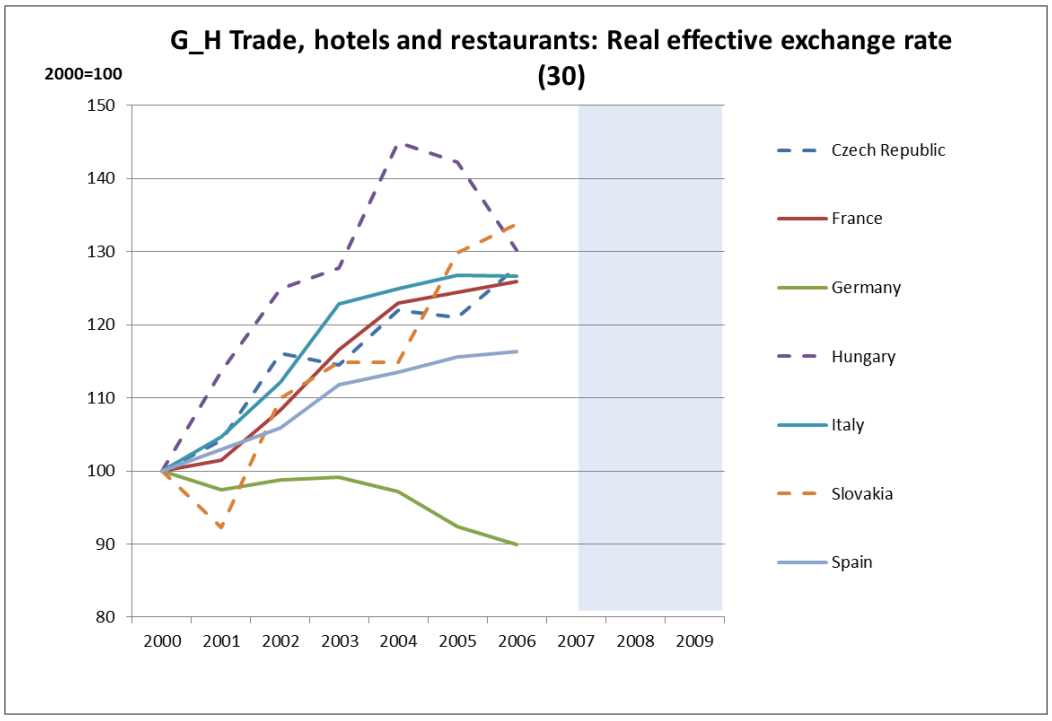
6 Unit labour costs in service sectors

In this section we focus on three service sectors, namely 'Trade, Hotels and Restaurants', 'Transport, Storage and Communication' and 'Financial and Business Services'. We consider the same seven states as in the section above in order to compare differences in old and new Member States. At the same time we try to identify differences between manufacturing and service sectors. Since our focus is on long-term trends, we concentrate on the pre-crisis period up to 2007. The blue boxes in the figures denote the crisis period.

6.1 Trade, hotels and restaurants

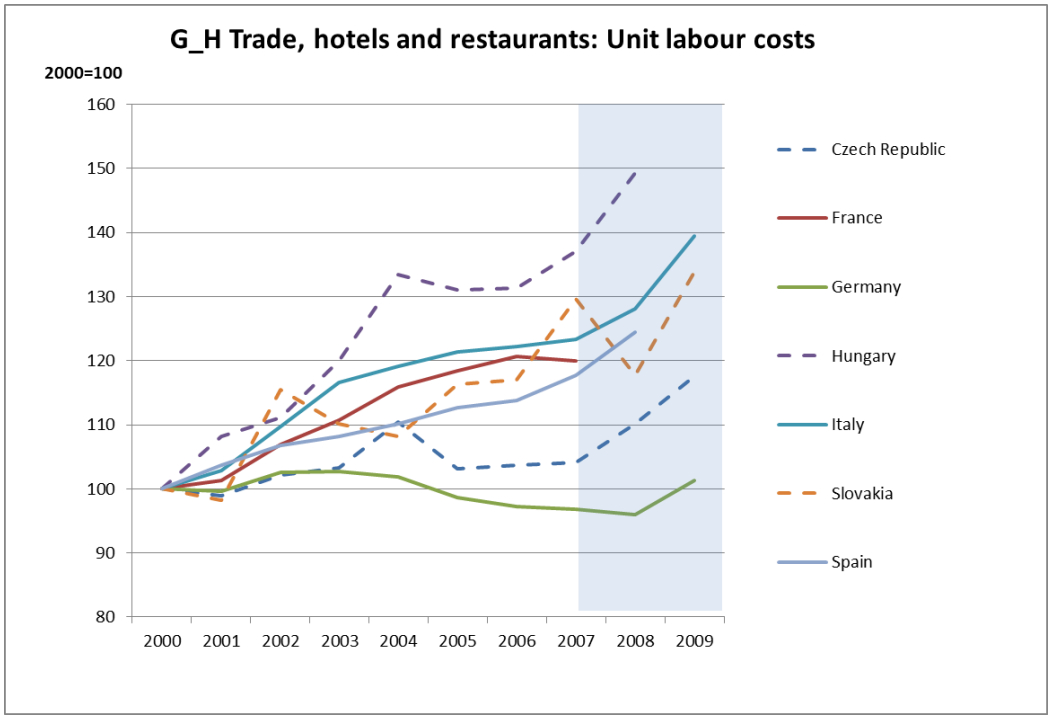
In trade, hotels and restaurants, we observe similar developments in REERs for all new Member States over 2000-06. Their REERs rose by about 30%. In Hungary a strong increase until 2004, the year of EU accession, was followed by a two-year downward trend. In the Czech Republic and Slovakia, REERs rose.

Figure 6.1: Real effective exchange rates in trade, hotels and restaurants in selected Member States



REERs in France and Italy increased by 25%, while in Spain, they rose by just 15%. Germany is the only country that experienced a drop in REERs.

Figure 6.2: Unit labour costs in trade, hotels and restaurants in selected Member States



The developments of ULCs are slightly different to the trends in REERs, at least for the new Member States. In the case of Hungary, the depreciation of its currency in 2005 and 2006, after accession, more than offset the rapid increase of ULCs in those years, and the REER fell.

Germany's better performance reflected both slower growth in average wages and stronger growth in productivity, the latter associated with relatively weak employment growth. The relatively strong increases in ULCs in Spain and Italy were associated with falling recorded productivity growth reflected in fast employment growth.

6.2 Transport, storage and communication

In the transport, storage and communication sector, Figure 6.3 shows that Germany had a more or less constant REER, France and Italy had increases between 10% and 20%, while Spain had the highest increase in the group of old EU Member States by about 45%.
Among the new Member States a very large increase of about 120% was recorded for Slovakia. For the Czech Republic and Hungary, REERs rose by approximately 35% and 55% respectively.

The ULCs are depicted in Figure 6.4 and are similar to those in real effective exchange rates. Slovakia's ULCs rose by about 160%, while Hungary's and those of the Czech Republic respectively increased by more than 35% and 5%. Spain, in the group of old Member States, had the highest increase in ULCs, reflecting a sharp increase in employment and slowdown in productivity growth. Pre-crisis ULCs of Italy were close to the base year level. France and Germany had decreases of about 4% and 10%.

Figure 6.3: REERs in transport, storage and communication in selected Member States

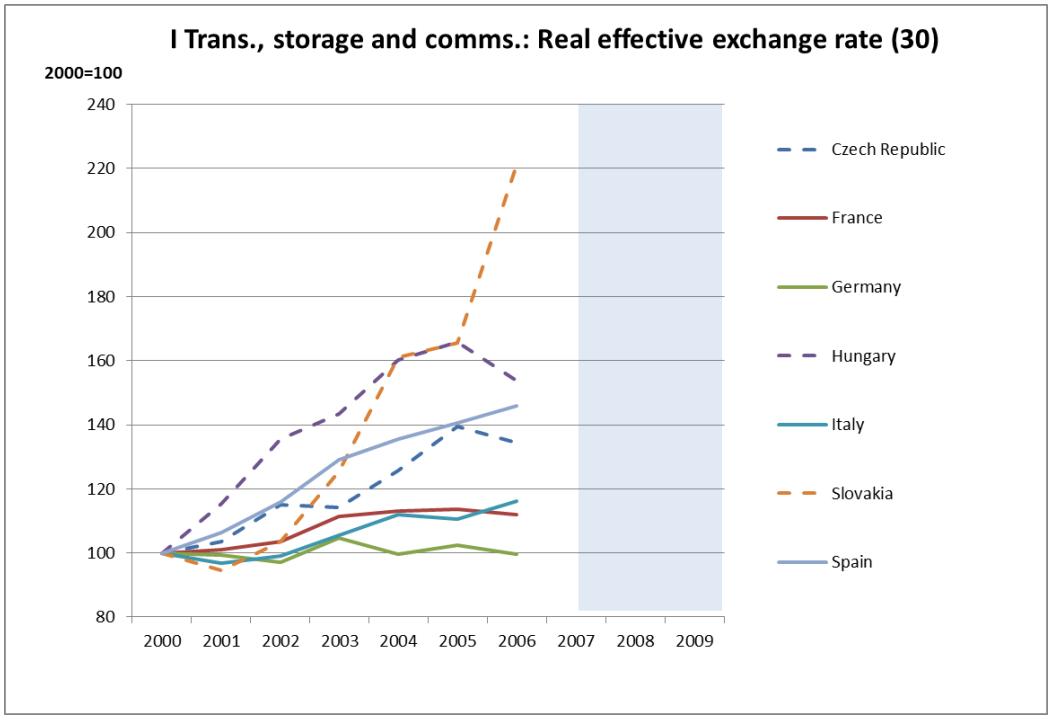
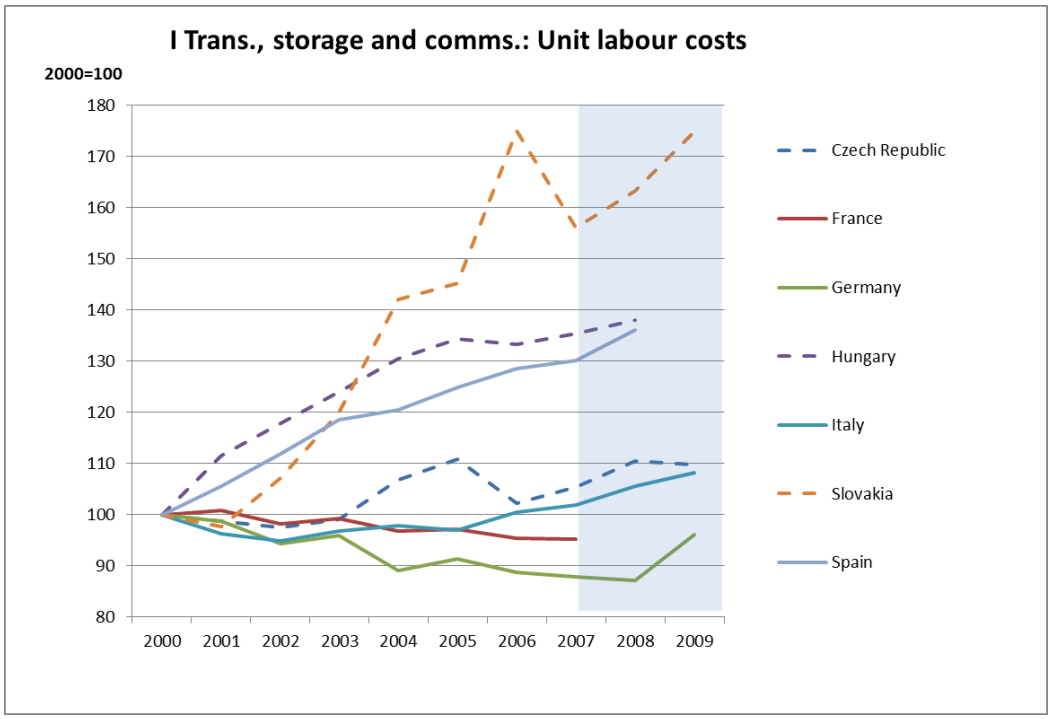


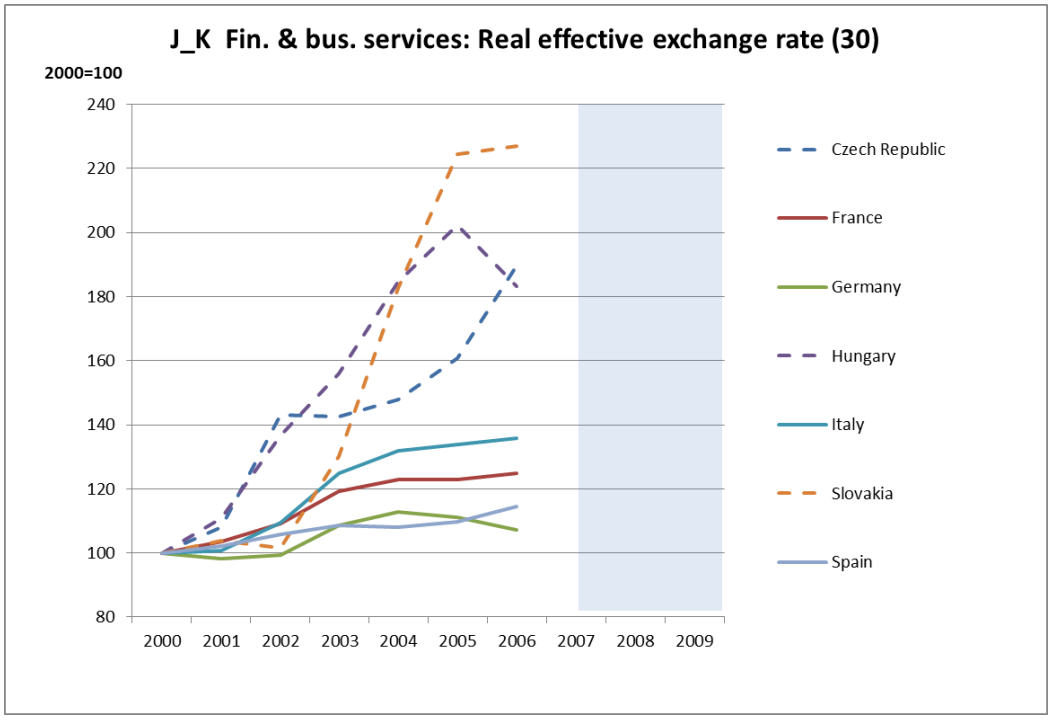
Figure 6.4: Unit labour costs in transport, storage and communication in selected Member States



6.3 Financial and business Services

Figure 6.5, shows that in financial and business services new Member States again experienced substantial increases in REERs. Slovakia's REERs rose by more than 125%. As before, currency movements were responsible for the change in Hungary's upward trend into a two-year downward trend in 2005 and 2006. The REERs of the Czech Republic rose by 90%.

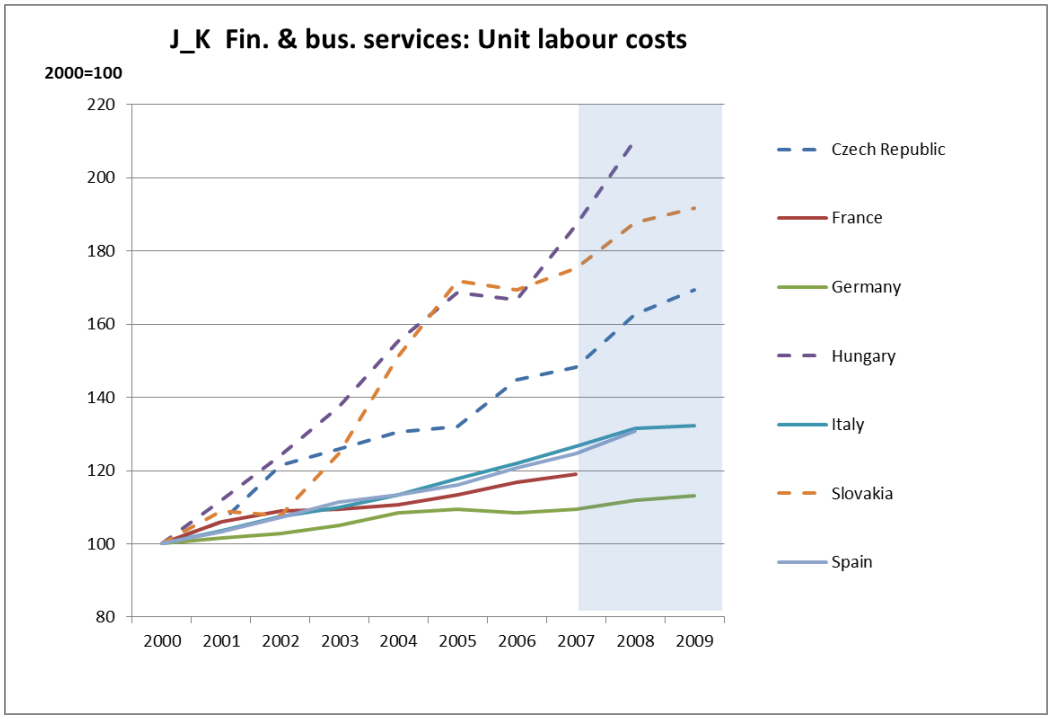
Figure 6.5 EU real effective exchange rates in financial and business services



The old Member States had increasing REERs too, Italy by more than 30%, France by more than 20%, Spain by more than 15% and Germany by a little less than 15%.
The ULCs for the financial and business services sectors are depicted in Figure 6.6. These trends broadly correspond to those for REERs.

The strong growth in ULCs in the new Member States reflects strong increases in average wages, while productivity growth was broadly similar to that recorded for the old Member States. This could be an example of the implications of the Balassa-Samuelson effect: strong growth in productivity drives strong growth in average wages in the traded sector, and this in turn drives strong growth of average wages in the non-traded sector.

Figure 6.6 EU unit labour costs in financial and business services



In conclusion, the new Member States experienced a deterioration in labour cost competitiveness in service sectors. In general their increases in ULCs and REERs were higher than those of the old Member States. In manufacturing industry there were very substantial increases in labour productivity in the new Member States, and these were associated with strong increases in average wages. The service sectors have also seen strong increases in average wages, but the corresponding increases in productivity have not been as large as in manufacturing, and so the result has been an increase in ULCs and REERs.

7 Trends in unit labour costs in Brazil, China and India

In this section, we focus on three important emerging market economies, Brazil, China and India, in comparison to an average of 16 Member States[15]. The trade partners included in the calculation of EERs and REERs are Estonia, Lithuania, Portugal, Romania, Canada, Iceland, Japan, Norway, South Korea, the USA, Brazil, India and China. We focus on the pre-crisis period up to 2007. The blue boxes in the figures denote the crisis period.

Figure 7.1: Brazil, China and India real effective exchange rates in manufacturing

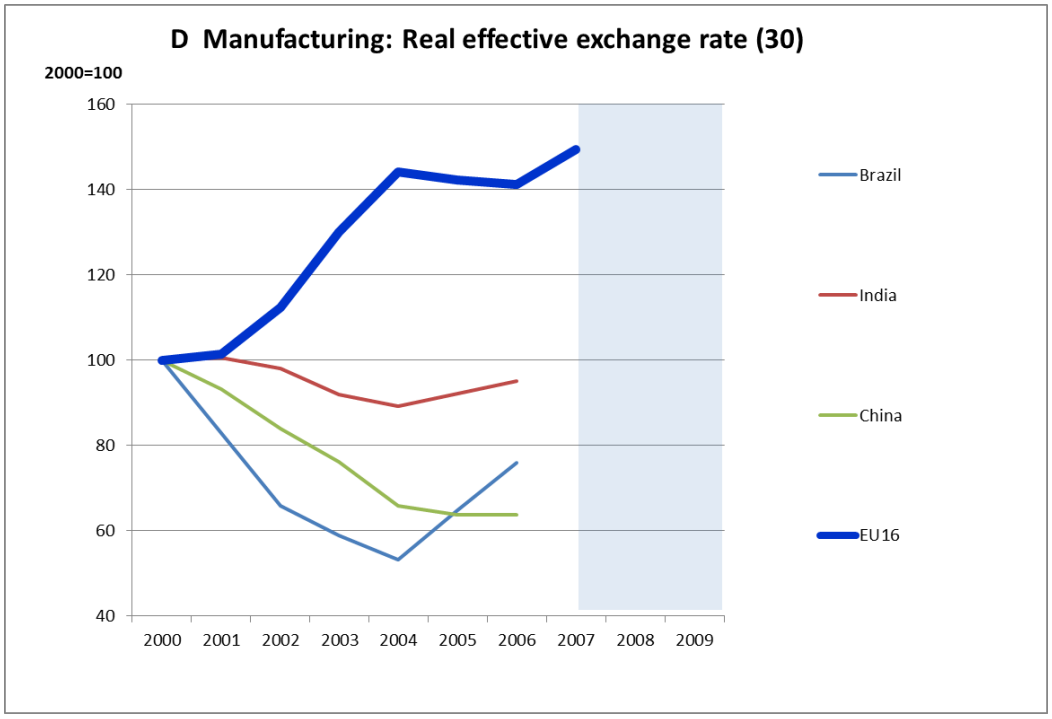


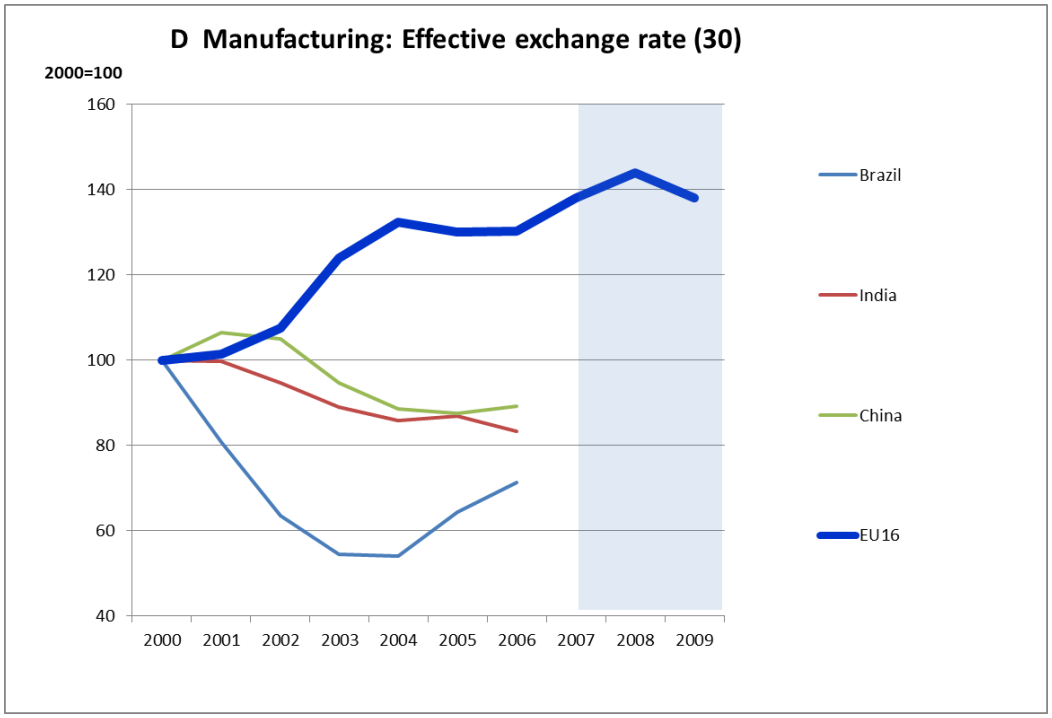
Figure 7.1 shows the trends in REERs. Brazil, China and India had clear decreases in REERs. From 2000 until 2004, India's REERs fell by about 10%. After that we observe a two year period of increasing REERs until 2006. The general development is an advancement of the relative cost competitiveness. China's downward trend until 2004 was followed by a more moderate development of REERs over two years. The

[15] Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Netherlands, Slovakia, Slovenia, Spain, Sweden and the UK.

value in 2006 is approximately 35% below the level in 2000. A fast downward trend in Brazil by more than 40% was succeeded by a sharp increase in REERs over 2004-06, so that the overall decrease was just over 20%.

Since REERs are calculated relative to trading partners, the trend in the EU16 REER reflects the gains in cost competitiveness seen in Brazil, China and India. Accordingly, after an increase of 40% we observe a trend reversal in 2004, when the upward trend in REERs stopped and for two years they slightly decreased. From 2006 to 2007 we observe a shift again. Unfortunately the lack of data allows no comparison to Brazil, China and India for that year.

Figure 7.2: Brazil, China and India effective exchange rates (manufacturing trade weights)

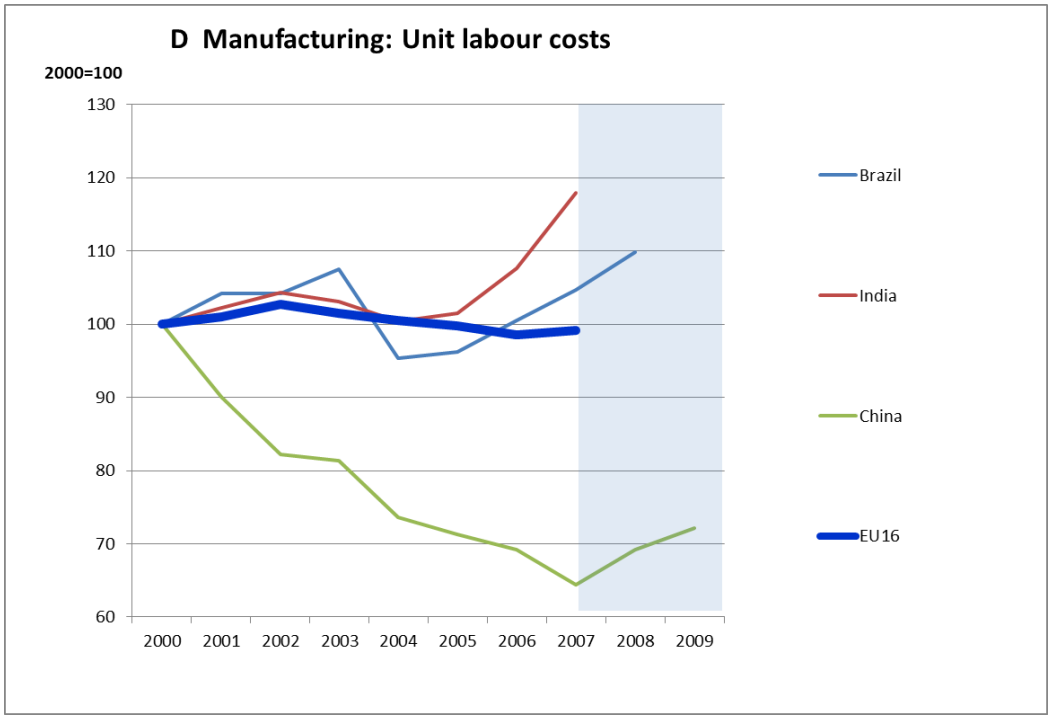


The nominal EERs (weighted by trade in manufacturing) are shown in Figure 7.2. These are broadly consistent with the REERs, showing the importance of currency movements to global REER trends, at least in the short run. The European average nominal EER rose by 40% until 2007. India and China saw a currency depreciation over this period (keeping broadly in line with the depreciation of the US dollar). Brazil had the largest depreciation over the first four years: about 45%. The drop of the Brazilian Real was followed by an appreciation until 2006. Over the whole six-year period, the Brazilian Real depreciated by nearly 30%.

The trends in ULCs in Figure 7.3 show that, with the exception of China, differences among the countries were not substantial, so that they contributed little to changes in cost competitiveness. Hence, Brazil's improved cost competitiveness was driven primarily by the massive devaluation of the Real. A similar, though less pronounced same effect is observable in India: ULCs rose more rapidly than in the EU16, but a currency depreciation produced a gain in cost competitiveness. In China the rapid fall in ULCs

combined with currency depreciation (following the US dollar) to give a sustained improvement in its REER.

Figure 7.3: Brazil, China and India unit labour costs in manufacturing



As Figure 7.4 shows, China's trade surplus in manufactures is very large compared to the trade balances of India, Brazil and the EU16. China's surplus grew rapidly over 2003-07. Figure 7.5 shows that Brazil's surplus also increased over that period, whereas the balances in India and EU16 showed no trend upwards or downwards.

There is some correspondence between trends in REERs and in trade balances. Brazil and China had strong improvements in REERs and in their trade surpluses. India had a modest improvement in its REER and no change in its trade balance. But there was no clear trend in the EU16 trade balance despite its loss of labour cost competitiveness.

Figure 7.4: Trade balances in manufacturing in Brazil, China, India and the EU16

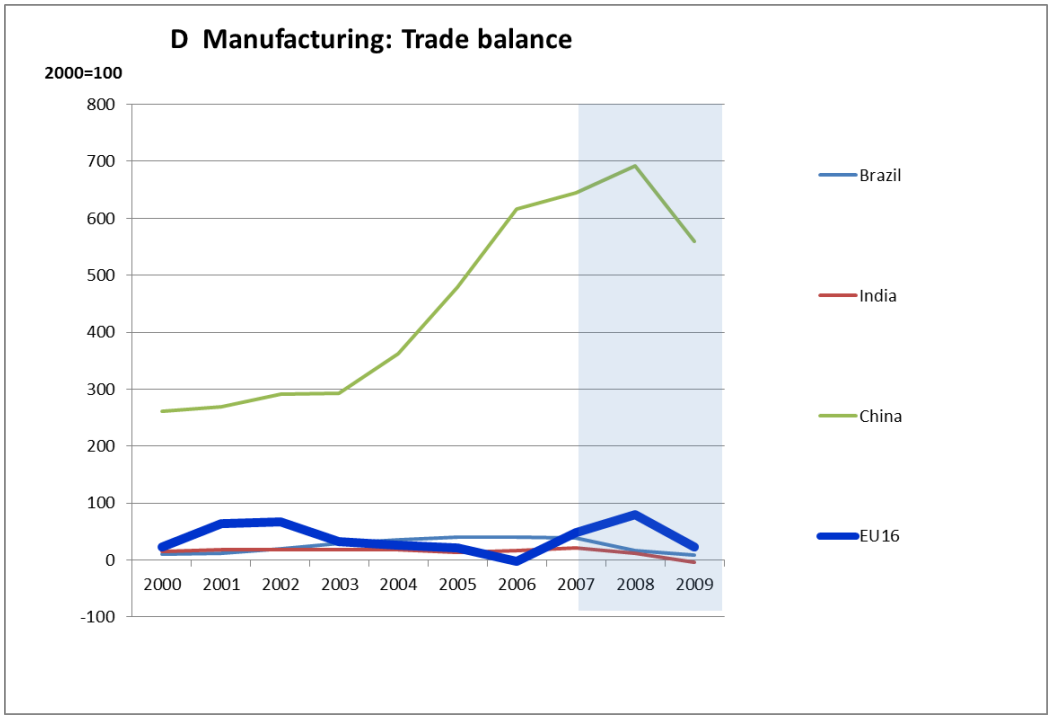
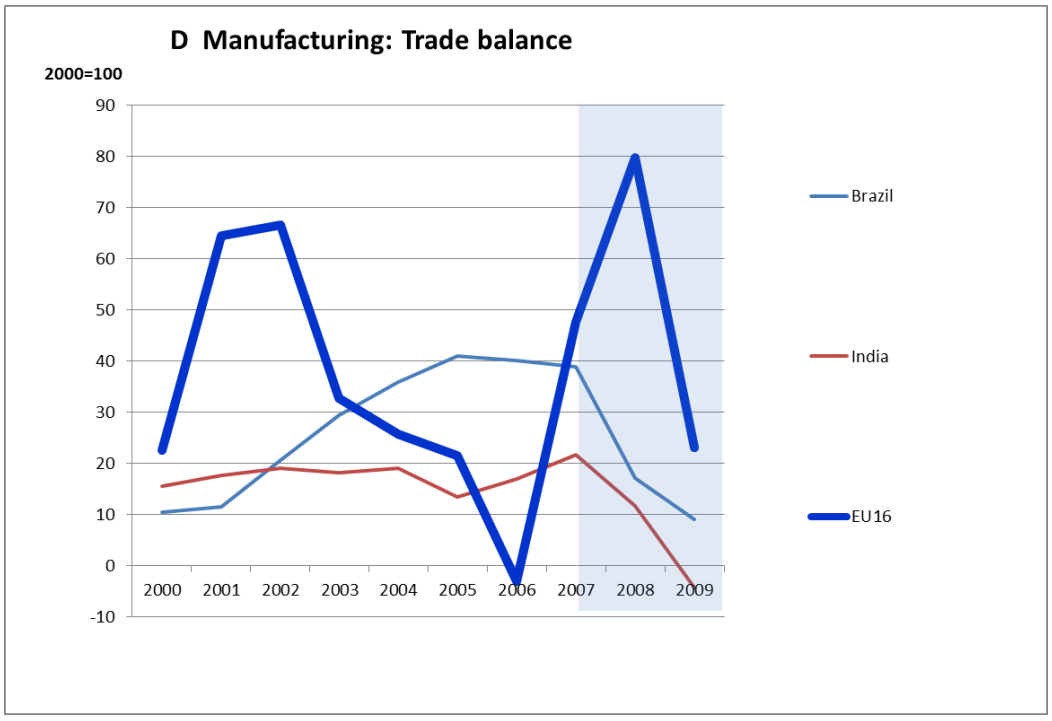


Figure 7.5: Trade balances in manufacturing in Brazil, India and the EU16



8 Conclusions and policy implications

This section provides a summary of our findings for each previous section as well as some further implications.

8.1 General findings for trends in REER and the competitiveness of EU Member States

For some countries, the *impact of macroeconomic changes* is felt across most sectors. This is true for the southern European eurozone members, where the loss of competitiveness is seen across all sectors. It is also true of countries outside of the eurozone whose currency movements have a common impact across sectors (Sweden, the UK and the USA).

When the range of trading partners in the calculation of REERs is *broadened to include low cost competitors*, the effect is, as expected, to make the trend in REERs among the EU countries worse. The largest impact is the inclusion of China, imports from which have risen very sharply in some sectors (including, but not limited to, sectors in which low labour costs are traditionally a source of comparative advantage such as wearing apparel and textiles).

The macroeconomic finding noted in Section 3.2 that there is no simple, consistent relationship between *trends in the trade balance and trends in REERs* is also borne out at the level of individual sectors. There is no common theme that improvements in ULC competitiveness are associated with an improved trade performance, or vice versa. There are examples consistent with this pattern, and there are counter-examples. In some cases, the examples of an improved trade balance despite a deterioration in ULC competitiveness seem consistent with known strengths in terms of quality. We cite some econometric evidence for the factors explaining extra-EU export performance in support of this finding.

While labour costs by no means dominate the cost structure of manufacturing subsectors, they remain more important for the competitiveness of different geographical locations than this statistic might suggest, because they are *an important cost element which varies between those locations*. Another important element for some manufacturing industries whose cost varies greatly across countries is energy costs.

8.2 Intra-European comparison in manufacturing sectors

For the intra-European comparison of ULCs and REERs we considered seven countries, representing either old or new Member States of the EU. France, Germany, Italy and Spain represented the old Member States, while the Czech Republic, Hungary and Slovakia represented the new ones.

We observed high increases in productivity and gross value added for the new Member States, suggesting a process of convergence. In several cases increases in nominal compensations exceeded the increases in productivity so that there was a deterioration in labour cost competitiveness. In general, new Member States had more volatile developments than the old ones, which signifies restructuring processes in the new EU economies.

Motor vehicles was one of the sectors that had the largest increases in productivity and production. Slovakia in particular saw very large increases. Smaller increases were seen in Hungary, but even so it is dependent on motor vehicles: Audi, Opel, Suzuki and Visteon make 90% of the Hungarian automotive industry and the exports of Audi, Opel and Suzuki make 17% of all Hungarian exports.[16]

As expected, currency movements had important influences on REERs for new Member States outside of the eurozone. The Czech and the Slovak currencies experienced an appreciation which weakened their cost competitiveness.

8.3 Intra-European comparison in service sectors

For the intra-European comparison in service sectors, we considered the same seven Member States and found some differences compared with manufacturing sectors. Unit labour costs in the broad service sectors covered in Chapter 6 tended to grow faster in new Member States, and particularly in financial and business services sectors, reflecting stronger growth in nominal compensation (which was not offset by stronger growth in productivity). Transportation, storage and communication was the only broad service sector in which employment in the new Member States fell, despite the fact that GVA grew faster than in old Member States in all except Slovakia. However convergence towards the productivity levels of the old Member States was not as strong as in the manufacturing sectors.

8.4 Comparison between emerging economies and the EU

In Chapter 7, we compared the trends of unit labour costs and real effective exchange rates in all manufacturing sectors of three important emerging economies, Brazil, China and India with a European average of 16 Member States. The REERs trends of the selected BRIC countries moved in the opposite direction to those of the European average, and in general the BRIC countries saw a fall in REERs.

[16] Hungarian Investment and Trade Development Agency, ITD Hungary

The trends in unit labour costs were different to those in real effective exchange rates. China was the only country in which ULCs fell. The countries' competitiveness was generally improved by depreciation against European currencies. We found some empirical evidence for the relation between developments in real effective exchange rates and developments in trade balances. Improvements in cost competitiveness for the emerging economies went along with a growing trade surplus, but this was not so evident for the European average, supporting the earlier finding that in most sectors the trade performance of the higher-cost European countries depends less on cost competitiveness.

Appendix A: The definition of unit labour costs and real effective exchange rates

A.1 The definition of unit labour costs and the choice of indicators

As a concept, unit labour costs (ULCs) are defined as the ratio of labour costs to output.

With regard to the numerator, the measure of labour costs defined in the system of national accounts is 'compensation of employees', which is the sum of expenditures on (1) wages and salaries and (2) employers' social contributions.

Compensation of employees covers the labour costs associated with employees, but not those associated with self-employment. The distinction between wage income and operating surplus is not a meaningful one for the self-employed, and the system of national accounts combines them in the single concept of 'mixed income'. In its construction of unit labour costs the OECD[17] multiplies compensation of employees by the ratio of total hours worked (i.e. by employees and the self-employed) to the number of hours worked by employees. This makes the implicit assumption that the breakdown between capital and labour costs is the same for the self-employed as it is for other kinds of enterprise. If we are to replicate this treatment at the detailed sectoral level, we need to gather data on the hours worked by employees and the self-employed at that level. Data on hours worked are unlikely to be available, and an alternative is to use the number of employees and the number of self-employed as a proxy. In practice, data availability may prevent even this (not least because employment data at the detailed sectoral level usually comes from surveys of businesses, and the coverage of micro-enterprises is often poor or non-existent). For most manufacturing industries, the proportion of self-employment is relatively small, and so the lack of data on self-employment may not be too serious.

This discussion therefore suggests the following definition of labour costs, subject to data availability:

Labour costs	=	Compensation of employees	*	Number of employees + self-employed	/	Number of employees

[17] See Annex 4 'OECD System of Unit Labour Cost and Related Indicators' of OECD (2008) *Compendium of Productivity Indicators*, OECD: Paris, available at www.oecd.org/dataoecd/5/41/40526588.pdf.

With regard to the denominator in the ULC calculation, *output*, there are two candidate measures:

- gross output
- gross value added

Gross output is the sum of all inputs to production together with value added, and is broadly equivalent to turnover. Gross value added is the difference between gross output and inputs to production. In principle, an argument can be made for the relevance of either measure. If gross output is used, this reflects the entire cost structure of production (so that, for example, the share of labour costs can be compared with the share of other key input costs such as energy). On the other hand, the measure of gross output in the national accounts is vulnerable to differences in statistical convention and industrial organisation (for example, the extent of subcontracting within an industry) that can distort comparisons across countries or time. In practice, data on value added are typically more readily available.

It is important to ensure that the measure of output treats taxes on products in a consistent way across countries. Specifically, gross output should be valued at basic (i.e. excluding taxes on the product of the industry) rather than producer prices, so that gross value added also excludes such taxes.

This discussion therefore suggests the following definition of output:

Output	=	Gross value added at basic prices

The question arises as to whether output should be valued in current prices (nominal) or in a measure that adjusts for the effects of inflation ('real'). The OECD uses real output, so that changes in ULC reflect the difference between trends in labour costs per worker (or hour worked), on the one hand, and productivity (defined as real output per worker, or hour worked) on the other. Similarly, the IMF's ULC-based REER uses real value added (together with normalised ULCs)[18]. In the same way, the study of van Ark et al (2005) of the levels of relative unit labour costs used real output and Kang et al (2009) replicated van Ark et al's methodology. This measure of productivity therefore excludes (by design) the effect of changes in the price of the industry's product. Instead, using a metaphor that implies homogeneous output across countries, the concept is labour costs per widget produced (or, more precisely when GVA is the denominator, per stage in widget-processing).

However, a case can be made for the use of a current price measure of output, on the grounds that firms' decisions are taken on the basis of nominal magnitudes. For example, a 'real terms' measure of gross value added could show positive growth while the industry moves from profit to loss because of movements in the price of its output. In practice, gross value added is normally available only in current prices in the business

[18] IMF (2010) *International Financial Statistics Country Notes 2010*, Washington: IMF, p3.

surveys which gather data at the detailed industry level; whether or not a 'real terms' measure is available depends on whether the statistical office has carried out the additional work required to construct the estimate.

For the purposes of interpretative analysis (rather than construction of the ULC estimate), it can be helpful to do some further manipulation.

Unit labour costs	=	Labour costs	/	Gross value added
	=	Labour costs per worker	/	Gross value added per worker
	=	Labour costs per hour worked	/	Gross value added per hour worked

In each of the two alternative formulations above, both the numerator and denominator have been divided by a measure of physical labour input, so that the numerator is transformed into a measure of the wage rate and the denominator into a measure of labour productivity. In the simplest case, the measure of physical labour input is the number of workers (both employees and self-employed). A more sophisticated analysis uses hours worked as the measure, since this results in a definition of labour productivity that is not affected by changes in the number of hours worked. However, at the detailed sectoral level it is unlikely that data for hours worked are available.

Sector-specific issues

The National Accounts imputes to owner-occupiers of dwellings a rental for the service provided by the dwelling. This imputed rental is included in the value added of real estate activities (Section L of ISIC Rev.4, in Class 6810 'Real estate activities with own or leased property'), but it has no associated labour input. Consequently, if the calculation of ULCs for Section L (or any aggregate that includes Section L) includes this imputed rental in the denominator, the ULCs will be understated. If the relative importance of the imputed rental varies across countries, its inclusion will distort cross-country comparisons. Imputed rentals are normally fairly stable over time, and so interpretation of temporal comparisons for the same country is less likely to be affected.

OECD[19] applies a procedure to adjust the data for value added in current and constant prices, designed to take account of the fact that data for the contribution of ownership of dwellings to value added is not available for many countries.

[19] See www.oecd.org/dataoecd/37/31/37664867.pdf.

A.2 The construction of nominal and real effective exchange rates

Nominal effective exchange rate

A country's (nominal) *effective exchange rate* is a weighted average of its bilateral market exchange rates with its trading partners, where the weights reflect the relative importance of each partner to the country's trade performance[20]. The ideal effective exchange rate has the property that no information relevant to competitiveness is lost in the reduction of dimensionality from the many bilateral rates to the single effective rate. If the effective rate shows a depreciation of, say, 10%, it should not make any difference to an assessment of the impact on competitiveness which particular configuration of changes in the cross rates accounted for the change. Similarly, the ideal effective exchange rate has the property that

> 'a change in cross rates has no effect on a country's key macroeconomic aggregates as long as the real effective exchange rate remains constant'[21].

These requirements imply that the elasticity of substitution between imports from any two countries is the same for all countries. In practice, international specialisation and differentiation of products, even at the 2-digit ISIC level intended here, means that this condition is unlikely to hold, so that there is some loss of information in collapsing the cross rates into a single index.[22]

Since the focus of this study is on the competitiveness of EU industries, trading partners are considered 'important' here insofar as they represent important (and, it is assumed, competing) suppliers to the markets also served by EU producers, both inside and outside of the EU.

With regard to the domestic market, the relevant weights are the share of imports from a given origin country in the home country's imports from all countries, for the product under consideration. With regard to external markets, the preferred method of measuring relative importance is the 'double export weights' procedure. This measures the scale of competing production from a given country by the value of its production sold to its home market and the value sold to third markets as exports. Each such market is then weighted by its importance to the country for which the effective rate is being constructed, as measured by the country's exports to that market. However, in an era of substantial global integration of value chains in some industries, the use of gross value trade data to form weights could be misleading: a country which imported high value components, assembled them with minimal value added and then exported the finished product would be treated as an equally significant competitor in the market for the finished product as a

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[20] In principle, an effective exchange rate could be calculated for various purposes, for each of which case a different set of weights might apply.

[21] See p52 of Klau, M and Fung, S.S (2006), 'The new BIS effective exchange rate indices', *BIS Quarterly Review*, March 2006 available at http://www.bis.org/publ/qtrpdf/r_qt0603e.pdf on which the subsequent discussion draws, and Turner P and Van't dack J. (1993), 'Measuring International Price and Cost Competitiveness', *BIS Economic Paper* No. 39 available at http://www.bis.org/publ/econ39.pdf.

[22] Neary (2006) explores the theoretical issues involved in constructing an appropriate index in more detail, and develops 'GDP-neutral' and 'employment-neutral' REERs, by making explicit assumptions about the response of output and employment to changes in prices and costs.

country where a much higher proportion of the value of the finished product was accounted for by domestic value added. But it would be a complex and data-intensive exercise to attempt to measure the domestic value added in exports.

The following equations set out the formula for calculating the weight to be applied between the home country (designated *j*) and the competing country (designated *i*). The overall weight is designated w_i (equation (3)), which is a weighted average of a weight related to imports from country i, w_i^m (equation (1)), and a weight related to the competition producers in the home country face in country i and in third markets, w_i^x (equation (2)).

$$w_i^m = m_j^i / \sum_k^N m_j^k \quad (1)$$

the weight for imports from country i (into country j)	the value of imports from country i into country j	the value of imports from all countries into country j

$$w_i^x = \left(\frac{x_j^i}{\sum_k^N x_j^k}\right)\left(\frac{y_i}{y_i + \sum_{h,h\neq j}^N x_k^i}\right) + \sum_{k,k\neq i}^N \left(\frac{x_j^k}{\sum_h^N x_h^i}\right)\left(\frac{x_i^k}{y_k + \sum_{h,h\neq j}^N x_h^k}\right) \quad (2)$$

the weight for exports from country j competing with producers in country i	the share sold to country i of all country j's exports	country i's sales to its home market as a share of total supply to country i (excl. exports from country j)	the sum over all third countries	the share sold to (third market) country k of all country j's exports	country i's export sales to third market country k, as a share of total supply to country k (excl. exports from country j)

$$w_i = \frac{\sum_k^N m_j^k}{\sum_k^N m_j^k + \sum_k^N x_j^k} w_i^m + \frac{\sum_k^N x_j^k}{\sum_k^N m_j^k + \sum_k^N x_j^k} w_i^x \quad (3)$$

the weight for the cross rate of country j's currency with the currency of country i	the ratio of country j's imports (from all countries) and country j's total trade with all countries (imports plus exports)	the weight for imports from country i (into country j)	the ratio of country j's exports (to all countries) and country j's total trade with all countries (imports plus exports)	the weight for exports from country j competing with producers in country i

The data requirements to calculate double export weights are considerable. Firstly, a complete matrix of bilateral trade between every pair of countries in the group is needed (and, for the present study, this means a distinct matrix for the products of every ISIC industry distinguished). To take account of changing trade patterns, this set of matrices must be constructed for each year for which an effective exchange rate is to be calculated; in order to smooth short-term fluctuations in such patterns (which can be substantial for particular products) although a moving average of the annual figures is preferable[23]. Secondly, a measure of the sales of each country's producers to its home market (by sector/product and year) is required. Turner and Van 't Dack (1993)[24] discuss the options of using (a) gross output less exports, and (b) gross value added. In principle, gross output less exports is closer to the desired concept, since the value of the supply of a product, whether from foreign producers (as imports) or domestic producers includes the value of the bought-in inputs to production as well as the value added. However, because of subcontracting, gross output double-counts inputs and so is likely to overstate the value of the supply from domestic producers that is competing with imports. On the other hand, the use of gross value added understates the value of supply because it excludes the value of any inputs. In practice, data for gross value added are much more readily available.

The final stage in calculating the (nominal) effective exchange rate is to apply the weights w_i to the bilateral exchange rates between the home country (j) and all the countries to be included as competitors (*i=1 to N*). The conventional[25] choice is a geometric mean, giving the following formula[26]:

$$EER_j = \prod_{i=1}^{N} (e_{ij})^{w_i} \quad (4)$$

[23] Klau and Fung (2006) suggest a three-year moving average (p57).
[24] Turner and Van 't Dack (1993) p23.
[25] Klau and Fung (2006) p52,
[26] The weights w_i sum to 1.0 for each country j.

where

EER_j	the (nominal) effective exchange rate for country j
e_{ij}	the bilateral exchange rate between the currencies of country i and country j (units of foreign currency per unit of domestic currency), indexed to a common base year

The choice of numerator and denominator in the definition of e_{ij} here has the result that a rise in the EER is interpreted as an appreciation of the currency.

Real effective exchange rate

The real effective exchange rate (REER) is the nominal effective rate adjusted by some similarly weighted measure of relative prices or costs. In the context of the present study, the EER is to be deflated using relative unit labour costs[27]. Hence, the REER is to be interpreted as an aggregate measure of the unit labour costs of a country relative to its competitors expressed in a common currency. Since this study focuses on unit labour costs at the sectoral level, each country has a distinct REER for each sector.

For any given sector (or for the whole economy), the REER is therefore defined as follows:

$$REER_j = \prod_{i=1}^{N}\left(\frac{ULC_j}{ULC_i} * e_{ij}\right)^{w_i} = \prod_{i=1}^{N}\left(\frac{ULC_j}{ULC_i}\right)^{w_i} * \prod_{i=1}^{N}(e_{ij})^{w_i} \quad (4)$$

where the expression on the right-hand side demonstrates that the calculation can be expressed as the product of an 'effective relative unit labour costs' index and the previously-defined EER, and where

$REER_j$	the real effective exchange rate for country j
ULC_k	the unit labour costs of country k expressed in domestic currency and indexed to a common base year

Market or purchasing power parity exchange rates

Our discussion in this section has focused on the construction of a REER as a weighted average of relative unit labour costs converted to a common currency. However, the literature on relative unit labour costs commonly does not construct a REER, but simply presents a bilateral comparison of one country's ULC with another (or, more generally, presents such bilateral rates for several countries relative to a single country such as the US)[28]. This literature does not attempt to answer the question as to which bilateral comparisons matter most when considering the competitive position of a given country, and so it does not attempt to weight the various bilateral comparisons. It thereby avoids the need to undertake the analysis of trade data required to carry out the weighting. In the

[27] As proposed for use, for example, to the LIME Working Group in European Commission (2011a).
[28] For example, van Ark et al (2005) and Kang et al (2009).

same way, the OECD publishes indices of trends in unit labour costs for each country, and it publishes nominal EERs[29]. It does publish[30] REERs in which the EERs are deflated using (a) consumer prices and (b) ULCs in manufacturing industry (as a whole), but it does not publish REERs separately for sectors within manufacturing industry.

But the literature on relative unit labour costs does pay attention to a particular issue, namely whether *purchasing power parity* (PPP) exchange rates should be used in preference to market rates when converting the denominator in the ULC calculation, output, to a common currency. The issue arises in the context of an attempt to construct ULCs in which real, rather than nominal, output is used as the denominator, and the goal is to produce ULCs that can be compared as *levels* across countries (rather than as trends in indices), as in van Ark et al (2005)[31]. The argument is as follows. We are interested in comparing the level of labour costs for a (in principle homogeneous) product (such as a globally standard car). We can convert labour costs to a common currency using the market exchange rate. But the price of the product in common currency may differ between countries when we use the market exchange rate. If so, the unit labour cost comparison will include an effect which is due neither to labour costs nor to productivity but simply the fact that the exchange rate is not at a level which equalises the prices of output. Instead of using a market exchange rate, this method uses a PPP exchange rate to convert output to a common currency, which is simply the exchange rate at which the two prices would be equalised.

But this approach is open to the following criticisms. Firstly, the definition of the 'price' to be used when constructing a PPP is more complicated when the measure of output is gross value added rather than gross output. When the unit of 'work done' is, say, assembling components of a car, the only available price is the value added (double) deflator which does not support a comparison in levels (since it is only available as an index, rather than a 'price per car').

Secondly, for highly traded goods, it is unclear why cross-country price differences would be sustained for any length of time. If price differences are sustained, these may reflect differences in quality that have not been measured and reflected in the construction of the price comparison, or differences in the nature of the value adding process.

Thirdly, although a market exchange rate in any particular year may be abnormal, over time firms have to operate in the context of the market rates. As an illustration, when converted at market exchange rates, the price of a given product in China may be less than the price of the equivalent product in the EU, in which case the PPP exchange rate for the renminbi against the euro would be stronger than the market rate. If the PPP rate were used in a comparison of unit labour costs, it would (by design) understate the difference in the relative costs actually faced by producers. That may be appropriate when seeking to abstract from the impact of an abnormal market exchange rate[32] in a particular year, but it gives a misleading message over the longer term. It may be

[29] See, for example, OECD (2010b) *Factbook 2010* Economic, Environmental and Social Statistics, available at www.oecd-ilibrary.org/economics/oecd-factbook-2010_factbook-2010-en, pp100-101.
[30] OECD (2010b), pp 102-103.
[31] van Ark et al (2005) pp3-4.
[32] This is the justification offered for using PPS in Mann (1999), p102.

interesting to know that (say) the mechanical engineering industry in the EU has a similar labour cost per unit of physical work done as China, but if it cannot realise the same value for its production it still suffers from a cost competitive disadvantage.

In its table of ULCs converted to a common currency, the OECD uses market exchange rates, not PPPs (and notes that, as a result, the short-term changes may be volatile due to exchange rate changes). Similarly, the IMF's published REERs use market exchange rates.[33]

[33] IMF (2010) *International Financial Statistics Country Notes 2010*, Washington: IMF, p3.

Appendix B: Data sources and methods

B.1 Data requirements

Component indicators

The construction of *unit labour cost* indicators for any given country and sector requires data for:

- compensation of employees
- gross value added (volume)
- market exchange rates (to convert values into a common currency)

Ideally, data are also required for

- the number of employees
- the total number of persons working in the sector (including those who are not employees)

The employment data are used to construct a factor to gross up compensation of employees to a measure of labour costs that includes an allowance for self-employment income. However, in the absence of employment data, this study uses the unadjusted value for compensation of employees as the denominator. Since it is the *trends* in unit labour costs that are compared, the difference made by the adjustment will only be important if the proportion of the self-employed in total employment is changing markedly. For the manufacturing sub-sectors that are the main focus of this project, self-employment is in any case not large.

The construction of *effective exchange rates* (EERs) for any given country and sector requires data for:

- for the products of the sector of interest, the value of exports to and imports from all the trading partners to be included in the EER calculation
- for the sector of interest, gross value added (value) in all the trading partners and third markets (for the double export weights to be calculated)
- market exchange rates with the currencies used by all the trading partners

The construction of *real effective exchange rates* (REERs) for any given country and sector imposes no additional data requirements beyond those noted already.

Sector coverage

The sector coverage adopted for the study was as follows[34].

Broad sectors

D	Manufacturing
G-I	Trade, transport and communication distinguishing Hotels and restaurants (H) where feasible
J-K	Financial and business services

2-digit manufacturing sectors

15	Manufacture of food products and beverages
16	Manufacture of tobacco products
17	Manufacture of textiles
18	Manufacture of wearing apparel; dressing and dyeing of fur
19	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear
20	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
21	Manufacture of paper and paper products
22	Publishing, printing and reproduction of recorded media
23	Manufacture of coke, refined petroleum products and nuclear fuel
24	Manufacture of chemicals and chemical products
25	Manufacture of rubber and plastics products
26	Manufacture of other non-metallic mineral products
27	Manufacture of basic metals
28	Manufacture of fabricated metal products, except machinery and equipment
29	Manufacture of machinery and equipment n.e.c.
30	Manufacture of office, accounting and computing machinery
31	Manufacture of electrical machinery and apparatus n.e.c.
32	Manufacture of radio, television and communication equipment and apparatus
33	Manufacture of medical, precision and optical instruments, watches and clocks
34	Manufacture of motor vehicles, trailers and semi-trailers
35	Manufacture of other transport equipment
36	Manufacture of furniture; manufacturing n.e.c.
37	Recycling

[34] The sector definitions adopted here are ISIC Rev. 3, which was the classification most commonly adopted in the data sources used for the study.

Time period

The study collected annual data for as long a period as was practicable. The earliest data collected were for 1970, and the most recent were for 2009.

B.2 Data for unit labour costs component indicators sourced from multinational databases

With the exception of data for Brazil, China, India and Russia, for which a special treatment was adopted as described in a separate section below, the general procedure adopted was as follows:

1 Gather data from the OECD databases (principally STAN).
2 Supplement these with data from Eurostat (for those EU Member States that are not covered in the OECD data).
3 Undertake various ad hoc data filling procedures to fill gaps.
4 Where necessary, extend backwards using Cambridge Econometrics' E3ME database (which has been developed over time, using official sources).

Data-filling procedures

One of the principal outputs of the study was the calculation of real effective exchange rates (REERs) for each sector. If data are missing for a single cell (country-sector-year), the REER calculation also yields a missing value. Judgment was therefore exercised to determine whether it was preferable to adopt a simple data-filling procedure to estimate missing values, or to exclude the country from inclusion in the calculation.

Where adopted, data-filling procedures were generally implemented in a copy of the spreadsheets in which the raw data were initially collected. This has the benefit that the formulas adopted can be inspected. In addition, since the pattern of missing values is quite unsystematic, it was considered more transparent to implement data filling at this early stage rather than in the subsequent programs that were used to process the raw data. The most commonly-used procedure was as follows.

- Calculate the implied GVA deflator for a grouping of 2-digit sectors and apply this to published data for GVA values at the 2-digit sector level to construct GVA volume estimates, and then use the growth rates from these estimates to extend a published series back in time.

In the case of Germany prior to 1991, growth rates were calculated for data for the former West Germany up to an including 1991 and these were applied to the levels for Germany in 1991 to extend the series back.

B.3 Brazil, China, India and Russia

This section documents how data for Brazil, China, India, and Russia have been collected and how these data have been processed to allow the required competitiveness measures to be generated. The procedure for each of the BRIC countries is described in a separate subsection.

Brazil

Data Sources

All data for Brazil comes from the Brazilian Ministry of Statistics (IBGE)[35] and has been extracted from the National Accounts.[36]

Data Availability

The following variables have been made available for Brazil as raw data.

- Whole Economy Data
    - Consumer Price Index (1989 – 2010)
- Sector-level Data[37]
    - Gross Value Added at Current Prices (2000 – 2008)
    - Gross Value Added at Constant 2000 Prices (2000 – 2008)
    - Average Compensation to Employees (2000 – 2008)
    - Total Number Employed (2000 – 2008)

Data Processing

Sectors in the Brazilian data are classified according to a scheme which is close to ISIC3.1. The exact transformation to NACE1.1 is given in the following concordance table.

[35] http://www.ibge.gov.br/home/default.php

[36] http://www.ibge.gov.br/servidor_arquivos_est, to get to the National Accounts, first go to „Contas_Nacionais", then to "Sistema de Nacionais" and finally select "Sinoticas".

[37] On their website, the Brazilian Ministry of Statistics declares they provide production data beginning in 1991 (http://www.ibge.gov.br/home/estatistica/indicadores/industria/pimpfbr/default.shtm). We have not found consistent data for the whole period as proclaimed on the website. Employees of the Ministry of Statistics have not been able to provide the requested data, too.

Table B.1: Concordance table for Brazilian ISIC3.1 to NACE1.1

NACE1.1	Brazilian Classification (close to ISIC3.1)
G_I	Comércio + Transporte, armazenagem e correio
J_K	Intermediação financeira, seguros e previdência complementar e serviços relacionados relacionados + Atividades imobiliárias e aluguéis + Serviços prestados às empresas
H	Serviços de alojamento e alimentação
A_B	Agropecuária
C	Petróleo e gás natural + Minério de ferro + Outros da indústria extrativa
D	Sum of sector 15-35
E	Produção e distribuição de eletricidade, gás, água, esgoto e limpeza urbana
F	Construção Civil
I	Transporte, armazenagem e correio
J_K	Intermediação financeira, seguros e previdência complementar e serviços relacionados relacionados + Atividades imobiliárias e aluguéis + Serviços prestados às empresas
15	Alimentos e bebidas
16	Produtos do fumo
17	Têxteis
18	Artigos do vestuário e acessórios
19	Artefatos de couro e calçados
20	Produtos de madeira - exclusive móveis
21	Celulose e produtos de papel
22	Jornais, revistas, discos
23	Refino de petróleo e coque
24	Álcool + Produtos químicos + Fabricação de resina e elastômeros + Produtos farmacêuticos + Defensivos agrícolas + Perfumaria, higiene e limpeza + Tintas, vernizes, esmaltes e lacas + Produtos e preparados químicos diversos
25	Artigos de borracha e plástico
26	Outros produtos de minerais não metálicos
27	Fabricação de aço e derivados + Metalurgia de metais não ferrosos
28	Produtos de metal - exclusive máquinas e equipamentos
29	Máquinas e equipamentos, inclusive manutenção e reparos
30	Máquinas para escritório e equipamentos de informática
33	Aparelhos/instrumentos médico-hospitalar, medida e óptico
34	Automóveis, camionetas e utilitários + Caminhões e ônibus + Peças e acessórios para veículos automotores
35	Outros equipamentos de transporte

Estimation of indicators (where not directly available from the source)

Compensation of employees was calculated by multiplying the average income of one worker with total people employed for each sector on two-digit level.

China

Data Sources

Data for China have been provided by Prof. Dr. Markus Taube, holder of the "Chair of East Asian Economics Studies – China" at the Mercator School of Management in Duisburg, Germany[38].

All data for China originally come from the National Bureau of Statistics from the People's Republic of China[39] and have been extracted from the Statistical Yearbooks.

Data Availability

The following variables have been made available for China as raw data.

- Whole-economy variables
  - Consumer price index (1978-2009)
  - GDP deflator (1980-2010)
  - Producer Price Index (1978-2009)
- Sector-level data
  - Gross Value Added at Current Prices
    - Absolute values from 1993-2007; missing data for 2004
    - Year-on-year growth rates from 2008-2010
  - Number of employees (1993-2009)
  - Average wages (1993-2009)
  - Producer Price Indices
    - NACE 1.1. 2-digit manufacturing PPIs from 2004-2009
    - Longer data availability for these sectors (1993-2009)
      - Coal Industry
      - Food Industry
      - Textile Industry
      - Leather Industry
      - Timber Industry
      - Paper Industry
      - Petroleum Industry
      - Chemical Industry
      - Metallurgical Industry

[38] Personal website: http://www.msm.uni-due.de/index.php?id=2506&L=1, E-mail: markus.taube@uni-due.de
[39] URL: http://www.stats.gov.cn

- Machine Manufacturing Industry
- Cultural, Educational & Handicrafts Articles
- Power Industry
- Building Materials Industry
- Tailoring Industry

Data Processing

Estimation of indicators (where not directly available from the source)

The following processing steps have been conducted to construct variables.

Gross Value Added at Current Prices

Current GVA in absolute values is only available until 2007. Later on, only year-on-year growth is reported. The values for 2008 to 2010 have therefore been calculated by taking the 2007 values and applying year-on-year growth rates.

Gross Value Added (volume)

GVA at constant prices is derived by deflating GVA at current prices with producer price indices. As full two-digit NACE1.1 producer price indices are only available from 2004 onwards, a concordance table has been constructed to match two-digit NACE1.1 sectors with the longer available time series.

Table B.2: Concordance table for Chinese producer price indices to NACE1.1

Description as in Yearbook	**Closest NACE1.1 equivalent**
General Index	D
Coal Industry	C
Food Industry	15
Textile Industry	17,18
Leather Industry	19
Timber Industry	20
Paper Industry	21
Petroleum Industry	23
Chemical Industry	24
Metallurgical Industry	26,27,28
Machine Manufacturing Industry	29
Cultural, Educational & Handicrafts Articles	36
Power Industry	E

Compensation of Employees

Total compensation of employees has been calculated by multiplying a sector's number of employees with the average wages paid in this sector[40].

India

Data Sources

The *Annual Survey of Industries (ASI)* is the principal source of industrial statistics in India. It provides statistical information to assess and evaluate, objectively and realistically, the changes in the growth, composition and structure of organized manufacturing sector comprising activities related to manufacturing processes, repair services, gas and water supply and cold storage.

Data for India were bought from the Central Statistics Office[41].

Data Availability

The following variables[42] have been made available for India as raw data.

- Whole-economy variables
    - Consumer Price Index[43] (1988-2007)
- Sector-level data
    - Net Value Added at Current Prices (1989-1998)
    - Depreciation (1989-1998)
    - Gross Value Added at Current Prices (1999-2007)
    - Compensation of Employees (1989-2007)
    - Wages and Salaries (1989-2007)
    - Total Number Employed (1989-2007)
    - Number of Employees (1989-2007)

[40] There has been a change in the definition of employment and remuneration from 1998 onwards.

[41] Central Statistics Office, Ministry Of Statistics & Programme Implementation, 1, Council House Street, Kolkata – 700001, Tel: +91-33-22481521; Fax: +91-33-22483501, E-Mail: pc.mohanan@nic.in; pc.nirala@nic.in. Further information can be found on http://mospi.nic.in/Mospi_New/upload/mospi_asi.htm?status=1&menu_id=88. The data set provided by the Central Statistics Office covers Capital, Input, Output, GVA, Employment & Emoluments from 1980-81 to 1998-99, Capital, Input Output and GVA from 1999-2000 to 2007-08 and Employment & Emoluments form 1999-2000 to 2007-08. The reference period for ASI is the accounting year of the industrial unit, ending on any day during the fiscal year. The fiscal year starts on April 1st and ends on March 31st.

[42] Definitions for the variables are reported in **Error! Reference source not found.**.

[43] Available on http://labourbureau.nic.in/indtab.pdf. For the years 1988 to 2005 the basis year is 1982. In 2006 the base year was set to 2001 for the years 2006 to 2007. The indices were rebased to 1982.

Data Processing

Three different sector classifications have been used in our raw data: NIC-1987 (from ASI 1989-90 until ASI 1997-98), NIC-1998 (until ASI 2003-04), and NIC-2004 (until ASI 2007-08). The estimates used in this study were delivered at three-digit level and aggregated to a two-digit NACE 1.1 level. The exact transformation is given in a NACE-NIC concordance table.

Table B.3: Concordance table for Indian NIC to NACE1.1

NACE 1.1		NIC 04	NIC 98	NIC 87
15	15,1	151	151	200-207 & 209-224
	15,2			
	15,3			
	15,4			
	15,5	152	152	
	15,6	153	153	
	15,7			
	15,8	154	154	
	15,9	155	155	
16	16	160	160	225-229
17	17,1	171	171	2231/232-236/240-243/ 245-247/250-257/289
	17,2			
	17,3			
	17,4	172	172	261-264/267-269
	17,5			
	17,6	173	173	260
	17,7			
18	18,1	181	181	265/266/292/964
	18,2			
	18,3	182	182	294-296
19	19,1	191	191	290/293/299
	19,2			
	19,3	192	192	291/311
20	20,1	201	201	270
	20,2	202	202	271-275/279
	20,3			
	20,4			
	20,5			
21	21,1	210	210	280-283
	21,2			
22	22,1	221	221	285
	22,2	222	222	286-289
	22,3	223	223	not in NIC87
23	23,1	231	231	318-319

	23,2	232	232	314-316
	23,3	233	233	317
24	24,1	241	241	300/302
	24,2	242	242	208/303-305/307/309
	24,3			
	24,4			
	24,5			
	24,6			
	24,7	243	243	306
25	25,1	251	251	310/312
	25,2	252	252	313
26	26,1	261	261	321
	26,2	269	269	320/322-327/329
	26,3			
	26,4			
	26,5			
	26,6			
	26,7			
	26,8			
27	27,1	271	271	330-332
	27,2			
	27,3			
	27,4	272	272	333-336/339/3338
	27,5	273	273	337
28	28,1	281	281	340/341/352
	28,2			
	28,3			
	28,4	289	289	343-346/349
	28,5			
	28,6			
	28,7			
29	29,1	291	291	352/356/391
	29,2			
	29,3	292	292	350/351//353/354/357/359/390/392/393/397/399
	29,4			
	29,5			
	29,6			
	29,7	293	293	355/364/388
30	30	300	300	358/367
31	31,1	311	311	360/395
	31,2	312	312	
	31,3	313	313	361
	31,4	314	314	362
	31,5	315	315	363

	31,6	319	319	369
32	32,1	321	321	368
	32,2	322	322	365/396
	32,3	323	323	366
33	33,1	331	331	380
	33,2			
	33,3		332	381
	33,4	332		
	33,5	333	333	382
34	34,1	341	341	373/374
	34,2	342	342	
	34,3	343	343	
35	35,1	351	351	370
	35,2	352	352	371/372
	35,3	353	353	377
	35,4	359	359	375/376/378/379
	35,5			
36	36,1	361	361	276/277/342
	36,2	369	369	383-387/389
	36,3			
	36,4			
	36,5			
	36,6			
37	37,1	371	371	
	37,2	372	372	

Estimation of indicators (where not directly available from the source)

The following processing step has been conducted to construct the following variable.

Gross Value Added at Current Prices

From 1989 to 1999 GVA at current prices has been generated by summing up depreciation and net value added at current prices.

Gross Value Added (volume)

Volume estimates of GVA for two-digit manufacturing have been calculated by multiplying current GVA values with the wholesale price indices of the respective sectors.

Table B.4: Variable Definitions for India

Variable	Definition
Compensation of Employees	Compensation of employees is the total of emoluments and supplement to emoluments.
Depreciation	Depreciation is consumption of fixed capital by the factory due to wear and tear and obsolescence during the accounting year and is taken as provided by the factory owner, or if not provided by the factory this is estimated on the basis of cost of installation and working life of the fixed assets.
Employees	Employees relate to all persons engaged by the factory whether for wages or not, in work connected directly or indirectly with the manufacturing process and include all administrative, technical and clerical staff as also labour in production of capital assets for factory's own use. This is inclusive of persons holding position of supervision or management or engaged in administrative office, store-keeping section and welfare section, watch and ward staff, sales department as also those engaged in the purchase of raw materials etc. and production of fixed assets for the factory. It also includes all working proprietors and their family members who are actively engaged in the work of the factory even without any pay and the unpaid members of the co-operative societies who work in or for the factory in any direct and productive capacity. Persons in the head office connected with the manufacturing activity of the factory are also included in this item.
Emoluments	These are defined in the same way as wages but paid to all employees plus imputed value of benefits in kind i.e. the net cost to the employers on those goods and services provided to employees free of charge or at markedly reduced cost which are clearly and primarily of benefit to the employees as consumers. It includes profit sharing, festival and other bonuses and ex-gratia payments paid at less frequent intervals (i.e. other than bonus paid more or less regularly for each period). Benefits in kind include supplies or services rendered such as housing, medical, education and recreation facilities. Personal insurance, income tax, house rent allowance, conveyance etc. for payment by the factory also is included in the emoluments.
Gross Value Added	Net Value Added plus Depreciation.
Supplements to Emoluments	These include: (i) employer's contribution to old age benefits, i.e., provident fund, pension, gratuity, etc.; (ii) employer's contribution towards other social security charges such as Employees' State Insurance, compensation for work injuries, occupational diseases, maternity benefits, retrenchment and lay-off benefits etc.; and (iii) group benefits like direct expenditure on maternity, creches, canteen facilities, educational, cultural and recreational facilities and grant to trade unions, co-operative stores etc. meant for employees.
Wages	Wages are defined to include all remuneration capable of being expressed in monetary terms and also payable/paid more or less regularly in each pay period to workers (defined above) as compensation for work done during the accounting year. It ***includes***: (i) Direct wages and salary (i.e. basic wages/salaries, payment of overtime, dearness, compensatory, house rent and other allowances); (ii) Remuneration for period not worked (i.e. basic wages), salaries and allowances payable for leave period, paid holidays, lay-off payments and compensation for unemployment (if not paid from source other than employers); (iii) Bonus and ex-gratia payment paid both at regular and less frequent intervals (i.e., incentive bonuses and good attendance bonuses, production bonuses, profit sharing bonuses, festival or yearend bonuses etc.). It ***excludes*** layoff payments and compensation for employment except where such payments are for this purpose, i.e., payments not made by the employer. It ***excludes*** employer's contribution to old age benefits and other social security charges, direct expenditure on maternity benefits and creches and other group benefit in kind and travelling and other expenditure incurred for business purposes and reimbursed by the employer. The wages are expressed in terms of gross value, i.e., before deductions for fines, damages, taxes, provident fund, employee's state insurance contribution etc. Benefits in kind (perquisites) of individual nature are only ***included***.

Russia

Data Sources

All data for Russia were obtained by requests put to Statistics of Russia[44]. Although some data are available for download from the website of the Federal State Statistics Service[45], this does not generally show the 2-digit SIC level for any of the indicators that are required for the analysis. Also, the website tables sometimes show only occasional years rather than a continuous series.

Data for Gross Value Added at Current Prices, Gross Value Added Volume Index and Compensation of Employees are taken from the publication *National Accounts of Russia 2002-09*, tables 2.5.7, 2.5.9, 2.3.55, 2.3.57, 2.3.59, 2.3.61, 2.3.63, 2.3.65, and 2.3.67. The publication is in Russian. Data for employment in 2-digit manufacturing sectors were provided by Statistics of Russia on request.

Data Availability

The following variables have been made available for Russia as raw data.

- Whole Economy Data
    - Consumer Price Index (1995 – 2010)
- Sector-level Data
    - Gross Value Added at Current Prices (2003 – 2009)
    - Gross Value Added Volume Index (2004 – 2009)
    - Compensation of Employees (2003 – 2009)
    - Employment (2005 – 2008)

Data Processing

The National Accounts publications only show detail within manufacturing industry for the period since the adoption of an industrial classification consistent with ISIC Rev3.1, which is what the *National Accounts of Russia 2002-09* uses. There are just a few sectors where the required breakdown is not available. In the case of data for gross value added and compensation of employees, data are not available for the production of nuclear fuel, of explosives or of weapons and armaments, and so these activities are excluded from the broader 2-digit sectors of which they form part (see Table B.5 below). In the case of employment, data were not provided for Coke, refined petroleum products and nuclear fuel, or for the breakdown between Paper and paper products on the one hand and Publishing, printing and reproduction of recorded media on the other (see Table B.6 below).

[44] http://www.infostat.ru.
[45] http://www.gks.ru.

Table B.5: Correspondence of Manufacturing Sectors in Russia for Gross Value Added and Compensation of Employees

Required ISIC Rev 3.1 Sector	**Sector used from Russian National Accounts (source title, translated into English)**
15 - Food products and beverages	15 Manufacture of food products, beverages
16 - Tobacco products	16 Manufacture of tobacco products
17 - Textiles	17 Textile industry
18 - Wearing apparel	18 Manufacture of wearing apparel; dressing and dyeing of fur
19 - Tanning and dressing of leather	19 Leather, leather products and footwear
20 - Wood and of products of wood and cork	20 Wood and wood products and cork, except furniture
21 - Paper and paper products	21 Manufacture of pulp, wood pulp, paper, paperboard and articles thereof
22 - Publishing, printing and reproduction of recorded media	22 Publishing printing and reproduction of recorded media
23 - Coke, refined petroleum products and nuclear fuel	23.1 +23.2 Manufacture of coke, petroleum products
24 - Chemicals and chemical products	24 without 24.61 Chemical products (excluding the production of gunpowder and explosives)
25 - Rubber and plastics products	25 Manufacture of rubber and plastic products
26 - Other non-metallic mineral products	26 Manufacture of other non-metallic mineral products
27 - Basic metals	27 Manufacture of basic metals
28 - Fabricated metal products, except machinery and equipment	28 Manufacture of fabricated metal products
29 - Machinery and equipment n.e.c.	29-29.6 Manufacture of machinery and equipment (excluding weapons and ammunition)
30 - Office, accounting and computing machinery	30 Manufacture of office machinery and computers
31 - Electrical machinery and apparatus n.e.c.	31 Manufacture of electrical machinery and apparatus
32 - Radio, television and communication equipment and apparatus	32 Manufacture of electronic components, equipment for radio, television and communication
33 - Medical, precision and optical instruments	33 Manufacture of medical devices, measuring instruments, control and testing, optical instruments, photographic and film equipment; hours
34 - Motor vehicles, trailers and semi-trailers	34 Manufacture of motor vehicles, trailers and semitrailers
35 - Other transport equipment	35 Manufacture of ships, aircraft and spacecraft and other vehicles
36 - Furniture; manufacturing n.e.c.	36 Manufacture of furniture and other products not included in other categories
37 - Recycling	37 +24.61 +23.3 +29.6 Other products processing industries

Table B.6: Correspondence of Manufacturing Sectors in Russia for Employment

Required ISIC Rev 3.1 Sector	**Sector used from Russian Employment Statistics Accounts (source title, translated into English)**
15 - Food products and beverages	Subsection DA Manufacture of food products, beverages and tobacco - Manufacture of tobacco products
16 - Tobacco products	Manufacture of tobacco products
17 - Textiles	Subsection DB Manufacture of textiles and textile products - Manufacture of wearing apparel, dressing and dyeing of fur -
18 - Wearing apparel	Manufacture of wearing apparel, dressing and dyeing of fur+Dressing and dyeing of fur, manufacture of articles of fur
19 - Tanning and dressing of leather	Subpart DC Manufacture of leather, leather products and footwear
20 - Wood and of products of wood and cork	Subpart DD Wood and wood products
21 - Paper and paper products	Subsection DE Pulp, paper and paper products, publishing and printing, split according to shares in GVA
22 - Publishing, printing and reproduction of recorded media	
23 - Coke, refined petroleum products and nuclear fuel	#N/A
24 - Chemicals and chemical products	Subsection DG Manufacture of chemicals
25 - Rubber and plastics products	Manufacture of rubber products+Manufacture of plastic products
26 - Other non-metallic mineral products	Subsection DI Manufacture of other non-metallic mineral products
27 - Basic metals	Metallurgical production
28 - Fabricated metal products, except machinery and equipment	Manufacture of fabricated metal products
29 - Machinery and equipment n.e.c.	Manufacture of machinery and equipment (excluding weapons and ammunition)
30 - Office, accounting and computing machinery	Manufacture of office machinery and computers
31 - Electrical machinery and apparatus n.e.c.	Subsection DL Manufacture of electrical and optical equipment - Production of electronic components, equipment for radio, television and communication - Production of medical devices, measuring instruments, control and testing; optical devices, photo and film equipment; hours
32 - Radio, television and communication equipment and apparatus	Production of electronic components, equipment for radio, television and communication
33 - Medical, precision and optical instruments	Production of medical devices, measuring instruments, control and testing; optical devices, photo and film equipment; hours
34 - Motor vehicles, trailers and semi-trailers	Manufacture of motor vehicles, trailers and semitrailers
35 - Other transport equipment	Subsection DM Manufacture of transport vehicles and equipment - Manufacture of motor vehicles, trailers and semitrailers
36 - Furniture; manufacturing n.e.c.	Subsection DN Manufacturing nec - Recycling
37 - Recycling	Recycling

B.4 Data for bilateral trade in manufactures

Data for bilateral trade in goods were extracted from the UN COMTRADE database by a team supervised by Prof Dr Joseph Francois, Department of Economics, Johannes Kepler University, Linz, which specialises in handling this data set.

The team developed best-match correspondence tables between the various international trade statistics classifications that prevailed over 1970-2009 and the required products of 2-digit manufacturing sectors. The resulting data set was delivered as one file per year, with each file containing imports by country A from country B of products classified to 2-digit sector N, where A and B span 259 countries in existence over at least some period during 1970-2009 and N spans the 23 2-digit manufacturing sectors.

B.5 Data for bilateral trade in services

Data for bilateral trade in services were extracted from the *OECD Statistics on International Trade in Services* database. The data have been extracted for seven different services and then processed and aggregated appropriately to match to the three services sectors required, using the match described in Table B.7. Where there were inconsistencies between export and import data in the OECD database, the export data have been used.

The resulting data set was delivered as one file per year, with each file containing imports by country A from country B of products classified to service sector N, where A and B span 215 countries with exports and imports over at least some period during 1999-2009 and N spans the services sectors: "G_H - Wholesale and Retail Trade - Restaurants And Hotels", "I - Transport, Storage and Communications", "J_K - Finance, Insurance, Real Estate and Business Services".

Table B.7: Correspondence of Services Sectors in "OECD Statistics on International Trade in Services" database.

Required Service Sector	**Sector used from "OECD Statistics on International Trade in Services"**
G_H - Wholesale and Retail Trade - Restaurants And Hotels	TRAVEL
I - Transport, Storage and Communications	TRANSPORTATION + COMMUNICATION SERVICES
J_K - Finance, Insurance, Real Estate and Business Services	INSURANCE SERVICES + FINANCIAL SERVICES + COMPUTER AND INFORMATION SERVICES + OTHER BUSINESS SERVICES

Appendix C: Comparison of results with those from other sources

This appendix compares selected results produced for the present study with those available from other sources, to check the consistency of the results with earlier work.

C.1 Comparisons of unit labour costs with those published by the OECD

Since the source data for many of the countries is the OECD, it might be expected that the results for ULCs match exactly the equivalent data published by the OECD. However, in some cases we undertake some additional processing (for example, constructing data for 'Germany' prior to unification which uses growth rates for the former West Germany). Also, we construct ULCs from data for component indicators rather than simply sourcing the OECD's ULC results, and so there is the potential for differences to emerge.

To confirm that the results are similar to those published by the OECD we compare results for all-manufacturing ULCs for selected EU Member States in the following charts. In some cases the series are virtually identical; in others there are small but negligible differences.

Figure 8.1 Comparison between Cambridge Econometrics data and OECD data on unit labour costs in Germany

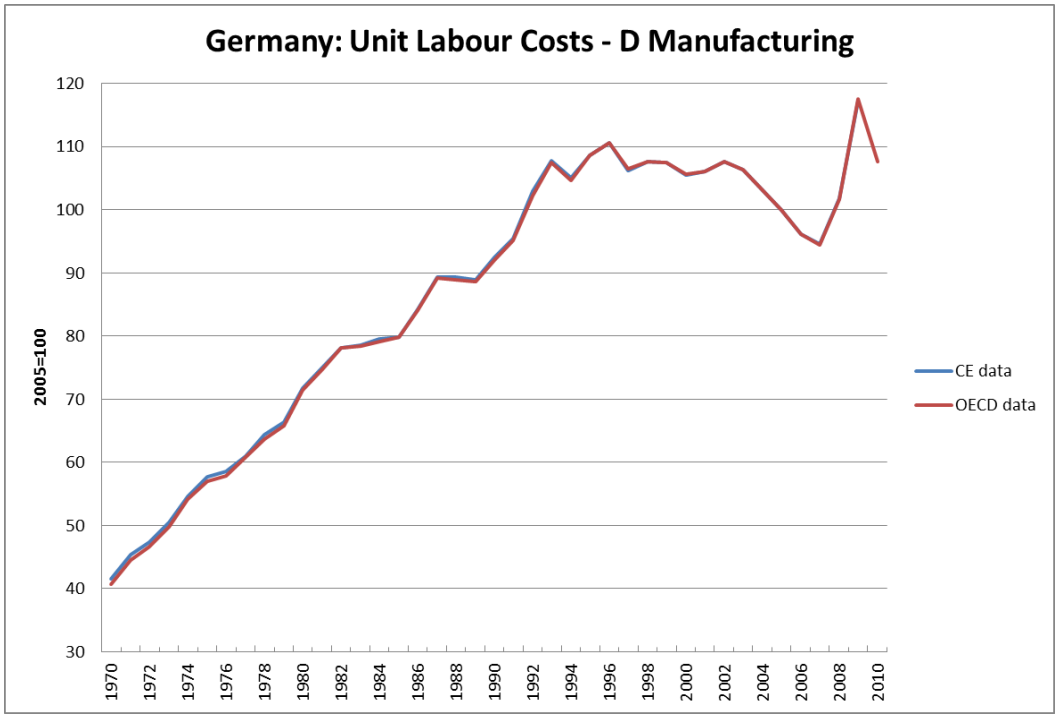


Figure 8.2: Comparison between Cambridge Econometrics data and OECD data on unit labour costs in France

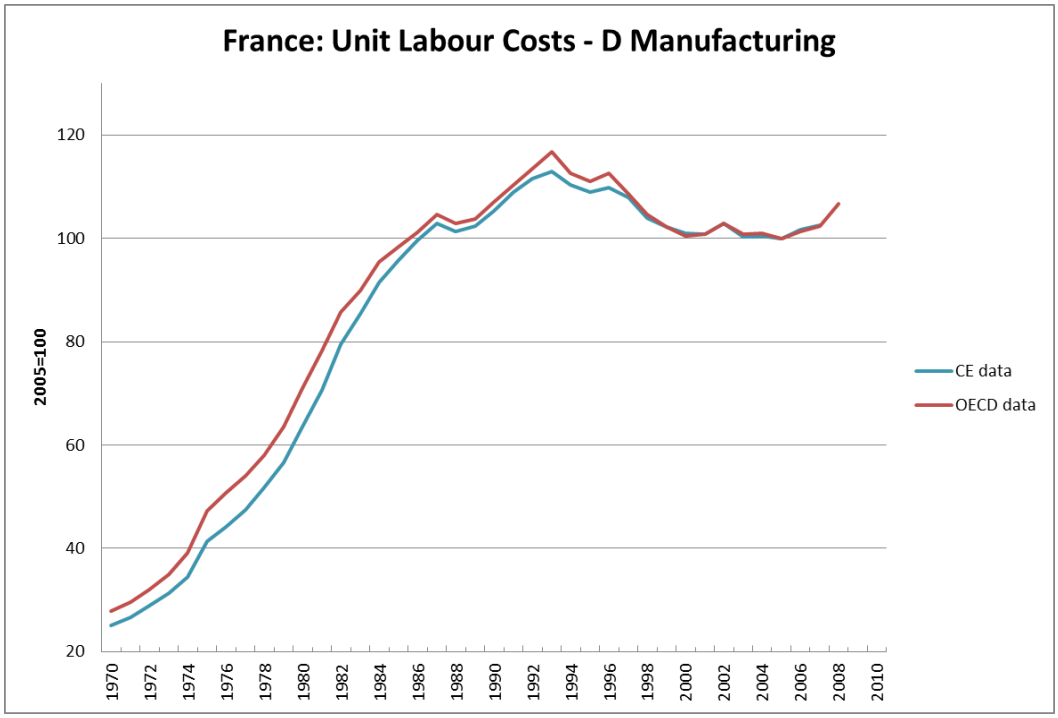


Figure 8.3: Comparison between Cambridge Econometrics data and OECD data on unit labour costs in Italy

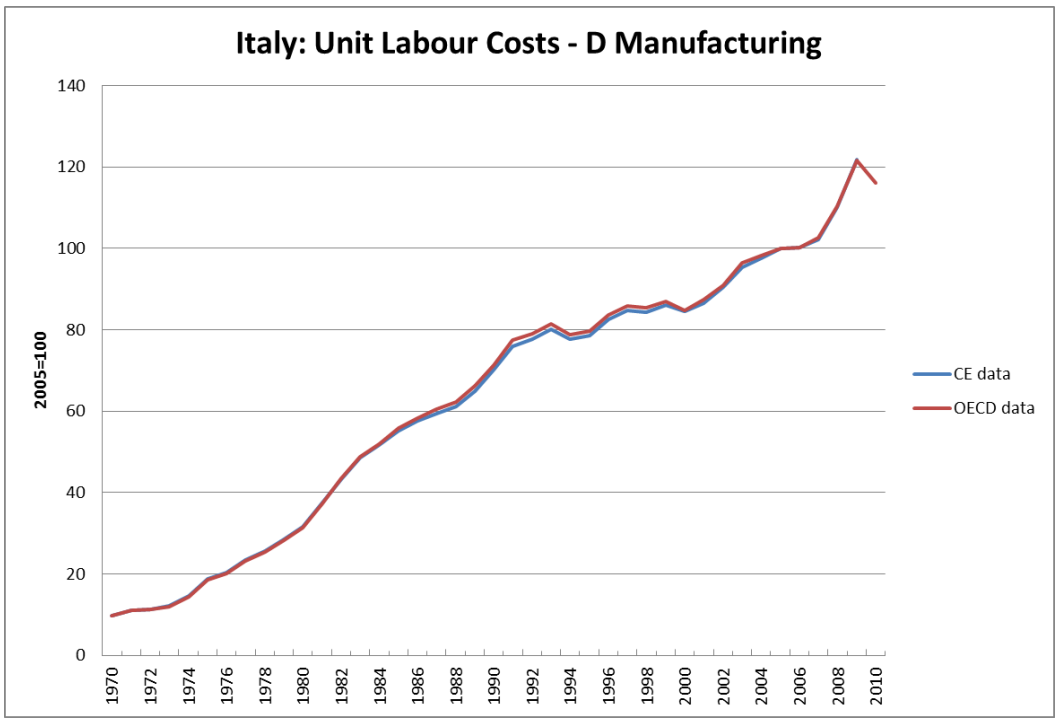
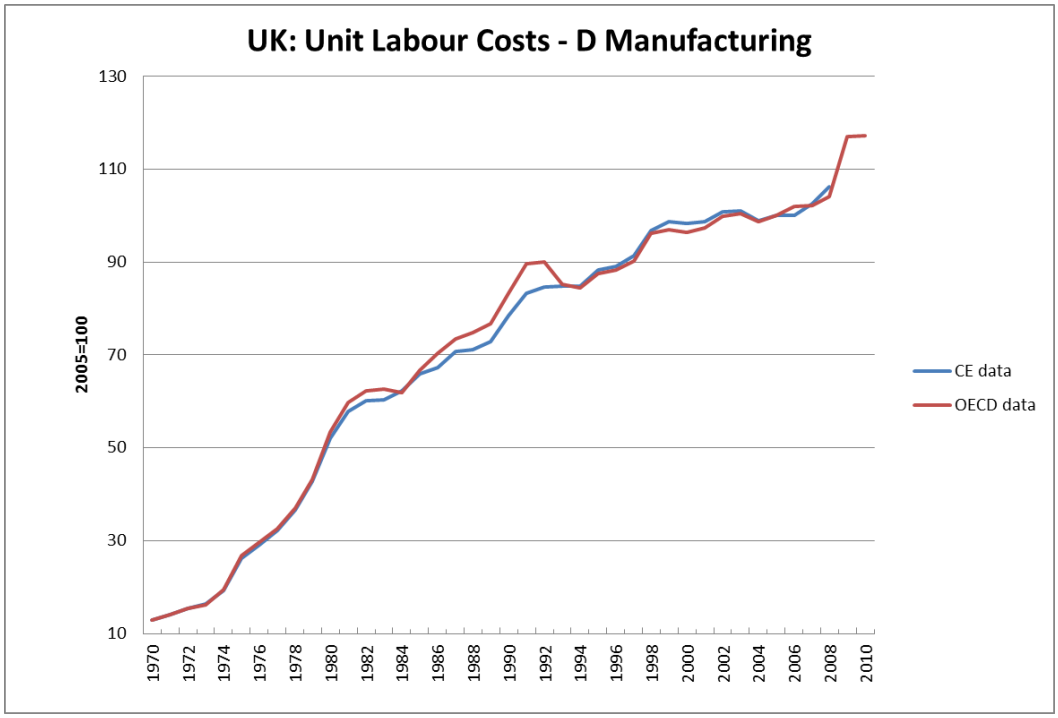


Figure 8.4: Comparison between Cambridge Econometrics data and OECD data on unit labour costs in the UK



C.2 Comparisons of real effective exchange rates with those published by the OECD

The following charts provide a comparison of (ULC-based) real effective exchange rates for manufacturing as a whole with those published by the OECD, for a selection of countries. The OECD data include 30 OECD countries and 12 non-OECD countries in the calculation. Our coverage is less extensive because of the requirement to have data for manufacturing sub-sectors for a sufficiently long period. We define two indicators with different groups of countries included: REER (19)[46] and REER (30)[47].

The charts show that, despite the differences in country coverage, the results for Member States are quite similar on all three indicators.

[46] REER (19) competitors are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, UK, Canada, Japan, Norway, South Korea and USA.

[47] REER (30) competitors are Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Lithuania, Luxembourg, Netherlands, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, UK, Canada, Iceland, Japan, Norway, South Korea, USA, Brazil and China.

Figure 8.5: Comparison between Cambridge Econometrics data and OECD data on REER, ULC-based in Germany

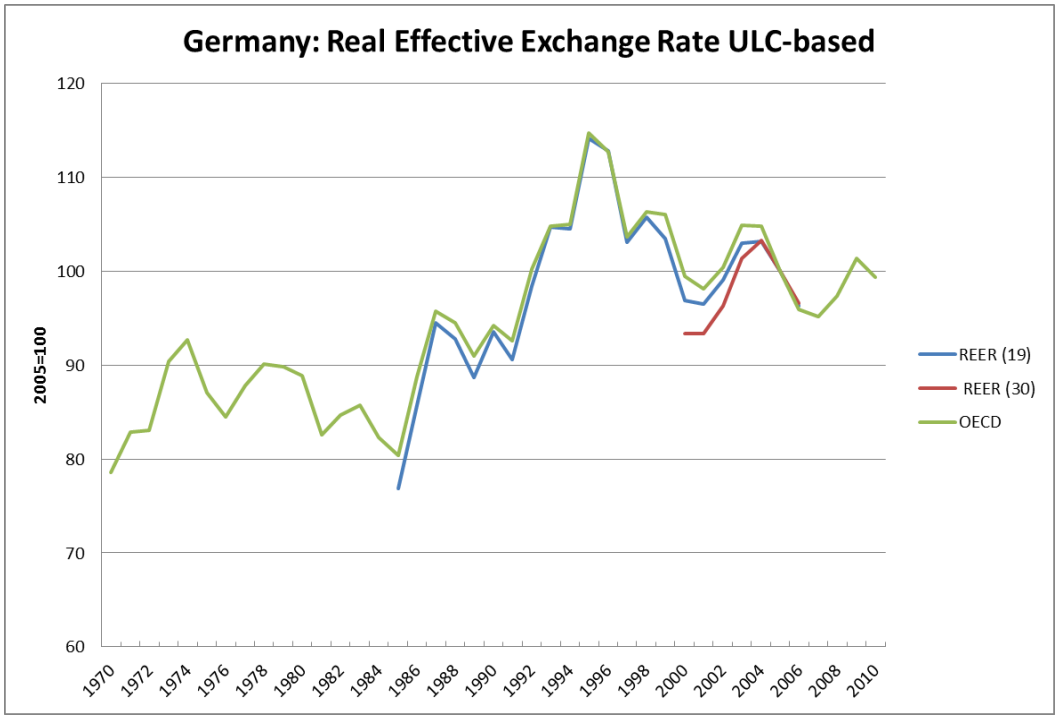


Figure 8.6: Comparison between Cambridge Econometrics data and OECD data on REER, ULC-based in France

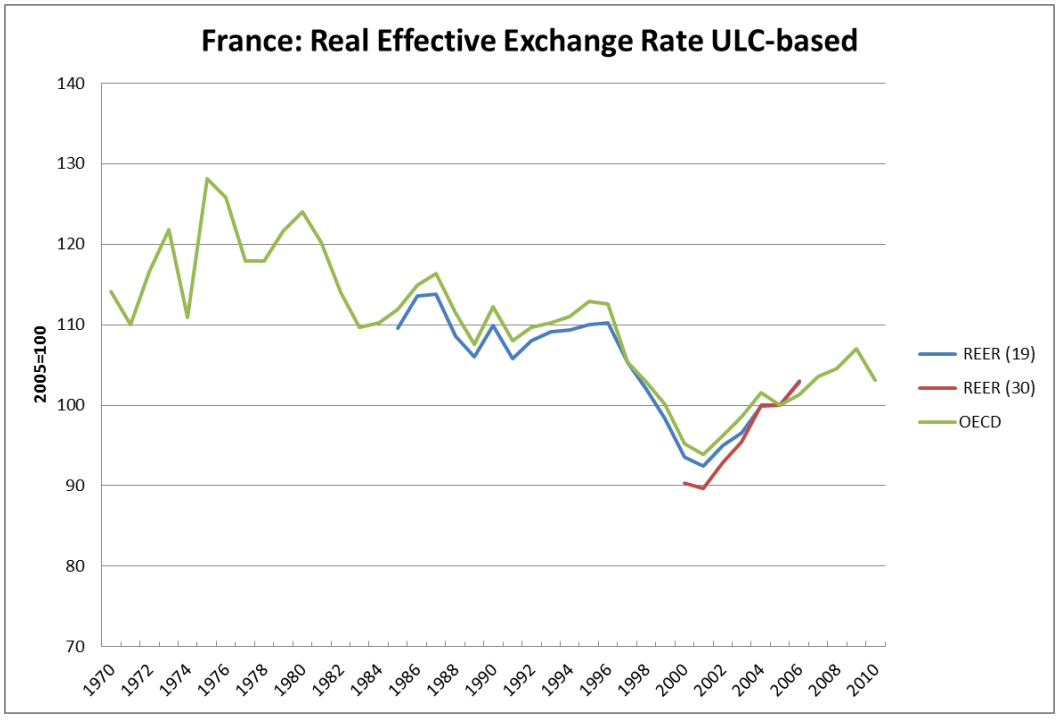


Figure 8.7: Comparison between Cambridge Econometrics data and OECD data on REER, ULC-based in Italy

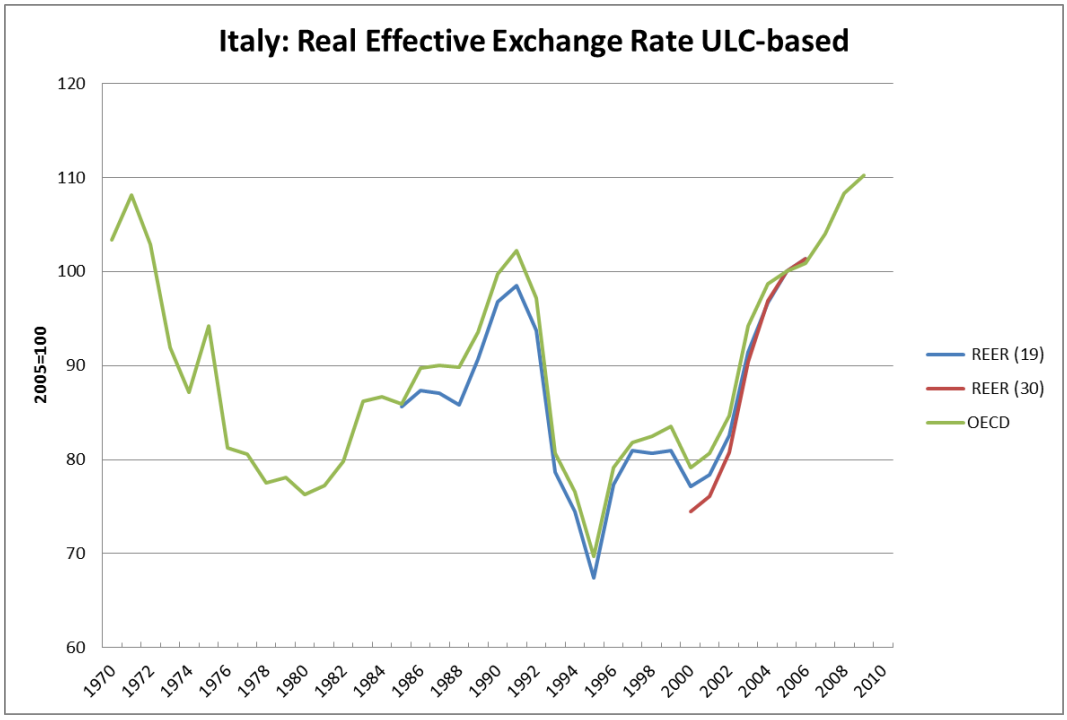
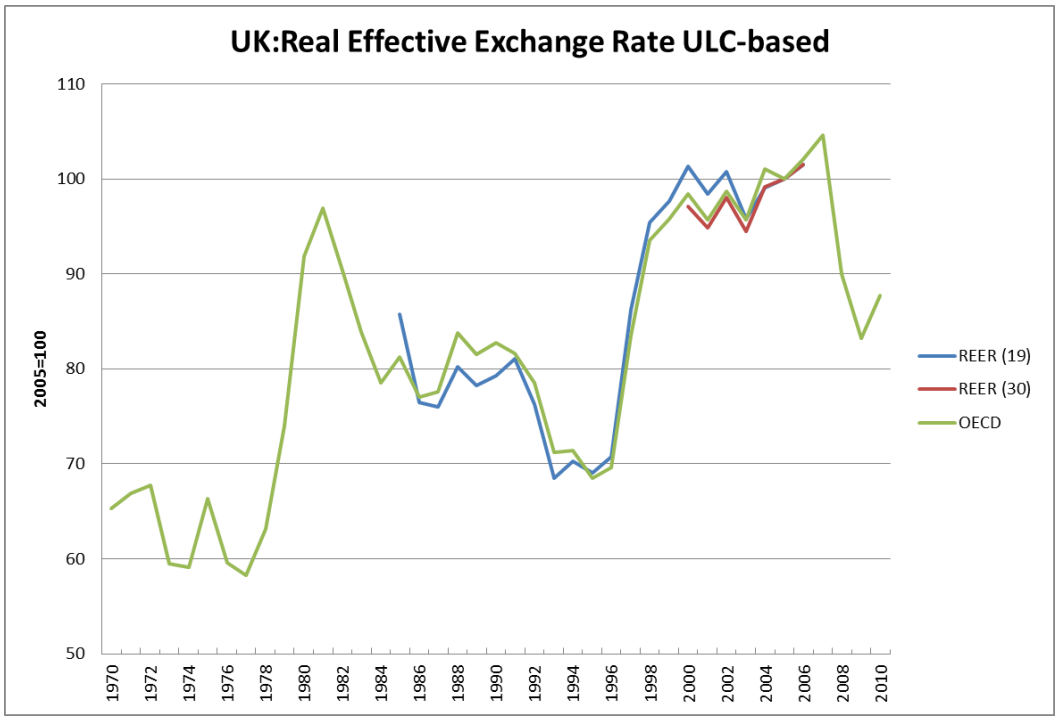


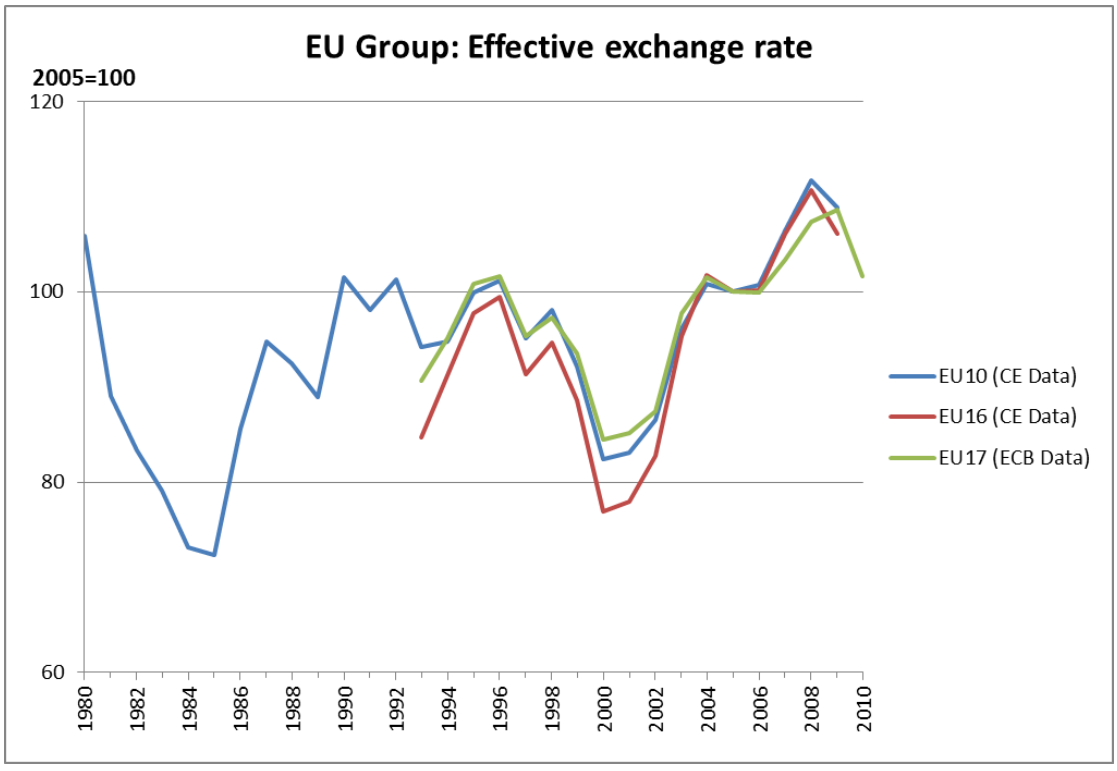
Figure 8.8: Comparison between Cambridge Econometrics data and OECD data on REER, ULC-based in the UK



C.3 Comparisons of effective and real effective exchange rates with those published for groups of EU Member States by the ECB

Finally, in this comparison exercise, we compare our results for effective and real effective exchange rates for groups of EU Member States with those published by the ECB. In our results we construct two groups of EU Member States, referred to as EU10[48] and EU16[49]. EU10 comprises those countries for which the data required to construct REERs for manufacturing sub-sectors are generally available for a longer period. Consequently, the countries chosen as trading partners for the construction of EERs and REERs for this group are also limited by the same criterion. We refer to the nearest-equivalent index published by the ECB as EU17[50]. Although these groups and the selected trade partners do not have exactly the same composition, the results for both the EER (shown in Figure 8.9) and the REER (shown in Figure 8.10) for manufacturing as a whole show a reasonable match among all three indices.

Figure 8.9: Comparison between Cambridge Econometrics data and ECB data for EERs (all-manufacturing trade weights)

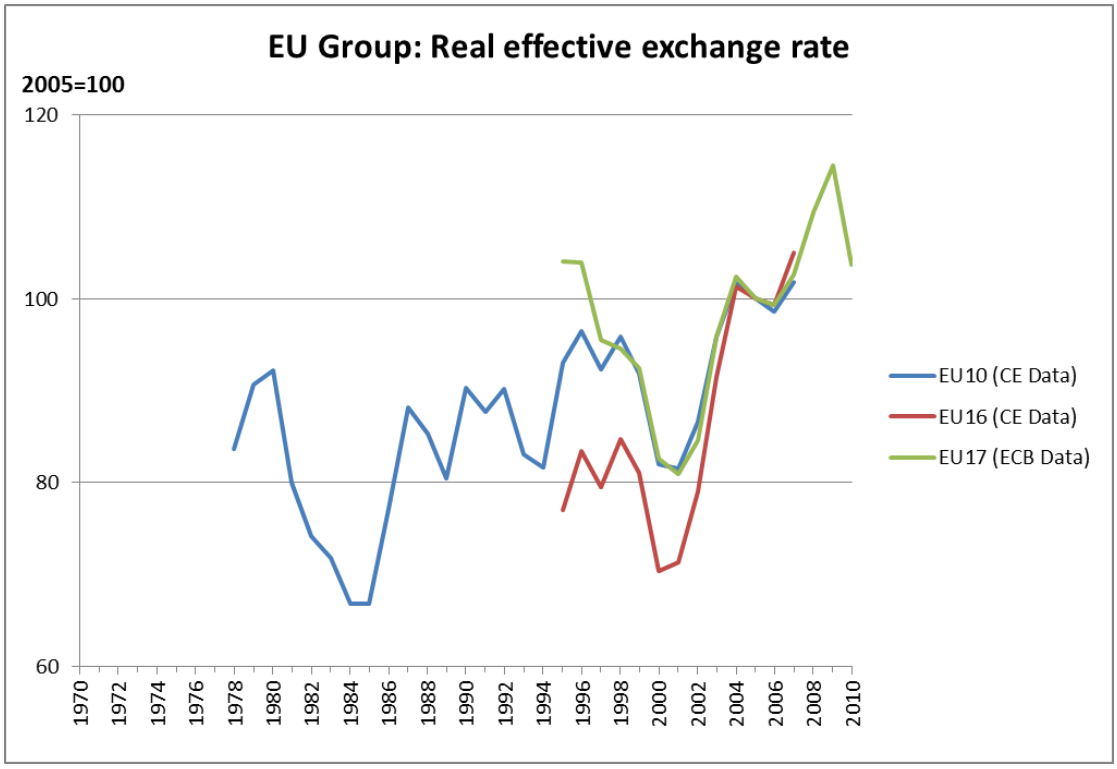


[48] EU10 comprises Austria, Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Sweden, UK. The trade partners included in the EER and REER calculations are Greece, Portugal, Spain, Canada, Japan, Norway, South Korea, and the USA.

[49] EU16 comprises Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Netherlands, Slovakia, Slovenia, Spain, Sweden, UK. The trade partners are Estonia, Lithuania, Portugal, Romania, Canada, Iceland, Japan, Norway, South Korea, the USA, Brazil, India, and China.

[50] EU17 comprises Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, Netherlands, Portugal, Slovakia, Slovenia and Spain. The trade partners are Australia, Bulgaria, Canada, China, Czech Republic Denmark, Hong Kong, Hungary, Japan, Republic of Korea, Latvia, Lithuania, Norway, Poland, Romania, Singapore, Sweden, Switzerland, the UK and the USA.

Figure 8.10: Comparison between Cambridge Econometrics data and ECB data for ULC-based REERs (all manufacturing)



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