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Price Competitiveness of the Manufacturing Sector – a Sector Approach Based on Technological Intensity Level

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Abstract

The developments in real effective exchange rates among different manufacturing activities point to the presence of diverse price competitiveness conditions in the economy. Broken down by the sectors into which activities are categorised according to the technological intensity of the manufacturing process, price competitiveness in Croatia improved in the medium-low-technology sector and deteriorated in the high-technology sector in the 2000–2016 period. At the same time, it saw no significant changes in the low-technology and medium-high-technology sector. The developments in price competitiveness at sector level varied in other EU countries as well, particularly in the new member states. Among new members, Poland improved price competitiveness the most in the low-technology and the medium-high-technology sector, Croatia witnessed the largest improvement in the medium-low-technology sector, while the price competitiveness of the high-technology sector improved the most in Slovenia. It is noteworthy, however, that changes in price competitiveness across sectors in the majority of the observed EU member states were not accompanied by the expected changes in the share of exports on the global market, which, among other things, indicates the relevance of non-price export competitiveness factors.

Keywords:

competitiveness, real effective exchange rates, manufacturing industry, exports

JEL:

F10, F30, F31, F40

Content

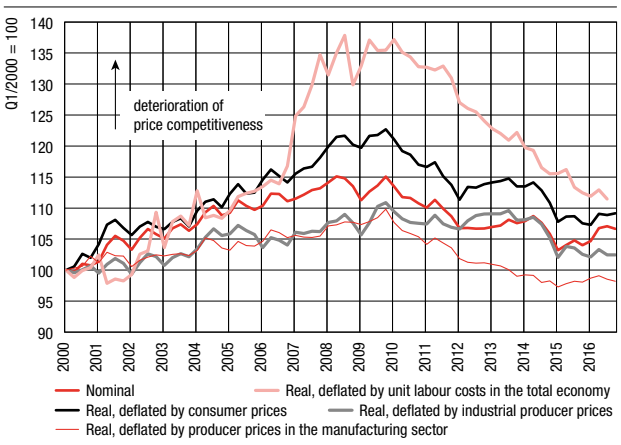
1 Introduction

Changes in the price or cost competitiveness of an economy are usually analysed using real effective exchange rate indices (REER) deflated by prices or unit labour costs at the level of the total economy. REER indices show changes in domestic prices or costs compared with those abroad adjusted by changes in nominal bilateral exchange rates of the domestic currency against a basket of foreign currencies. Usually, the change in the value of the domestic currency is observed against the currencies of the major trading partners and shown as the nominal effective exchange rate index (NEER). Depreciation (appreciation) of the REER, that is, improvement (deterioration) in price or cost competitiveness thus may be a result of a slower (faster) increase in domestic prices or costs than those abroad and/or NEER depreciation (appreciation). However, commonly used aggregate indicators may mask the changes in competitiveness conditions due to differences among particular economic activities, in particular the differences in the geographical structure of foreign trade among different activities as well as divergent price developments. This survey focuses on the calculation and the descriptive analysis of real effective exchange rates deflated by producer prices across particular activities or manufacturing industry sectors (for more on calculation methodology, see the Appendix) in order to, among other things, gain better insight into the changes of price competitiveness in the economy, particularly within the tradable sector.[1]

Traditional aggregate indicators suggest that the price and/or cost competitiveness of Croatian exports deteriorated in the 2000–2016 period (Figure 1). Specifically, the real effective exchange rate of the kuna deflated by producer prices appreciated in the last seventeen years at total industry level, although only slightly. The deterioration of the price and/or cost competitiveness in that period was more pronounced if real effective exchange rates of the kuna deflated by consumer prices and/or unit labour costs in the total economy are observed. Although the price and/or cost competitiveness improved in the period after the crisis, this did not suffice to offset the losses from the pre-crisis period.

In contrast, if a narrower scope of the industrial sector is considered, it is evident that there was no significant change in the price competitiveness of Croatian exports in the last seventeen years. To be specific, in the 2000–2016 period, the real effective exchange rate index of the kuna saw only a slight depreciation in the manufacturing sector (with the exception of activities excluded from analysis[2]). Until 2010, its dynamics mostly followed the dynamics of the index at total industry level. After that, divergence ensued due to more favourable developments in the manufacturing sector compared with the developments in other industrial sectors[3], but possibly also due to relatively unfavourable developments in manufacturing activities not included in the analysis. In the period following 2010, this resulted in a relatively more substantial improvement of price competitiveness in the manufacturing sector than in industry as a whole.

Figure 1 Nominal and real effective exchange rates of the kuna



Note: A fall in the index indicates a depreciation of the real effective exchange rate of the kuna.
Source: CNB.

1 This survey continues and builds upon the analysis shown in Box 2 of the CNB's Macroeconomic Developments and Outlook No. 1, 2016.

2 Real effective exchange rates were not calculated for activities related to the manufacture of tobacco products (low-technology sector), coke and refined petroleum products (medium-low-technology sector), other transport equipment (medium-high-technology sector) and the printing and reproduction of recorded media (low-technology sector), due to the lack of necessary data and the fact that they are not usually the subject of competitiveness analysis. To be more specific, certain activities are usually excluded from analysis as they use raw materials that are considered homogeneous goods whose prices are determined on the global market without being affected by changes in the competitiveness of a country. Furthermore, the inclusion of activities where prices are largely regulated or subsidised may distort the competitiveness analysis.

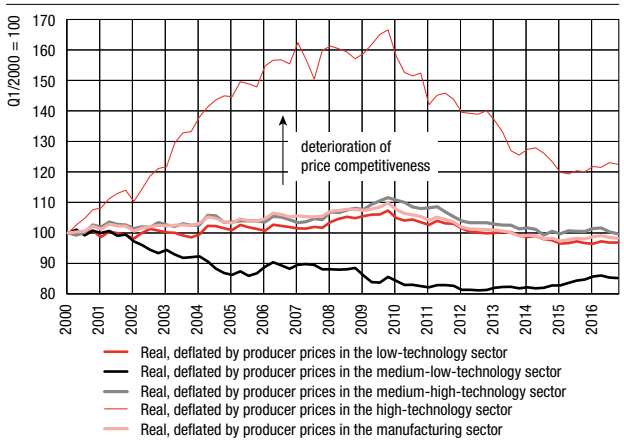
3 According to NACE, in addition to the manufacturing sector, industry also includes the mining and quarrying sector, the water supply sector and the electricity, gas, steam and air conditioning supply sector.

2 Dynamics of price competitiveness at the sub-sector level of the manufacturing industry in Croatia

At the level of individual sectors in the manufacturing industry, the dynamics of price competitiveness varied considerably, particularly in the pre-crisis period (Figures 2 and 3). The approach based on the levels of technological intensity, which categorises manufacturing activities into four sectors (the low-technology, medium-low-technology, medium-high-technology and high-technology sectors) reveals that the price competitiveness of Croatian exports before the crisis had improved only in the medium-low-technology sector and had deteriorated in other sectors, particularly in the high-technology sector. After the crisis, price competitiveness improved in all sectors, with the relatively most favourable development in the entire 2000–2016 period seen in the medium-low-technology sector. REER decomposition also shows that, throughout the entire observed period, more favourable developments of prices at home than abroad offset the pre-crisis appreciation of the nominal effective exchange rate of the kuna, except in the high-technology sector. Overall, the aforementioned improvement of price competitiveness in the medium-low-technology sector was offset by a deterioration in the high-technology sector, whereas the remaining two sectors saw no significant changes in price competitiveness.

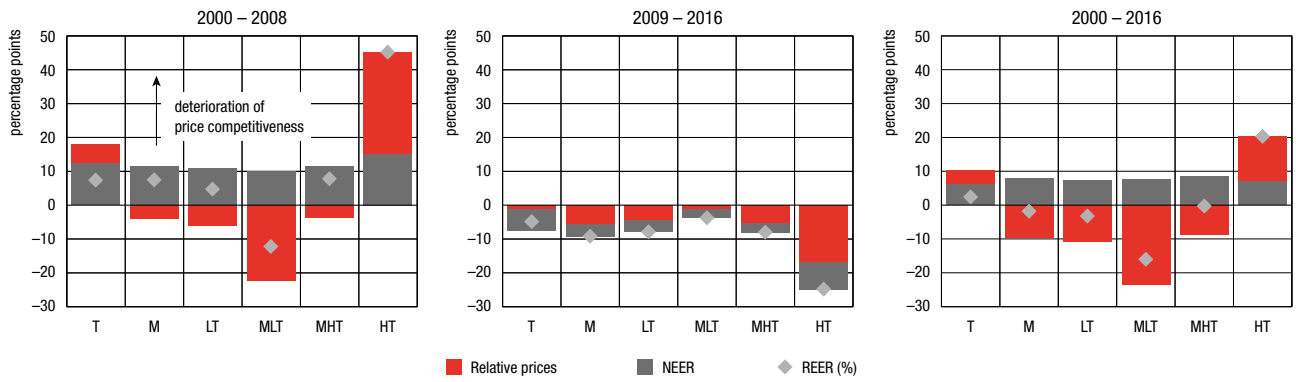
In the low-technology sector, the real effective exchange rate of the kuna depreciated by approximately 3% in the period from 2000 to 2016. This depreciation was a result of the trends in the manufacture of furniture, food products and textiles due to more favourable developments in domestic prices relative to those of major trading partners. In the majority of other activities, the relatively more favourable developments in prices did not suffice to offset the appreciation of the nominal effective exchange rate of the kuna in the period before the crisis. It is important to point out that in Croatia, the manufacture of food products is one of the dominant export activities in the manufacturing sector and the most important one in the sector of low-technology

Figure 2 Real effective exchange rates of the kuna in the manufacturing industry



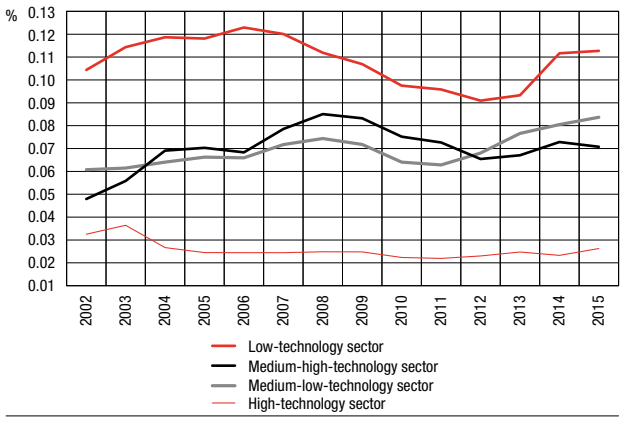
Note: A fall in the index indicates a depreciation of the real effective exchange rate of the kuna.
Source: CNB.

Figure 3 Decomposition of real effective exchange rates of the kuna deflated by producer prices
percentage points



Notes: "T" refers to total industry, "M" to the manufacturing sector, "LT" to the low-technology sector, "MLT" to the medium-low-technology sector, "MHT" to the medium-high technology sector and "HT" to the high-technology sector. The manufacturing sector "M" does not include activities related to the manufacture of tobacco products, coke and refined petroleum products, other transport equipment and the printing and reproduction of recorded media (see footnote 1).
Source: Author's calculation.

Figure 4 Market share of exports



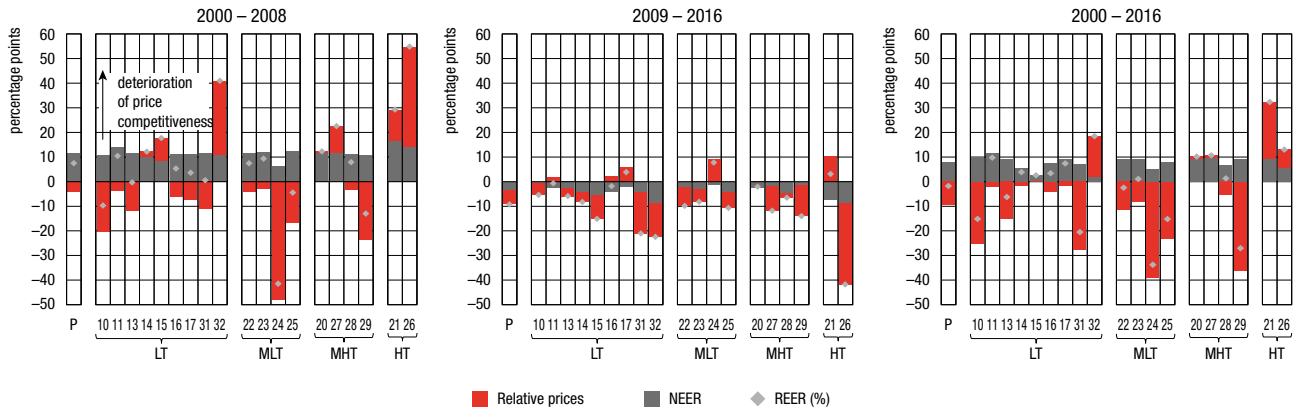
Notes: The market share shows the share of Croatian exports of manufactured goods in global imports. Sectors do not include activities which are not the subject of this analysis (see footnote 1).
Sources: Eurostat and author's calculation.

intensity of production (see Table 1 in the Appendix). In that activity, the real effective exchange rate of the kuna depreciated by approximately 15% in the last seventeen years and thus contributed the most to the improvement of price competitiveness in the low-technology sector. Nevertheless, it would seem that this improvement did not have a significant impact on the sector's share of exports on the global market – following a relatively moderate pre-crisis increase, the share shrank continuously until Croatia entered the EU, after which it began to grow again (Figure 4). This was due to the fact that Croatia's EU accession significantly diminished administrative hurdles in trade, leading to a surge in trading with EU countries.

In the medium-low-technology sector, the real effective exchange rate of the kuna depreciated by 16% in the 2000–2016 period owing to favourable developments in domestic prices relative to those of major trading partners. Such trends were followed by an increase in the share of exports of this sector on the global market, although the increase was not really significant until Croatia's accession to the EU. Within the medium-low-technology sector, the real effective exchange rate of the kuna depreciated the most in the manufacture of basic metals due to favourable developments in domestic prices compared with those of major trading partners, particularly in the pre-crisis period (Figure 5). At end-2016, producer prices in the manufacture of basic metals in Croatia were at approximately the same level as at the beginning of 2000, whereas the majority of Croatia's trading partners experienced a hike in these prices, especially Central and Eastern European countries and Turkey.

In the medium-high-technology sector, the real effective exchange rate of the kuna at end-2016 stood at approximately the same level as in early 2000, mostly following the dynamics of the index at the level of the total manufacturing sector. A more detailed analysis shows that the improvement in price competitiveness seen in the manufacture of motor vehicles, trailers and semi-trailers, caused by the relatively more favourable developments in domestic prices, was offset by the corresponding deterioration in other observed activities. It is also noteworthy that all observed activities of medium-high-technology intensity of production experienced an improvement in price competitiveness after the crisis, although this, in the majority of cases, did not suffice to offset the losses recorded in the preceding period. In spite of the deterioration of price competitiveness, the

Figure 5 Real effective exchange rates of the kuna deflated by producer prices according to NACE divisions
percentage points



Note: Double-digit numerical denotations on the horizontal axis mark activities on the second NACE level (see Table 1 in the Appendix).
Source: Author's calculation.

market share of this sector grew on the global market, indicating the relevance of international non-price competitiveness factors.

In the high-technology sector, price competitiveness deteriorated significantly in Croatia in the 2000–2016 period. Over the entire period, the real effective exchange rate of the kuna appreciated by around 20% in that sector, mainly due to the unfavourable developments in domestic prices compared with those of Croatia's major trading partners in the period before the crisis. Specifically, Croatia saw an increase of around 20% in producer prices in the manufacture of pharmaceutical products in the pre-crisis period, while the majority of the major trading partners experienced either a slower increase or a decline in these prices. Similarly, producer prices in the manufacture of computer, electronic and optical products in Croatia grew by approximately 15% in the pre-crisis period, while in most of the major trading partner countries, the prices dropped. After the crisis, price competitiveness recovered to a certain extent in the high-technology sector, owing exclusively to the positive developments recorded in the manufacture of computer, electronic and optical products, mainly due to the relatively more favourable developments in domestic producer prices. In that particular manufacturing activity, Croatia saw producer prices decline by around 35% after the crisis, while in most of Croatia's major trading partners the prices dropped less or even increased. In spite of considerable fluctuations in price competitiveness in the high-technology sector, its market share on the global market remained relatively stable, standing at fairly low levels and decreasing only slightly over the past seventeen years, which again points to the relevance of non-price factors of export competitiveness.

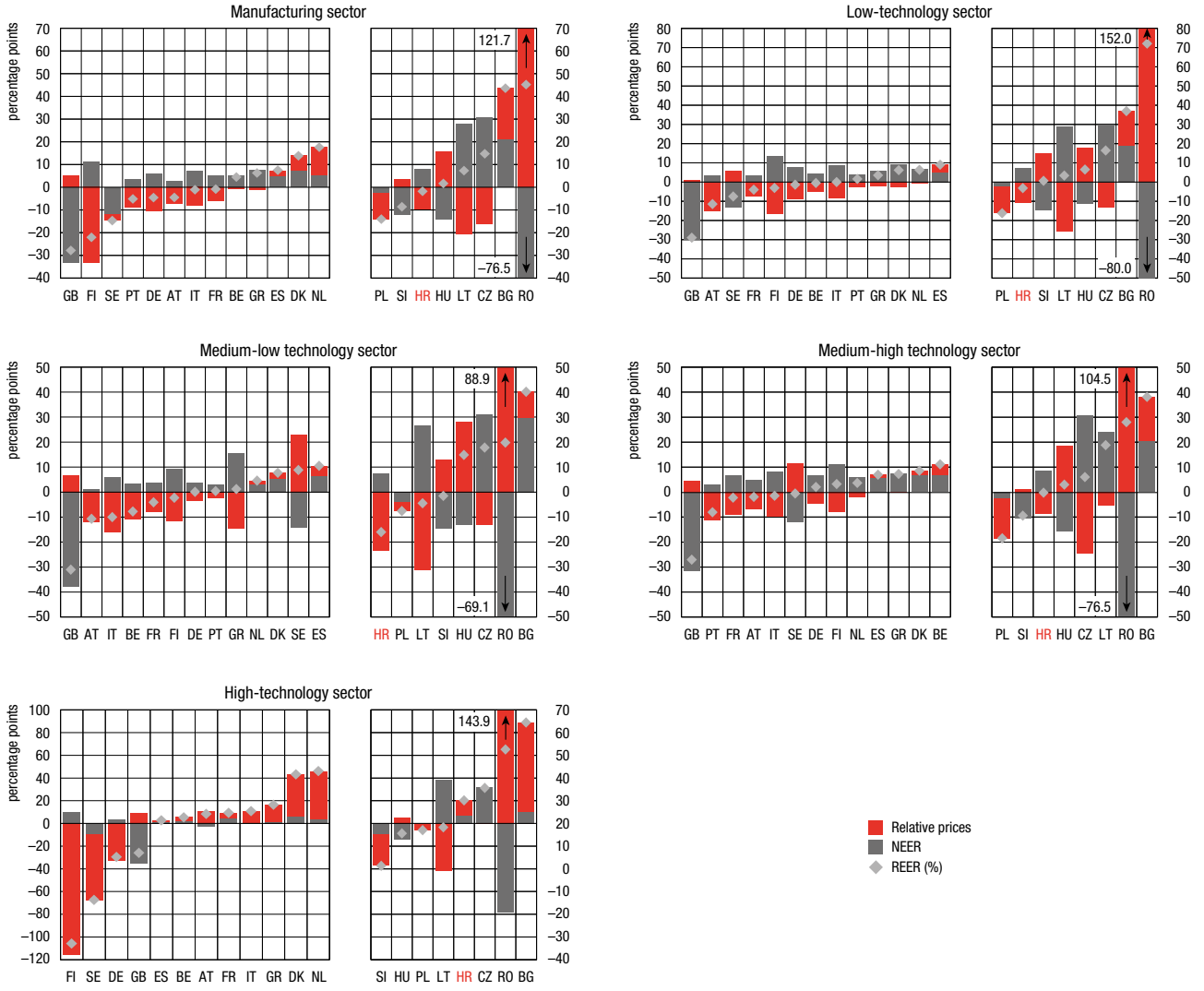
3 International comparison

Observed at the level of the total manufacturing sector, Poland and Slovenia recorded the most notable improvement in price competitiveness among new EU member states in the 2000–2016 period (Figure 6). In Croatia and Hungary, the price competitiveness of the manufacturing sector remained relatively stable in the same period, while other observed new EU members recorded a deterioration in price competitiveness, particularly Romania and Bulgaria. At sector level, the dynamics of price competitiveness varied greatly not only in Croatia, but also in other EU countries, particularly in the new member states. Poland saw the most significant improvement in price competitiveness in the low-technology and the medium-high-technology sector, while the largest improvement in the medium-low-technology sector was recorded in Croatia. On the other hand, price competitiveness in the high-technology sector improved the most in Slovenia. It is also worth noting that, among new EU member states, it was only in Poland that the improvement in price competitiveness spread across all sectors throughout the entire observed period. In contrast, Romania, Bulgaria and the Czech Republic witnessed a decline in price competitiveness in all sectors. In Romania, the unfavourable dynamics of domestic prices compared with those of its major trading partners significantly exceeded the effect of a rather strong depreciation of the nominal effective exchange rate. In comparison, the decline in price competitiveness in the Czech Republic was exclusively the result of the appreciation of the nominal effective exchange rate.

An analysis of export performance factors at sector level[4] suggests that price competitiveness was not the key determinant of the dynamics of exports (Figure 7). In the majority of observed EU countries, including Croatia, the change in price competitiveness was not accompanied by an expected change in market shares in the period before and after the crisis (upper left and lower right quadrant of Figure 7). For instance, Romania and Bulgaria saw a considerable deterioration of price competitiveness in all sectors in the pre-crisis period, but at

4 In Box 3 Real effective exchange rates of the kuna at the level of individual manufacturing activities and their impact on exports in the CNB Bulletin No. 176 of December 2011 the authors have shown that the elasticity of exports may vary across manufacturing activities depending on their technological classification. The relatively higher elasticity of exports relative to the real effective exchange rate deflated by producer prices is mainly observed in the traditional activities at low-technology or medium-technology level. Furthermore, having estimated the elasticity of exports relative to the real exchange rate in ten European countries, including Croatia, Demian and de Mauro (2015) have demonstrated that the impact of changes in exchange rates and/or prices on the developments in exports varies greatly across countries and particular activities. The authors have also shown that the elasticity of exports tends to be lower in sectors with a higher concentration of highly productive firms.

Figure 6 Real effective exchange rates at sector level in the manufacturing industry in the EU, 2000–2016
percentage points

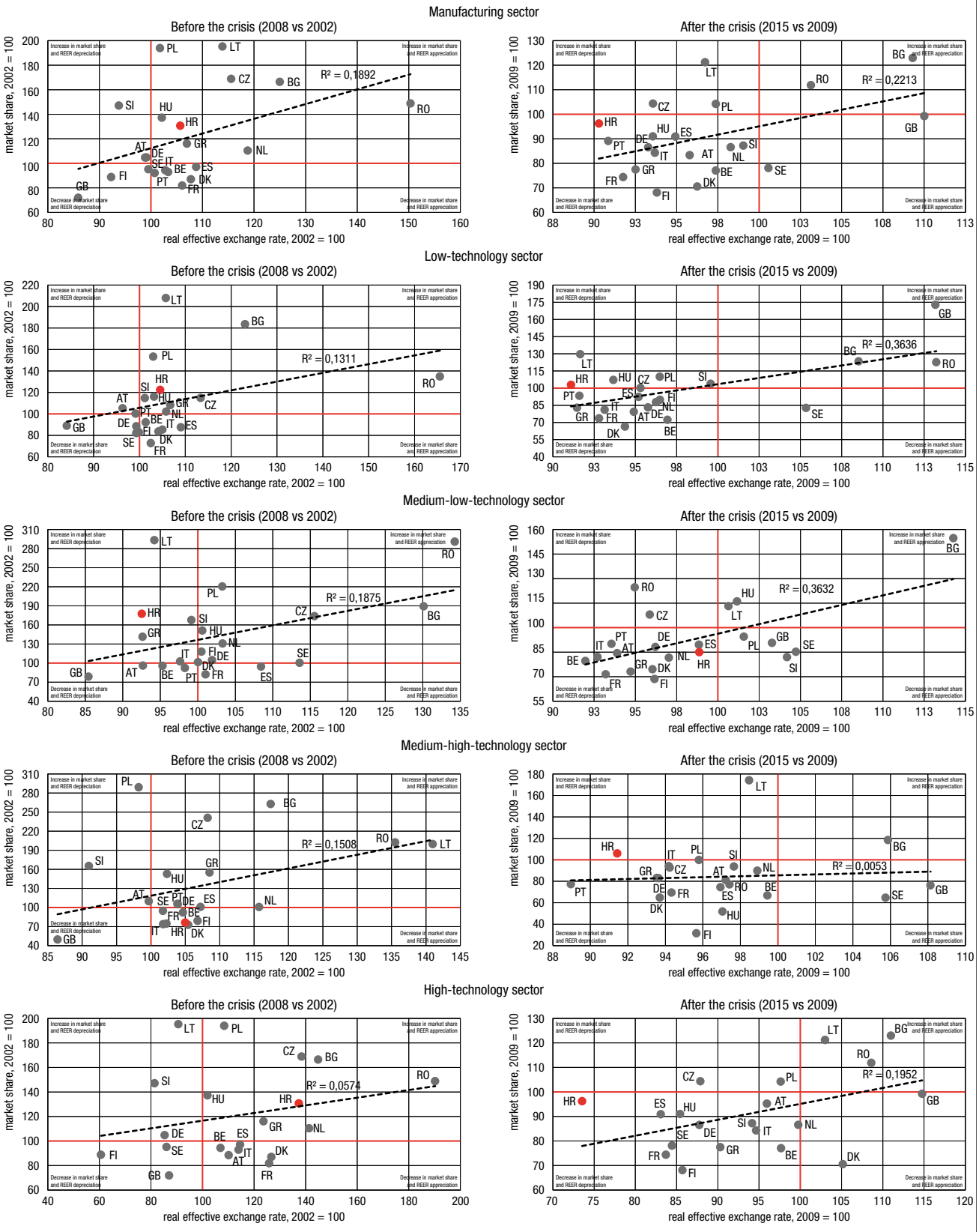


Notes: Figures show old EU members on the left side and new EU members on the right side. Negative values indicate depreciation.
Sources: ECB and author's calculation.

the same time, these countries recorded a marked increase in the market share of these sectors (upper right quadrant of Figure 7). Similar developments were seen in the period after the crisis as well. It is worth noting that certain countries were exposed to various degrees of economic convergence in the observed period, which can simultaneously, to a certain extent, affect price competitiveness and exports. Nevertheless, it would seem that in most cases, the expected link between real effective exchange rates and exports is missing, pointing to the relevance of non-price competitiveness factors. These include the quality of the business environment, the inflow of investments into export-oriented sectors, the geographical and production structure of exports, integration in global value chains and investments in research and development.[5]

5 See, for example, Ahmed et al. (2015): *Global Value Chains and the Exchange Rate Elasticity of Exports*, IMF Working Paper. Based on a sample of 46 countries, the authors have shown that, in the period from 1996 to 2012, the elasticity of real manufacturing exports to REER changes decreased over time. They have also shown that the integration in global value chains reduces the elasticity of manufacturing exports to REER changes by 22% on average.

Figure 7 Market shares and price competitiveness



Notes: The market share shows the change in the share of exports of goods of a particular country in global imports (relative to the reference year), while the real effective exchange rate shows the change in the real effective exchange rate index deflated by producer prices (relative to the reference year). The period under analysis was shortened in comparison to earlier graphic presentations as the data for market shares was available for the period from 2002 to 2015.

Sources: Eurostat, UNCTAD, ECB and author's calculation.

4 Conclusion

The developments in real effective exchange rates deflated by producer prices can vary across different manufacturing activities or sectors, suggesting that there are diverse price competitiveness conditions within an economy. Price competitiveness indicators at sector level can therefore provide additional information that typically cannot be derived from the indicators at the level of the economy as a whole. Price competitiveness in Croatia, measured by the developments of aggregate indicators, deteriorated slightly in the period from 2000 to 2016, while at the same time, it remained relatively stable in the manufacturing industry. A more detailed analysis reveals that the improvement of price competitiveness in the manufacturing sector characterised by the medium-low-technological intensity of production was offset by the deterioration in the high-technology sector, whereas there were no significant changes in price competitiveness in the low-technology and medium-high-technology sector. Furthermore, as in Croatia, the dynamics of sectoral level price competitiveness varied in other EU countries as well, particularly in the new EU member states. It is also evident that in most of the observed countries changes in price competitiveness were not accompanied by an expected change in exports, suggesting, among other things, the relevance of non-price export competitiveness factors.

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Turner, P., and J. Van't dack (1993): *Measuring International Price and Cost Competitiveness*, Bank of International Settlements Economic Paper Series, No. 39.

Appendix: Notes on methodology

Real effective exchange rates shown in this survey have been calculated as a weighted geometric average of bilateral exchange rates deflated by relative producer prices. They have been calculated for the majority of manufacturing industry activities at the two-digit level of the National Classification of Economic Activities (NACE). The calculation process includes the following methodological aspects: 1) the trade basis for weight calculation; 2) choice of trading partner countries, i.e. the criteria according to which they will be included in the basket used for the calculation of the index; 3) choice of weight structure; and 4) choice of deflator for the construction of the real effective exchange rate index. Particular methodological aspects are described below.

1) The trade basis for weight calculation is the trade in goods in the manufacturing sector classified according to NACE. The trade in the manufacturing sector is usually observed due to its significant sensitivity to the changes in competitiveness and due to the relatively good availability of data on the prices in the manufacturing sector.[6]
2) The choice of trading partner countries included in the basket for REER calculation depends on their relative importance as trading partners – the share of a particular partner country in the total foreign trade in the manufactured goods of a country for which the effective exchange rate is calculated as higher than 0.5% – and the availability of data on exchange rates, prices and the geographical structure of trade in manufactured goods. According to such criteria, countries included in the basket for REER calculation are mostly EU member states, Switzerland, USA, China, Turkey, Russia and Japan.
3) Effective exchange rates were calculated using simple overall trade weights (including imports and exports) and, in order to simplify the calculation which, due to the nature of the analysis, includes a large amount of data, they were limited solely to direct bilateral trade. Effective exchange rates are usually based on double-weighted export weights that take into account indirect competition, i.e. the competition in third markets[7]. Furthermore, weights are time-varying as they were calculated to reflect the average structure of foreign trade over non-overlapping three-year periods. The last reference period for weight calculation is the period from 2013 to 2015.
4) Deflators used to calculate the real index are industrial producer price indices measuring changes in industrial producer prices for products manufactured in the country and sold by producers on the domestic and/or the non-domestic market.[8] Among other elements, they include prices of capital and intermediary goods in the manufacturing industry that can be traded on an international level and are thus considered a relatively good substitute for the prices of tradables. In addition, producer prices are available at a higher level of disaggregation and are therefore well suited for a sectoral analysis of price competitiveness. Producer prices for EU countries on the second NACE level were obtained from the Eurostat database, while national sources were used for other countries.

The sector approach on which the analysis of real effective exchange rates described in this survey is based implies the grouping of activities according to the level of the technological intensity of the manufacturing process.[9] Total manufacturing sector activities are thus categorised into four subcategories (Table 1): the low-tech-

6 See Turner, P. and J. Van't dack (1993): *Measuring International Price and Cost Competitiveness*, Bank of International Settlements Economic Paper Series, No. 39.

7 See, for example, Box 2 of CNB Bulletin No. 165, 2010 and Schmitz et al. (2012): *Revisiting the effective exchange rates of the euro*, ECB Occasional Paper, No. 134.

8 In the majority of cases, producer prices of industrial products refer to the total market (domestic and non-domestic). In some cases where such data were unavailable, producer prices of industrial products refer to either the domestic or the non-domestic market; export prices were also used. The data on the aforementioned prices have been available since 2000 for most countries.

9 According to Eurostat glossary, the sector approach is a special classification of manufacturing industry activities according to the level of their technological intensity (investment in research and development/value added) using the National Classification of Economic Activities (NACE) on 2-digit and 3-digit levels (see http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:High-tech_classification_of_manufacturing_industries).

Table 1 List of manufacturing sector activities according to NACE divisions

Code	Low-technology sector (LT)
10	Food products (8.1%)
11	Beverages (0.9%)
12	Manufacture of tobacco products (0.5%)[1]
13	Textiles (2.2%)
14	Wearing apparel (4.4%)
15	Leather and related products (2.6%)
16	Manufacture of wood and of products of wood and cork (2.6%)
17	Paper and paper products (2.6%)
18	Printing and reproduction of recorded media (0.02%)[1]
31	Furniture (2.3%)
32	Other manufacturing (1.9%)
Code	Medium-low-technology sector (MLT)
19	Manufacture of coke and refined petroleum products (7.1%)[1]
22	Rubber and plastic products (3.5%)
23	Other non-metallic mineral products (3.1%)
24	Basic metals (5.9%)
25	Fabricated metal products, except machinery and equipment (4.7%)
Code	Medium-high-technology sector (MHT)
20	Chemicals and chemical products (8.4%)
27	Electrical equipment (6.6%)
28	Machinery and equipment, n. e. c. (9.2%)
29	Motor vehicles, trailers and semi-trailers (6.5%)
30	Other transport equipment (6.2%)[1]
Code	High-technology sector (HT)
21	Basic pharmaceutical products and pharmaceutical preparations (4.0%)
26	Computer, electronic and optical products (6.7%)

[1] The analysis does not include activities related to the manufacture of tobacco products, coke and refined petroleum products, other transport equipment and the printing and reproduction of recorded media (see footnote 1).
Note: Numbers in brackets indicate the share of a particular activity in the total trade of Croatia's manufacturing sector in the period from 1995 to 2015.
Sources: Eurostat and author's calculation.

nology (LT), medium-low-technology (MLT), medium-high-technology (MHT) and high-technology (HT) sector, respectively. Accordingly, REER indices initially calculated on the second NACE level are aggregated into the aforementioned four categories using weights representing the relevance of a particular activity in the total trade of the manufacturing sector. REER indices have not been calculated for Cyprus, Estonia, Ireland, Luxembourg, Latvia, Malta and Slovakia due to the lack of necessary data on producer prices.

Two-letter country codes

AT – Austria
BE – Belgium
BG – Bulgaria
CY – Cyprus
CZ – Czech Republic
DE – Germany
DK – Denmark
EE – Estonia
ES – Spain
FR – France
GR – Greece
HR – Croatia
HU – Hungary
IE – Ireland
IT – Italy
LT – Lithuania
LV – Latvia
LU – Luxembourg
MT – Malta
NL – The Netherlands
NO – Norway
PL – Poland
PT – Portugal
RO – Romania
SE – Sweden
SI – Slovenia
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The second page should contain the abstract and the key words. The abstract is required to be explicit, descriptive, written in third person, consisting of not more than 250 words (maximum 1500 characters). The abstract should be followed by maximum 5 key words.

A single line spacing and A4 paper size should be used. The text must not be formatted, apart from applying bold and italic script to certain parts of the text. Titles must be numerated and separated from the text by double-line spacing, without formatting.

Tables, figures and charts that are a constituent part of the paper must be well laid out, containing: number, title, units of measurement, legend, data source, and footnotes. The footnotes referring to tables, figures and charts should be indicated by lower-case letters (a,b,c…) placed right below. When the tables, figures and charts are subsequently submitted, it is necessary to mark the places in the text where they should be inserted. They should be numbered in the same sequence as in the text and should be referred to in accordance with that numeration. If the tables and charts were previously inserted in the text from other programs, these databases in the Excel format should also be submitted (charts must contain the corresponding data series).

The preferred formats for illustrations are EPS or TIFF with explanations in 8 point Helvetica (Ariel, Swiss). The scanned illustration must have 300 dpi resolution for grey scale and full colour illustration, and 600 dpi for lineart (line drawings, diagrams, charts).

Formulae must be legible. Indices and superscript must be explicable. The symbols' meaning must be given following the equation where they are used for the first time. The equations in the text referred to by the author should be marked by a serial number in brackets closer to the right margin.

Notes at the foot of the page (footnotes) should by indicated by Arabic numerals in superscript. They should be brief and written in a smaller font than the rest of the text.

References cited in the text are listed at the last page of the manuscript in the alphabetical order, according to the authors' last names. References should also include data on the publisher, city and year of publishing.

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