CHANGES IN THE INNOVATION PERFORMANCE OF THE CR AND DEVELOPMENT IN THE HIGH-TECH SECTOR

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Abstract

Sharpening of competitive conditions caused by economic crisis showed that the competitive advantage of Czech firms in global markets can be also based on a convenient proportion of the workforce and quality of production and low cost. Redirecting growth model and an increase in export performance in the published analysis is primarily associated with traditional innovation strategy, i.e. expenditures on research and development to succeed in developed European markets by offering sophisticated products with high value added. In following text we will first focus on the position of our economy in international comparison according to the Summary Innovation Index. Our second aim is to deal with the changes in the perspective branch of hi-tech industry and to evaluate performance and innovative behaviour of this branch according to the size of the enterprise and according to the owner of firms.

Key words: innovation performance, European Innovation Scoreboard, Summary Innovation Index, Czech high-tech sector

JEL Code: E20, O11, O30, O34, O38

Introduction

Manufacturing sector is the key industry for the competitiveness of Czech economy. Sustainability of Czech firms´ competitive advantage is connected to their export performance, which is determined by product quality, skilled workers and low cost. The article deals with the character of the existing competitive advantages and it analyzes the current position of the Czech economy in international comparison of innovation performance (Innovation Union Scoreboard 2011, which means IUS 2011). Data analysis of high tech manufacturing industry (in years 2005 - 2010) in the CR allows to describe the importance of the sector and to highlight the differences in performance and innovative behaviour among firms with domestic and foreign-owned companies and the differences according to the size (number of employees).

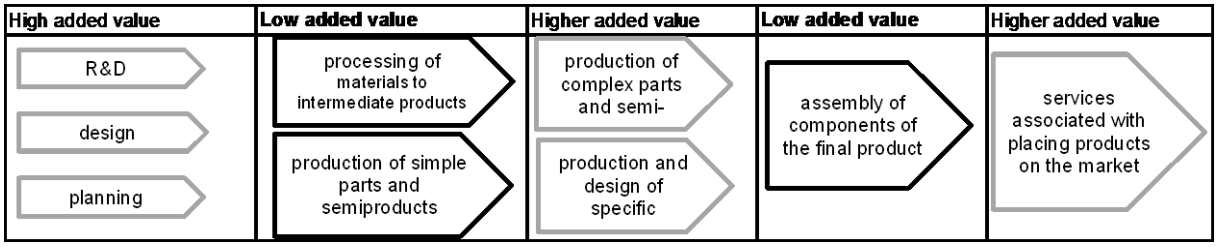
1 Character of competitive advantage of the CR

Competitive advantage may be based on qualitative factors, on cost conditions and location of the economy. Relatively high level of spending on research and development (R & D expenditure), or increasing in the innovation performance or a high proportion of skilled employees is usually related to quality-based competitive advantage. Low level and dynamics of unit labor costs is connected to cost-based competitive advantage. The ability of the Czech companies to penetrate demanding foreign markets of advanced EU countries is still the result of the central position of the CR and of relatively low production costs. The Czech Republic and other countries of Central and Eastern Europe are known abroad as low-cost manufacturing base of foreign and multinational companies serving primarily markets in Western Europe. The existing Czech firms´ competitive advantage is derived from the favourable ratio of workforce quality and production quality and low cost and it is mainly due to the attractiveness of the CR in the global division of labor.

However, the Czech Republic and other CEE countries are gradually loosing its traditional cost-oriented competitive advantage as a result of rising living standards. According to the traditional view of competitiveness the current Czech companies´ competitive advantage in global markets can be maintained by strengthening the quality factors of competitiveness, i.e. expenditures on research and development directed to the sectors and industries that produce sophisticated products of high value added. In the changed conditions of global markets, where the role of emerging economies will be increasingly important, the one-sided orientation of our exports to the developed, primarily Western countries means a handicap. The necessity to look for new opportunities outside the EU markets is also determined by a declining inflow of direct foreign investments and the expected stagnation or decline in exports to the markets of developed countries. Analyses of the international competitiveness of the CR (e.g. NERV, 2011, the Government of the CR, 2011, or Žížalová 2011, Rojíček, 2011) therefore emphasize the need to redirect the growth model and the competitiveness of Czech companies. In addition to traditional recommendations focused on successful innovation strategy it is necessary to promote the search for new types of innovations that will be targeted to new foreign markets of developing countries. The possible formation of counterweight to action of large multinational companies can be considered as a positive effect of promoting the expansion of private domestic firms in these markets. The current position of the CR in global production networks is described on Figure number 1.

The involvement of Czech companies in the Global Value Chain (GVC) is a prerequisite for the competitiveness of the economy. Rojíček (2012) states the increasing importance of SMEs for the country's successful involvement in the GVC. In the current phase of globalization there is a shift from vertically structured multinational companies to horizontally structured ones. While in the vertically structured companies, one company provides all phases of the production chain; in the horizontal structure each phase of production chain can take place in different companies.

Fig. 1: Position of the CR in global production networks



Source: EEIP, 2009

Global value chains allow SMEs to take advantage of their flexibility and quick response capability and to create value added of processing products due to specialization on the particular part of the value chain. (Rojíček, 2012) The success in engaging SMEs in GVC is closely related to the ability of firms to innovate. Srholec (2009) examines whether foreign ownership promotes cooperation on innovation with non-affiliated partners at home, abroad or both. An estimate of a profit model indicates that foreign affiliates are more likely to channel knowledge through innovation cooperation, although important differences have been found in this relationship between countries at different levels of economic development.

2 Innovation performance of the Czech economy according to SII 2011

A prerequisite for quality-based competitive advantage is the increase in technological capabilities and innovative capacity. In connection with the growing importance of innovation the importance of analytical tools for measuring innovation performance increases. There is no clear consensus in professional circles on what source data are the best to evaluate the innovative performance. Zemplinerová (2010) examines the relationship between the character of the sector, company size and the number of R & D employees while assessing innovation performance of Czech firms. Kadeřábková a Cícha (2008) prefer the modern concept of innovation as an interactive process (innovation depends not only on inputs but also on their combination, on the ability of the environment to support the development of

knowledge and skills of workers). These authors note that the apparent attempt to shift the emphasis from the evaluation of innovative inputs (i.e., traditionally understood research and development activities) to identification of innovative outputs and their effects on competitiveness. Another characteristic feature of the current approach to evaluating innovation performance according to these authors (Kadeřábková, Cícha 2008) is an attempt to capture the widest range of innovation activities as possible (including non-technical innovations and innovations in services) and also an effort to include a broader context of assumptions and results of innovation activities in a complex concept of quality-based competitiveness (institutional characteristics of the environment, linkages and networking, the quality of human resources and education system specifically while supporting lifelong learning, quality of working environment and work organization, the globalization of economic activities and positions of countries in the multinational value chain).

Summary innovation index (compiled annually since 2001) is considered the main tool for international comparison of innovation environment and innovation performance on the level of EU countries. SII (Summary Innovation Index) is currently composed of 24 indicators, which are arranged into three main groups (activators, corporate activities, outputs) and eight categories. Due to changes in methodology it is not correct to formulate definite conclusions on the basis of our economic position changes over time, so we mention only the evaluation of the last period. The Czech Republic, according to SII in recent years, ranks third in the group of countries known as moderate innovators with SII value slightly below the EU-27 average[1].

2 High-tech sector

Innovation performance of firms operating in high-tech sector is the key prerequisite for diverting our economy´s competitive advantage from cost orientation to qualitative competitive advantage. High-tech sector is defined as a set of economic activities which widely use advanced technology for their production. At the same time development of outputs from such activities is accompanied by high expenditures on innovations or on research and development (R & D). These economic activities also generate higher value added. High-tech sector is defined by Classification of Economic Activities (NACE) in the

[1] Moderate innovators are countries reaching from 50 to 90% of the level of EU-27. Countries belonging to the innovative leaders (Innovation Leaders) reach at least 20% higher innovation performance than the average for the EU-27, among the followers of innovation (innovation followers) there are countries whose innovation performance is within 10% below average to 20% above the EU-27 average. Performance of group of countries called Moderate Innovators is less than in the EU-27, but it reaches higher values than that is corresponding to 50% of the EU-27.

Czech Republic and it is divided into two main categories: high-tech manufacturing industry and high-tech services. High-tech manufacturing industry includes the following activities: production of pharmaceutical products and preparations, production of computers and electronic components, production of consumer electronics and optical equipment, manufacture of measuring, testing, navigating and medical equipment, manufacture of aircraft and its engines, spacecraft and their equipment. High-tech services include the following activities: audiovisual and information activities, activities in the field of ICT, research and development on natural sciences, engineering, social sciences and humanities.

Used indicators for assessing performance of firms are summarized in Table 1.

Table 1: Indicators of evaluating firms´ performance

Performance indicator	Measure
Labor productivity	Book value added/employee
Unit labor costs	Personnel costs/book value added
Investment rate	Investment/book value added
Innovativeness	Expenditures on R&D/ book value added

Position of high-tech manufacturing industry in MI in the CR

The position of high-tech manufacturing industry is stable in the terms of manufacturing industry in the CR (see Table 2) during the examined period (which means from 2005-2010). Employees of high-tech manufacturing industry comprised approximately 5% of staff throughout the whole manufacturing industry, the share of high-tech MI in the performance of MI (including margin) is unchanged in the period and it reaches 9% on average. The increase in the share of high-tech MI by 1 pp in 2009 is caused a smaller decrease in performance in comparison to MI as a whole and it can be considered as an evidence of greater adaptability and competitiveness of this sector in crisis conditions.

The share of high-tech MI in the output consumption of MI was stable at 10% (respectively 11% in 2008 and 2009). The share of book value added does not change either during the period - it is stable at 5%. The character of production in high-tech MI in the CR is obvious from these data, which means focusing on activities with low value added. This conclusion is also evident from the indicator documenting the differences in demand for inputs. While the share of output consumption per output is approximately 77% in MI, this intensity is by 10 percentage points higher in high-tech MI. This fact is also reflected in labor

productivity measured as book value added per employee - see Table 2. The slight recovery in 2010 meant an increase in book value added per employee in MI and in high-tech MI, too. Reducing the "negative gap" of high-tech MI in labor productivity in 2010 compared with the previous year (an increase of the share by 8 percentage points) can be explained by a greater year decrease in workers (by 3% in MI, by 9% in high-tech MI) in this sector and a higher year increase in book value added (by 16% MI, by 17% in high-tech MI).

Table 1: Position of HT sector in manufacturing industry

subject	2005	2006	2007	2008	2009	2010
Book value added per employee (thousands CZK)						
high-tech MI	531	648	531	545	479	616
MI	558	626	658	628	617	716
share of high-tech in MI	95%	104%	81%	87%	78%	86%
average registration number of employees (thousands of persons)						
high-tech MI	60	63	66	70	60	55
MI	1 195	1 206	1 235	1 235	1 081	1 049
share of high-tech in MI	5%	5%	5%	6%	6%	5%

Source: elaborated on the basis of data by Czech Statistical Office

Changes in high-tech sector according to the owner and firm´s size in years 2005 -2010

This analysis is based on data published by Czech Statistical Office in statistics of advanced technologies. According to the industry classification of NACE it is possible to work with data from the years 2005-2010. Used data base corresponds to the objective to monitor the impact of economic recession on the high-tech manufacturing industry. Higher share of high-tech MI in output consumption compared to the book value added is mainly due to the processing nature of production of foreign-controlled companies and their majority share on employees, performance, sales, output consumption and book value added in industry. Immediately after starting the forceful flow of FDI into the Czech economy, significant differences were seen such as differences in labor productivity between domestic and foreign companies operating in our territory. These differences led to the fact that the Czech economy has been characterized as a two-speed, respectively dual economy.

Confirming the successful participation of Czech companies in the production chains of multinational companies and the evidence of decreasing differences between companies with different owners is represented by the convergence of labor productivity, which we will observe absolutely and relatively – i.e. according to the change in share of domestic firms in

the overall labor productivity for the whole sector. An absolute increase in the number of companies with home ownership and of small firms (under 50 employees) in the period can be regarded as another proof of competitiveness of Czech companies. During the reporting period, the number of firms owned by foreign and domestic owner increased, while the number of employees decreased in both types of businesses - it is obvious that there was a gradual dividing of larger companies and strengthening the sector of especially small, but also medium-sized enterprises.

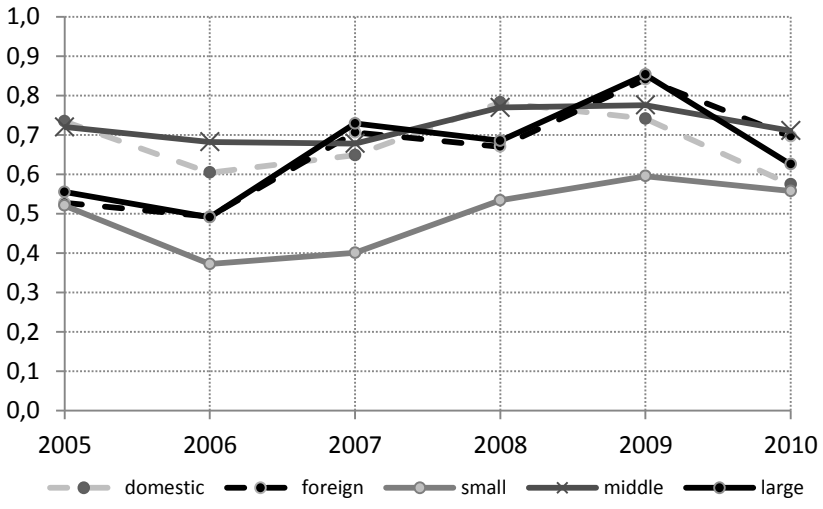
The change in the size structure of firms happened mainly due to the economic crisis - the number of large companies in the industry fell by nearly 20%, the number of employees in large firms by almost 30%. The increase in personnel costs in domestic firms and foreign affiliates were mainly in the pre-crisis period, with foreign affiliates, this decline was recorded in 2010 as well, which is due to the decline in their number in the industry. On the other hand, personnel costs of domestic firms increased in connection with the increase in their number (especially in the small business segment) in the period during the recession and after it. Trend in sales and outputs was almost identical. The increase in foreign firms was greatest in the first two years of the period, decrease was recorded in 2009, in 2010 their sales and output reached slightly above pre-crisis level. Looking at sales, output and output consumption of firms according to their size, it is clear that the crisis has affected medium-sized enterprises the least of all - only in those firms there was the growth of output, sales and output consumption in the crisis period. Given that a slight increase in the indicators mentioned occurred during the crisis period in foreign affiliates, we can say that **the economic crisis in high-tech manufacturing industry touched medium-sized companies** with foreign owners **at least**. With regard to the previously mentioned focus of foreign-owned firms on activities with low added value, a decline in accounting value added of foreign affiliates happened during the period - particularly in the context of economic recession. The reason for this increase in accounting value added in firms with domestic ownership is lower growth of output consumption compared with increase in outputs. Small and medium-sized enterprises have responded to crisis conditions by reducing costs, large companies involved in transnational production chains often have no option to react so flexibly in the crisis conditions and to pull down costs by changing the supplier-customer relationships. Decrease in the number of large foreign-owned companies is projected to decrease in expenditures of foreign affiliates on research and development - the decline was particularly noticeable in critical conditions. A significant increase in these expenses in the sector of domestic firms - especially small and medium-sized (an increase in these expenses showed in medium-sized

firms in the year 2009) can be understood as a positive signal for the innovative performance and competitiveness of these companies. While evaluating changes in investments it is necessary to take into account first the decrease in the number of large companies and decrease in their size, second companies´ caution when estimating the future development of the relevant markets. The decline in labor productivity in foreign affiliates and its significant increase in the sector of domestic companies has causes that have already been mentioned - changes in ownership, lower output consumption and subsequently higher accounting value added realized in the domestic medium-sized enterprises. The decline in unit labor costs in the segment of domestic enterprises was mainly due to the significant increase in labor productivity in companies with a domestic owner. In the foreign-owned companies, these costs doubled compared with domestic firms in the period (in the crisis year 2009 the costs were even triple). Increased pressure on the economies in domestic and medium-sized and large companies led to a decline in unit labor costs in terms of crisis and in post-crisis period.

Changes in enterprises´ productivity in high-tech manufacturing industry

Following figures 3 to 6, where it is captured how indicators described in table 1 changed, allow a closer look at the development of unit labor costs and labor productivity. Higher costs and sensitivity to changes in a recession is typical for large enterprises and foreign affiliates. Costs are significantly more stable and more dependent on market demand in domestic companies and small and medium-sized firms, which is usually associated with a higher degree of operating leverage of larger companies.

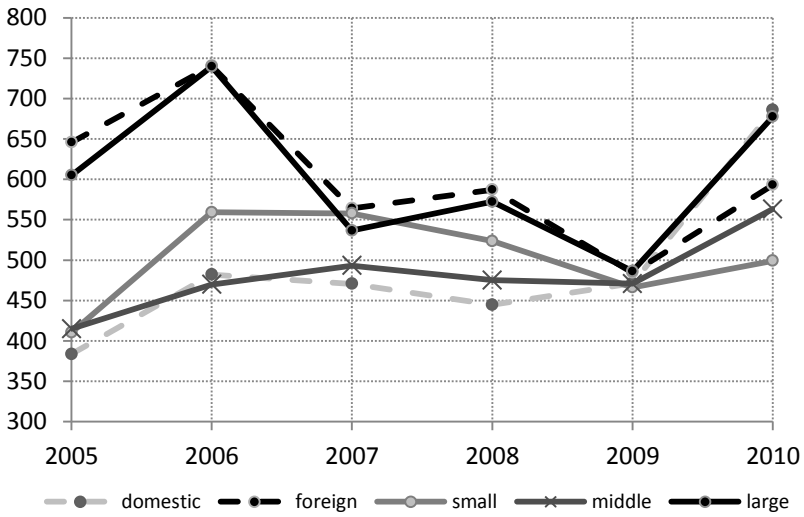
Fig. 3: Unit labor costs



Source: Czech Statistical Office 2012. Own customization and processing.

Convergence of unit labor costs happens again in terms of recovery, but labour costs are still on the lowest level in small and domestic companies. Middle and local companies have got the highest stability (measured by standard deviation).

Fig. 4: Labor productivity (in thousands of CZK/staff)



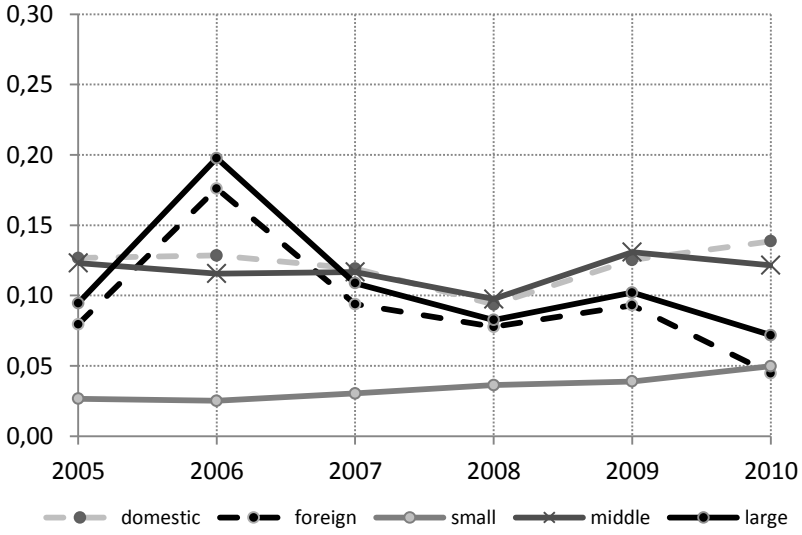
Source: Czech Statistical Office 2012. Own customization and processing.

Figure 4 obviously shows that the gradual convergence of labor productivity occured between particular segments. Above-average labor productivity in foreign affiliates and large enterprises showed - especially after 2008 - a downward trend. In 2009 the productivities coincided with no regard to the type of company. Labor productivity in domestic firms was even higher than in foreign ones after recovery in 2010. Effects of ways of creating value added are reflected in the development as well as the differences between domestic and small and midsize companies and large foreign affiliates due to the position in the production network. Foreign affiliates belonging to bigger entities usually realize their value added at the end of the production chain (see Figure 1) and therefore there are more sensitive to market fluctuations - their productivity declines in the recession and increases during the recovery. The apparent possibility of reducing the number of workers does not seem as effective because it is associated with the personal costs in the longer term (on restrictions according to the labor law). Small and medium-sized companies create their value added in the middle of the production chain, and thus market fluctuations have less impact on them.

The level of innovativeness of firms is measured by the ratio of R & D expenditures and value added. It is clear from Figure 5 that after the convergence of innovation in 2008, the most

significant increase in innovative activity is in medium-sized businesses with a home owner, a small but steady increase in innovative activity of small firms can certainly be considered a positive trend.

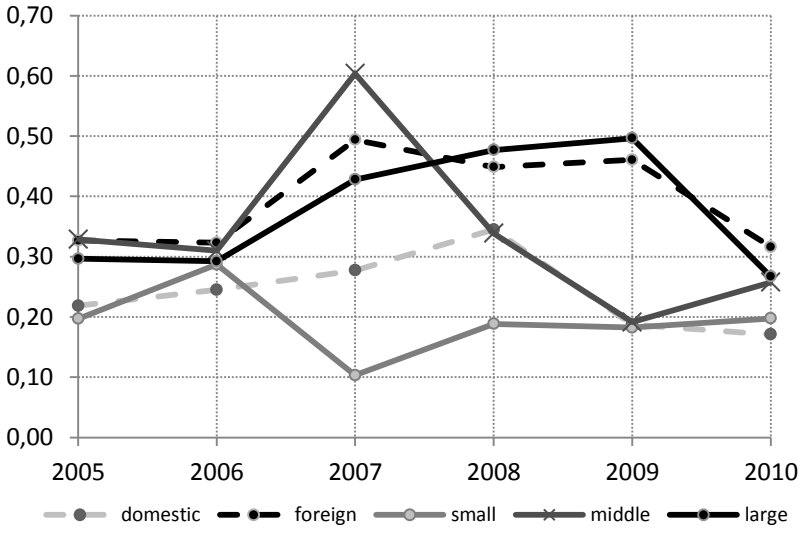
Fig. 5: Innovativeness



Source: Czech Statistical Office 2012. Own customization and processing.

Investment rate (measured as the ratio of investment to financial value added of the enterprise) has the highest rate of instability.

Fig. 6: Investment rate



Source: Czech Statistical Office 2012 . Own customization and processing.

Instability was caused during the recession by the postponement of investments to a more favourable time and it took shape by following growth. The fluctuations are also caused by the decline in book value added and only subsequent reactions. Decision-making on investment is not trivial, and the larger the company is or the more complicated decision-making structure it has (foreign affiliates), the slower is the response to the current internal and external development. This is the reason why the results of small and home businesses seem logical.

As it can be seen on Figure 6, in the end of 2010 the rate of investment in all types of businesses was practically the same as during the period 5 years ago (2005).

Conclusion

The aim of the article was to outline the possible perspective of competitiveness of Czech industry by analyzing the current state, international comparison and evaluation of innovative potential of Czech industry. Innovation performance of firms operating in high-tech sector is the key assumption for redirection of the competitive advantage of the Czech economy from cost orientation to qualitative competitive advantage.

Data analysis of high-tech manufacturing (in 2005 - 2010) in the CR allows to describe the importance of the sector and to highlight the differences in performance and innovative behaviour among firms with domestic and foreign owner. The analysis of selected performance indicators of high-tech sector in the years before the recession, in recession and during beginning recovery shows impact of recession, but also the sensitivity of large firms and foreign affiliates to market fluctuations. On the other hand, we can see both the stability of small and medium-sized domestic companies, but also flexibility of responding to the changing situation. Taking into the account not only the innovative potential and prospects in terms of creating a competitive advantage of domestic small and medium-sized firms, but also other aspects such as the development of human potential and employment, we see that these firms are comparable in the creation of value added and they are not smaller employers than large firms (those are 42%). While eventual support for creating competitive advantages of the Czech economy therefore the stress should be put on the support (whether direct or indirect) of local companies, particularly medium-sized, because they have the potential of creating product, innovation development and skilled labor, as well.

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