

INNOVATION PERFORMANCE, LABOUR PRODUCTIVITY AND ULC IN CZECH AND SLOVAK AUTOMOTIVE INDUSTRY AND HIGH-TECH MANUFACTURING INDUSTRY

Hana Scholleová - Marta Nečadová

Abstract

Innovation performance of Czech and Slovak firms is a key prerequisite for redirection of competitive advantages from cost-orientation to qualitative competitive advantage. The positive changes in labour productivity determinate not only the present state of countries' economic performance, but the effectivity of innovation processes and the level of upgrading local technological capability as well. The reciprocal connections between industries which are generally described as being 'high technology' and other sectors are necessary for effective innovative processes and thriving technological transfer to the whole economy. The reciprocal connections and the symbiosis between high-tech MI and automotive industry are therefore considered to be an important assumption for the Czech and Slovak long-term economic performance. The objective of this article is to compare the Czech and Slovak car industry (so called automotive) from the abovementioned points of view. This paper deals with the changes in the innovative intensity, labour productivity and unit labour costs in the high-tech sector and in the automotive industry in both countries. We analyse the status and development of these sectors in MI in years 2008 – 2015 (– 2016) and compare changes in the abovementioned indicators.

Key words: car industry, manufacturing industry, labour productivity, unit labour costs, investment performance, innovative performance

JEL Code: L62, O12, R11

Introduction

With passenger car production at 128 vehicles per 1,000 persons, the Czech Republic has maintained its supreme position among world automotive leaders in terms of per-capita output. It is also among the fifteen largest passenger car producers by volume in the world. The Slovakia car production is relatively higher, 192 vehicles per 1,000 persons (International

Organization of Motor Vehicle Manufacturer, 2017). The performance of the industry then very depends on the automotive industry (suppliers).

However, the importance of the automotive industry can not be reduced to performance indicators, because this sector plays a significant role in terms of employment.

Classification of Economic Activities CZ-NACE (Czech Statistical Organization, 2017) by the automotive industry means the section with code 29. Car production sector in the Czech Republic and in the Slovak Republic and EU is in Eurostat data evidence defined through Classification of Economic Activities (NACE_R2) and is divided into two main categories: Manufacture of motor vehicles, trailers, semi-trailers and of other transport equipment. For analyse have been the catagories sumarized.

Recently, there has been a great deal of discussion on the direction and development of motorism at world level. Major changes are expected in the form of new trends that are emerging as a consequence of the response to all the problems that the expansion of motorism brings. They include pressure on the safety of all production processes (automation and robotics), but also traffic (elements of self-management), efficiency of sharing on the part of consumers, ecology both in terms of production, operation and disposal (materials).

It is very difficult to predict further developments; in general, growth can be expected, but depending on the region (Pavelková et al, 2018). If future development is to succeed, we need to monitor the efficiency and innovation of development and the current state of the art with a focus on future stability, as the economic recession has shown since 2008 the great fragility of the automotive dependent economy. Industry risk is difficult to diversify (Aliu et al, 2017). Therefore, the analysis focuses on comparing the specifically created indicators and their comparisons for the Czech Republic, the Slovak Republic with data across the EU and looking for opportunities that would reduce the fragility of the car industry in the future.

1 Methods

To redirect our economy competitive advantages from cost-orientation to qualitative competitive advantage. At the same time the development of such activities accompanies the high cost of innovation or research and development (R&D). These activities depend of the role the staff by produce, change the role from producer to controller, that means, increase the demand for technical education people of higher quality level. These economic activities also generate higher added value. Car production sector in the Czech Republic and in the Slovak Republic and EU is defined through Classification of Economic Activities (NACE_R2) and is

divided into two main categories: Manufacture of motor vehicles, trailers, semi-trailers and of other transport equipment. For analyse have been the catagories sumarized.

The statistical data collected by the Eurostat (Eurostat, 2018) was used for the analysis. For the evaluation was used data of Value added (VA) in current prices in million units of national currency, Gross investment in tangible assets (GI) in current prices in million units of national currency, R&D expenditure (BERD) in current prices in million units of national currency, Wages and salaries (PC) in current prices in million units of national currency, Employment persons (E) in thousands persons, Worked hours (H) in thousands hours. The statistical data was collected specialy for sector Manufactory Industry (MI) and for sector Car Industry (CI) and both in Europe Union (EU), Czech Republic (CZ) and Slovakia (SK) during time period 2007 - 2016. The reason for choosing the time interval was to cover the entire typical length of the business cycle. The following indicators were created for comparison in different years and environments:

Investment rate (IR) = GI /VA and Investment growth (IG) = GI in year 2/ GI in year 1
 Worked hours per person = H/E ; Personel rate (PR) = PC/VA.

We used the logarithmic method (Synek et al., 2009) for analysing the Innovation rate (IRERD) = BERD /VA with the aim describe the effect of change in gross investment and value added on the change of investment rate. For the indicators A and B in the multiplicative relation is correct: If $X = A/B$ then also $I_x = I_A / I_B$ and then is also $\log(I_x) = \log(I_A) - \log(I_B)$, it means, that effect on change in X can be decompose on

effect A on change X = $\log(I_A) / \log(I_x) \cdot (X_1 - X_0)$ and analogic for effect B.

For eliminating inaccuracies (using different national currencies, evolution over the period), all analyzes works with ratios.

2 Car Industry in the Czech Republic, Slovakia and EU

For the comparison of the importance the automotive sector in individual geographical sites we used the VA ratio - VA of car industry on the VA of theirs manufacturing industry.

Tab. 1: VA for CI to VA for MI in EU, CZ and SK during period 2007 - 2016)

size	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
EU	12%	11%	11%	12%	12%	12%	13%	14%	14%	14%
CZ	17%	17%	18%	20%	20%	20%	20%	21%	22%	23%
SK	14%	15%	14%	16%	18%	18%	18%	20%	20%	20%

Note: The VA ratio = VA for CI / VA for MI, both in current prices (CZK, EUR)

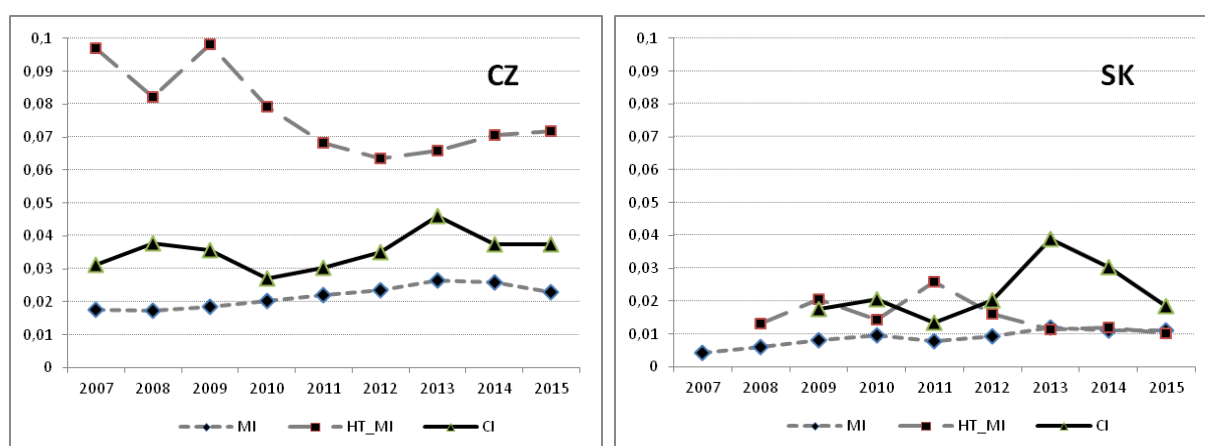
Source: own processed by Eurostat (2018)

The VA ratio for all regions (EU, CZ, SK) during the time increases. But for EU, the VA ratio is considerably noticeable than for CZ or SK. This makes the two countries generally more sensitive to the business cycle, as Car Industry is a cyclical sector.

2.1 Innovation rate (IRERD) in Car Industry

Car Industry as a driving force of Manufacturing Industry has a special role as an innovator in CZ and SK. Fig. 1. shows using the IRERD indicator a comparison of developments in the high tech and car industry with the manufacturing industry total.

Fig. 1: The IRERD in High tech, Car and Manufacturing industry during 2007 - 2015



Source: own processed by Eurostat (2018)

In both countries there is a lower and stable IRERD rate in the MI. In CZ is a long-term higher IRERD in the HT industry than in the car industry. In Slovakia, innovation rates do not differ much until 2012. Then, innovation in Car industry is growing significantly and is even higher than in the HT industry. (The downward trend is in fact caused by a decline in innovation expenditure, not a significant increase in VA). From this point of view, the development of CI in SK can be perceived as more towards innovation development but still with higher volatility.

2.2 The Employment in the Car Industry

At the time of the economic recession, Car Industry's contribution to GDP is declining, but at the same time there is a problem with the potential of unemployment, because the share of people employed in CZ and SK in CI is considerable, as shown in Tab. 2. In all monitored regions, the share of persons employed in CI increases, but in CZ and SK it is rising

significantly faster than in the EU and currently reaches 15% of the total number of employed in MI.

Tab. 2: The personnel ratio CI/MI (in %)

size	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
EU	9%	9%	9%	9%	9%	9%	10%	10%	10%	
CZ	13%	13%	13%	13%	14%	14%	14%	14%	15%	15%
SK	10%	12%	11%	12%	13%	14%	14%	14%	15%	15%

Note: The PER ratio = employee in CI / employee in MI, both in number of employee
Source: own processed by Eurostat (2018)

In times of economic growth, the economy is experiencing a shortage of labor. If we look at the annual hours worked per employee and their development during the reference period, then in tab. 3 or better in fig. 2 we can see that the hours worked per person annually in the car industry are lower than the hours worked in the manufacturing industry in all years and regions. The highest is this difference in CZ. It must be noted that there are multiple causes of disproportion and development.

Tab. 3: The Worked hours per employee and year in EU, CZ and SK (in hours)

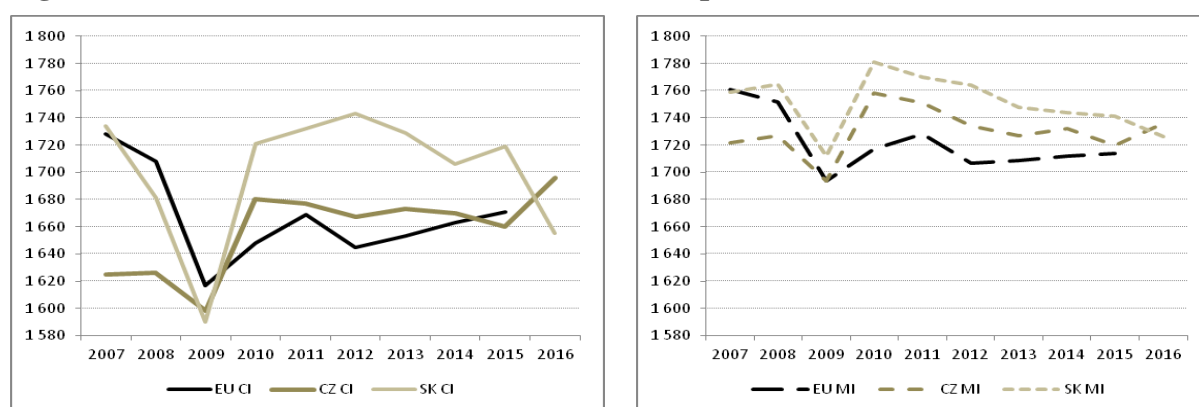
H/E for Car Industry	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
EU	1 728	1 708	1 617	1 648	1 669	1 645	1 653	1 663	1 671	
CZ	1 625	1 626	1 598	1 680	1 677	1 667	1 673	1 670	1 660	1 696
SK	1 734	1 681	1 590	1 721	1 732	1 743	1 729	1 706	1 719	1 655
H/E for Manufact. Industry										
EU	1 761	1 752	1 694	1 717	1 728	1 707	1 709	1 712	1 714	
CZ	1 722	1 727	1 694	1 758	1 751	1 734	1 727	1 732	1 720	1 736
SK	1 759	1 765	1 712	1 781	1 770	1 764	1 748	1 744	1 741	1 726
CI time free gap										
EU	32	44	77	69	59	62	56	48	43	
CZ	97	101	96	78	73	67	55	62	60	40
SK	25	83	123	59	38	21	20	38	21	71

Note: The CI time free gap =H/E for CI - H/E for MI
Source: own processed by Eurostat (2018)

First of all, it is a fluctuation due to an economic recession that affects all sectors, but its impact on Car industry is and will be substantially higher than in the manufacturing sector (particularly visible as a fall in 2009). Businesses did not want to resort to the dismissal of qualified people during this period (Čámská, 2012), if the economic situation allowed them, they would rather have the option of shorter working hours, but the productivity in automotive was high even during the crises (Klečka, 2015) - in comparison with other branches.

The second reason is the growing shortage of middle-level technical professionals and the resulting human resource policy extending benefits with additional working hours. From the point of view of the worker's capacity to observe labor laws, the maximum hours per person is annually 1 800 hours. (This is an absolute limit for eight-hour working hours and a 20-day holiday, in fact it is lower because it depends on both the normal number of days not working and the fixed holidays and their possible overlap with non-working days, but it is a negligible difference.)

Fig. 2: The H/E in CI and MI (in EU 28, Czech Republic and Slovakia)



Source: own processed by Eurostat (2018)

The third cause of the trend decline may be the desire for a change of the production factors. With labor shortages and pressure to respect employees' rights, personnel costs become fixed in the medium term, and behave in the medium term as much as the cost of more automation, businesses are more likely to consider changing these factors of production.

2.3 The Employment in the Car Industry

Tab. 4 shows the wage performance of CI using the Wage and Salaries / Value added indicator to each region.

Tab. 4: Share Wage and Salaries on Value Added in EU, CZ, SK during 2007-2016

PC/VA	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
EU	46%	49%	54%	45%	44%	46%	46%	44%	43%	42%
CZ	33%	36%	35%	32%	33%	34%	34%	31%	31%	31%
SK	31%	32%	42%	31%	32%	36%	37%	33%	34%	36%

Source: own processed by Eurostat (2018)

The results show that in the EU, labor costs are higher in the Car industry. While the CZ trend tends to decrease, in SK the wage costs are higher and the trend is pointing to further increases. It should be added that labor costs are also dependent on what enterprises are

included in the Car industry of each region - whether end producers or sub-contractors and how professional work within the sub-components must be carried by Trier 2 enterprises.

Wage developments can also be monitored by hourly wages in individual regions (ie total personnel costs divided by the number of workers and average hours worked) and comparisons with the value added generated for 1 hour of the employed worker. Given that the input data are in a national currency, the CZK / EUR exchange rate for the year was CZK / EUR average for the year according to the CNB. Table 5 shows how wages per hour and value added per hour evolved in individual regions.

Tab. 5: A comparison of Wage and Salaries per hour with VA per worked hour

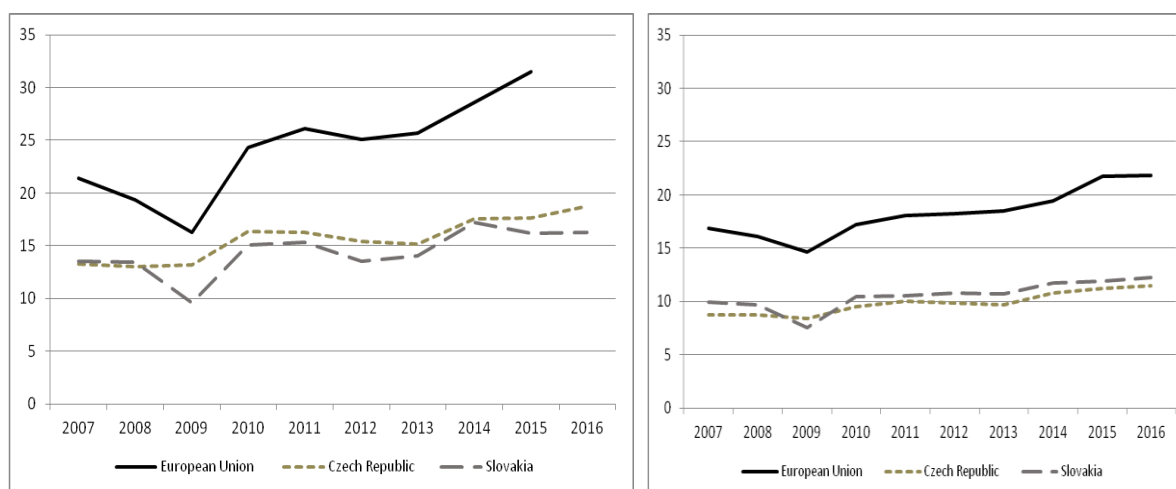
Wage and sal./year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
European Union	18	19	19	20	21	22	22	23	23	
Czech Republic	6	7	7	8	8	8	8	8	8	8
Slovakia	6	6	7	7	7	8	8	9	9	9
VA/ year										
European Union	40	38	35	44	47	47	48	51	55	
Czech Republic	20	20	20	24	24	23	23	25	26	27
Slovakia	19	20	17	22	23	21	22	26	25	26

Source: own processed by Eurostat (2018) and data about CZK/EUR from Czech National Bank (2018)

While the evolution and the hourly wage and VA rates in CZ and SK are very similar, the EU is double the value added, but the hourly wage is three times higher. It is better to compare the so-called profit gap, ie the difference between the VA/hour and hourly wage per region in both of CI and MI.

In the EU, even with rising wages, the added value increases so much that the profit gap is increasing. In Slovakia and the Czech Republic, due to the fact that most companies are not end producers, but suppliers, it is possible to increase the added value so that, under pressure to raise wages, the profit gap will not only stop growing but will decrease. The chart on the right shows the profit gap for MI, where the profit gap is lower, the differences between regions are less noticeable, and the scissors are no longer noticeable and the gap increases. In the case of rising wage costs, labor shortages and the cyclical market, it is logical to expect a higher effort by CIs for automation, and it is worthwhile comparing these results with the degree of innovation and investment across sectors and regions.

Fig. 3: Comparison of "profit gap" for EU, CZ, SK during 2007 - 2015 in CI and MI



Note: Profit gap = VA - Wage and Salaries (all in EUR/one employee and worked hour)

Source: own processed by Eurostat (2018) and data about CZK/EUR from Czech National Bank (2018)

3 Rate of investment in CI during 2007-2015

The investment rate shows Gross Investment compared to value added, both in national currencies, so it is advisable to work with a benchmark that reflects operating performance.

Tab. 6: Investment rate during 2007 -2015

	2007	2008	2009	2010	2011	2012	2013	2014	2015
IR CZ	37%	37%	31%	22%	28%	37%	37%	31%	35%
change IR CZ (p.p.)		0%	-6%	-9%	7%	9%	-1%	-5%	4%
effect investments on change		0%	-8%	-5%	9%	8%	0%	1%	7%
effect VA on change		0%	2%	-4%	-2%	1%	0%	-7%	-3%
IR SK			50%	35%	49%	54%	37%	25%	37%
change IR SK (p.p.)				-15%	14%	5%	-17%	-12%	12%
effect investments on change				2%	21%	5%	-16%	-8%	14%
effect VA on change				-17%	-7%	0%	-1%	-5%	-1%

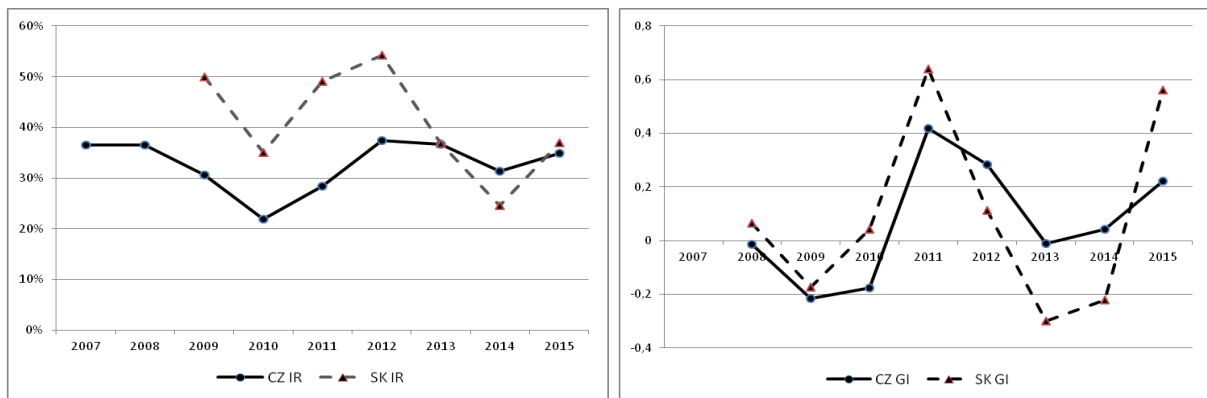
Note: IR = investment/VA, both in national currencies

Source: own processed by Eurostat (2018)

The investment rate is practically in all monitored years higher in Slovakia than in the Czech Republic, at the same time it can be said that the development is less stable. While in the Czech Republic, changes in IR are mainly driven by developments in investment, possibly linked to the development of invested funds with current VA production, the effects alternate in Slovakia. The graphs in Fig. 4 show both the development of the IR in both countries and the year-on-year growth of the investments themselves. Although the investment activity is

higher and more volatile in SK, the dynamics of development over time is very similar in both economies.

Fig.4: Indicators IR and GI in EU 28, Czech Republic and Slovakia during 2007-2015



Source: own processed by Eurostat (2018)

Conclusion

A longer production chain is typical for the production of cars, with a larger number of suppliers involved in the production process, so most of the enterprises operate in the production of parts and car parts. The effort of all involved actors is to maximize efficiency as the total added value of production is shared among a larger number of stakeholders.

It is to be expected that in the context of risk diversification, automotive sector enterprises will consider the allocation of resources to more efficient production, higher incremental innovations, and investment in their implementation, while at the same time addressing major changes. In the field of employment and its costs, the situation is more stabilized in the Czech Republic, however, the problems with the labor force, the pressure on its costs and the marked cyclical nature of the sector are already beginning to create a higher need for investment and innovation leading to higher automation in both countries. In the long run, it is not possible to reckon with the development of the profit gap, because a large part of CZ and SK companies in Car industry are not end producers but only part of the supply chain, hence the profit generation can influence the effectiveness of the cost structure. Due to the extent to which the time capacities of the workers and the production efficiency of the intermediate consumption are practically impossible, it is impossible to change costs by means of incremental changes. Therefore, higher spending on innovation and investment in automation can be expected in the future, resulting in a change in the cost structure.

References

- Aliu, F. et al (2017). Portfolio risk-return analysis: The case of the automotive industry in the Czech Republic. *Journal of International Studies*. vol. 10, issue 4, p. 72-83. ISSN 2071-8330.
- Czech Statistical Office (2018). Metodická příručka k NACE rev. 2. Available at 5. 4. 2018 on https://www.czso.cz/csu/czso/klasifikace_ekonomickych_cinnosti_cz_nace
- Čámská, D. (2012). *Úloha zaměstnanců při zvládnutí krize*. In Jedlička, P. (Eds.), *Mezinárodní vědecká konference Hradecké ekonomické dny 2012* (pp. 43-47). Hradec Králové: Gaudeamus.
- Czech National Bank (2018). Kurzy devizového trhu. Data. Available at 18. 3. 2018 on http://www.cnb.cz/cs/financni_trhy/devizovy_trh/kurzy_devizoveho_trhu/prumerne_form.jsp
- International Organization of Motor Vehicle Manufacturers (2018). Production statistics. Available at 5. 4. 2018 <http://www.oica.net/category/production-statistics/2017-statistics/>
- Eurostat (2018). Database. Available at 18. 3. 2018 on http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_10_a64&lang=en
- Klečka, J. (2013). *Development of Value Productivity in Selected Industry Branches*. In Löster, T., Pavelka, T. (Eds.), *The 7th International Days of Statistics and Economics Conference Proceedings* (pp. 611-620). Slaný: Melandrium.
- Pavelková, D. et al (2018). Passenger car sales projections: Measuring the accuracy of a sales forecasting model. *Ekonomický časopis*. vol. 66, issue 3, pp. 227-249. ISSN 0013-3035.
- Synek, M., Kopkáně, H., Kubáková, M. (2009). *Manažerské výpočty a ekonomická analýza*. Prague, C.H. Beck.

Contact

Hana Scholleova

Czech Technical University in Prague

MIAS School of Business

Kolejní2a

160 00 Prague 6

hana.scholleova@cvut.cz

Marta Necadova

Department of Microeconomics, Faculty of Business Administration

University of Economics, Prague

W. Churchill Square 4

130 67 Prague 3

necadova@vse.cz