Competition policy and economic analysis:

What can we learn from firm and industry data?

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CERGE-EI

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i. *Introduction*

This monograph presents results of empirical research based on the analysis of firm data and attempts to provide some background for the ongoing debate on the reform of competition policy. Empirical research based on firm data related to competition policy has a long tradition. Individual enterprise data that cover the full population of firms operating in national markets, however, were not available until recently in the last few decades when national census bureaus allowed economists in the field of industrial organisation, international trade or labor economics to analyze the primary records of firms, their inputs, efficiency, behaviour, and development trajectories. The availability of large statistical data sets allow for the possibility to continue the intensive research done in the field of industrial organisation mainly in the US and the UK during the period 1950-1990 and to test some basic hypotheses and theoretical models and draw some policy implications.

In addition, the transformation of a centrally planned economy and the accession to the EU market went hand in hand with changes in the industrial structures, and it is a special historical circumstance which provides the opportunity to test old theoretical hypotheses, to measure regularities in firm data, and to identify the factors explaining them. Numerous empirical and econometrical studies exist that use firm data to analyze the various aspects of the transformation. An overview of the empirical research on transformation of Czech firms during 1990-2000 can be found in Kocenda and Lizal (2002).

During the period 1989-2006, the Czech Statistical Office provided CERGE-EI with anonymised individual firm data that are comparable in terms of time and structure and have the highest available coverage. These should be the best data available to trace changes in market structures and in the competitive environment firms have been facing in the Czech economy for the last two decades of transformation, and the aim of this volume is to take advantage of the availability of firm data with full statistical coverage and of time series and reconsider some "old" questions in industrial

economics in a transitional economy. These questions include the following relations on which both theoretical as well as empirical research in industrial organisation are not conclusive: Are high profits related to industry concentration? How is firm and industry performance related to market concentration? Does foreign competition have a positive or a negative effect on growth? Is there any systematic link between innovation and market structure? What is the effect of state subsidies on competitiveness?

There are five chapters in this volume that are dealing with the above five questions. Chapters are united and interrelated from two aspects. Not only they are based on the same set of enterprise data systematically created at CERGE-EI and provided by the Czech Statistical Office but also the answers to these questions have important implications for competition policy. Competition policy or anti-trust as it is called in the USA is "the set of policies and laws which ensure that competition in the marketplace is not restricted in a way that it is detrimental to society" (Motta, 2004, p. 30).

Competition laws are a system of legislation acts which aim to protect competition and prevent the creation or enhancement of the monopolistic market power of enterprises. These laws include the approval of large mergers („concentrations"), the prohibition of cartel agreements, and prohibition of abusive business behaviour by dominant firms. At the EU level, an integral part of competition policy is also a ban on the provision of state aid to enterprises. For about the last ten years, the competition policy has been reformed on both the EU level as well as on the national level with the purpose to implement more economic analysis in the assessment of competition cases (see more, for instance, Neven and Albæk, 2007). Evidence based on the analysis of firm data attempts to provide some background analysis for the ongoing debate on the role of economic analysis of private firm practices that allegedly restrict competition and the debate on state actions against private firms in the framework of industrial policies and state subsidies.

From an economic point of view, competition policy aims to limit excessive market power and prevents the abuse of market power. The

rationale behind the competition policy is that too much market power can be detrimental to consumer welfare and to new entrants. In economic theory, market power is the ability of firms to increase prices above marginal costs. Market power is, however, not easy to measure in practice. Competition authorities traditionally measure market power indirectly via market concentration. For all fields of competition policy – not only for merger approval but also for antitrust assessment of a dominant position, cartel detection, or for state aid ban - a key indicator of competition intensity is market concentration, which is expected to be related to firm or industry profit.

Since Bain's seminal work (Bain 1951, 1956), the relation between market concentration and profitability is the most tested hypothesis in industrial organization (Aghion & Tirole, 1994). In the first chapter we first describe more in detail competition laws and particular fields of competition policy and the significance of concentration measures as one most frequently used measure of competition or market power respectively. Then we compute measures related to the level of market concentration and analyze the change of market concentration during 1998-2006 in the Czech economy. Finally, we replicate Bain's model to analyze the link between market concentration and profitability in the Czech firm data.

The last few decades have seen an expansion in international trade and foreign direct investment (FDI) that have an important impact on market competition and its international dimension. The Czech Republic is a small open economy and the growth of investment inflows in the Czech Republic has been impressive and initiated research on the role of FDI in the economy focusing on various aspects. For instance Jurajda & Stancik (2009) based on firm data 1997-2005 deal with a question if foreign ownership improves corporate performance; Zemcik & Toth (2006) analyse foreigners target firms with a greater ownership concentration in industries with a higher level of risk. Zemplinerova & Jarolim (2001) tried to find an answer whether significant differences by industries exist as for mode of FDI entry, i.e. mergers and acquisitions (M&A) and greenfield investments. The most frequently asked question "whether foreign trade and FDI contribute to

growth" is not yet answered unanimously. In preparing the econometric analysis carried out later in the third chapter, we compute import penetration, export performance, and concentration ratios adjusted for foreign trade in the second chapter. Furthermore, FDI penetration in industries is computed, and their links to foreign trade operations are illustrated. Finally, competition policy is discussed in an international context in this chapter.

Neither the existence of high profits nor high market concentration are sufficient to infer the existence of competition restraints as there are competing explanations for high profits as well as for high market concentration. High concentration can be the outcome of a competitive process between firms and high profits can be related to higher cost efficiency (Demsetz, 1973). Therefore, inferences drawn on mere market concentration are not sufficient, and what finally is decisive is the growth of the performance of firms and industries. Chapter three carries out the econometrical analysis linking efficiency and market concentration. It aims to explain growth not only by market concentration but also by import penetration and by foreign direct investment which were both the focus of the previous chapter on market internationalization.

Competitive strategies and the competition process are related not only to the production process but also to the pre-production stages, to research and development as an assumption for innovation, and new technologies. Innovations, however, cannot be easily measured. Since Schumpeter's hypothesis about the large enterprises as engines of innovation and growth, the relation between firm size or market concentration respectively and innovation intensity is the second most tested one (Aghion & Tirole, 1994). The fourth chapter is devoted to the analysis of links between firm size, market concentration, and R&D. To our knowledge, not many studies exist that would analyse innovation on firm-level data in the Czech Republic, except for Srholec (2005) who focuses on the effects of foreign ownership on research and development (R&D) activity carried out by innovative firms in the Czech Republic. In this chapter, we first overview the existing research in this area, and then we carry out our own statistical analysis of the

innovation activities of firms based on the Czech data aiming to answer the question whether there is a systematic link among R&D employment in the firm, its size, market concentration, and the foreign ownership of the firm. Finally, we discuss competition relating to the dynamic efficiency, the innovation activity of firms, the development of information and communication technologies (ICT), and the new waves of mergers leading to a higher concentration, which pretends to be justified based on R&D scale economies.

Competition can be undermined not only by business practices but also by governments granting state aid to businesses. State aid to enterprises distorts market signals and competition, and state aid to enterprises, is therefore, in principle prohibited by the EU Treaty. Despite the ban, governments continue to provide state aid to enterprises, and in the Czech Republic subsidies to enterprises were high during the transformation and above the European Union average (Zemplinerova, 2006). However, not many studies exist that would analyze the effects of subsidies to enterprise on the competitiveness and growth on industry at the firm level. We assume that the government's commitment to grant state funds is changing the behaviour of firms. On the one hand, government providing state aid weakens the incentives for firms to improve efficiency, while it also provides the incentives for firms to invest in wasteful rent-seeking activities in order to obtain state aid rather than invest in productive activities. In addition, if "state aid" is provided for a long term for a certain company, the company enjoys a monopoly and x-inefficiencies occur. Companies became dependent on state aid claiming to get the state aid in the interest of the welfare state, e.g. to improve on technology etc. An analysis of the effects of state aid to enterprises is the focus of the last chapter of this book.

The remainder of the publication is organised as follows: First, summary of the results of each chapter are presented including competition policy implications and the data used for the analysis described in more detail together with some methodological issues. Then, particular chapters, each containing both a survey on the existing main empirical economics literature, which purports to find the answer to the above questions as well

as the author's own statistical and econometrical analysis based on Czech firm data.[1]

ii. Summary of results

In the Czech economy, national levels of market concentration in most industries are relatively high and many industries are dominated by a few large firms. Market concentration in many markets depends not only on the character of the product but also on exports of the goods and imports in the market. For many markets, import penetration and export performance correct the concentration levels sufficiently. In a small economy such as the Czech one, this is especially the case, and in many markets, competition can be maintained by opening the markets.

Frequent and extensive changes in market concentration indicate a high intensity of competition during the period 1997-2006 in most industries of Czech manufacturing. Changes in market concentration over time are a better indicator of competition intensity than the mere levels of concentration as competition can occur also when there are a small number of firms in the market and market concentration is high. Only if dominance is maintained for a long period of time, there may be a maintained kind of collusion. Currently in many cases, anti-trust policy cannot be carried out by national institutions alone as the relevant market cannot be limited to a domestic market.

It was confirmed by our analysis, using the traditional Bain model, that the effect of market concentration on profitability is significant and positive in the case of Czech manufacturing industries for 1997-2006. Two explanations exist: The profitability can be a response to market power based on market concentration (the market power paradigm), and market concentration can be translated into an improvement inefficiency, which has allowed firms to realize greater profits (the efficiency paradigm). In many markets, efficiency may dictate an increase in market concentration. This dilemma between market power and market concentration is the curtail problem of competition policy.

At a firm-level analysis of the link between the size of the firm and profitability, several tentative results have been found. Profitability of a firm

strongly depends on the profitability in the industry, where the firm operates. The effect of market share on profitability is significant (and positive) in models not containing labor intensity in specification. When dividing the sample of firms into two groups, where firms with positive and negative profits are separated, different results have been obtained. While positive profits are influenced by investment, negative profits are influenced by market share. As for an implication for competition policy, it is to analyze whether cost-saving efficiency is one of the sources of profitability.

Not only were import penetration and export performance growing considerably during 1998-2006, but also foreign direct investment (FDI) inflows increased dramatically, however, differently according to industries. In some markets, foreign trade matters a lot, but there are goods that have markets with national or local boundaries, and both export performance as well as import penetration are minimal. Foreign direct investments influence the volumes and structure of international trade – they not only contribute to exports of the country but also to the imports. Depending on the character of product, foreign investors are either aiming to acquirie local market share or to increase their share on the world market. In the first case, exports are minimal. In the latter case, the foreign investor exports the majority of the output. In the first case, the foreign investor has to compete with domestic producers, in the latter with other multinationals on the world market. In the first case, foreign involvement in the market often comes to the dominant position. In the second case, it is more probable that foreign investors will expand production, increase capacities, and invest into the new technologies improve the quality and marketing. On the one hand, there are attempts to "buy" the Czech local markets; on the other hand, an overly active competition policy and tough enforcement of competition laws without deeper economic analysis can repel foreign investors.

Several interesting results from an econometrical analysis linking efficiency, market concentration, and market internalisation have been obtained. Using panel data, we found a strong increasing non-linear (diminishing) relationship between the performance of manufacturing industries and market concentration. According to our analysis, Czech

manufacturing industries with a high concentration performed better than industries that had fragmented market structures during 1998-2002. It could be explained by the fact that the Czech economy is a small economy. In many markets, firms must reach competitive scales of production, advertisement, and R&D in order to be competitive, which requires increasing market concentration. As long as potential competition exists and no major barriers to entry exist, firms in concentrated markets can be efficient.

Our analysis finds that industries with high import penetration are declining. It shows that Czech firms did not withstand import competition because numerous Czech markets are too small to have efficient domestic production facilities. At the same time, our analysis confirmed that industries with a high share of foreign direct investment are the growing industries. However, we cannot claim a causality between competition and performance, but we can only claim that there is a significant relationship between the level of concentration and the performance of industries as well as between foreign involvement in the Czech economy and the performance of industries during the investigated period.

Three tentative conclusions emerged from the analysis of the link between innovation and market structure. First, it follows from a regression analysis that a positive relationship between size and R&D activity of firms exists, which is not linear however. Second, the results indicate that negative relationship between R&D employment and market concentration exists. If market concentration is a measure of competition in the sense that high market concentration means high market power and low competition, then we can conclude that innovation is related to the competitive market structure. We arrived at the same conclusion when innovation was measured by intangible assets and competition was measured by the Lerner index; hence, the hypothesis that innovation is related to competition has been confirmed. Finally, our analysis concluded that although foreign firms are on average larger than domestic firms, a negative relationship between the foreign ownership of the firm and the number of R&D employees exists. In

comparison to domestic firms, foreign firms have less R&D employees implying that they carry out R&D activity mainly in their home countries.

Our computation of R&D intensity at the industry level confirmed that R&D intensity is significantly diverse by industry. A firm's incentive to invest into R&D is determined not only by market structure – competition or monopoly – but also by the possibility to appropriate the profit from this investment. This appropriability depends on the protection of intellectual property rights and costs of imitation that firms have to face. The appropriability differs significantly by industries, and we cannot infer it from the firm data. The empirical relationship between innovation and size of the firm and market concentration is controversial for other reasons, too. First of all, a reverse causality exists: Firms, which are innovative, will grow and therefore have higher market shares. Furthermore, an unobserved heterogeneity of firms exist in terms of cost efficiency, which is given by different technological opportunities. We believe that there is space for future research in the area of competition in dynamic markets.

An analysis of the links between subsidies to enterprises and competitiveness of manufacturing industries in both cross-sections as well as in a time-series perspective indicates that systematic links exist between subsidies and competitiveness. Our hypotheses that large enterprises (national champions) and large industries receive more subsidies and industries that receive subsidies do not improve competitiveness have been confirmed by our analysis. However, this is valid only for industries with bigger market power on the domestic market. These hypotheses did not hold for industries that are competitive in an EU single market.

By providing subsidies to enterprises governments not only distort competition and trade but also weaken incentives for firms to improve efficiency and allow for wasteful rent seeking activities. There exist several open questions related to the economic analysis of state aid and to the measurability of state aid effects, especially in a long run. Data and reliable information on subsidies are not always available because of low transparency of provided subsidies to enterprises. Non-transparent state aid

contributes to the inefficiency of public aid and allows for corruption in political structures and in the administration of funds. Therefore, if subsidies to enterprises cannot be fully prohibited, transparency and the accountability of government agencies are the assumptions of distribution and allocation of subsidies to enterprises.

iii. *Data and some methodological issues*

Assumptions to a meaningful statistical and econometric analyses are good data. The statistical and econometrical analysis presented here is based on a set of firm individual data sets systematically build at CERGE-EI during 1989 – 2006. For the analysis presented here, mainly the data from 1997-2006 are used. The firm-level data were provided by the Czech Statistical Office (CSO), and if not stated explicitly otherwise, the source for the data in the tables and graphs are CSO data.[2] Enterprise data are from regular surveys of the CSO (forms P5-01 and P3-04 respectively). In the case of the quarterly surveys (P3-04), data have been aggregated in order to get annual observations, which are comparable with the yearly survey (form P5-01). The data set used in the analysis comprises information on Czech firms employing enterprises with 20 or more employees. For some parts of the analysis, enterprises with 100 or more employees are used.[3]

The main variables used in the analysis are output (sales), the number of employees, value-added, investment, profit, and capital as recorded in the balance sheets and financial statements of enterprises. In addition to these for certain years, enterprises recorded also direct exports and imports by each individual firms.

Output or **sales** (S) is reported in the CSO forms as *„revenues from sales of own products and services"* since 1997[4]. The indicator enables us to analyse the total volume of industrial output and its structure and to calculate the growth rate and labour productivity.

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[2] The chapter entitled market internalisation describes the custom statistics used for the trade data, and the chapter on state aid and on performance contains a subsection with a more detailed description of the data and methodology.

[3] In the methodology of the Czech Statistical Office, the borderline between „small" and „big" enterprises changed over time. The Czech Statistical Office recorded full information on all enterprises with 25 or more employees up to 1994. In 1995 and 1996, full information on manufacturing enterprises with 100 or more employees was recorded. Starting in 1997, the reporting unit for industrial statistics is a firm with 20 or more employees, both legal and natural persons.

[4] "Revenues from sales of own products and service" are the difference between the credit and debit sides on accounts in the Account Group 60 (Revenues from own outputs and goods). Before 1997, **Industrial output** had been reported as „*production of goods*" or "*revenues from sales of own products and services*"

Employment (L) data are consistent with the output and are data from the same statistical reports of enterprises. Employment is the sum of workers in the enterprises which have been included into the analysis. The average number of registered employees encompasses all categories of permanent, temporary, and seasonal employees contracted to work in the enterprise, which are then re-computed for full-time.

Capital (K) can be expressed as own assets, fixed assets, equity, the basic or subscribed capital of the company.

Value added (VA) is the difference between gross output and intermediate consumption (products, goods and services minus raw materials, supplies, energy and services.

Foreign direct investment (FDI), which is (as a rule) recorded by a balance of payment statistics is here captured through the „enterprises with foreign capital" or „enterprise under foreign control" i.e., based on industrial statistics and same enterprise data as data on output and employment mentioned above.[5]

Direct export sales: The enterprise statistic serves as one source for the export data (the second is custom statistics). Although exports from enterprise statistics differ from exports from the custom statistics, they are compatible with output data and are being based on a regular survey carried out through the years (Form P5-01). Enterprise export statistics are not available for 1995 and 1996 as the methodology of statistical recording changed not only for the size of involved enterprises but also for items being recorded. Exports have not been recorded for those two years.

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[5] **Type of ownership** can be identified by each enterprise. Two ways exist on how to identify ownership which are relatively compatible. The CSO distinguishes the following types of ownership: private, cooperative, state, foreign (100% owned by foreigners), international (any 1-99 per cent of foreign ownership), mixed (state and private), others (communal, political organizations, and associations or not-identified). The other identification uses the definition of a firm „under foreign control" which means either the dominant share of asset ownership or the control of enterprises through the majority on a firm's board of directors. For the purpose of this analysis, both enterprise and groups of foreign firms were merged (fully and partially owned) into one group „enterprises with foreign capital", and we use this definition throughout the book. Subsequently, all enterprises have been broken into the two groups: foreign-owned enterprises (international and firms wholly owned by foreigners or firms under foreign control respectively) and domestically owned enterprises.

Direct imports: Enterprise statistics can serve as a source of direct imports by firms. As a rule, these imports are not related to the major activity of the firm but are either equipment (machines) or materials, parts and the like needed for the final product of the firm.

Measures of innovation are R&D *employment (R&DL)* and *intangible assets (ITA)*. We assume that human capital and intellectual asset are most important determinants for the generation of innovation and growth. We were able to distinguish between firms that carry out *R&D* activity and have R&D employees and firms without R&D activity. These are yearly data based on a regular survey carried out through the years (Form P5-01). Each firm with R&D activity reports the number of R&D employees. **Intangible assets** (ITA) are from the statistical reports of enterprises in compliance with the bookkeeping principles. According to these principles, tangible fixed assets represent a sum of expenditures spent by reporting units on the acquisition of tangible fixed assets (by purchase of own activity) together with the overall value of tangible assets acquired free of charge or by transfer. Acquired intangible fixed assets contain the value of acquisition expenses, of intangible results from research and similar activities, of software and of appraisable rights (i.e., know-how, licenses, subjects of industrial rights, and other results of creative intellectual activity).

The statistical source on subsidies, which is used in our analysis, includes all subsidies to costs gathered on enterprise level. The CSO defines subsidies according to P5-01, A039 account No. 41 as follows: "subsidies and contributions from public budgets and other funds to own capital". The value is computed for companies with 100 or more employees and estimates are recomputed for smaller companies. For the fourth chapter on subsidies and competitiveness, we also used Eurostat data (COMEXT for international trade and the New Cronos Database for data on industrial output). The same source has the data on total export of the Czech manufacturing industry to the EU-15 common market. All data used were converted to euros, based on average annual exchange rates published by the Czech National Bank. When

matching the Czech database with the European one, we had to re-compute the values in CZK to euros. Details are given in chapter four.

Consistency checks have been performed. The firm's capital at the end of each year should be positive; depreciation should be positive; investment should be non-negative and smaller than end-of-the-year capital stock; production should be positive; sales should be non-negative; and wages should be higher than the minimum wage.

Each firm is identified by **industry** according to the three-digit NACE industries. For the purpose of some parts of the analysis on industry level, we aggregated the firm data according to their **major activity**[6] into NACE and the 101 manufacturing sectors according to 3-digit NACE respectively. (Manufacturing NACE or OKEC codes range from 151 to 372). As mentioned above, the 3-digit level of NACE allows us to link data from the industrial statistics with trade statistics. The analysis of the 3-digit NACE aggregated industry data allows us to avoid a problem of unbalanced panel data that often is present when we work with enterprise-level data. Especially, it poses a serious problem in transition economies during restructuring from a centrally planned toward a market economy. This transition period was characterized by a large number of green field investment and spin-off firms that are entering the market and firms exiting from the market through bankruptcy.

Most of the analysis is done for manufacturing industries. In some parts, the analysis is expanded from firms operating in manufacturing industries to other non-financial enterprises. There are caveats related to the industry definition: According to the Czech Statistical Office, a firm belongs to a 3-digit industry if the largest share of its revenue comes from the sale of products classified within that industry. The shortcoming of this methodology is that firms can switch industries over time because the relative shares of different products in total revenue may change due to the market condition, new strategies, and other factors.

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[6] The enterprise can manufacture products falling into several sectors (groups of products); however, its classification is governed by the nature of the *major part of its output* (for the industrially defined on a 3-digit level we also use „sector").

We work with the statistical definition of an industry which does not correspond with the economic definition of the market and also not with the definition known as „relevant market definition". Such an attitude may allow us to reveal some systematic relations that are important from the methodological point of view such as an international dimension of the markets but would not be recommendable or eligible for the purpose of competition law enforcement or for application in administration and courts.

In economics, a common approach is to use the definition of „industry" and „market" interchangeably. Industry or market is defined as a group of firms producing goods or services that are close substitutes by buyers and sellers. A market is defined as a group of firms producing products for which the cross elasticities are significant. The estimation of cross elasticities is not easy, and there is no simple way to decide on product substitution. For statistical purposes, firms are grouped based on their supply side characteristics, and industries are defined in terms of firms producing a product or group of products that are related by a technical process or used materials. Firms, however, are to switch resources to produce different products, and the supply side groupings do not correspond to the demand side of the definition of a market as group of substitutes to consumers. Another problem arises from the fact that firms produce, as a rule, more than one product and firms are allocated to the major activity of product. The result is that the number of firms producing a product may be underestimated and, the total sales of the product are not accurate (Curry & George, 1983, p. 214).

Not only industries or markets differ in many respects but also firms within an industry differ in many respects – in size, factor intensity, labour skills, degree of vertical integration, capacity of product line, the extent of advertising, R&D expenditures as a percentage of sales, geographically served markets, distribution channels, and firms are therefore different as for their efficiency. Competitiveness assumes the use of technologies that enable the decrease of costs and thus also prices. Some of these indicators can be relatively reliable measurement based on firm data, some others cannot. Sources of market power exist that cannot be measured so easily and

are more "hidden" – for instance switching costs or a lock-in effect that might create a substantial market entry barrier as customers do not switch to another supplier even if (an)other supplier(s) offer a product or service for a lower price and that cannot be inferred from the statistical firm data.

One should pay attention to the following: The data presented in the paper result from a careful adaptation of the data from the Czech Statistical Office. However, the data are not always fully comparable with officially published as they are results of our own computations but based on the data from the Czech Statistical Office. Thanks to those adaptations and to our own computations, these unique results are shedding more light onto the developments in manufacturing enterprises, their structure, and performance. As well, links with trade and foreign direct investment have been obtained.

1. Competition policy and market power

In the Czech Republic, first Competition Protection Act has been passed by parliament in January 1991.[7] This Law has been amended since its enactment several times. The first amendment has been reaction to the split of Czechoslovakia in 1992. The later amendments were related to the Commercial Code amendment, law harmonization and to the EU accession in 2004.[8] The governmental agency created for the purpose of competition policy was the Ministry of Economic Competition, which has been transformed into an independent agency "Office for protection of the competition" in 1996.[9] Since 2004 the supra-national jurisdiction – the EU laws introduced by the Treaty of Rome and its amendments - are valid for the Czech firms. Most important provisions are in Article 81 of the Treaty of the European Communities that prohibits cartel agreements, in Article 82 that prohibits abuse of dominant position and in Article 87 that prohibits state aid. To the set of laws belongs also the European Commission (EC) Merger Regulation.[10]

Large mergers have to be notified and approved by competition authority as they reduce number of firms and result in change of market structure as firm size and market concentration typically increases.[11] Concerns of antitrust institution are so called „unilateral effects" and „coordinated effects" of merger. Unilateral effect means using the market power of merged firms for increasing price due to dominant position, and coordined effect means that a merger will create conditions which increase the probability of collusion and cartel agreement.

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[7] No 63/1991 Coll. of Laws
[8] Consolidated Act on the Protection of Competition Act No. 143/2001 Coll. of 4 April 2001 as amended by Act No. 340/2004 Coll., Act No. 484/2004 Coll., Act No. 127/2005 Coll., Act No. 361/2005 Coll., Act No. 71/2007 Coll., Act No. 296/2007 Coll. and Act No. 155/2009 Coll.
[9] Law No. 273/1996 Coll of Laws
[10] Article 81, 82 and Article 87 of the Treaty of the European Communities, EC Merger Regulation No 139/2004
[11] Czech Office for protection of competition deals with mergers of „national" dimension, large mergers have to be notified on EU level. A concentration has a Community dimension if the combined aggregate worldwide turnover of all the undertakings concerned is more than EUR 5 000 million or if total turnover at least two of mergering enterprises is more than EUR 250 million on the EU single market.
In case of the Czech Republic the merger has to be notified with UOHS if merging firms have total net turnover on the Czech market more than 1.5 bn CZK or at least two of merging competitors have turnover more than 250 million CZK.

Czech antitrust agency – Office for Protection of Competition (UOHS) notified about 1400 mergers during 1992-2008 but did not block any.[12] During the period 1991-2001, European Commission (EC) notified 2400 mergers or concentrations. As mergers and acquisition refer to the corporate strategy, which is closely related to both - costs efficiency as well as to market power, in case of large and important mergers „effect analysis" - both the „cost to society" (expected dead weight loss from high concentration and monopoly) as well as the „cost economies" related to the merger - is supposed to be carried out to provide the evidence to block the merger. To weight the potential of costs to society against cost economies is a role of economic analysis. EC did block about 1% of total number of notified mergers, however several decisions of EC have been later abolished by the decision of European Court of Justice or Court of First Instance (CFI) respectively to which merging companies appealed and won the trial based on economic analysis and efficiency argument.[13]

Cartel agreement between competing firms occurs when two or more firms make an agreement to the detriment of other firms in the market, potential entrants or consumers. Such agreements are usually secretive and are difficult to detect. The European Commission receives about 1000 complaints related to the violence of the competitive environment (price fixing, market sharing etc.) every year but opens investigations in about 10% of those cases, of which only a few are penalised. Competition laws however exempt cartel agreements, which contribute to improving the production or distribution of goods or to promoting technical or economic progress while allowing consumers a fair share of the resulting benefit. Hence again there exist space for economic analysis which might allow for the decision in favour of or against the cartel agreement – cartel agreement on common research and development are as a rule except from the ban due to the expected dynamic efficiency gains.

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[12] Firms may appeal to the courts against the UOHS or repectively European Commission decision. The litigation can last long. For instance the case of approval of merger of three largest producers of mineral water did last 5 years. ÚOHS did first blocked the merger because the share of mergerd producers on the market with mineral water would reach 80%.

[13] In 2002 CFI annuled the decision of EC to block merger Airtours, Schneider/LeGrand, Tetra Laval/Sidel and GE/Hoeywell in 2001.

Abusive behaviour includes excessive pricing and exclusionary practices such as predatory pricing, exclusive dealing, refusal to sale and tying (bundling). These practices are prohibited if a firm is in a dominant position. Hence it is not a dominant position or high concentration which is prohibited by competition law but it is the monopoly behaviour and conduct which is prohibited.[14] Cases related to abusive behaviour are among the most controversial cases as dominance can be derived from competition by efficient enterprises and in fact business practices of successful companies can be challenged. Categories of conduct, such as predatory pricing, discrimination, rebates or tying: the same conduct can also have either pro- or anticompetitive effects, depending on the circumstances. Low prices on the marginal cost level are the prediction of competition, hence is desirable. In cases of introductory pricing, economies of scale and scope, learning-by-doing, network effects prices can be even below cost for some period and constitute normal competitive price strategies.

The task of competition policy is to curb excessive market power. For that purpose competition authorities need to measure market power or intensity of competition respectively. Although firms compete regardless on number of firms in the market, cartel agreement or collusion is more probable in markets with low number of firms and in more concentrated markets. Therefore as an economic tool, market concentration is used for all fields of competition policy as a first approximation for measurement of the degree of market competition or the degree of market power respectively.

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[14] Abuse of dominant position to the detriment of other undertakings or consumers shall be prohibited.
Abuse of dominant position shall consist particularly of:
a) enforcement of unfair conditions in agreements with other participants in the market
b) making the conclusion of contracts subject to acceptance by the other party of supplementary performance, which has no connection with the object of such contracts (tied sale),
c) application of dissimilar conditions to identical or equivalent transactions (discrimination),
d) termination or limitation of production, sales or research to the prejudice of consumers ,
e) consistent offer and sale of goods for unfairly low prices (predatory pricing)
f) refusal to grant other undertakings access for a reasonable reimbursement, to own transmission grids or similar distribution networks or other infrastructure facilities, ("essential facility"
Article 11, paragraph (1), Consolidated Act on the Protection of Competition Act No. 143/2001 Coll. of 4 April 2001 as amended by Act No. 340/2004 Coll., Act No. 484/2004 Coll., Act No. 127/2005 Coll., Act No. 361/2005 Coll., Act No. 71/2007 Coll., Act No. 296/2007 Coll. and Act No. 155/2009 Coll (shortened and amendment by notes by A.Z.)

In any antitrust case for any abuse of dominant position to exist it must be proved that a dominant position exists, meaning that there is a certain market concentration. Czech Law as well as European Commission and Courts assume that a dominant position may exist when an undertaking has a market share of 40% and more. As a rule a firm with a market share below 25% is not supposed to have significant market power. The courts have usually found that firms with market shares of 50% or more have a dominant position. Competition laws do concern with behaviour of individual firms only when the market concentration is high. Only large enterprises are suspected to curb competition.[15]

In a standard „competitive-market approach", based on the theory of entry barriers (Bain, 1956) a market analysis is de-composed into „structure-conduct-performance", where structure is determined by number and size of producers/sellers, buyers and potential entrants, hence by market concentration. Market conduct is the behaviour of the firms in terms of price policy and sales as related to the existing market structure. Competition or antitrust policy is than recommended to be based on the market structure. (Kaysen C. and Turner D., 1959). Even the Chicago school economists believed that an industry that does not have a competitive structure will not have competitive behaviour (Stigler, 1952).

Market structure is defined by number of firms, their market shares and barriers to entry. Hence the market concentration as a first approximation of market competition is useful indicator and in the next chapter we will measure the concentration in manufacturing industries presents results of measurements of market concentration in manufacturing industries and the extent to which industries are dominated by large companies and a small number of producers. As competition is considered to be a process through which a new equilibrium is achieved in the market, we look at the change of market concentration which is a better indicator of competition than the level of concentration itself.

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[15] Small enterprises have a block exemption from antitrust laws as well from the state aid ban.

First task for competition policy is to find out what is the level of market concentration, second what is the relation of market concentration and profitability? If the market concentration is high, competition policy faces a dilemma: On one hand it is more probable in case of high levels of industrial concentration that the competition is weak (collusion hypothesis), on the other hand the large size of a firm and the high concentration may be an assumption for a cost efficiency due to economies of scale and growth of productivity due to learning by doing and specialization. In addition high profits and market power in concentrated markets may be incentive for innovation in and for growth in a dynamic sense (efficiency hypothesis). Finally what is the source of profitability: is it collusion or efficiency? Measurement of market concentration is related to the problem of market definition.

In what follows we first compute measures related to the level of market concentration and analyze the change of market concentration during 1998-2006 in the Czech economy. Than we replicate Bain's model to analyze the link between market concentration and profitability. Finally we try to explain profitability of firms via measurable barriers to entry, namely capital intensity.

1.1 Market concentration

There are several indicators to measure the level of market concentration. The simplest is number of firms in the market and their size structure. Many firms in the market indicate low market concentration (and perfect competition), few firms in the market indicate high market concentration (and collusion or oligopolistic competition) and one firm in the market indicates a monopoly. In the Czech Republic the supply of most products and services has been controlled by one or a few state enterprises before 1989 and monopoly was a general phenomenon in the economy (Zemplinerova, 1989). Not only small enterprises were completely liquidated but also there existed no really large enterprises in the economy as by 1989 (Zemplinerova and Stibal, 1996).

Following the liberalization of market entry and market exit, number of enterprises increased dramatically in all industries due both, numerous new entries and starts-ups as well as to spontaneous break-ups of larger enterprises prior to and during privatization. As by 2007, there were more than 285 000 of enterprises operating in the Czech economy according to the CSO firm register. About 78 % of all firms are so called microenterprises and have only up to 10 employees, 17 % are small enterprises (up to 50 employees) and 4 % are medium sized enterprises. The mere 1 % of all enterprises have more than 250 employees (according to the definition of EU "large" enterprises). There are about 2 thousand of such enterprises in the Czech economy. Large enterprises though low in number are responsible in majority of employment and output (sales) of most sectors of the economy.

Number of firms can be useful first indicator of market concentration but as firms can have different size, the mere number of firms may not be sufficient. For example, the exit of one large firm and entry of many small ones may increase number of firms but reduce concentration. It can also lower the vigour of the rivalry of the remaining large firms in the industry. This problem is clearly illustrated in transition economy where the exit of one large enterprise from an industry along with the simultaneous entry of many new small firms or medium size firms could have resulted in a reduction in effective competition (Kattuman and Domanski, 1997 on Poland).

If firms are identical (symmetric), with *n* firms, each firm has 1/n market share, concentration is inversely related to number of firms. If firms however firms hold unequal market shares, number of firms is not likely to capture concentration. Size structure of firms can be better indicator market concentration.[16] Common measures of market concentration however are concentration ratios and Hirschman Herfidahl Index. Market concentration (seller concentration or industrial concentration) is a function of the number of firms and their shares of the total production or alternatively, total capacity, total employment etc. in a market. High market concentration

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[16] Proxy for size might it be sales, value added, or number of employees respectively

means situation in which a relatively small number of firms account for a relatively large percentage of the market.

For market concentration large enterprises are important. Market shares of largest, two, three etc largest firms are used which are called "concentration ratios" (CR) are used for indication of dominant position. The concentration ratio is the percentage of all sales contributed by the leading x (one, two, three or five, say, firms in a market). So the concentration ratio (CR1, CR2, ...) can be calculated by using the cumulative share of the largest firms according to their sales revenue share, summarised in the following equation:

$$CR_X = \sum_{i=1}^{x} S_i$$

(1.1)

where , i=1…x and S_i =sales revenue of ith firm/sales revenue of total market(industry).

We computed CR4 in sectors of the Czech economy in 2003 and 2006 and results are in table 1. Results illustrates that market concentration is very different according to sectors and share of four largest enterprises in total sales of sector did increase in all sectors between 2003 and 2006. Share of four large producers (CR4) is high in mining, electricity supply, transport and telecommunication, the latest being so called network industries to which most of large competition cases in the Czech Republic are related.

For instance on August 10, 2006 the Competition Office imposed a fine of CZK 370 million on RWE Transgas for abuse of dominance on the gas market. The dominant company had been accused in violation of the Competition Act and Article 82 of the EC Treaty since November 2004 when it proposed to operators of regional distribution systems outside the RWE holding group contracts for purchase and sale of natural gas containing conditions disadvantaging such operators vis-à-vis their competitors - regional distributors within the RWE Group. According to the decision of the Competition Office, RWE Transgas had further been restricting through its distribution contracts the option of selling gas outside the territories

serviced by the distributors since January 1, 2005, thus effectively preventing the development of competition on the gradually liberalized market (UOHS, 2006, p. 7).

In November 2005, the Competition Office imposed a penalty of CZK 205 million on ČESKÝ TELECOM for the breach of Article 82 of the Treaty Establishing the European Community. Since 2002, ČESKÝ TELECOM had offered price plans intended for households and small entrepreneurs, which contained call credits or free minutes as a part of a monthly lump. By tying together services, ČESKÝ TELECOM was accused to prevent the development of competition, progress of existing alternating operators and as a consequence it limited the possibilities of consumers to obtain better services for competitive prices (UOHS, 2005, p. 10).

Relatively surprising is high growth and level of concentration in retail trade. Share of four largest retailers grew from 16% in 2003 to 65% as by 2006. During this period of time numerous mergers of retail chain occurred and oligopoly structure in this traditionally deconcentrated industry has been created. Again there were several important cases related to this increase of competition.

For instance the Anti-monopoly office (UOHS) imposed a fine on alledged cartel agreement between Billa and Julius Meinl retailers CZK 51m (€1.8m). The Office dealt with the conduct of these retail chains towards their suppliers and came to a conclusion that the two companies violated the law in 2001-2003 by agreeing on the same purchase policy and forcing suppliers to offer them the same conditions. Moreover, the two chains harmonised the assortment they offered and threatened that unless distributors provided the same services to both companies, they would lose their contracts. The two companies appealed to the regional court in Brno, which however confirmed an earlier verdict of UOHS. UOHS had to reassess the sanction and lowered the fine to CZK 43 m. Julius Meinl decided to leave the Czech market in 2005 and sold its retail network which consisted of 67 supermarkets in the country to Ahold Czech Republic. (UOHS, 2005, p. 12).

Table 1: Share of largest four enterprises (CR4) on total sales of selected sectors 2003 and 2006

NACE/OKEC	2003	2006
Agriculture and forestry 01-05	10.03%	12.98%
Mining 10-14	65.23%	74.13%
Manufacturing industries 15-37	13.26%	14.63%
Electricity supply (production and distribution) 40-41	33.32%	60.74%
Construction 45	16.30%	36.21%
Trade 50-52	7.80%	65.08%
Transport and telecommunication 60-64	36.29%	68.87%
Real estate and renting 70-74	9.77%	29.29%
Other services 75-99	26.55%	44.14%

Source: Data CSO, own computations

If measured on the sectoral level, the concentration increased in all sectors, computations of concentration indicators on three-digit NACE level however show that the market concentration of manufacturing industries is changing in both directions. In the Appendix I, results of CR 4 computations for the period 1998-2006 are presented. It follows from the computations that in case of 56 industries, CR4 decreased over the period 1998-2006, and in case of 32 industries it increased. The rest of industries – about 10 industries did the share of four largest firms in sales did not change.

Market concentration often depends on the stage of the industry life cycles, with the early stages favouring the production of many new technologies or ideas. Klepper[17] points to the fact that even an industry as concentrated as the automobile one was highly fragmented when it started, with a great deal of entry and exit. A shake-out then gradually reduced the number of suppliers. The internet boom of the 1990s was a similar process. Too many firms were created and the shake-out of the early 2000's adjusted the information technology (IT) industry structure. In general periods of technological transitions are typically marked by entry of new firms.[18] In addition, in many cases, new companies are the carriers of new technologies, precisely because incumbents embody old knowledge. Incumbent firms, firms that are established in the market, tend to carry gradual innovation;

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[17] Klepper, S. (1996)
[18] Orsenigo, L., F. Pammolli, and M. Riccaboni (2001)

newcomers come often with drastic innovation. Thus, some of the new firms are able to displace old leaders.

The advantages of the new companies are not linked to their size but often they are small because they are young and if successful they will grow larger. Thus, some of the large firms that have become prominent worldwide are new firms in a long-term perspective. This is especially true of the IT firms. Moreover, it is not always the case that new firms inevitably end up dominating the industry. In many instances, incumbents are able to survive technological disruptions and maintain their leadership: to a significant extent, for example, this is the case of pharmaceuticals after the biotechnology revolution.[19]

Changes in market concentration over time are a better indicator of competition intensity than levels of concentration. Only if the level of concentration is high and maintained for a longer period of time, competition in such market is most probably weak and there may be some kind of collusion. Frequent and extensive changes in market concentration in three digit level indicate high intensity of competition during the period 1997-2006 in most industries of the Czech Republic. As long as less efficient firms exit the market and new firms enter it can be assumed that the process of competition occurs.

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[19] Dosi G. et.al.(2007)

Figure 1: Concentration ratio (CR4), selected manufacturing industries 1997-2006
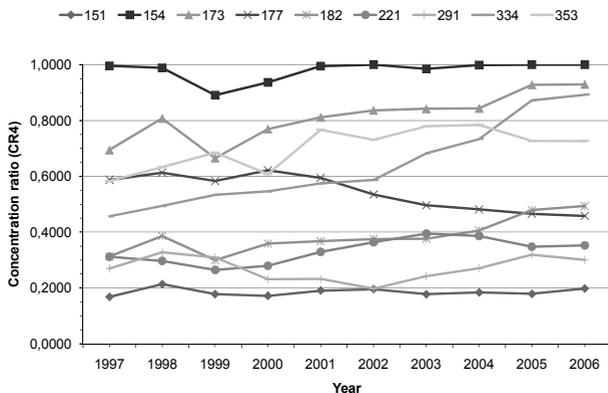
Concentration ratio is a suitable indicator for dominant position; it however does not take into the consideration all firms in the market. This enables Herfindahl Hirschman Index (HHI) which is the sum of the squares of the market shares of *all* firms in the market. HHI is commonly used measures of market concentration during the mergers approval.

$$HHI = \sum_{i=1}^{n} S_i^2 \qquad (1.2)$$

HHI is influenced both by the number of firms in the market and differences in their relative size. The value of the HHI decreases as the number of firms in a market rises. Similarly the value of the HHI will be greater the larger the degree of inequality in firm size. The maximum value of the HHI is 10,000, i.e. 100^2.

We computed HHI for the period 1998-2006 and the results for all industries are in the Appendix I. Out of manufacturing industries 101 industries, HHI increased in case of 40 industries. HHI increased in the market with ceramic tiles, instruments and appliances for measuring,

checking, testing, navigating and other purposes, manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy, manufacture of office machinery and computers, manufacture of optical instruments and photographic equipment between 6000 and 2 000 points.

In the rest of industries, concentration either remained unchanged or almost unchanged (manufacture of other non-metallic mineral products, manufacture of jewellery and related articles, fabricated metal products, manufacture of basic chemicals, prepared animal feeds and special purpose machinery) or decreased. Highest decline in concentration (by 3 to 5 thousand points) between 1998 and 2006 has been recorded in case of man-made fibres, processing and preserving of fish and fish products, manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations, recorded media, agro-chemical products, Manufacture of other transport equipment, manufacture of sports goods, manufacture of steam generators, except central heating hot water boilers.

Table 2: Most concentrated industries as by HHI 1998-2006

		Herfindahl Hirschman Index (HHI)				
NACE	NAME	1998	2000	2002	2004	2006
160	tobacco products	8306	7023	7507	7548	9861
263	ceramic tiles	3074	3010	3060	9425	9317
232	petroleum products	7121	7495	7783	4807	8061
323	TV	5792	3937	3789	7831	6962
351	ships and boats	8912	8006	6379	7349	6783
181	leather clothes	3884	4029	9810	5047	6173
223	recorded media	10000	5501	5823	3848	6077
341	motor vehicles	7808	8030	8458	8201	5794
242	agro-chemical products	9209	8237	6802	5309	5294
247	man-made fibres	10000	5029	4223	3741	4947

Source: Data CSO, own computations

Table 3: Least concentrated industries as by HHI 1998-2006

NACE	NAME	Herfindahl Hirschman Index (HHI)				
		1998	2000	2002	2004	2006
343	parts for motor vehicles	482	325	376	307	269
157	prepared animal feeds	259	241	227	263	259
158	food products	684	284	323	280	256
285	general mechanical engineering	346	183	201	123	255
266	concrete, plaster and cement	284	236	225	256	239
287	fabricated metal products	207	172	173	193	225
151	meat and meat products	268	212	242	210	221
295	special purpose machinery	252	164	166	130	193
281	structural metal products	549	184	147	128	160
252	plastic products	356	142	197	104	94

Source: Data CSO, own computations

Competition offices in some cases use the HHI for evaluating mergers. For instance the U.S. Department of Justice considers a market with HHI less than 1,000 to be a competitive market. Markets where HHI is between 1,000-1,800 is suppese to be a moderately concentrated marketplace and a market where HHI exceeds 1,800 points are considered to be highly concentrated markets. As a general rule, mergers that increase the HHI by more than 100 points in concentrated markets raise antitrust concerns.

The Commission Merger Guidelines [20] uses the HHI measure of market concentration, as employed by the US horizontal merger guidelines. The Notice sets out a single set of thresholds that are designed to capture both unilater and coordinated effects concerns. Thresholds are expected to constrain the Commission's enforcement discretion. At paragraph 19, the Commission Merger Guideline states that markets with HHI's below 1000 "normally do not require extensive analysis". Paragraph 20 then sets out two tentative safe harbours, as follows:

Mergers where the post-merger share is between 1000 and 2000, and where the increase in HHI arising from the merger is less than 250; and
Mergers where the post-merger HHI is above 2000 but where the increase is less than 150.

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[20] "Commission Notice – Guidelines on the assessment of horizontal mergers under the Council Regulation on the control of concentrations between undertakings", DG COMP, 28 January 2004.

However, even for mergers that meet these safety criteria the Merger Guideline lists several conditions that might create an exception to the safe harbour. (if one of the firms had a pre-merger share in excess of 50% in case of unilateral effects or if there is existing evidence of coordination for coordinated effects etc.).

The Merger Guideline aims to clarify the economic framework for assessing the competitive effects of horizontal mergers, however, the successful application of a merger control depends on if and how these guidelines can be applied in practice. Decisions to block or intervene in the merger have to be based on an empirical evidence and its interpretation related to a particular merger which varies from case to case.

There exit attempts to use empirical economic methods to study the likely competitive effects of mergers such as merger simulations which aims to evaluate the ability of the post-transaction firm to raise the prices of products through unilateral decisions and without resort to overtly collusive activities. Such simulation uses economic models grounded in the theory of industrial organization to predict the effect of mergers on prices in relevant markets. The applicability of such simulation however depend on data availability and on the definition and characterization of the market or markets at issue. (Epstein R. and D. Rubinfeld, 2001)

On many recent markets few large firms dominate and for competition policy it is important to understand that market concentration in some markets can be explained in terms of *technological and economical factors* – minimum efficient scale, scale economies, in others by comparative advantage in skills and management. Another reason can be created by consumer royalty for a brand or by distribution channels. For other markets frequency of innovation and the stage of product life cycle or product differentiation are important and sunk cost as investment into R&D or advertisement may be high. In many markets there exist institutional (incorporated in the *legislation or administrative barriers*) explanation of the existence of market concentration such as, political, social safety, patent,

regulatory, ie. initiated by state action.[21] Only if markets and firms will pass a filter through economic barriers to entry and administrative barriers to entry, there can be *strategic reasoning* for high market concentration and market power. For antitrust a problem arises to distinguish between innocent (economic) barrier to entry and a strategic entry-deterrence. Also there can be a mixture of economic and strategic barriers.

1.2 Profitability, market concentration, and competition policy

The traditional Structure-Conduct-Performance (S-C-P) paradigma assumes that structure affects conduct and conduct determines economic performance. Within this S-P-C paradigma firms operating in concentrated markets (close to monopoly) will have higher average profit return than firms in less concentrated industries. Theory predicts that if small number of sellers account for a large share of the market, firms recognize mutual interdependence what can result in the absence of price competition and prices and profits will be above the level of marginal costs.

The seminal empirical work on the relationship between market concentration and profitability was carried out by J. Bain (1951 and 1956). He found a linear relationship between concentration and profitability. According to his study (Bain 1956), profit rates in industries with eight-firm concentration ratios above 70% were higher and significantly different from profit rates for industries with lower concentration. Since Bain's studies, many researchers followed his model and confirmed the linear relation between market concentration and profitability on various data and for various periods of time. Overview of this empirical literature is given in Curry and George (1983) or Schmalensee (1989).

In what follows we replicated Bain's (1956) model[22] using the panel data 1997-2006 and employed same model and found support for Bain's

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[21] Competition policy is concerned only with the unregulated industries of the economy that means that industries are not subject to governmental control of prices, outputs, profits, entry or exit to the market, hence where competition and market are the mechanism that society relies upon to produce good economic results. (Viskusi K.,Vernon J. and Harrington J., 2005)
[22] J. Bain in his sample found an average mark-up over long run cost 4.6% in the concentrated industries.

results in Czech data on manufacturing industries. Following variables have been used in the analysis:

PRO is defined as profit and is calculated as a total sales (saltot) from own products and services (salown) as well as merchandise sales (salmer) minus cost of material (cosmat), cost of merchandise sold (cosmer) and cost of labor or personal costs (cosper).

wPROw is average profit within each industry with weights equal to share of sales of the particular company in the industry total sales using salown (sale of own products and services). This variable can be called weighted industry profit.

PROF - Industry Profitability (Prof) is a variable defined as sum of all industry profits (PRO) over sum of all industry sales (salown) for each industry.

For each industry concentration ratio CR8 has been calculated (Sum of sales of 8 largest firms/ total sales of the industry (saltot). Than using this CR8 index we have redistributed industries into 9 groups according their concentration level. In each group we have averaged Industry Profitability of all industries in the group and over whole data period 1997-2006.

Table 4: Descriptive statistics, Bain's model using Czech panel data 1997-2006

1997-2006	wPRO/saltot	wC	CR8	HHI
Mean	0.018384765	2875335.06	0.720022	1930.8
Standard Error	0.001933572	352658.009	0.007408	69.70952
Median	0.008031016	615334.974	0.753609	1094.269
Standard Deviation	0.060991872	11124110.4	0.233678	2198.891
Sample Variance	0.003720008	1.24E+14	0.054605	4835120
Kurtosis	49.34487841	72.4378362	-1.05175	3.842707
Skewness	0.024230284	8.046445	-0.39277	2.056952
Range	1.264114024	124565616	0.828673	9912.791
Minimum	-0.720992923	7607.26702	0.171327	87.20916
Maximum	0.543121101	124573223	1	10000
Sum	18.29284122	2860958383	716.4219	1921146
Count	995	995	995	995
Confidence Level (95.0%)	0.003794352	692039.52	0.014537	136.7947

Table 5: Profitabily of industries according to market concentration 1997-2006

Groups	CR8	Profitability
9	100-90%	0.044687
8	90-80%	0.028238
7	80-70%	0.015719
6	70-60%	0.012568
5	60-50%	0.009112
4	50-40%	0.004172
3	40-30%	0.003096
2	30-20%	0.001548
1	10-29%	0.001019

In the next step of the empirical analysis we worked on firm level using data from balance sheets and financial statements of individual enterprises. All firms with 100 or more employees operating in manufacturing industry are involved in the analysis. The analysis is carried out on the firm level.

List of variables used in regression analysis follows.

PROFITAB	Firm's profitability, computed as the firm's accounting profit divided by firm's output.
PROFIND	Profitability of the industry (weighted average), in which firm is operating.
SHARE	Firm's market share, computed as a firm's output divided by the total output of the industry.
INV	Firm's investment divided by firm's output.
N	Number of firms in the industry where the firm is operating.
CAPIN	Capital intensity, computed as firm's depreciation divided by firm's output.
LABIN	Labour intensity, computed as firm's number of employees divided by firm's output.
LABIN2	Alternative measure of labour intensity, computed as firm's wages divided by firm's output.

Regression Results

In Table 6 results of regressions are presented. Firm's profitability was used as the explanatory variable. Following five different models were computed:

$$PROFITAB = f(PROFIND, SHARE, INV, N) \qquad (1)$$
$$PROFITAB = f(PROFIND, SHARE, INV, N, CAPIN) \qquad (2)$$
$$PROFITAB = f(PROFIND, SHARE, INV, N, LABIN) \qquad (3)$$
$$PROFITAB = f(PROFIND, SHARE, INV, N, CAPIN, LABIN) \qquad (4)$$
$$PROFITAB = f(PROFIND, SHARE, INV, N, CAPIN, LABIN2) \qquad (5)$$

Table 6: Regression results, t-statistics in parentheses, 2063 observations, dependent variable: PROFITAB

Model	(1)	(2)	(3)	(4)	(5)
Constant	**-0.041**	**0.080**	**0.158**	**0.172**	**0.176**
	(-2.38)	(5.33)	(8.81)	(10.7)	(9.98)
PROFIND	**0.784**	**0.639**	**0.580**	**0.549**	**0.534**
	(7.64)	(7.40)	(6.26)	(6.59)	(6.28)
SHARE	**0.261**	**0.222**	-0.177	-0.025	0.014
	(2.37)	(2.40)	(-1.76)	(-0.28)	(0.15)
INV	-0.037	**0.102**	-0.027	**0.080**	**0.097**
	(-1.13)	(3.65)	(-0.92)	(2.98)	(3.55)
N	2.80E-05	2.70E-05	-1.70E-04	-8.90E-05	-4.90E-05
	(0.09)	(0.098)	(-0.59)	(-0.34)	(-0.18)
CAPIN		-2.013		**-1.613**	**-1.686**
		(-29.3)		(-22.3)	(-22.6)
LABIN			**-75.800**	**-44.130**	
			(-22.2)	(-13.0)	
LABIN2					**-0.562**
					(-9.88)
R^2	0.03	0.32	0.22	0.37	0.35
F-statistic	Yes	Yes	Yes	Yes	Yes
Heteroscedasticity	No	Yes	Yes	Yes	Yes

Source: Data CSO, own computations

In Table 7 model (2) is computed for all firms (1st column), firms with positive profits (2nd column) and firms with negative profits (3rd column).

Table 7: Regression results, t-statistics in parentheses, dependent variable: PROFITAB

Firms	All	PROFITAB > 0	PROFITAB < 0
Constant	**0.080**	**0.089**	**-0.108**
	(5.33)	(9.38)	(-3.04)
PROFIND	**0.639**	**0.195**	**0.774**
	(7.40)	(3.54)	(4.00)
SHARE	**0.222**	-0.102	**0.749**
	(2.40)	(-1.88)	(3.20)
INV	**0.102**	**0.085**	0.053
	(3.65)	(3.89)	(1.07)
N	2.70E-05	-1.50E-04	8.90E-04
	(0.098)	(-0.93)	(1.35)
CAPIN	**-2.013**	-0.010	**-2.120**
	(-29.3)	-0.121	(-20.0)
R^2	0.32	0.02	0.4
F-statistics	Yes	Yes	Yes
Heteroscedasticity	Yes	No	Yes
No. of observations	2063	1382	680

Source: Data CSO, own computations

In the firm level approach few interesting results have been found. Profitability of a firm strongly depends on the profitability in the industry, where firm operates. The effect of market share on profitability is significant (and positive) in models not containing labour intensity in specification. The effect of capital intensity and labour intensity is highly significant, negative, and these two variables probably introduce heteroscedasticity into the models.

When dividing sample of firms into two groups, where firms with positive and negative profits are separated, different results have been obtained. While positive profits are influenced by investment, negative profits are influenced by market share.

These results can be compared with previous studies as for instance Schmalensee (1989.) on the samples of U.S. firms that include many industries shows that market share is strongly correlated with profitability; the coefficient of concentration is generally negative or insignificant in

regressions including market share). Ravenscraft (1983) found market share, growth and import to be significant, concentration and exports to not to be significant (R square received between 0.13 and 0.21).

Schmalensee (1989) The relation, if any, between seller concentration and profitability is weak statistically, and the estimated concentration effect is usually very small. Geroski (1981) found CR5 and capital intensity not significant. He found advertising-sales ratio, import-sales ratio and export-sales ratio to have significant coefficients. He incorporated non-linear dependency between concentration and profits. In the model without nonlinearity he found just advertising-sales ratio to be significant. For the linear model he received R square to be 0.22. For non-linear models he received R square between 0.34 and 0.46.

As regard to positive relation between profitability, there exist two positions: on one hand the profitability can be response to market power based on market concentration (market power paradigm), on the other hand, market concentration can be translated into improvement efficiency which allows firms to realize greater profits (efficiency paradigm). However measuring efficiency is not an easy task. In general economic efficiency has three components: technical efficiency, allocative efficiency and dynamic efficiency. Technical efficiency is related to a firm's ability to reach the maximum level of production given a combination of inputs, say capital and labor. Allocation efficiency refers to the firm's ability to use the optimal combination of inputs which allows firms to maximize profit under the condition of given prices and best available technology. While first two components of economic efficiency are static in a sense that they do not consider change of technology, the third dimension of economic efficiency – the dynamic efficiency takes in consideration innovation and technological progress. Concentrated market structures may be favourable to the technology change and hence for efficiency and growth.

Positive correlation between industry concentration and industry profits is often by antitrust interpreted as evidence of collusion among firms in the market or as monopoly profit in industries dominated by one firm

(*collusion hypothesis*). The measurement of market power via market concentration is an indirect way of market power measurement as there is an implicit assumption that high concentration is positively related to high profits. High market concentration was perceived by antitrust *per se* as a potential threat to competition and consumer welfare because of its relation to high profits and excessive market power of firms in concentrated industries.

Antitrust attitude to relate market concentration with firm conduct and strategies such as mergers or acquisition that can increase market power of firms has been challenged by Chicago school economists in 60th and 70th of the last century. Demsetz (1973) argues that efficient firms can earn both - high market share as well as high profits (*efficiency hypothesis*) and later empirical work aimed to test the efficiency interpretation of the correlation between profit and market concentration.

Collusion hypothesis considers economies of large scale, absolute cost advantage and product differentiation to be economic barriers to entry. The presence of these "structural" barriers to the new entry and from seller concentration mutual dependence of decisions among incumbents in the industry which hinders the firm rivalry within the industry a provide firms with market power a barriers to entry that protect equally all firms in the industry from competition for this market. Such an approach however assumes that profit and market power is divided symmetrically to all firms in the market – that all firms are homogenous as for cost efficiency and profitability. Firms in an industry however as a rule differ in a variety of dimensions such as degree of vertical integration, level of fixed costs breadth of product line, extent and type of advertising, innovation policies and internationalisation policies. These variations reflect differences in the competitive strategies of the firms within an industry as for vertical integration, capacity of product lines or advertisement.

In 1960s and 1970s the focus of competition analysis did shift to business strategies that may create market power such as advertising, product differentiation, research and development and strategies that affect

market structure and may create barriers to entry endogenously that would otherwise not exist. In antitrust jargon these conduct is called "exclusionary practices". Among factors that can impede the entry of a firm into a market, the advantage which has first entrant – first mover advantage - as a result of economies of scale, advantage due to superior knowledge of incumbents (learning by doing) and advantage due to market niche with consumer loyalty. In addition, the quality of product may be unknown at the time of purchase and is only revealed when the good or service is used. Reputation, acquired by incumbent firms who have history records for quality products, can act as an effective barrier to entry to new firms. This can be called "informational barriers to entry". Domestic firms can have incumbency advantages based on the familiarity with local culture, customs, tastes, language and legal systems. Some goods and services are non-tradable, and therefore trade liberalization, removal of tariffs, quotas, and other measures, may result in no change in some markets.

Although market concentration is a significant dimension of market structures and is regarded as an indicator of market power or collusion, competition can occur also when there are not a large number of firms in the market and market concentration is high. Merger strategy allows for fast growth of the size of a firm which may curb competition as it increases market share and with one or fewer firms in the industry, prices may increase. Merger can however also intensify competition between few rivals. Firms can behave competitively also in a monopoly or dominant position if the entry to the market is free and no entry barriers exist, the probability of monopoly behaviour or continued cartel stability is however more probable if the concentration is high. (Stigler, 1964).

One way how to define barrier to entry is "any cost of production that must be borne by potential entrants but is not incurred by incumbent firms" (Stigler, 1968, p. 67). In Stigler's understanding of market access barrier capital does not create barrier to entry as it has to be invested also by firms which are already in the industry. O. Williamson (1975) suggests that internal financing and being first in the market can also became a barrier to entry.

According to anti-trust, in some situations, the firms in oligopoly markets may employ restrictive trade practices and create a long lasting cartel aiming at fixing prices or market sharing to create a barrier and prevent to new entry and be able to behave as a monopoly. Other types of conduct that may create market access barrier may be vertical restraints such as tying agreements or exclusive dealing. In oligopoly markets where there is only small number of players, incumbent are not passive as for potential new entries. Incumbent firm can employ strategies to detter new entry such as capacity expansion or long-term contract. (Salop 1979). Excess capacity investment is considered to be credible strategy only if the cost is high and sunk. Incumbent can also considered to be able to induce the exit of other firms in the market by strategy of predatory pricing, which is below cost.

According to Bork (1978) all the barriers to entry that are created by conduct or strategies of firms and complained of in antitrust are, in fact, activities that create efficiency. As a consequence business conduct that has been considered by so called "Structuralist school" to be exclusionary, "Chicago school" considered precisely the opposite – competitive. While Structuralists consider market structure endogenous to conduct, Chicago school considers scale economies, superior skill and management to be sole determinant of market structure (Audretsch 1985).

It is important to determine what is the source of the market concentration as a result of the past conduct of the firms. Market concentration can be result of past efficiency of firms that survived in the competition contest. In other words, concentration can be explained not only by collusion but also by efficiency grounds. To distinguish between innocent (pro-effective) and harming (anti-effective) conduct of firms is not an easy task. For instance low price can be perceived by antitrust as consequence of cost efficiency and price competition as well as a strategy to prevent new entry (predatory prices). An incumbent firm may invest into enlargement of capacity to deter new entry or to allow for economies of scale. An incumbent firm can invest into R&D not only to improve its product but also to impose R&D costs on its potential entrants. Similarly incumbent firm may

invest into advertising for the purpose to increase advertising sunk cost on potential entrants.[23]

In empirical analysis economists call attention to the fact that high concentration can be associated with higher efficiency and this new learning postulated that high concentration can be result of some firms being more efficient than others and thus enforcement of antitrust competition would prevent growth of efficiency. Demsetz (1973) has argued that the profits of large firms in concentrated industries are due to their above average efficiency, and not to market power or monopolistic practicies. Demsetz did show that if firms in concentrated industries collude, then smaller firms in the industry share in the collusion and profit rates of both small as well as large firms are be positively related to profits. If it is better efficiency what explains both high concentration and high profits, then only the profits of large firms would be correlated with concentration.

As concentration measures do not capture business conduct, measures of concentration have to be used with caution and should be accompanied by efficiency analysis (Curry and George, 1983). Sources of the efficiencies however are difficult to identify. Hence the competition authorities have a difficult task to decide which hypothesis is more probable. For that purpose economic analysis of efficiency and performance can be useful and provide additional evidence for the competition authorities or court decisions.

1.3   The measurement of competition Intensity

Market concentration is most common measure of competition and most frequently used measure in competition cases. There exists a practical reason for the popularity of measures competition based on concentration which is the data availability needed for such measurement a relatively easy measurement. There exist however several problems with measurement of intensity of competition via market concentration as well – first there are barriers to entry which market concentration does not measure and which are

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[23] The problem of innocent versus strategic barriers to entry is discussed for instance in Salop, 1979.

structural conditions that can determine conduct of the firms. If there are no barriers to entry, especially no sunk cost and markets are contestable firms in the market can behave competitively despite high market concentration (Baumol, Panzar, Willig, 1982). Second problem is related to market delineation.

Market concentration measurement depends on defining the relevant market, which assumes finding goods or services that are substitutes for each other while being distant substitutes for all other goods or services. In our analysis we work with statistical definition of an industry which neither does not correspond with economic definition of the market nor with definition of so called „relevant market definition" for competition policy. Such an attitude may allow to reveal some systematic relations but would not be recommendable or eligible for the purpose of competition law enforcement and application in administration and courts.

There exist several other ways of measuring competition or market power, none of them however is without problems. One way is to try to measure the freedom which firms posses when choosing their business strategies such as prices independently of other firms without losing market share to other firms. This method attempts to estimate the residual elasticity of demand for the firm's own products. Residual elasticity measures the extent to which a price rise by the firm would decrease of sales as customers substitute the firm's product by the rival firms' one. This method however need good data on prices and quantities sold over certain period of time which are not easily available.

Another way of measuring competition is to look directly at the profit margin of firms and to infer from this the extent of market power or the competition respectively that they themselves believe to face. In this case the price-cost margin (PCM) is measured. This method assumes that a firm is maximizing profit and has constant marginal costs, hence that technology is exogenous and firm cannot change it by own innovation strategy. In this case, PCM will be inversely proportional to the own-price elasticity of demand for its products and can serve as an inverse indicator of the intensity

of competition in the market or market power measurement respectively. In other words a higher elasticity of demand for goods means higher competition. (Carlin et. All, 2004)

PCM or profit margin is used as measure of competition with reference to its implication for welfare measure (prices closer to marginal costs lead to higher welfare). However as shown by theoretical as well as empirical literature, there is no simple relation between profits and welfare. Recently, there exist attempts to introduce a new way to measure competition based on firms' profits assuming that competition can be intensified through both - a fall in entry barriers as well as through more aggressive interaction between players. (Boone, 2008)

Economists are rather sceptical as for precise borders or delineation of a specific relevant market. Competition and thus a definition of the market goes beyond established industry rivals (incumbents), it includes customers, suppliers, potential entrants, and substitute products (M. Porter, 1980). These forces define industry's structure which might differ from one another as industries in some respects but competition as a driver of profitability is the same in all industries or markets be it car industry or airlines where firms compete globally or a hair-dressing industry where markets are local. In addition vertical links are important and there exist strategies that are related to vertical links and to the complementarities of products.

A market is the "place" where price of a product or group of products is determined through interactions of buyers and sellers. In a theoretical model, market is precisely defined – it is said if a product is homogenous or differentiated, number of firms and entry is free or blocated. A. Cournot understand under the term market '..., not any particular market place in which things are bought and sold, but the whole of any region in which buyers and sellers are in such free intercourse with one another that the prices of the same goods tend to equality easily and quickly.' (A. Cournot,1883) A. Marshall (1920, p. 324) was among the first economists to attempt a more specific definition of a market as „a space where prices of the same goods tend to be the same after deducting transportation cost".

For the purpose of competition policy in each particular case, a so-called "relevant" market has to be defined. The relevant market definition is often crucial for decisions in specific competition cases. There may be considerable difference between statistical definition of industry and the relevant market. To define markets in real-life practice, it is a task for managers and owners of enterprises – and they as a rule know their "relevant markets" rather well. One needs microeconomic data on prices and volumes sold, product differentiation, cost and technologies as well as an understanding of the demand side of the market, consumer preferences that determine demand elasticity. Vertical dimension of the market is important as well.[24]

According to the Czech Act on the protection of competition "Relevant market shall be deemed to mean the market of goods, which are identical, comparable or mutually interchangeable from the point of view of their characteristics, price and their intended use in an area, where the conditions of competition are sufficiently homogenous and which can be clearly distinguished from neighbouring areas." (Art. 2, par. 2)

A number of statistical and econometric tests have been developed since in an effort to find specific relevant market definitions. However there may be considerable differences between the economic market and the relevant market because the relevant market does not take into account potential competition and entry conditions. Another reason to be sceptical about totally unequivocal definition of relevant antitrust market boundaries includes the interdependency of markets, the role of market dynamics and lack of relevant information.

However if we wish to measure market competition, market has to be defined. One must first define the relevant product and geographic market and only then it is possible to measure market concentration. Market definition is important not only from a public policy perspective but market definition is important for companies as it is crucial to understand who are

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[24] Economy and econometrics offer methods that may help us to better approximate size and scope of particular "relevant markets".

major and potential competitors and be able to set price, determine advertising budgets, or make capital investment decisions etc.

To define markets in real-life practice, one need detailed microeconomic data on prices and volumes sold, product differentiation, cost an technologies as well as an understanding of the demand side of the market, consumer preferences that determine demand elasticity. Although economics and econometrics offer methods may help us achieve a better approximation of the size and scope of the relevant market, none of the available methods provides an ideal solution. (Zemplinerova, 2008)

2. Market internationalization

Czech Republic is a small open economy. Companies penetrate Czech markets either by international trade or via investment in production abroad – foreign direct investment. Foreign direct investment in turn influences the volumes and structure of international trade. International trade and foreign direct investment is enhanced not only by the liberalization of foreign trade and capital movement but also with a decrease in transport costs and development of new communication techniques. As a consequence, many enterprises have to compete with exports on larger than domestic markets but also have to face competition on domestic markets via imports and FDI. In this chapter we analyze the levels and developments of import penetration, export performance and FDI by manufacturing industries during the period 1998-2002 and compute concentration ratios with adjustment for foreign trade. These computations will be used in the chapter 3 for the analysis of the role of FDI and concentration for the growth of industries. At the end of this chapter, competition policy discussed in an international context.

2.1 Foreign trade and foreign direct investment

For a small economy, foreign trade is one of the engines of industrial growth (Benáček and Víšek, (1999)). Openness of an economy is one of the assumptions of the creation and maintenance of competition in many markets. The higher is the share of imports of goods as a percentage of the supply on manufacturing markets, the more the domestic producers are exposed to competition from abroad. In this part of the analysis we computed import penetration, export performance and re-computed concentration ratios adjusted for foreign trade.

Data on imports and exports can be taken either from the industrial census – from firm data and the P5-01 form or on the basis of the custom statistics which is collected also on on the micro-level by the Directorate General of Customs. Custom (trade) data are FOB values/prices and import data are CIF values is used. Custom (trade) data include the value of goods imported in the framework of inward processing in the volume of total

exports and the value of goods exported after the processing in the total value of exports, inclusion of the value of goods exported for outward processing and of the value of goods after the processing abroad in imports. Goods imported as financial lease in also included. The data do not include individual exports or imports out of business sphere. Data have been obtained in the individual 8digit level of the Harmonized system nomenclature (around 11 000 commodities) and have been trans-coded and aggregated with the key to 3digit NACE level. Trade data have been obtained from the Ministry of Industry and Trade already trans-coded and aggregated on the 3 digit level.

We computed import penetration in the following way:

$$Ip_i = Import_i /(Output_i + Import_i) \tag{2.1}$$

where imports are taken from customs statistics and output from industrial statistics aggregated on 3-digit NACE level. Foreign trade data that were obtained from the Ministry of Industry and Trade (see also the section on methodology and data description). These are data recorded on the firm level on the basis of the custom statistics which were collected by the Directorate General of Customs.

As figure 2 illustrated, during the 1998-2002 import penetration in the Czech manufacturing increased significantly. Median import penetration increased in the Czech Manufacturing from 69.8 % as by 1998 to 78.8% in 2002.

Figure 2: Import penetration, Czech manufacturing 1998-2002
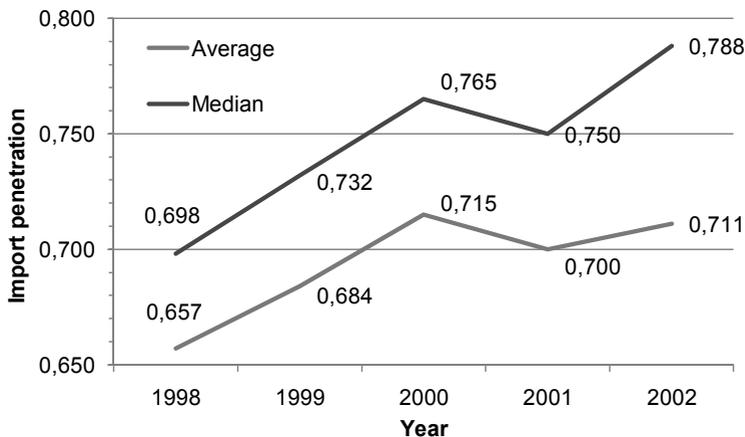
Data: CSO and MPO, own computations

A more detailed computation of import penetration (IP) has been made for manufacturing industries and the results are in the Appendix III. In most of the industries the import penetration increased significantly between 1998 and 2002. Sharpest increase experienced consumer goods industries such as textile and apparel, leather products, paper, computers, but also rubber, plastics and machinery. However in coke and oil, communication equipment, cars, furniture and others as well as in optical and medical, the share of import in the domestic supply decreased. Following tables show manufacturing industries with lowest and highest import penetration

Table 8: Industries with highest import penetration, 1998-2002

NACE	NAME	Import Penetration				
		1998	1999	2000	2001	2002
355	Other transport equipment	0.396	0.799	0.996	0.989	1.000
204	wooden containers	0.966	0.959	0.954	0.891	0.999
321	electronic valves, tubes	0.883	0.933	0.964	0.983	0.998
300	Office machinery and computers	0.997	0.958	0.996	0.992	0.997
364	sporting goods	0.953	0.960	0.963	0.967	0.975
192	Luggage, handbags, etc.	0.807	0.885	0.935	0.975	0.974
191	Leather	0.885	0.910	0.934	0.958	0.974
291	Power-generating machinery	0.802	0.890	0.906	0.878	0.965
322	transmitter, phone and telegr.	0.867	0.858	0.819	0.735	0.963
246	Other chemical products	0.899	0.966	0.947	0.969	0.962

Data: CSO, own computations

Table 9: Industries with lowest import penetration 1998-2002

NACE	NAME	Import Penetration				
		1998	1999	2000	2001	2002
266	articles of concrete and cement	0.172	0.143	0.140	0.124	0.108
160	tobacco products	0.225	0.194	0.251	0.122	0.110
155	Dairy products	0.090	0.113	0.123	0.118	0.128
159	Beverages	0.101	0.110	0.138	0.132	0.129
264	clay bricks, tiles, flags	0.086	0.107	0.150	0.132	0.145
283	Steam generators	0.246	0.173	0.268	0.158	0.146
151	Meat	0.139	0.129	0.162	0.151	0.160
265	cement, lime, plaster	0.124	0.149	0.174	0.196	0.214
157	prepared animal feeds	0.184	0.182	0.214	0.206	0.219

Data: CSO, own computations

In the next step we computed export performance

$$EP_i = Export_i / Output_i \qquad (2.2)$$

Where $Export_i$ is value of export of all firms in the industry and $Output_i$ is sum of sales of all firms in the industry i. Detailed results are in the Appendix IV. Export performance differs significantly with the industry. Some industries export almost all of its production only a minority of industries operate only within national markets, among these beyond

publishing, printing, food products, steel or iron. Also the growth of export performance of firms and industries differ significantly between 1998 and 2002.

The following figure depicts the development of export performance which is computed as a sum of values of firm exports divided by total value of sales of firms. The development of export performance is breaked-down by size of the firm and by ownership. "Z" are foreign firms with more than 100 employee, or firms with 25 to 100 employees respectively. "D" are domestic firms with more than 100 employee, or firms with 25 to 100 employees respectively and "T" are all firm, foreign as well as domestic. Export performance of the Czech manufacturing was growing over the period 1997-2004 It follows from the chart that foreign firms export more on average than small firms reaching about 54% as by 2004.

Figure 3: Export performance by size and ownership of firms, Czech manufacturing 1993-2004
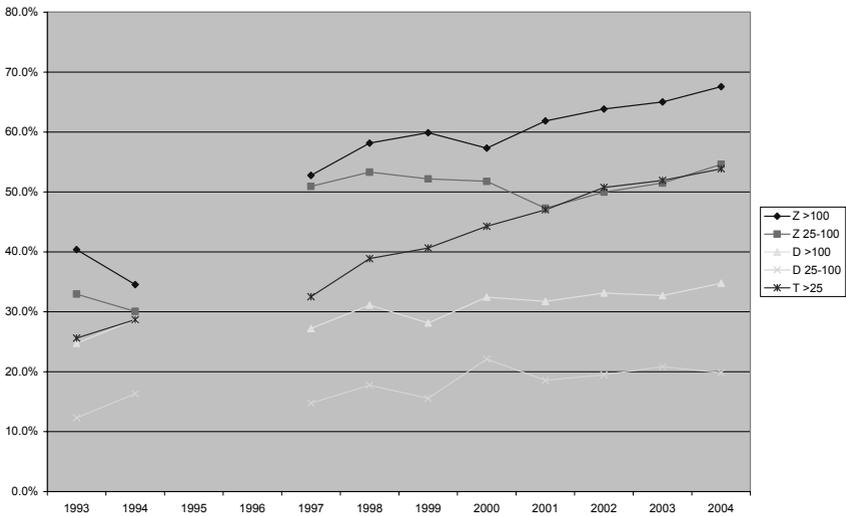
Data: CSO, own computations

It follows from our computations in chapter 1 that national levels of concentration in domestic supply are relatively high. In the next step of the analysis we computed concentration ratios adjusted for imports and exports. For the purpose of the analysis we aggregated sales of individual firm according to their major activity recorded as NACE 3digit level of „The Branch Classification of Economic Activities" – OKEC (a variant application of NACE). This level allows for matching the trade data with industrial statistics. For the computations we used in addition to the enterprise data also custom statistic data. For this purpose the formula for adjusted concentration ratio in an industry has been defined as follows:

$CR_4adj = \Sigma$ output of the four largest producers $/ \Sigma$ (Total output + Imports – Exports)   (2.3)

where imports are from custom statistics and exports and outputs are from industrial statistics.

There exist certain inconsistencies related to the linking of trade and industrial statistics due to which data on export from enterprise statistics have general lower value than data on exports from custom statistics.[25] In order to avoid the above discrepancies we use exports from enterprise statistic for calculation of export performance, but exports from trade statistics for calculation of comparative advantage and trade balance.

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[25] The inconsistencies between the firm's trade data and trade data from custom statistics are caused by following facts:

- imported inputs for further processing (in the framework of OPT custom tariff avoidance) are when exported recorded in gross terms (imported inputs plus processing), which in the enterprise statistics these exports are in net term (without imported inputs)
- imported inputs for further processing are recorded in one sector (for instance textile) and recorded as exported in a different sector (apparel)
- part of manufacturing exports is exported not directly but through intermediaries
- part of manufacturing exports is produced in different sectors (not classified under manufacturing – for instance in mining or agriculture)
- trade statistics works with FOB/CIF prices and industrial statistics with producer prices
- exporters can have less than 20 or 25 employees respectively and thus their output/exports are not involved into our analysis
- a lag can exist between export sales recording and date of the crossing border recorded by custom statistics . In order to avoid the above discrepancies we use exports from enterprise statistic for calculation of export performance, but exports from trade statistics for calculation of comparative advantage and trade balance.

Table 10: Market concentration with and without adjustment for foreign trade; Selected industries with highest and lowest concentration, 1997

NACE	NAME	CR$_4$	CR$_4$ adj
160	Tobacco	100.0	84.8
231	Coke products	100.0	82.4
232	Petroleum products	99.8	81.9
263	Tiles	99.0	79.9
273	Iron, steel, and Fe-alloys	86.8	77.4
355	Transport equipment	82.9	72.1
296	Weapons	88.4	70.0
154	Oils	99.7	69.6
271	Basic iron	95.0	69.1
173	Finishing of textiles	70.2	66.9

Source: Data CSO, Ministry of Industry and Trade, enterprises with 25 and more employees, own computations

If aggregate domestic supply is adjusted for imports and exports, estimations of CR^4_{adj} are lower almost in all markets. The most significant decreases were found in industries where the unadjusted CRs were close to average (i.e. in the range 50-35). Especially it was on markets for fabrics, man-made fibres, watches, PCs, pesticides, domestic appliances, sporting goods, soaps, musical instruments, non-ferrous metals and TV sets. CRs changed very little in the production of bricks, articles of concrete, meat, printing, grain, cement and dairy. As we can see, the largest domestic producers have still retained a significant market power in a quite substantial number of markets even after the adjustment for foreign trade.

Market structure and market concentration depend on the character of the product and market and imports in the market. The national levels of concentration in domestic supply are often very high. For many markets concentration import corrects the levels sufficiently and in these markets competition can be maintained only via imports. There are however many goods that have markets with national or local boundaries but in these markets there can be still foreign penetration via foreign direct investment.

In the Czech Republic, as of 1994, foreign enterprises' position was still relatively weak. With about a 12 % share of output, foreign penetration is still fairly far behind small developed countries in which the respective

share reaches about half of total output. The role of FDI in the Czech privatization process has been underutilised. A method of selling directly to strategic foreign investors has not been fully exploited. Instead, the "Czech way" of privatization has been pursued despite its not enhancing the beneficial features of FDI. The voucher method led to a very dispersed ownership structure without establishing a long-term commitment between owners and privatized companies. It did not become a source of necessary capital investments, which was also the case with direct sales of state-owned companies to domestic owners. As a result, a great differentiation in the performance of individual companies has been observed.

Figure 4: Share of foreign enterprises in total manufacturing 1993-2006
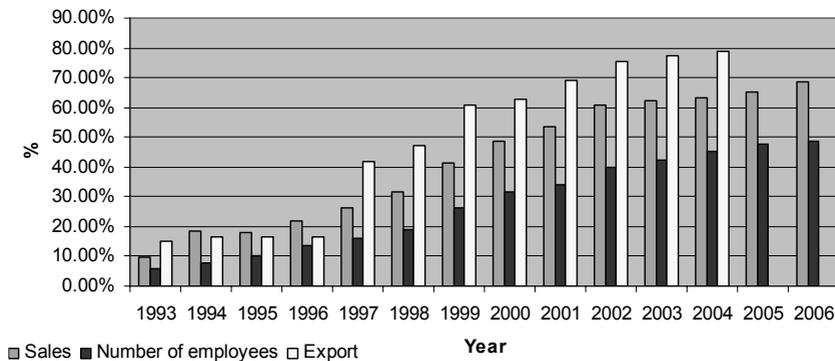
Source: Data CSO, own computations, companies with more than 25 employees

During the period 1994-1998 the Czech government had certain reservations about *foreign investors* (usually for political reasons), and thus built certain administrative barriers to foreign penetration into domestic markets. The disincentives for foreign investors included not only exclusion from the privatization but also restrictions on the foreign investor's ownership of land and/or ownership of real estate, a special approvals, process, and restrictions on certain sectors or public procurement.

Since 1997 the growth of investment inflows in the Czech Republic has been impressive and initiated discussion about the international specialization of production and growth in the Czech economy and if FDI

are the channel of technology transfer or if they are only using cheap un-skilled labor for assembly of final products.

In Appendix V, share of sales of foreign firms operating in the industry on the total sales of the industry is presented.

$$FDI_i = Output_i/FDI\_Output_i) \tag{2.4}$$

There are industries, in which On the other hand there are industries in which foreign penetration via ownership is zero or negligible (Appendix V). Depending on the character of the product, foreign investors are either aiming at acquiring a local market share or at increasing their share on the world markets. In the first case, exports are minimal. In the latter case, the foreign investor exports the majority of the output. In the first case it has to compete with domestic producers; in the latter with other multinationals on the world markets. In the first case foreign involvement in the market often results in the monopoly creation, what can have for the host country negative consequences. In the second case it is more probable that foreign investors will expand production, increase capacities and invest in new technologies, thus improving both quality and marketing.

From Table 11 we can see that industries with high degree of foreign ownership are as a rule industries with above-average productivity, investment activity and export performance. Foreign direct investments are penetrating to all sectors of Czech economy, however with different intensity. As by 2000, FDI was negligible in agriculture but rather high in manufacturing and trade, restaurants and hotels. The highest share of foreign owner however can be found in financial services where the foreign banks and financial intermediaries employ more than 70% of all employees of financial sector and invest almost ¾ of total investment done in financial sector in 2000. In total companies under the foreign control employees almost quarter of all employees in the Czech Republic and provided 35 % of total output. That indicated higher average productivity of foreign firms by more than one third higher productivity. From the table also follows that the

share of foreign companies on the total value added of the sector and on investment done within the sector is highly over-proportional. Foreign direct investment in turn influences the volumes and structure of international trade – they not only contribute to exports of the country but also to the imports.

Table 11: Shares of foreign enterprises in the Czech economy by activity and selected indicators, in 2000

NACE	Sector	Employ-ment	Sales	Value Added	Invest-ments	Export	Import
01-05	Agriculture	0.70	0.80	0.70	0.80	11.10	24.30
10-14	Mining	20.20	28.90	29.80	31.70	23.90	22.60
15-37	Manufacturing	28.50	42.00	40.90	59.10	56.70	68.90
40-41	Energy distribution	35.60	44.50	47.60	35.90	9.10	43.40
45	Construction	8.10	12.00	11.20	18.60	25.10	50.60
50-52	Trade	32.70	39.50	46.30	56.20	35.90	65.30
55	Hotels. Restaurants	30.80	41.20	43.30	41.20	71.50	79.30
60-64	Telecom.. Transport	13.70	29.00	26.00	27.30	38.70	36.20
65-67	Financial Sector	71.70	53.21	-	74.67	-	-
70-74	Business services	23.80	41.10	37.80	30.80	59.70	64.00
75-99	Other Services	11.70	17.70	14.00	15.50	8.50	44.30
01-99	TOTAL	23.30	35.00	35.60	45.80	53.20	66.30

Source: Data CSO

Many of existing studies deal with technology and know-how transfers imported by multinationals to their foreign subsidiaries and with spillovers to domestic firms in the host country through various channels such as imitation or skill acquisitions. The conclusions and results of existing studies are ambiguous – they find either negative ones (Stančík, 2007) or significantly positive innovation effects on Total Factor Productivity (Zemplinerova and Jarolim, 2001). In practice the actual effect of foreign direct investment might be positive as well as negative depending on circumstances. It is not only the quantity but primarily the quality of FDI what determines the long-term positive impact on the host economy (Havlik, 2003).

Enterprises with foreign participation are expected to improve the productivity after the acquisition by investment into the technology (Knell M.et al., 2003). In the long-term with the entry of foreign investors, the

potential of economies to scale is increasing and so does the concentration in these industries. That development has an impact on the specialization and the division of labor, and shift from inter-industry to intra-industry patterns. (Zemplinerová and Benacek, 1999)

2.2 Competition policy in an international context

During the past decade the world economy experienced an increasing rate of internationalisation, leading to ever-greater geographical dimension of markets. Barriers to foreign trade and foreign investment have been removed and their growth rates have been growing faster than production. National economies became more internationalised. Recently, many enterprises compete on larger than domestic markets. Driving forces of the above processes are among others comparative advantage, privatisation of network industries and information technology.

It can be concluded that with liberalization of trade and capital movement, relevant market definition is changing in the case of many markets. Geographically, the markets are growing for firms that are able to exploit comparative advantage based on the economies of scale, scope, skills and knowledge. Therefore internatilization of markets has important implications for competition policy. The opening-up of the Czech economy to the world during the transition was potentially the most important de-monopolisation policy.

Most multinational firms view whole Central and Eastern Europe as market rather than particular countries and their strategy may be to select one country as a hub for expansion to other CEE countries while using the network created under the planned economy. Moreover, links of foreign and domestic firms together with spill over effect may act as a stimulus for restructuring of domestic firms and their expansion abroad. For most markets it is therefore important to include imports into the relevant market and deduct exports from the domestic supply for determining the market concentration ratio or the individual firms' market shares.

On one hand in a global world, large size can be needed for economies of scale, R&D expenditures and creating networks. In addition to it, FDI can increase contestability of markets, as they ease the entry to the market. On the other hand large size gives market power and market dominance, what can provide opportunities for anti-competitive practicies and create barriers to entry. Thus large companies can both – promote as well as restrict competition. Depending on the character of product, foreign investors are either aiming in acquiring local market share or in increasing of their share on the world markets. In the first case, exports are minimal. In the later case, foreign investor exports majority of the output. In the first case it has to compete with domestic producers, in the later with other multinationals on the world markets. In the first case foreign involvement in the market often arrives into the monopoly position, what can have the host country the above negative consequences. In the second cased it is more probable that foreign investors will expand production, increase capacities and invest into the new technologies, improve the quality and marketing.

As we have shown elsewhere (Zemplinerova, 1998), enterprises with foreign participation assist economic re-structuring and speedup the process of transforming entire industries. For this reason politicians in many countries implement some kind of investment incentives. Following a prolonged debate and in light of the trade balance situation, in April 1998, also the Czech government approved a national investment incentive package, which was amended and codified in May 2000. The incentives include corporate tax relief for up to 10 years, financial support for creating new jobs, grants for retraining new employees and a provision for low-cost building land or infrastructure. Incentives apply equally to both foreign and domestic investors and are provided in the case of M&A's as well as greenfield investments. However there are some limitations: for instance investment must be made in manufacturing sector and at least 50 % of the production line must consist of machinery listed on a government-approved list of high-tech machinery. The original requirement to invest at least $10 mil within three years has been reduced to $5 mil in regions with a high unemployment rate. As of mid of 2001, 63 firms had been awarded incentives, and a further 50 applications were being processed. Each of these

grants however has to be approved by the anti-trust authority as it represents a kind of subsidy and establishes unequal conditions.

Since 1998 the Czech government has made special efforts to attract strategic foreign investors through investment incentives. Against this background, an issue of current interest is whether FDI actually enhances welfare, which basically depends on how FDI enterprises perform and how they are distributed among sectors. As there are costs involved in attracting foreign investors with investment incentives, an analysis should shed more light on whether such costs are in fact offset by benefits.

The reasons for investors' decisions to invest abroad are complex and therefore it is multi-criterial. Ceteris paribus FDI incentive policies can drive an investor's decision if investment attractiveness given by macroeconomic and political stability or other disincentives for investment is reaching certain parameters. This of course is the case when, in the long term, investors expect growth and stability in the economy and the political system of the country. In attracting foreign investors, more attention has to be devoted to the disincentives, which deter foreign investors. In the long-term with the entry of foreign investors, the potential for economies of scale is utilized. In many markets efficiency dictates increasing market concentration in order to meet competitive scales of production, advertising and R&D. Thus, the competitive process itself can form barriers to entry. The competitive process can end in dominant-firm monopolistic or oligopolistic structures and increase the market power of such firms. That again can reduce the competitive pressure to increase efficiency over time. Collusion and cartels become more probable. Currently, in many cases anti-trust policy cannot be carried out by national institutions alone as the relevant market cannot be limited to a domestic market, but instead must be adjusted for foreign trade. Cross-border M&A requires joint action by all countries in which the company operates. Competition regulators need to cooperate in order to analyze and evaluate the respective consequences of the M&A. International mergers need international policies.

3. Competition and performance

There are numerous empirical investigations of the influence of competition on industry's and firm's performance, however, the results are mixed.[26] In many studies of developed countries a positive correlation between the degree of market competition and the growth rate of different measures of performance has been recorded. For example, Nickell (1996) analyzes the impact of competition on both the level and the growth of total factor productivity (TFP) in the UK. He found that competition measured by increased numbers of competitors or by lower levels of rents, was associated with a significantly higher rate of total factor productivity growth. Geroski (1990) used panel data to show that concentration reduces the innovation rate and the productivity growth. Vining and Boardman (1992) found that market competition had a positive influence on performance for Canadian companies.

There exist studies that have investigated the relationship between the performance and concentration intensity measured by the Herfindahl-Hirschman Index (HHI) in transition countries[27]. For example, Halpern and Korosi (2000) found a positive relationship between concentration and performance in Hungary; Brown and Earle (2000) reported a positive relationship between the HHI and TFP for Russia. Angelucci et al. (2001) found that domestic competitive pressure was associated with better firm performance in Poland, while increased import competition was associated with lower total factor productivity in Romania and Bulgaria. Most of the studies focused on the enterprise level data. One of the advantages of enterprise level data is that it can capture such performance related effects as ownership structure. For example, Hanousek et al. (2004) found that concentrated foreign, but not domestic, ownership improves performance relative to state ownership in the Czech Republic.

A small number of studies have focused on performance at the industry level rather than at enterprise level. Haskel (1991) used a panel of

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[26] Note that this chapter is an adapted version of Zemplinerova and Medvedev (2005)
[27] For a survey of the influence of different measures of competition on performance of enterprises and industries in transition countries see Djankov and Murrell (2002).

81 UK industries over the period 1980-1986. He found a positive, although weakly significant, relationship between the degree of market concentration and productivity growth. Chirmiciu (2003) used industry wide data from Hungary over the period 1992-98. He found a non-linear inverse-U relationship between the HHI and the level of total factor productivity, i.e. the middle level of market concentration is related with the highest total factor productivity levels. There exist a study carried out on the enterprise level for the Czech manufacturing that found negative correlation between import competition and enterprises' performance (Sabrianova et al. 2005). They also report that foreign-owned firms are increasingly displacing domestic firms, due to slower "learning" by domestic firms, higher efficiency of foreign start-ups, and foreigners' acquisitions of more efficient domestic firms in Czech Republic and Russia.

In this part of our analysis we use the industry-wide 3-digit NACE data to estimate the relationship between market concentration and the performance of Czech industries in manufacturing. At the same time we assess the relation between import penetration and performance of Czech manufacturing industries. For this purpose we matched import data from the trade statistics on 3-digit level to the industrial enterprises data. The data set consists of a panel of 102 industries over the period of 1998-2002 and, therefore, we can control for unobserved heterogeneity across industries. In what follows we first derive the basic model to be estimated. Then we describe the data more in detail, and proceed with the discussion of the obtained results.

3.1 Empirical model

The methodology used to analyze the relationship between competition and performance using industrial level data is largely based on Haskel (1991) and Chirmiciu (2003). The standard Cobb-Douglas production function of a firm is given as:

$$Y_i = A_i K_i^{\alpha_i} L_i^{\beta_i} \qquad (3.1)$$

where K_i and L_i denote the capital and labor employed by a firm i, respectively, and A_i is a total factor productivity, which captures the labour and capital efficiencies (or inefficiencies such as excessive labour and obsolete assets) and other unobserved factors of production. The total amount of capital in the industry is $K = \sum_{i=1}^{n} K_i = K \sum_{i=1}^{n} k_i$, where k_i is the share of firm's i's capital in total. Identically the total employment in the industry is $L = \sum_{i=1}^{n} L_i = L \sum_{i=1}^{n} l_i$, where l_i is the share of firm i in total industry employment. The total output in an industry is the sum of the outputs of each individual firm:

$$Y = \sum_{i=1}^{n} A_i K_i^{\alpha_i} L_i^{\beta_i} = \sum_{i=1}^{n} A_i (k_i K)^{\alpha_i} (l_i L)^{\beta_i} = \sum_{i=1}^{n} A_i k_i^{\alpha_i} l_i^{\beta_i} K^{\alpha_i} L^{\beta_i} \qquad (3.2)$$

Then, the output of an industry can be represented in the following way:

$$Y = K^{\alpha} L^{\beta} \sum_{i=1}^{n} A_i k_i^{\alpha_i} l_i^{\beta_i} K^{\alpha_i - \alpha} L^{\beta_i - \beta} \qquad (3.3)$$

We can assume that elasticities of output with respect to input factors do not differ a lot across firms in the same industry. In this case, the terms $K^{\alpha_i - \alpha}$ and $L^{\beta_i - \beta}$ are negligible and can be dropped from the analysis. If we can control for the size of an industry (total capital and labour employed by an industry), then the performance of an industry is determined by the industry wide total factor productivity (the summation term in Formula 3). In its own turn, the industry wide total factor productivity is determined by the shares of the firms in production inputs and differences in TFP across firms. Therefore, we can approximate industry wide TFP with competition within industries (market concentration, competition from abroad, and foreign ownership). Our choice of the dependent variable is the annual industry-wide level of sales[28]. This choice is consistent with the fact

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[28] Djankov and Murrell (2002) surveys different measures of performance of enterprises and industries. Some authors use level variables, others growth rates. It is possible to use volume of sales, or value added, or labour productivity as a performance variable.

that the HHI is calculated based on the volume of sales of enterprises[29]. In the paper we would like to assess the relationship between competition and the performance of industries, and look at the effects of different types of competition on the performance of Czech manufacturing industries.

Using a standard transformation procedure the Cobb-Douglas production function can be written in logarithmic form as follows:

$$\ln Y_{it} = TFP_{it} + \alpha \ln K_{it} + \beta \ln L_{it} \qquad (3.4)$$

To control for industry size we include capital as measured by the industry-wide volume of current assets, and labour as measured by the number of employees in an industry. In order to control for functional form of the production function we can use a translog approximation of the unknown production function. It approximates a wide variety of functional forms without imposing many restrictions. The inclusion of this term imposes the constant elasticity on the production function but allows all three types of returns to scale. At the end it adds a new term, *(ln K_{it} - ln L_{it})^2*, into the estimated model of the production function (see Chirmiciu, 2003). However, this term appeared to be insignificant under different specifications of the model.

We approximate the intensity of competition in the following way. Domestic competition is measured by the HHI, which measures the concentration in an industry taking into consideration both the number of firms and their size. We might expect the relationship between competition and performance to be non-linear; Schmidt (1997) shows that moderate levels of competition have a positive impact on managerial effort and productivity, whereas very fierce competition reduces profits and, consequently, incentives of managers to improve performance. In order to check this hypothesis we include a squared HHI term in the model[30].

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[29] The HHI is calculated based on the volume of sales of enterprises which belong to a 3-digit NACE industry.
[30] However, the quadratic form is vulnerable to an extreme observations, therefore we double-check the same hypothesis by running regressions with the interaction term between HHI and dummies for low,

While the HHI describes structure of a market and intensity of domestic competition, competition from abroad has two different modes – via import and via foreign direct investment. Hence, foreign competition is captured by the import penetration ratio, which is the share of import in domestic sales, and by the FDI penetration ratio, which is the share of foreign owned enterprises in the i-th industry total output. From observing the performance of the best-known and the most successful companies in the Czech Republic we could expect that the best performance is achieved in more concentrated industries with high share of foreign ownership. At the same time most of the studies reported that foreign owned enterprises perform better than domestic ones and, consequently, industries with a high share of foreign ownership do better than domestically controlled industries (Zemplinerova 1998). Therefore we expect to find support for a widely hold view that the level of foreign direct investment positively affects industry performance.

In order to capture potentially significant unobservable industry specific effects we include the industry dummy α_i which controls for unobservable reasons of differences in TFP among industries. At the same time to control for the economy wide shocks, and the movement towards the production frontier by the whole economy through the period of time of interest, we introduce a time trend variable. While the trend variable picks up the effect of growth in all industries through time, we also include an interaction term between the HHI and trend to test whether more concentrated industries grow faster with time (more concentrated industries picking up more the time effect).

Hence, the full model that we would like to estimate is:

medium and highly concentrated industries, and checking whether the relationships between HHI and performance is different for these three types of markets.

$$\ln Y_{it} = \alpha + \alpha_i + \beta_t trend + \delta_1 \ln K_{it} + \delta_2 \ln L_{it} + \delta_3 \left(\ln K_{it} + \ln L_{it} \right)^2$$

$$+ \gamma_1 HHI_{it} + \gamma_2 HHI_{it}^2 + \gamma_3 trend * HHI_{it} + \gamma_4 impopen_{it}$$

$$+ \gamma_5 FDI_{it} + \mu_i + \varepsilon_{it}$$

(3.5)

In this part of the analysis we use two basic data sets: industrial enterprise data and foreign trade data (see the part iii for more details). Industrial enterprise data are based on regular statistical reports and financial statements of enterprises and we obtained them from the Czech Statistical Office. Enterprises with 20 and more employees for legal unit and both incorporated and unincorporated natural persons are included into the database. Trade data were obtained from the Ministry of Industry and Trade and were aggregated on 3 digit level. The data have been gathered on the micro-level on the basis of the custom statistics which were collected by the Directorate General of Customs. We use data for 102 manufacturing industries (3-digit NACE codes from 151 till 372) in the Czech Republic during the period of 1998-2002.

The analysis of the 3-digit NACE aggregated industry data allows us to avoid a problem of unbalanced panel data that often is present when we work with an enterprise level data. Especially it poses a serious problem in transition economies during restructuring from the centrally planned toward market economy. This transition period is characterized by a large number of green field investment and spin-off firms that are entering the market and firms exiting from the market through bankruptcy.

We calculated the HHI based on the volume of sales of enterprises which belong to a 3-digit NACE industry taken from the Czech Statistical Office dataset. There are several caveats related to the data: According to the Czech Statistical Office a firm belongs to a 3-digit industry if the largest share of its revenue comes from the sale of products classified within that industry. The shortcoming of this methodology is that firms can switch industries over time, because the relative shares of different products in total

revenue may change due to market condition, new strategies, and other factors. Further problem is related to the linking of trade and industrial statistics. For computation of import penetration we subtracted direct exports taken from the industrial statistics and added imports taken from the trade statistics into the domestic supply. The import penetration ratio is the share of import in domestic sales (*import penetration=imports/(domestic production-exports+imports)*). Such method omits exported goods via wholesale; however, it works better than trade exports that lead to negative values of many industries on 3-digit NACE level.

Foreign direct investment is captured through foreign ownership of enterprises. As explained above our analysis draws on corporate financial statements submitted to the Czech Statistical Office (CSO), covering the total population of manufacturing enterprises with more than 20 employees. To begin with, we aggregated monthly or quarterly data of individual enterprises to get annual observations, and performed controls for data consistency. Then the enterprises, which can be identified by type of ownership,[31] were broken down into two groups: foreign-owned enterprises and domestically owned enterprises. Then the FDI penetration ratio was calculated as the share of foreign owned enterprises in the *i*-th industry total sales.

Labour is measured by the number of employees in an industry and capital is measured by the industry-wide volume of current assets. Current assets consist of the sum of receivables and inventories owned by firms in an industry. Given the lack of industry-wide total assets in our dataset we think that it is the best way to represent the size of the industry in terms of capital. These data were obtained from the Czech Statistical Office.

We made every effort to ensure data comparability regarding methodology changes made in statistical recording during the review period and at the same time to provide for a broad coverage of data. While the data

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[31] The CSO distinguishes the following types of ownership: private, cooperative, state, foreign (100 per cent), international (any 1-99 per cent of foreign ownership), mixed (state and private), others (communal, political organizations and associations or not-identified). For the purpose of this analysis the two groups of foreign firms (fully and partially owned) were merged into one group and the rest into a second group of domestic enterprise.

presented in the article and used for the analysis result from careful adaptation of CSO data they are not fully comparable with the officially published figures as they reflect own computations.

In Table 12 and 13 there is a short description of the data. Table 12 provides some summary statistics for the variables used in the analysis. Table 13 shows the pairwise correlations between the variables used in our analysis.

Table 12: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
ln Sales	502	15,1425	1,5799	8,5757	18,6030
ln L	502	8,3197	1,3470	4,0662	10,7955
ln K	502	12,8645	1,5861	6,2916	16,2056
(ln K-ln L)^2	502	21,3555	7,3388	0,7773	53,4973
trend	510	3	1,4156	1	5
HHI	510	0,1993	0,2189	0,0115	1
HHI2	510	0,0875	0,1912	0,0001	1
trend*HHI	510	0,5831	0,7590	0,0214	5
Import Penetration	464	0,6933	0,2460	0,0864	0,99999
FDI	423	0,4786	0,2829	0,0064	1

Source: Data CSO

Table 13: Pairwise correlation between the variables

	ln Sales	ln L	ln K	(ln K - ln L)^2	trend	HHI	HHI^2	trend*HHI	Import Pen	FDI
ln Sales	1									
ln L	0.8957*	1								
	0,0000									
ln K	0.8585*	0.8491*	1							
	0,0000	0,0000								
(ln K - ln L)^2	0.1675*	-0,0468	0.4760*	1						
	0,0002	0,2949	0,0000							
trend	0.1015*	0,0062	-0,0349	-0,073	1					
	0,0229	0,8899	0,4359	0,1025						
HHI	-0.2280*	-0.4613*	-0.3719*	0.1167*	-0,0477	1				
	0,0000	0,0000	0,0000	0,0089	0,2825					
HHI^2	-0.1559*	-0.3721*	-0.3094*	0,0948*	-0,0389	0.9495*	1			
	0,0005	0,0000	0,0000	0,0336	0,3801	0,0000				
trend*HHI	-0.1236*	-0.3712*	-0.3414*	0,0334	0.3477*	0.8193*	0.7686*	1		
	0,0055	0,0000	0,0000	0,4559	0,0000	0,0000	0,0000			
Import Pen	-0.4404*	-0.3075*	-0.4104*	-0.3216*	0,0715	0,019	-0,0359		1	
	0,0000	0,0000	0,0000	0,0000	0,124	0,6827	0,4407	0,4556		
FDI	0,0413	-0.1996*	-0.2167*	-0,0658	0.2360*	0.4539*	0.4258*	0.4668*	0,0537	1
	0,3967	0,0000	0,0000	0,1765	0,0000	0,0000	0,0000	0,0000	0,2883	

Note: * significant at 5%;
        P-values under the estimates

Source: Data CSO

Having a panel of 102 industries over the 5 years period, we expect that the fixed effect model is a better framework to work in. To check this we run the Hausman test to determine whether the fixed or random effect model is appropriate in our case[32]. Inclusion of fixed effects would help us to incorporate and control for unobservable industrial heterogeneity[33]. It appears that for all specifications of the model the Hausman test rejects random effect model in favor of fixed effect model, therefore we report only results for the OLS and Fixed Effect models[34].

3.2 Results of the analysis

The results of estimations are presented in Table 14. We find a significant relationship between competition and performance, and the coefficients of interest stay significant, preserve the same signs and do not differ much under different specifications of the model. Under all specifications of the model the coefficient in front of the HHI is significant as well as the coefficient in front of the squared HHI. The coefficient in front of the HHI is positive, but negative in front of the squared term[35]. The data shows that there is an increasing but diminishing return of the industry-wide performance on the level of concentration in the Czech manufacturing sector, i.e. the more concentrated industry, the higher the level of performance.

However, we cannot claim the causality between competition and performance, but we can only claim that there is a significant relationship between level of concentration and performance of industries in Czech Republic during the 5 years period.

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[32] Hausman test is a specification test which checks a more efficient model against a less efficient but consistent model to make sure that the more efficient model also gives consistent results (Hausman 1978). In other words, the test compares two estimators that are consistent under the null hypothesis. Pooled regression is more efficient than fixed effects regression under the null; while under the alternative, only fixed effects regression is consistent.

[33] For the importance of fixed effects in panel data analysis see Ashenfelter (1978), Ben-Porath (1973), Hsiao (1985), Hoch (1962), Griliches and Hausman (1986).

[34] However, we would like to mention that for all regressions that we present in the paper coefficients of the random effect model are also significant and have the expected signs.

[35] Later in the section we will conduct a robustness test of the non-linearity of the relationship.

Table 14: Results of the analysis, dependent variable: ln Sales

	1 OLS	2 FE	3 OLS	4 FE	5 OLS	6 FE	7 OLS	8 FE	9 OLS	10 FE
ln L	0.7563*** [0.0450]	1.1079*** [0.0511]	0.8298*** [0.0508]	0.9626*** [0.0507]	0.8644*** [0.0476]	1.0046*** [0.0545]	0.7493*** [0.0445]	1.0987*** [0.0512]	1.9046*** [0.2245]	1.2510*** [0.1442]
ln K	0.3247*** [0.0365]	0.0703*** [0.0203]	0.3500*** [0.0439]	0.1207*** [0.0223]	0.2797*** [0.0422]	0.0634*** [0.0218]	0.3285*** [0.0366]	0.0741*** [0.0203]	-0.8148*** [0.2180]	-0,079 [0.1422]
trend	0.0949*** [0.0155]	0.1023*** [0.0075]	0.1392*** [0.0174]	0.1166*** [0.0075]	0.1484*** [0.0172]	0.1234*** [0.0075]	0.0584*** [0.0198]	0.0920*** [0.0095]	0.0921*** [0.0150]	0.1031*** [0.0075]
HHI	2.4487*** [0.4798]	3.0482*** [0.3700]	1.8885*** [0.4260]	2.9353*** [0.4143]	2.2540*** [0.4276]	2.9497*** [0.4246]	1.5949*** [0.6036]	2.7828*** [0.3992]	2.1361*** [0.4425]	3.0347*** [0.3702]
HHI^2	-1,0396 [0.6414]	-1.8954*** [0.3293]	-0,1985 [0.5092]	-1.9213*** [0.3699]	-0,6093 [0.4668]	-1.7919*** [0.3863]	-0,8067 [0.5699]	-1.7446*** [0.3394]	-0,913 [0.5632]	-1.8567*** [0.3312]
Import Penetration	-0.7455*** [0.1002]	-0.7809*** [0.2140]			-0.7617*** [0.1083]	-0.5862*** [0.2122]	-0.7244*** [0.1025]	-0.7477*** [0.2141]	-0.6798*** [0.0988]	-0.7737*** [0.2140]
FDI	0.5794*** [0.0888]	0.4206*** [0.0743]					0.5849*** [0.0914]	0.4279*** [0.0741]	0.5786*** [0.0858]	0.4097*** [0.0750]
trend*HHI							0.2240* [0.1206]	0.0620* [0.0357]		
(ln L-ln K)^2									0.1314*** [0.0246]	0,0182 [0.0172]
Constant	4.3207*** [0.2982]	4.6666*** [0.4862]	2.9671*** [0.2833]	4.8216*** [0.3559]	4.0536*** [0.3239]	5.5854*** [0.4980]	4.4407*** [0.2862]	4.7062*** [0.4851]	6.6412*** [0.4967]	5.0098*** [0.5840]
Observations	393	393	502	502	464	464	393	393	393	393
R-squared	0,91	0,83	0,89	0,71	0,9	0,74	0,91	0,83	0,91	0,83
Number of nace		84		102		94		84		84

Robust standard errors in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%

Source: Data CSO

The trend variable picks up the effect of growth in all industries through the time. In our analysis the trend variable is positive and significant across all specifications. It could be explained by the movement of the Czech manufacturing, and the economy in general, toward the production and technological frontier. In one of the specifications of the model (Table 14, column 8) we include an interaction term between trend and the HHI. The coefficient in front is positive and significant at 10% significance, which indicates that the more concentrated the industry, the higher total factor productivity (i.e. more concentrated industries are growing faster with time).

The coefficient in front of the import penetration is negative and highly significant under all specifications. That might underline the fact that Czech companies which operate in manufacturing industries are not catching up with their foreign rivals, and the gap is widening. This contradicts the idea (and hope) at the beginning of the transition period that the presence of

and competition with foreign companies would make Czech companies more efficient through the technology and skills spillovers.

We could argue that there is a certain number of industries that are not attractive for foreign investors to acquire and to move the production to the Czech Republic and it could be explained by various reasons. Certain markets in Czech Republic are not big enough to have production facilities in the country and it is much more profitable to keep the production in other countries, say in Germany, and export goods to Czech Republic so such industries could be described by a high import penetration rate. Another reason could be that Czech Republic might not possess comparative advantages in some industries and the production facilities are located in neighbouring transition countries as Poland, Slovakia, or Hungary. In this case again the products of these industries will be imported to the Czech Republic.

As it was expected and well documented in the literature on transition economies the industries with high share of foreign direct investments are performing significantly better than domestic ones. The coefficient in front of FDI is positive and significant under all specifications of the model. This could be explained by the inside-the-multinational-firms transfer of the up-to-date technology, better access to financial resources and the application of the best managerial practices.

However, we could be suspicious of the quadratic term in our model. The quadratic term is sensitive to extreme observations and the significance of the coefficient in front of quadratic term could be accidental and spurious. Thus we will conduct a robustness check of our non-linearity hypothesis by creating dummies for different level of the HHI and then run regressions with interaction terms between dummies and HHI. It will allow us to estimate the difference in slopes for industries with different concentration levels (for example, with high and low levels of concentration) and to check whether the slope of the line becomes flatter as concentration increases.

We can split the sample in many ways but all of them are arbitrary. Here we present two possible segmentations of industries according to the

concentration level. The first segmentation follows the US Department of Justice. According to the Horizontal Merger Guidelines[36], the spectrum of market concentration as measured by the HHI is divided into three regions that can be broadly characterized as non-concentrated (HHI below 1000), moderately concentrated (HHI between 1000 and 1800), and highly concentrated (HHI above 1800). In the second case we split industries into two segments: non-concentrated (HHI is below 1000) and concentrated (HHI is above 1000).

We test for significance of the total difference between industries with different level of concentration (none, medium, and high in the first case and concentrated and not concentrated in the second case). We predict that if the non-linear model is valid then the coefficient in front of the interaction term of the non-concentrated industries (HHI is below 1000) will be positive and greater than the coefficient(s) in front of the term for the concentrated industries (medium and highly concentrated industries).

In Table 15 and 16 we can see the results of the estimations and the support for the non-linear model. The coefficients in front of the interaction terms are significant and there is a change in slope for different levels of concentration. In the case of three different levels of concentration, the value of the coefficient for the non-concentrated industries is 1.6039, but then it decreases for medium and highly concentrated industries (0.877 and 1.1048, respectively). This decrease shows the increasing diminishing return of performance to the level of concentration. The same evidence of the non-linearity we can observe in the case of two-segment concentration with the value of the coefficient 1.8962 for the non-concentrated industries and the decrease in the coefficient value to 1.1405 for the concentrated industries with HHI above 1000. Therefore, both checks support the idea of the increasing non-linear diminishing relationship between the level of concentration and the performance of Czech manufacturing industries.

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[36] US Department of Justice Horizontal Merger
Guidelines:http://www.usdoj.gov/atr/public/guidelines/hmg.htm

Table 15: Regression with dummies for not concentrated, mid-concentrated, and highly concentrated markets. Dependent variable: ln Sales

	1 OLS	2 FE
ln L	0.7480***	1.1449***
	[0.0442]	[0.0533]
ln K	0.3256***	0.0599***
	[0.0379]	[0.0212]
trend	0.0954***	0.0979***
	[0.0156]	[0.0078]
HHInot	1.2794	1.6039***
	[0.9805]	[0.5694]
HHImid	1.8643***	0.8770***
	[0.5848]	[0.3327]
HHIhigh	1.6287***	1.1048***
	[0.2359]	[0.1672]
Import Penetration	-0.7300***	-0.9718***
	[0.0942]	[0.2222]
FDI	0.5797***	0.4873***
	[0.0875]	[0.0769]
Constant	4.4432***	4.7909***
	[0.3370]	[0.5103]
Observations	393	393
R-squared	0.9	0.81
Number of nace		84

Robust standard errors in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%

Source: Data CSO

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Table 16: Regression with dummies for low and high concentrated industries

	1 OLS	2 FE
ln L	0.7474***	1.1443***
	[0.0441]	[0.0533]
ln K	0.3242***	0.0599***
	[0.0370]	[0.0212]
trend	0.0947***	0.0987***
	[0.0155]	[0.0078]
HHI low	0.9921	1.8962***
	[0.8411]	[0.4694]
HHI high	1.6001***	1.1405***
	[0.2290]	[0.1625]
Import Penetration	-0.7264***	-0.9841***
	[0.0948]	[0.2217]
FDI	0.5782***	0.4873***
	[0.0877]	[0.0769]
Constant	4.4857***	4.7823***
	[0.3135]	[0.5101]
Observations	393	393
R-squared	0.9	0.81
Number of nace		84

Robust standard errors in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%

Source: Data CSO

According to our analysis Czech manufacturing industries with high concentration performed better than industries with fragmented market structures during 1998-2002. It could be explained by the fact that Czech economy is a small economy. In many markets firms must reach competitive scales of production, advertisement and R&D in order to be competitive, which requires increasing market concentration. As long as there exist potential competition and no major barriers to entry exist, firms in concentrated markets can be efficient Schumpeterian theory of creative destruction claims that monopoly profit extracted from the dominant position creates enough financial resources and incentives to innovate, which in its turn leads to more efficient production and better performance.

Our analysis finds that industries with high import penetration are declining. It shows that Czech firms did not withstand import competition

because numerous Czech markets are too small to have efficient domestic production facilities. At the same time our analysis confirmed that industries with high share of foreign direct investment are the growing industries. However, we cannot claim the causality between competition and performance, but we can only claim that there is a significant relationship between level of concentration and performance of industries as well as between foreign involvement in the Czech economy and performance of industries during the investigated 5 years period.

4. Innovation and market structure

Economists agree that new technologies are a source of a large share of productivity growth. Less consensus however exists as for link between market structure and innovation. In the economic literature there are in general two traditional theories on relationship between market structures and ability to generate innovation which however come to diverse results: first is attributed to J. Schumpeter (1942) and second to K. Arrow (1962). While J. Schumpeter (1942) considered large enterprises and monopoly to be an engine of technological progress, K. Arrow (1962) concludes that a firm in a competitive industry has a greater incentive to invest in research and development (R&D) than does a monopolist. Schumpeter argued that large firms are the main source of R&D as they have more resources to invest than small firms as capital markets are imperfect especially as for investment into R&D, in other words Schumpeterian theory claims that monopoly profit extracted from the dominant position creates enough financial resources and incentives to innovate, which in its turn leads to more efficient production and better performance.

The above traditional theories however are based on different assumptions that determine predictions of these models about the relationship between competition and innovation. The assumptions include whether patent laws and intellectual property rights provide perfect protection for innovators, whether the innovation creates a new product or lowers the cost of an existing product (process versus product innovation)[37], or whether the firms in industry are heterogeneous or homogenous as for cost efficiency.

Arrowian theory that works with an assumption that a monopolist is perfectly protected from competition by innovation and firms are homogenous, hence a pure monopoly is unexposed to competition for existing and new technologies and has less incentive to invest in R&D than

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[37] Via innovation, firms can either shift the demand curves of their products to the right by providing superior quality of their products (product innovation) or firms can reduce their average cost of production (process innovation).

does a firm in a competitive industry. A firm that has a monopoly position in a market has a flow of profit that it enjoys if no innovation takes place. The monopolist can increase its profit by innovating, but it loses the profits from its old technology. On net the monopolist gains only the increment to its profits but firm in a competitive environment, a firm will have the possibility to make profit from the original zero level when adopting the new technology. This reduction in incentives of a monopolist as compared to a competitive firm is known as the Arrow's "replacement effect".

Schumpeterian theory which assumes firm's heterogeneity and no patent protection claims that monopoly profit extracted from the dominant position creates both - financial resources as well as incentives to innovate, which in its turn leads to more efficient production and performance. Gilbert and Newbery (1982) predict based on an auction model of R&D that incumbent monopolists may have stronger incentive to innovate than potential entrants because total industry profits would decrease when new firm enters the market. This "efficiency effect" can be pre-empted (internalized) by a monopolist but will be ignored by the new entrant. As a result monopolist may innovate more and monopoly structure of an industry may be maintained. This however will be truth mainly in case of gradual but not drastic innovations.[38]

Not only theoretical literature but also empirical research give ambiguous evidence on the link between market structure and private spending of firms on innovation. There exist number of studies that analyze this link.[39] These studies however use various measures used in the empirical studies for measuring innovation activity. The measures can be divided into measures of inputs (the most frequent being R&D expenditures or employement in R&D) and measures of outputs (most often number of

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[38] Gradual innovation does not replace the existing product and the new product is sold parallel with the old one. In case of drastic innovation, the old product seases to be produced and its life cycle is terminated.
[39] For a survey of the relationship between R&D and market concentration see Kamien and Schwartz (1975) or Cohen and Levin (1989) for a good overview of older studies. A review of recent empirical studies in the manufacturing sector can be found in Becheikh, Landry and Amara (2006).

patents firms acquire or number of inventions). All measures have some advantages and disadvantages, all have some difficulties. R&D expenditures is often not reported by many firms. It is an input which assumes an output in the form of innovation. R&D expenditures are often allocated in an arbitrary way in firm accounts. Patents are not always implemented and many innovations are not patented. (see more for instance Griliches, 1990).

When explaining the results of empirical studies regarding innovation one should always consider the source of data, quality of data and method of measurement of innovation as differences in data can imply different results. The results might differ not only with quality of data but also with the historical period of time. (Klepper, 1996) Being aware of all these problems with the empirical analysis we carried out regression analysis based on our firm data aiming to provide an answer related to the following questions: Is there any systematic relation between size of the firm and R&D activity ? What are the determinant of R&D activity ?

4.1 Data description, empirical models, and the results of the analysis

In our analysis we use assume that human capital and intellectual asset is an important determinant of the generation of innovation and growth. Therefore one of the main variables of the analyses deals with employment in R&D (R&DL).[40] Second variable used in our analysis to capture innovation are long-term intangible assets (ITA). These are expenses on results of R&D, licences, software, patents, goodwill or know-how of a firm. Both variables are recorded by accounting of the firms in the form P5-01 and can be related to other individual firm's indicators recorded by the form P5-01. This is a unique source of information which secures the highest possible representativeness. In addition this data set allows to identify foreign firms, firms that are controlled by foreign owner as a result of foreign direct investment (FDI).

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[40] According to Czech Statistical Office (CSO), number of R&D employees in the business sector in 2006 were 24 thousand employees. The database which we use for regressions covers majority of R&D employees 18,5 thousand. The rest are researchers, engineers and scientists working at universities and financial institutions which are not in the database.

Table 17 describes the firm data. From the original data basis firms with zero sales have been removed and only firms with 9 and more employees have been included into the analysis. In the next step we created balanced panel data that include firms that were active on the market since 1998 throughout to 2006. It follows from the Table that R&D personnel have been growing between 2002 and 2006 by more than 10% and so did the average size of the team of researchers per firm.

Table 17: Number of firms 2002 and 2006

CSO Form P5-01	2002	2006
Number of reporting firms	55917	60358
firms with 9 and more employees	29082	28784
firms after cleaning the firm data (with non zero sales)	19545	18102
o/w panel data firms active during the period 1998-2006	5128	5128
o/w firms represented during the period 1998-2006 with R&D	708	708
Number of employees in R&D	16659	18587
Average number of R&D employees in firms with R&D	16,7	18,5

Source: Data CSO

Most of firms with R&D employment is concentrated in manufacturing in the Czech Republic. There is relatively high R&D employment in computer related activities and services (NACE 72) and research and experimental development on sciences and engineering (NACE 73). However there are no comparative indicators available as for output hence firms of these industries were removed from the analysis. In the rest of non-manufacturing industries, there is negligible representation of firms with R&D employees. In the Appendix IV R&D intensity by R&D employment in 3digit manufacturing industries is presented. R&D intensity is extremaly different according to industries. Highest R&D employment share in total employees of the industry can be find in industrial process control equipment (20%), aircraft and spacecraft (9%), phone and transmitter apparatus (8%), TV, radio, video, pharmaceuticals and motor and vehicles (5%). These industries are called high-tech industries.

In addition to R&D employement or intangibles, foreign direct investment is expected to be a chanel of new technologies. Therefore

penetration in the domestic markets as well as export performance of domestic firms is being analyzed among the determinants of innovation activities of firms. In most of these industries which record high R&D employement intensity, there is also large share of output produced by firms controlled by foreign firms but not always. There are several industries in which 70% and more of sales is produced by foreign firms (beverages, tobacco, textile fibres, printing, man-made fibres, iron, cement, tiles) but R&D is zero or negligible. Appendix IV provides the details.

As the table in the Appendix IV indicate, both – R&D intensity as well as FDI penetration is significantly diverse by industry. Firm's incentive to invest into R&D is determined not only by market structure – competition or monopoly – but also by the possibility to appropriate the profit from this investment which can differ significantly by industries and which we cannot infer from firm data.

Table 18: Size distribution of enterprises and manufacturing enterprises with R&D employees, Czech Republic, in 2006

Size of enterprise by number of empl.	Number of all enterprises	Number of enterprises with R&D employees	Share of enterprises with R&D empl.	Average size of the research team	Share of R&D empl. on total number of empl. Of the firm
9-49	1711	109	6.30%	6	19.40%
50-249	2569	340	13.20%	10	7.80%
250-499	492	118	24.00%	16	4.50%
499+	356	141	39.60%	47	3.00%

Source: Data CSO, enterprises with 9 and more enterprises

Out of all firms in our panel, 14% of firms have R&D personnel; however the share of firms with R&D differs according to the size of the firm. Almost 40% of all large firms have research department, the smaller the firm, the less frequent the firm has a research team. Most small firms have no formal R&D personnel. Innovation activity is often performed as a part of the working time of firm's engineers and managers. In absolute terms most firms with researchers are medium size (50-249 employees). Within firms with R&D employees, highest intensity can be found among small firm (up to 49 employees), in which almost of one fifth of all employees are researchers as compared to the mere 3%-4.5% in case of large firms.

We tested three models with fixed effects. First model attempts to answer the question if there exists any systematic relation between size of the firm and R&D activity, hence it tests the Schumpeter's hypothesis that large enterprises are engines of innovation and technology progress. Two remaining models search for the answer on the question what are the determinants of R&D activity. These two models differ as for dependent variable that measures innovation activity: R&D personnel and intangible assets. Our hypothesis to be tested by these two empirical models is that competition is an important determinant of R&D activity of firms. We assume that competition is important because it forces firms to pursue efficiency of the production of existing products and innovation in developing new products.

$$S = b_0 + b_1 K + b_{2l} ITA + b_3 L + b_4 FDI + b_5 R\&DL^2 + \mu \qquad (4.1)$$

$$R\&DL^2 = b_0 + b_1 K + b_2 ITA + b_3 L + b_4 FDI + b_5 HHI^2 + b_6 S + \mu \qquad (4.2)$$

$$ITA = b_0 + b_1 K + b_2 LI + b_3 L + b_4 R\&DL^2 + b_5 S + \mu \qquad (4.3)$$

Size of the firm is measured by sales (S) and is explained by nontangible assets (NTA), R&D employment (R&DL) and foreign ownership of firm (FDI). R&D activity is expressed in R&D employment and intangible assets (ITA). Competition is measured by Herfindahl-Hirschmann index (HHI). Number of rivals and their relative sizes can play a certain role in competition however other factors are also important such as product differentiation and the existing entry barriers. For this reasons we attempted to measure competition in other way than by number of rivals, their size or market concentration and used an alternative measure of competition - Lerner index (LI). Lerner index was computed as revenues minus cost divided by revenues on the firm level (R-C/R). Other firm lever varibles used in the models are capital (K) which is the basic capital of the firm and total number of employees in the firm (L). Because of internalization, foreign penetration in the domestic markets is included among the determinants of innovation activities of firms and FDI is dummy for foreign ownership of the firm. Next table shows the summary of statistics for enterprises

Table 19: Descriptive statistics

Variable	Obs.	Mean	Stnd. Dev.	Min.	Max.
NTA	10256	11377.9	1171.65	-111136	9.08E+06
HHI	10256	625.5	10.17	17	10000
LI	10256	0	0	0	0.802
R&DL	10256	2.3	0.24	0	1420
S	10256	498814	30811.4	2057	1.88E+08
FDI	10256	0.2	0	0	1
L	10256	191.2	5.14	10	23211
K	10256	132539	10087.6	27	5.92E+07

Source: Data CSO

Table 20: Results of the regressions

	(1) S Fixed effect		(2) R&DL^2 Fixed effect		(3) NTA Fixed effect	
FDI	411778.7		-826.5076			
	80745.32	***	463.4033	*		
NTA	1.547069		0.0026502			
	0.1626665	***	0.000939	**		
K	0.8130585		-0.000388		0.0102659	
	0.0134567	***	0.0001007	***	0.0014943	***
S			0.0015799		0.0112395	
			0.0000769	***	0.001176	***
L	1711.772		2.525803		42.72231	
	88.42882	***	0.5235033	***	7.770925	***
HHI						
HHI2			-0.0000777			
			0.0000201	***		
LI					39502.25	
					20954.01	*
R&DL^2	48.36361				0.5973088	
	2.341171	***			0.2071603	**
Const.	-145014.9		-357.016		6732.303	
	23938.09	***	140.0963	**	1807.634	***
R^2	0.53	***	0.13	***	0.10	***

P-value * ≤ 0.1, ** ≤ 0.05, *** ≤ 0.001

Source: Data CSO

Several tentative conclusions emerged from the analysis. First, it follows from the regression analysis that between size and R&D activity of firms exists a positive relationship which however is not linear as indicates the positive and significant coefficient in front of $R\&DL^2$ explanatory variable. There exist counterarguments that may cause that the evidence on the relationship between size and innovation is not linear. On one hand several arguments can be offered to explain positive effect of firm size in R&D activity of firm, the strongest being "deep pocket" arguments which claims that due to capital market imperfections, large firms have advantage in securing financing of R&D projects as they can more easily use internally generated funds in comparison with small firms. Second argument is that there exist economies of scale of R&D expenditures. In addition large firms can have lower average cost due to the dissolution of fixed costs of innovation over larger volume of products. Furthermore R&D can be more productive in large firms as a result of complementarities between R&D activity and other activities such as marketing. On the other hand there exist counterarguments: in large firms incentives of managers for risky R&D projects can be undermined. In addition incentives of scientist and researchers in large firms can be diminished as they are not able to capture benefit from their inventions due to the bureaucratization of inventive activity.

Some previous empirical studies found a positive relationship between industry R&D intensity and firm size (Horowitz, 1962 or Comanor, 1967). Other studies found no evidence of such a relationship (Mansfield 1964). Scherer (1965) who studied relationship between firm size and R&D personnel concludes that inventive activity measured by input (R&D personnel) or outputs (patents) increased more than proportionally with firm size up to a certain point after which the relationship was either negative or did not exist.

There exists also methodological problem related to the studies of the relationship between size of the firm and innovation activity of the firm. In most studies there is emphasis on a one-way direction of causality – from a firm size to R&D activity. The link however works in both directions – firms

which innovate grow and became large. It is clear that endogeneity of firm size should not be neglected in the research.

As for relation of innovation activity and competition our results indicate that between R&D employment and market concentration exists negative relationship. If market concentration is a measure of competition in a sense that high market concentration means high market power and low competition, we can conclude that innovation is related to competition environment. In the model where dependent variable were intangibles and competition measured by LI, it can be also concluded that innovation are generated in an competitive environment. Our resultcorrespond with the study of Williamson (1965) or Acs and Audretsch (1988) who found that the number of innovations is negatively related to concentration. Similarly Geroski (1990) used panel data to show that concentration reduces the innovation rate. Other studies however that examined the relationship between market concentration and R&D found a positive relationship (Horowitz 1962 or Mansfield 1968). Scherer (1967) found evidence of a non-linear, "inverted-U" relationship between R&D intensity and market concentration. Scherer used data from the Census of Population and found that R&D employment as a share of total employments increased with industry concentration up to a four-firm concentration ration between 50 and 55% and declined with concentration thereafter. His work was replicated by Levin et. al (1985) and others with same results.

An increase in competition has two contradictory effects on managerial incentives. Competition increases the probability of firm's bankruptcy, which has a positive effect on managerial effort in order to avoid bankruptcy, but competition also reduces the firm's profits and has thus a negative effect. Therefore R&D investment and efforts to reduce costs are predicted to peak at some intermediate level of market concentration (and competition). Result of these effects is a relationship between innovation and competition that has an "inverted-U" shape. (Compare Gilbert 2006).

Most recent studies consider opening of markets and their globalization and examine the determinants of innovation including FDI and foreign trade. The ambiguity of results however seems to be maintained. Thus some studies confirm that competition and innovation are positively correlated (Griffith, Harrison, and Simpson, 2006) or that there exist U-shaped relation between innovation and market concentration (Aghion et al. 2005 and 2006). Other studies however find that competition has a negative effect on innovation (Gorodnichenko, Svejnar, Terrell 2008).

Our results also showed that foreign firms are on average larger than domestic firms, there exist however negative relation between foreign ownership of the firm and number of R&D employees, in other words in comparison to domestic firms, foreign firms have less R&D employees. This result confirms the previous analysis of Srholec (2005) who used data from the third Community Innovation Survey (CIS) and studied effects of foreign ownership on research and development (R&D) activity found that foreign affiliates tend to engage less in internal R&D compared with domestic-owned firms.

As mentioned above, the empirical relationship between innovation and size of firm and market concentration is controversial from several reasons. First of all, there exists a reverse causality: firms, which are innovate, will grow and therefore have higher market shares. Furthermore, there exists unobserved heterogeneity of firms as for cost efficiency which is given by different technological opportunities. In addition, protection of intellectual property rights and cost of imitation that firms have to face as well as conditions of appropriability of the returns from innovations differ with the industry. We believe that there exists space for future research in the area of competition in dynamic markets.

4.2 Competition policy and innovation

There are important policy implications depending on the answer of the examined questions in the previous analysis. As the role of innovation in competitiveness is curtial, a number of policymakers argues that antitrust laws should be relaxed as the short-run gains from price competition are

offset in the long term by a slower rate of technological progress (Symeonidis 1996). Such view would be justified if there would proved clear effect of firm size or market concentration on innovation what however is not the case. Economic analysis of dynamic markets is more complex and yields a richer depiction of competition, than that of static markets (Audretsch, Baumol and Burke 2001).

The unambiguity of the relation between innovation and market structure is the reason why competition policy is lenient toward cooperation between firms in R&D and innovation activities. Competition policy is also benevolent in case of mergers or dominant firm strategies if R&D is involved. Merger of companies that would otherwise be blocked can be approved based on the argument of economies of scale in R&D, or lessening of potential for wasteful R&D spending as firms may duplicate R&D spending in competition.

Lenient "competition" policy is supposed to allow firms to create a competitive advantage and strengthen the position in the world markets. It assumes that allowing for cooperation between firms large scale ventures will be created, firms would be able to adapt, catch-up in certain areas of research and then will be capable to compete on the global markets. The expected result of such attitude is promotion and proliferation of innovation, increased economic progress and growth, of firms, industries and the whole economy. Softer approach to R&D mergers, firm strategies and exemption from the cartel agreement ban is because more positive externalities are automatically expected in case of R&D activities. These arguments are however not that straightforward from the economic point of view. The question if competition or cooperation is an important determinant of firm's R&D is relevant for enforcement of competition laws.

As the empirical evidence shows, it cannot be automatically assumed that there will be more innovation output if there is more R&D expenditures – this however might not be truth. The positive relation might work only to a certain point which might be different according to industries. Research joint ventures (RVJ) and co-operation between firms is expected to internalize

externalities and utilise R&D economies of scale. In reality this might not be truth. Firms that may wish to cooperate on R&D efforts can at the same time wish to eliminate competition. R&D cartel behaves as any other cartel and may endeavour to limit competition. Firms may engage in spending so much on R&D that it will deter rivals from R&D competition. As R&D and innovation becomes in many industries a key instrument to competition, it can be also misused. Firms can engage in pre-emptive innovation or patenting in order to create barrier to enter the market or firms may engage in spending so much on R&D that it will deter rivals from R&D competition. The issue of diagnosing anti-competitive conduct in innovative industries can be complex because of large uncertainty, network effects in demand, multi-product supply conditions, and high fixed-to-variable cost ratios.

During last decade this aspect of competition policy is more intensively discussed in relation with development of information and communication technologies (ICT) and dynamic markets where product differentiation is accelerated and firms' market share and domination is frequently changing. Innovation becomes in these industries a key instrument to competition. Competitive process means innovation, new technologies and finding opportunities for profit. F. Hayek (2002) regarded competition as a discovery procedure which compensated for the limits of knowledge, not as an end in itself. He wrote: „competition is important only because and insofar as its outcomes are unpredictable and on the whole different from those that anyone would have been able to consciously strive for" (p.10).

Bigger enterprises and, consequently, more concentrated industries have easier access to the capital, and large enterprises might be stronger in negotiation of state subsidies and different investment incentives. In general, the competition laws should not only constrain strategies available to firms to those contributing to welfare but also constrain state activities discriminating between economic agents. (Audretsch D., Baumol W., Burke A., 2001)

In praxis competition authorities are normally very strict as for cartel agreements between firms or as for subsidies to enterprises. In case of R&D contracts, the enforcement of competition policy tends to be rather soft. The rational is that more positive externalities are expected in case of collusion in R&D activities but still as any other cartel agreement or collusion, there will be negative effects on competition. In high-tech industries with product differentiation, firms' market share and domination is frequently changing. Competitive strategies and competition are related not only to production process but also to pre-production stages (research and development). Innovations as an assumption for differentiation are key strategy in many markets. Innovation strategy is many industries the most important strategy in order to be first in the market or defend the position against competitors. Innovations in transportation and communication technology are continuously helping to remove barriers to entry to markets. In addition, industries that are highly concentrated in domestic terms alone are not concentrated or at least substantially less concentrated and more contestable in a global economy.[41]

Because of positive externalities and growth related to innovation, states tend to subsidize and support business R&D – that however can be classified as state aid to enterprises and in such cases the states can be a source of distortion of competition. (see more chapter 5). Therefore the Community framework for state aid for R&D and innovation requires balancing test of effects of public R&D expenditures.[42] Policy makers should improve the procedures for identifying socially productive R&D projects. An increase in the level of public spending on R&D must not have the expected effect on growth and employment but can have extensive negative effect on enterprise motivation for R&D. Also there exists a danger of public policies that aim at 'picking winners' instead to 'pick losers'. Not only bigger enterprises have easier access to the capital, bigger enterprises might be stronger in negotiation of state subsidies and different investment incentives - bigger companies have more political power to force the governments to grant subsidies.

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[41] Zemplinerova A. (2000)
[42] Community Framework for State Aid for Research and Development and Innovation (2006)

Effective government funding of science would require the government to have information or foresight that others do not, and cannot have. Government has to pay for R&D from the income from taxation. Hence taxation being high, the motivation for private R&D is lower. In addition, one has also to consider costs of intervention and administration of R&D funds. More importantly, government R&D activities – government R&D - can crowd out private R&D investment. In the past there was a consensus that fiscal stimulus would crowd *in* investment, recent empirical work however suggests that the government spending crowds *out* investment, so that spending might be less effective as a stimulus than a tax load decrease.[43]

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[43] Wallsten, S. (2000)

5. State aid to enterprises and competitiveness

Despite there exist significant discrepancies in estimates of the magnitude of state aid provided during transition in the Czech Republic, it can be concluded that state subsidies were relatively high in the Czech Republic during transformation and well above the EU level as well as above other accessing countries. This holds not only for the share of state subsidies on GDP but also as for share of the subsidies on value added in manufacturing in case of old EU members. Precise quantification of the provision of finance by the government to the commercial sector however is difficult from several reasons. Information on the amounts approved by government for a company or sector is often not public and there existed no systematic evidence and control of state aid provided. It can be estimated that only about 25 % of the total state aid were provided through state budget. Beside, quasi-fiscal operation through transformation institutions have been used frequently - about 46 % went through transformation institutions, the rest through National Property Fund and Czech National Bank. To trace the state aid is complicated by the fact that among the transformation institutions existed complicated and intransparent system of financial links. In the *Analysis of transformation costs during 1991-2004* a gross estimate of fiscal costs of transformation reaches 577,5 bn CZK, of which 370 bn CZK went to banking sector, 137 bn CZK to enterprise sector and rest to the households. State aid has been asymmetric not only across sectors but also over time in the Czech Republic.

Naturally state subsidies increase deficits of public budget and increase tax burden and thus decrease investment incentives. From the point of view of cost opportunity state aid to rescue and restructuring ment limitation for education, R&D, culture that are field where one can expect more positive externalities from state aid than into the commercial enterprises. But the major negative effect of state aid that it distorts signals for strategic decisions and changes strategic environment in a long-term.

Empirical analysis of impact of state subsidies on competitiveness of Czech manufacturing during 1998-2002 has shown that industries that are

competitive on domestic markets are different from industries that are competitive on EU markets. We found that competitiveness of industries on domestic market is positively related to the total amount of state subsidies and also to the total change of state subsidies. Similarly, competitiveness of industries on foreign market is negatively related to the total amount of state subsidies per employee and also to the total change of state subsidies per employee, so there exists systematical relationship between cumulative foreign competitiveness of manufacturing industries and governmental policy of subsidizing. In addition we found that larger and more competitive on domestic market industries receive more subsidies and larger (more competitive on foreign market) industries receive less subsidies per employee.

Finally it was proved, that there exists systematical relationship between evolution of domestic competitiveness and state subsidies: evolution of domestic competitiveness negatively relates to the total amount of state subsidies and also to the total change of state subsidies: Industries that receive subsidies do not improve domestic competitiveness.

5.1 Subsidies and the competitiveness of manufacturing industries

The aim of the following part is threefold: 1) to describe state subsidies to manufacturing industries as recorded by official statistics in the Czech Republic during the time period of years 1998-2002, 2) to identify competitive manufacturing industries on domestic and European market, and 3) to analyze if there exists relation between state subsidies and competitiveness.[44]

We first explain data and methodology, then we describe subsidies to manufacturing industries, hence the question to be answered is *who gets the subsidies and how much*? In the second step we *identify competitive and non-competitive industries on domestic and foreign markets*. In the core part we analyze the *effect of subsidies on competitiveness based on correlations* that we tested in the previous chapters based on cross-tabulations.

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[44] Note that this subchapter is an extended version of Zemplinerova and Panes (2008)

Our preliminary hypotheses were:

H (1) larger industries receive more subsidies
H (2) industries that receive subsidies do not improve competitiveness

We applied definition of competitiveness of A. Kubiak (2003), where competitiveness is defined as adjusted market share, where market is total manufacturing. Method of identification of successful and non-successful industries follows Hashi (2004) and Hashi, Hajdukovic (2005) respectively.

Industry competitiveness on domestic market
(share of industry output sold on domestic market on the total domestic demand)

$$c_d = (q-x)/(Q-X+M) \qquad\qquad (5.1)$$

    where
    q............................ sales of 3digit industry,
    x............................ export of 3digit industry,
    Q............................ total sales of all manufacturing industries,
    X............................ total export of manufacturing,
    M........................... total manufacturing import.

Industry competitiveness on the European market
(share of industry export to EU market on the total European demand)

$$c_{eu} = (x_{eu})/(Q_{EU}-X_{EU}+M_{EU}) \qquad\qquad (5.2)$$

    where
    x_{eu}......................... export of industry to EU market,
    Q_{EU}........................ total sales of all EU manufacturing industries,
    X_{EU}........................ total export of all EU manufacturing to outside of EU-15,
    M_{EU}........................ total import of all EU manufacturing from outside of EU-15.

Four sources of data are used, that are matched on 3digit level of NACE.
(1) *Output (Q,,q), exports(X,x)* and *number of employees (L,l)*. Individual enterprise data based on regular statistical reports (form P3-04 CSO) collected by the Czech Statistical Office. Quarterly data has been aggregated for yearly observations and data have been checked for inconsistencies. In case of each enterprise we were able to identify the economic activity of the firm on 3digit NACE for selected years and we aggregated enterprises into

101 industries that correspond with 3digit NACE. These are data cover manufacturing enterprises with 100 and more employees.

(2) *Subsidies (S, s)* are data on individual enterprises from regular statistical reports (form P5-01 CSO, row A039, account No. 41, so „subsidies and contributions from public budgets and other funds to own capital"). These data have been obtained from Ministry of industry and trade (MIT) to 3digit manufacturing NACE - cover enterprises with 100 and more employees and estimates for small enterprises.

(3) *Imports (M, m)*. Data on imports from foreign trade statistics, obtained from MIT in aggregation on 3-digit level.

(4) *Output of industry of EU15 (Q_{EU})*, data on total export of industry *(X_{EU})* and data on total imports of industry *(M_{EU})* of EU15 are Eurostat data (Comext for international trade and New Cronos for data on industrial branches). The same source have the data on total export of Czech manufacturing industry to the common market of EU15 *(x_{eu})*.

For the analysis of foreign competitiveness were available data for 89 industries of Czech manufacturing according to NACE, in the case of domestic competitiveness were used data for 94, respectively 90 industries of Czech manufacturing, for which complete relevant data were available.

In the analysis we focus on static indicators and dynamic indicators, which describe growth. Then indicators of c_d *98-99*, c_d *00-02* and c_d *98-02* represent indicators of change of competitiveness during the mentioned time periods (in percent points) and are dynamic indicator; on the other hand the indicator of *summa c_d 98-02* represents the sum of competitivenesses (it means so-called cumulative competitiveness) as of the mentioned time period and is therefore static indicator, which describes long-term size of the industries. The same applies for indicators of c_{eu}. In the case of indicators of state subsidies, the indicators of *s 98-99, s 00-02* and *s 98-02* represents static indicators, share of the industries on the total amount of state subsidies received during the mentioned time period. The indicator of *delta s 98-02* is dynamic and describes share of the industries on the total change of state subsidies during the mentioned time period.

Furthermore, the indicator of cumulative competitiveness is on principle sum of market shares as of time period of 1998-2002. Talking about big industries, we are mentioning industries with great share on the domestic market, respectively on the European market. Cumulative competitiveness describes five-year size of the industries. The same purpose as the cumulative competitiveness could be achieved by average annual competitiveness in the time period of 1998-2002, because from the point of view of Pearson correlation and Spearman correlation would be after the averaging of indicator the result of analysis completely unchanged.

First, analysis uses cross-tabulations to see if we can expect some systematical link between the variables (indicators of state subsidizing and competitiveness), later are calculated correlation coefficient to express expected relationships mathematically (not only between subsidies and competition, but also between domestic and foreign competitions themselves to ensure answering to all hypothesis formulated in the introduction). Meanwhile would be identified successful and unsuccessful industries on both, it means domestic and foreign market. Note, that used certain limit levels of indicators were defined to separate certain number of industries with so-called significant value of corresponding variable (and to show them in the corresponding table).

State subsidies to manufacturing industries

From the analysis of total amount of state subsidies provided to Czech manufacturing industry as for 3digit NACE in the year of 2002 results, that among biggest receivers of state subsidies belong (in descending order) industries of 155 (manufacture of dairy products), 159 (manufacture of beverages), 316 (manufacture of electrical equipment), 252 (manufacture of plastic products), 343 (manufacture of automotive parts), 312 (manufacture of electricity dist. and control apparatus), 352 (manufacture of rail and tram locomotives), 291 (manufacture of power-generating machinery, ex. transport), 151 (production, processing and preserving of meat), 156 (manufacture of grain mill products and starches) and 246 (manufacture of other chemical products).

Listing of subsidized industries confirms relationship with subsidizing of agriculture (in the connection of the Czech EU-entry in 2004 were some subsidies appointed for adaptation of mentioned industries to European hygienic or environmental regulations, but others were lobbed just in connection with agriculture). Because of transformation of central planned economy towards market economy is in the local context not surprising, that among long-term most subsidized industries belongs also industry of 271 (manufacture of basic iron, steel, and Fe-alloys). Specific for Czech Republic are probably also long-term large state subsidies for industry of 154 (manufacture of vegetable and animal oils and fats).

Table 21: Industries that received largest amount of subsidies in 2002 and amount of subsidies received by these industries in 1998-2002 (in %)

NACE	s 2002	s/l 2002	s 2002	s/l 2002
151	2.5	1.0	2.9	1.0
155	33.6	21.7	22.1	12.1
156	2.3	9.6	2.5	9.8
159	5.1	2.8	4.7	2.0
205	0.5	2.5	0.8	3.5
242	0.1	2.3	0.0	0.6
246	2.3	8.3	2.3	6.4
252	3.3	1.0	3.2	1.0
291	2.9	1.2	2.0	0.6
312	3.1	1.6	1.7	0.8
316	4.1	1.1	2.0	0.5
322	1.0	2.3	0.7	1.2
343	3.2	0.5	2.2	0.3
351	0.0	2.2	0.0	0.6
352	3.1	2.0	3.2	1.8
365	0.2	2.3	0.3	2.5

Source: CSO, own calculations, Exchange rates CZK/EUR – 1998: 36,17; 1999: 36,88; 2000: 35,60; 2001: 34,07; 2002: 30,80; average 1998-2002: 34,704.

In relative terms – as of indicator of subsidies per employee – among the most subsidized industries belong (descending) industries of 155 (manufacture of dairy products), 156 (manufacture of grain mill products and starches), 246 (manufacture of other chemical products), 159

(manufacture of beverages), 205 (manufacture of other wood products), 242 (manufacture of pesticides and agro-chemicals), 322 (manufacture of transmitter, phone and telegraph apparatus), 365 (manufacture of games and toys) and 351 (building and repairing of ships and boats). It follows, that among the most subsidized industries of Czech manufacturing according to both indicators (of total amount and amount per employee) are industries of 155 (manufacture of dairy products) and 159 (manufacture of beverages). From long-term view among industries with largest state subsidizes per employee belong also industries of 154 (manufacture of vegetable and animal oils and fats), 232 (manufacture of refined petroleum products) and 267 (cutting, shaping, and finishing of stone).

From the scope of whole time period of the years 1998-2002, only nine industries received more than 1 percent of state subsidies and more than 1 percent of state subsidies per employee, from which two industries received in both cases more than 3 percents – industries of 154 (manufacture of vegetable and animal oils and fats) and 155 (manufacture of dairy products). 17 industries received more than 1 percent of change of state subsidies in this time period and more than 1 percent of change of state subsidies per employee in the same period, from which two industries received in both cases more than 3 percents – industries of 155 (manufacture of dairy products) and 246 (manufacture of other chemical products).

Table 22: Industries with largest share on the total amount and total change of state subsidies (in %) and their competitiveness in this time period (in p.p.) during 1998-2002

NACE	c_d 98-02	summa c_d 98-02	c_{eu} 98-02	summa c_{eu} 98-02	s 98-02	delta s 98-02	s/l 98-02	delta s/l 98-02
154	-0.21	1.91	-0.02	0.32	5.50	0.40	11.60	1.10
155	-0.21	7.34	0.01	0.19	22.10	40.10	12.20	25.90
246	-0.08	0.29	0.08	0.65	2.30	3.50	6.40	12.00

Source: *Eurostat, CSO, MIT, own calculations*

Competitiveness on the domestic markets (c_d)

Success on domestic market – growth of competitiveness of more than 0,2 percent point – in both partial watched time periods, it means both in

years of 1998-1999 and 2000-2002 simultaneously, wasn't recorded by any industry. Analysis on the other hand revealed industry, which was in both this periods unsuccessful, in means that every time lost more than 0,2 percent point. It's industry of 341 (manufacture of motor vehicles). Three other industries recorded contradictory evolution on domestic market during mentioned time periods – in the first period recorded decline of competitiveness of more than 0,2 percent point, whereas in the second period recorded rise of competitiveness of similar rate. These are industries of 241 (manufacture of basic chemicals), 252 (manufacture of plastic products) and 271 (manufacture of basic iron, steel, and Fe-alloys).

As to relationship of these four industries with economic policy of subsidizing, it's interesting, that all three mentioned industries with markedly unbalanced evolution of domestic competitiveness in both watched time periods received more than 1 percent from total amount of state subsidies and also of total change of state subsidies in 1998-2002. It follows, that in the case of these three (and – how we'll see below – also big) industries came to growth of received state subsidies, which were already not small, and nevertheless came to fluctuation of their competitiveness on the domestic market so that during the time period was decline turned into growth. As of industry of 341 (manufacture of motor vehicles), which was during the whole time period declining, amount of state subsidies received by it wasn't reaching (neither in partial nor in whole time period) level of 1 percent of total amount of state subsidies. In the case of all four industries analyzed in this section point is that everyone are so-called big industries, it means industries, which cumulative competitiveness on domestic market reached level of 2 percent point.

Table 23: Competitiveness on domestic market – industries with greatest change of domestic competitiveness (in p.p.) and their share on the economic policy of subsidizing in time period of years 1998-2002 (in %)

NACE	c_d 98-99	c_d 00-02	c_d 98-02	summa c_d 98-02	s 98-99	s 00-02	s 98-02	delta s 98-02
241	-0.43	0.21	-0.67	8.13	1.60	1.00	1.10	2.50
252	-0.21	0.28	0.08	3.75	3.60	3.00	3.20	2.90
271	-1.12	0.71	-1.74	15.63	1.40	1.10	1.10	1.70
341	-0.37	-0.60	-0.74	5.95	0.50	0.40	0.40	0.70

Source: *CSO, MIT, own calculations*

Focusing on so-called big industries, it means industries, which on domestic market in the time period of years 1998-2002 reached cumulative competitiveness of more than 2 percent point, only one industry, which in addition in this period recorded growth of competitiveness of more than 0,2 percent point, was industry of 251 (manufacture of rubber products). This industry in the case of any indicator of economic policy of subsidizing did not reach stated limit level and therefore doesn't belong among significant targets of this economic policy.

In the case of declining industries, then among industries, which during the years of 1998-2002 lost more than 0,2 percent point of domestic competitiveness, belong industries of 151 (production, processing and preserving of meat), 155 (manufacture of dairy products), 172 (textile weaving), 211 (manufacture of pulp, paper, and paperboard), 241 (manufacture of basic chemicals), 271 (manufacture of basic iron, steel, and Fe-alloys), 295 (manufacture of other special-purpose machinery), 312 (manufacture of electricity dist. and control apparatus) and 341 (manufacture of motor vehicles). Three of them – industries of 151, 241 and 271 – lost more than 0,4 percent point and in addition belong among very big industries (recorded cumulative competitiveness of more than 6 percent points). Interesting is, that all three belong among great receivers of state subsidies (level of 1 percent passed in the cases of both time periods), which in addition during the watched time period their share on provided state subsidies increased (gained more than 1 percent of total change of state subsidies).

Table 24: Competitiveness on domestic market – industries with greatest cumulative domestic competitiveness (in p.p.) and their share on the economic policy of subsidizing in time period of years 1998-2002 (in %)

NACE	c_d 98-99	c_d 00-02	c_d 98-02	summa c_d 98-02	s 98-99	s 00-02	s 98-02	delta s 98-02
151	-0.12	0.01	-0.44	8.45	1.10	3.50	2.90	3.30
155	-0.13	0.20	-0.21	7.34	20.70	22.60	22.10	40.10
172	-0.06	-0.07	-0.27	2.27	0.20	0.40	0.40	0.10
211	-0.08	-0.09	-0.30	2.19	0.00	0.00	0.00	0.00
241	-0.43	0.21	-0.67	8.13	1.60	1.00	1.10	2.50
251	-0.13	0.56	0.41	2.07	0.10	0.40	0.40	0.60
271	-1.12	0.71	-1.74	15.63	1.40	1.10	1.10	1.70
295	-0.18	-0.16	-0.36	3.26	12.30	3.10	5.50	1.70
312	0.01	-0.08	-0.20	2.23	1.30	1.90	1.70	3.90
341	-0.37	-0.60	-0.74	5.95	0.50	0.40	0.40	0.70

Source: *CSO, MIT, own calculations*

Very important relationship is between evolution of domestic competitiveness and subsidizing. In the years of 1998-2002 gained more than 0,2 percent points of domestic competitiveness industries of 251 (manufacture of rubber products), 323 (manufacture of televisions, radios, video and audio recorders) and 332 (manufacture of measuring and navigating instruments). No one from these three industries belong among great receivers of state subsidies according to any indicator.

Otherwise in the case of unsuccessful industries on domestic market. From 17 industries, which during the watched time period of the years of 1998-2002 lost more than 0,2 percent point of domestic competitiveness, great part (nine) belong among so-called big industries, but also great part (also nine) belong among great receivers of state subsidies. From the most unsuccessful industries (it means industries, which lost more than 0,4 percent point) to the industries of 151, 241 and 271, which were described in the previous part, let us add also industry of 291 (manufacture of power-generating machinery, ex. transport). This industry belong among greatest receivers of state subsidies (according to all total (not per employee) indicators for every time periods).

Table 25: Competitiveness on domestic market – industries with greatest change of domestic competitiveness (in p.p.) and their share on the economic policy of subsidizing in time period of years 1998-2002 (in %)

NACE	c_d 98-99	c_d 00-02	c_d 98-02	summa c_d 98-02	s 98-99	s 00-02	s 98-02	delta s 98-02
151	-0.12	0.01	-0.44	8.45	1.10	3.50	2.90	3.30
241	-0.43	0.21	-0.67	8.13	1.60	1.00	1.10	2.50
251	-0.13	0.56	0.41	2.07	0.10	0.40	0.40	0.60
271	-1.12	0.71	-1.74	15.63	1.40	1.10	1.10	1.70
291	-0.24	-0.14	-0.41	1.37	1.40	2.10	2.00	3.50
323	0.00	0.10	0.24	0.87	0.50	0.30	0.30	0.00
332	0.04	0.24	0.24	1.12	0.70	0.50	0.60	-0.30
341	-0.37	-0.60	-0.74	5.95	0.50	0.40	0.40	0.70

Source: *CSO, MIT, own calculations*

Among so-called big industries, it means industries, which in the time period of 1998-2002 reached cumulative competitiveness of more than 2 percent point, belong 22 industries. Thirteen of them belong among great receivers of state subsidies (in the sense of received minimally 1 percent of total amount of state subsidies, if we'll focus on received minimally 1 percent of total change of state subsidies, than this criteria will pass ten industries). Relationship of these two indicators (cumulative competitiveness and subsidizing) is evident (by the way hereinafter will be approved by correlation coefficients). Industries of 155 (manufacture of dairy products) and 159 (manufacture of beverages) belong among very big industries (as of cumulative competitiveness) and simultaneously among greatest receivers (as of share on total amount of state subsidies in years of 1998-2002 and on total change of state subsidies in this time period).

Table 26: Competitiveness on domestic market – industries with greatest cumulative domestic competitiveness (in p.p.) and their share on the economic policy of subsidizing in time period of years 1998-2002 (in %)

NACE	c_d 98-99	c_d 00-02	c_d 98-02	summa c_d 98-02	s 98-99	s 00-02	s 98-02	delta s 98-02
155	-0,13	0,20	-0,21	7,34	20,7	22,6	22,1	40,1
159	0,04	0,20	-0,07	8,10	6,2	4,2	4,7	3,5

Source: *CSO, MIT, own calculations*

Competitiveness on the EU market (c_{eu})

Success on foreign market – growth of competitiveness of more than 0,2 percent point – in both partial watched time periods, it means both in years of 1998-1999 and 2000-2002 simultaneously, was recorded by industries of 313 (manufacture of insulated wire and cable), 343 (manufacture of automotive parts) and 355 (manufacture of other transport equipment). All three industries belong among so-called big, it means industries, which cumulative competitiveness on foreign market reached level of 2 percent point. Industry of 343 (manufacture of automotive parts) received more than 1 percent of total amount of state subsidies also of total change of state subsidies in 1998-2002. More than 1 percent of total change of state subsidies was received also by industry of 313 (manufacture of insulated wire and cable).

Analysis on the other hand revealed industries, which were in both this periods unsuccessful, in means that every time lost more than 0,2 percent point. These are industries of 183 (dressing, dyeing, and manufacture of fur) and 363 (manufacture of musical instruments). These two industries belong also among so-called big, but no one from this industries reached limit level in the case of any indicator of economic policy of subsidizing (neither total subsidies nor subsidies per employee).

Other industries recorded contradictory evolution on domestic market during mentioned time periods – in the first period recorded decline of competitiveness of more than 0,2 percent point, whereas in the second period recorded rise of competitiveness of similar rate. It's industry of 311 (manufacture of electric motors, generators, transformers). Precisely contradictory evolution was recorded by two other industries, which after the beginning growth of competitiveness in the second period part of its competitiveness lost. These are industries of 231 (manufacture of coke oven products) and 352 (manufacture of rail and tram locomotives). All three industries belong among so-called big and on the European market recorded cumulative competitiveness of more than 2 percent point (all passed level of 6 percent point). While industry of 231 (manufacture of coke oven products)

did not reached in the case of any indicator of economic policy of subsidizing limit level and therefore couldn't be pointed out as a significant receiver of state subsidies, industries of 352 (manufacture of rail and tram locomotives) and 311 (manufacture of electric motors, generators, transformers) among the significant receivers belong.

Table 27: Competitiveness on foreign market – industries with greatest change of foreign competitiveness (in p.p.) and their share on the economic policy of subsidizing in time period of years 1998-2002 (in %)

NACE	c_{eu} 98-99	c_{eu} 00-02	c_{eu} 98-02	summa c_{eu} 98-02	s 98-99	s 00-02	s 98-02	delta s 98-02
183	-0.40	-0.26	-0.16	4.62	0.10	0.10	0.10	0.00
231	2.29	-0.54	-0.47	40.93	0.00	0.00	0.00	0.00
311	-0.36	0.24	0.03	7.43	1.30	1.40	1.40	0.90
313	0.46	0.57	0.92	6.92	0.80	1.00	0.90	1.40
343	0.22	0.51	0.94	6.33	0.30	2.80	2.20	4.60
352	0.28	-0.36	-0.01	6.14	5.90	2.20	3.20	-0.40
355	0.30	0.33	0.34	4.34	0.00	0.00	0.00	0.00
363	-0.21	-0.23	0.01	9.44	0.00	0.00	0.00	0.10

Source*: Eurostat, CSO, own calculations*

Focusing on so-called big industries, it means industries, which on foreign market in the time period of years 1998-2002 reached cumulative competitiveness of more than 2 percent point, then industries, which in addition in this period recorded growth of competitiveness of more than 0,2 percent point, were 25. If we constrict the selection on cumulative competitiveness over 6 percent point, then these industries are 172 (textile weaving), 313 (manufacture of insulated wire and cable), 314 (manufacture of accumulators, primary cells and batteries) and 343 (manufacture of automotive parts). Industries of 172 and 314 in the case of any indicator of economic policy of subsidizing did not reach stated limit level and therefore don't belong among significant targets of this economic policy. On the other hand industry of 313 received more than 1 percent of total change of state subsidies (so per employee) and industry 343 belongs among greatest receivers of state subsidies because of more than 1 percent of total amount of state subsidies and of total change of state subsidies received.

In the case of declining industries, then among industries, which during the years of 1998-2002 lost more than 0,2 percent point of foreign competitiveness, belongs only industry of 231 (manufacture of coke oven products). It lost more than 0,4 percent point and in addition belongs among very big industries because of reached cumulative competitiveness of more than 6 percent points. In the case of any indicator of economic policy of subsidizing (neither total, nor per employee) doesn't belong among great receivers of state subsidies, because didn't reach stated critical level in any case.

Table 28: Competitiveness on foreign market – industries with greatest cumulative foreign competitiveness (in p.p.) and their share on the economic policy of subsidizing in time period of years 1998-2002 (in %)

NACE	c_{eu} 98-99	c_{eu} 00-02	c_{eu} 98-02	summa c_{eu} 98-02	s 98-99	s 00-02	s 98-02	delta s 98-02
172	0,02	0,37	0,75	8,05	0,2	0,4	0,4	0,1
231	2,29	-0,54	-0,47	40,93	0,0	0,0	0,0	0,0
313	0,46	0,57	0,92	6,92	0,8	1,0	0,9	1,4
314	0,63	-0,10	1,16	11,07	0,0	0,0	0,0	0,1
343	0,22	0,51	0,94	6,33	0,3	2,8	2,2	4,6

Source: *Eurostat, CSO, own calculations*

Very important relationship is between evolution of foreign competitiveness and subsidizing. In the years of 1998-2002 lost more than 0,2 percent points of domestic competitiveness industries of 231 (manufacture of coke oven products) and 265 (manufacture of cement, lime, plaster). No one from these two industries belong among great receivers of state subsidies according to any indicator (neither total nor per employee).

Otherwise in the case of successful industries on foreign market. From 29 industries, which during the watched time period of the years of 1998-2002 lost more than 0,2 percent point of foreign competitiveness, great part (25) belong among so-called big industries, but also significant part (eight) belong among great receivers of state subsidies. From the most successful industries (it means industries, which gained more than 0,4 percent point) to the industry of 343, which was described in the previous part, let us add also industries of 291 (manufacture of power-generating machinery, ex.

transport), 295 (manufacture of other special-purpose machinery), 312 (manufacture of electricity dist. and control apparatus) and 316 (manufacture of electrical equipment). These industries belong among greatest receivers of state subsidies (according to all total (not per employee) indicators for almost every time periods).

Table 29: Competitiveness on foreign market – industries with greatest change of foreign competitiveness (in p.p.) and their share on the economic policy of subsidizing in time period of years 1998-2002 (in %)

NACE	c_{eu} 98-99	c_{eu} 00-02	c_{eu} 98-02	summa c_{eu} 98-02	s 98-99	s 00-02	s 98-02	delta s 98-02
231	2.29	-0.54	-0.47	40.93	0.00	0.00	0.00	0.00
265	-0.01	-0.18	-0.23	1.35	0.10	0.00	0.00	0.00
291	0.10	0.45	0.63	4.05	1.40	2.10	2.00	3.50
295	0.01	0.30	0.50	4.04	12.30	3.10	5.50	1.70
312	0.05	0.20	0.41	3.71	1.30	1.90	1.70	3.90
316	0.09	0.54	0.84	5.56	0.60	2.50	2.00	6.10
343	0.22	0.51	0.94	6.33	0.30	2.80	2.20	4.60

Source*: Eurostat, CSO, own calculations*

Among so-called big industries, it means industries, which in the time period of 1998-2002 reached cumulative competitiveness of more than 2 percent point, belong 45 industries. Twelve of them belong among great receivers of state subsidies (in the sense of received minimally 1 percent of total amount of state subsidies, if we'll focus on received minimally 1 percent of total change of state subsidies, than this criteria will pass ten industries). Relationship of these two indicators (cumulative competitiveness and subsidizing) is evident (by the way hereinafter will be (in the case of subsidies per employee) approved by correlation coefficients). Industries of 311 (manufacture of electric motors, generators, transformers), 343 (manufacture of automotive parts) and 352 (manufacture of rail and tram locomotives) belong among very big industries (as of cumulative competitiveness) and simultaneously among great receivers (as of share on total amount of state subsidies in years of 1998-2002).

Table 30: Competitiveness on foreign market – industries with greatest cumulative foreign competitiveness (in p.p.) and their share on the economic policy of subsidizing in time period of years 1998-2002 (in %)

NACE	c_{eu} 98-99	c_{eu} 00-02	c_{eu} 98-02	summa c_{eu} 98-02	s 98-99	s 00-02	s 98-02	delta s 98-02
311	-0.36	0.24	0.03	7.43	1.30	1.30	1.40	1.40
343	0.22	0.51	0.94	6.33	0.30	2.80	2.20	4.60
352	0.28	-0.36	-0.01	6.14	5.90	2.20	3.20	-0.40

Source*: Eurostat, CSO, own calculations*

Growth of competitiveness 1998-2002

In this part we try to figure if there is any relation between growth of domestic competitiveness and growth of competitiveness on EU markets during the time period of 1998-2002. We analyzed previously achieved data for domestic and foreign competitiveness to identify successful or unsuccessful industries on both (domestic and European) market.

If we focused on the first watched time period of the years 1998-1999, then there wouldn't be any industry, which recorded movement at the minimal level of 0,2 percent point on both markets, both on the domestic market and on the European market. If we left the limit level of 0,2 percent point on both markets and broadened selection on any level of change of competitiveness (of course in the same direction on the both markets), then there would be 21 industries successful on both markets and 25 manufacturing industries unsuccessful on both markets.

Figure 5: Evolution of domestic and foreign competitiveness of the Czech manufacturing industries 1998-1999 (in p.p.)
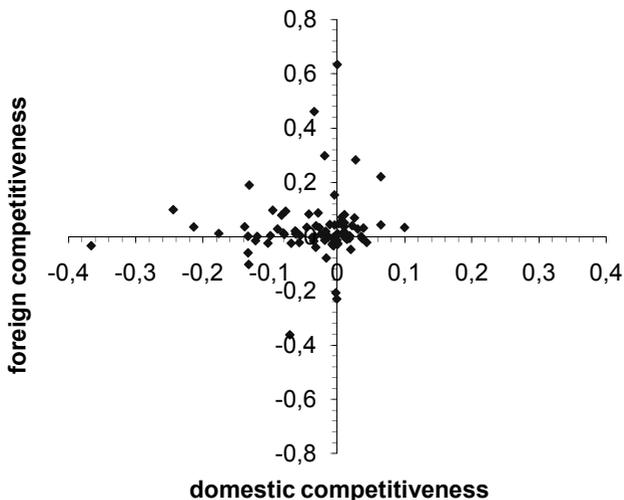
Notice: except of industries of 213 (-0,04; 2,29), 241 (-0,43; -0,01) and 271 (-1,12; 0,06).

Source: *Eurostat, CSO, MIT, own calculations*

Growth on the domestic market of more than 0,2 percent point and simultaneously any growth on the foreign market wasn't recorded by any industry, any growth on the domestic market and growth on the foreign market of more than 0,2 percent point was recorded by industries of 343 (manufacture of automotive parts) and 352 (manufacture of rail and tram locomotives). Fall on the domestic market of more than 0,2 percent point and simultaneously any fall on the foreign market was recorded by industries of 241 (manufacture of basic chemicals) and 341 (manufacture of motor vehicles), any fall on the domestic market and fall on the foreign market of more than 0,2 percent point was recorded by industries of 311 (manufacture of electric motors, generators, transformers), 363 (manufacture of musical instruments) and 364 (manufacture of sporting goods).

Table 31: Competitiveness on the both markets – industries with the biggest change of the competitiveness in years 1998-1999 (in p.p.) and their share on the economic policy of subsidizing in years 1998-2002 (in %)

NACE	cd 98-99	summa c_d 98-02	ceu 98-99	summa c_{eu} 98-02	s 98-99	s 00-02	s 98-02	delta s 98-02
241	-0.43	8.13	-0.01	1.47	1.60	1.00	1.10	2.50
311	-0.07	0.75	-0.36	7.43	1.30	1.40	1.40	0.90
341	-0.37	5.95	-0.03	2.71	0.50	0.40	0.40	0.70
343	0.06	5.43	0.22	6.33	0.30	2.80	2.20	4.60
352	0.03	1.12	0.28	6.14	5.90	2.20	3.20	-0.40
363	0.00	0.09	-0.21	9.44	0.00	0.00	0.00	0.10
364	0.00	0.03	-0.23	4.83	0.10	0.10	0.10	0.30

Source: *Eurostat, CSO, MIT, own calculations*

If we focused on the second watched time period of the years 2000-2002, then there would exist three industries, which recorded movement at the minimal level of 0,2 percent point on both markets, both on the domestic market and on the European market. Industry of 251 (manufacture of rubber products) in the watched period strengthened on both markets (on domestic by 0,56 percent point, on foreign by 0,34 percent point). In the case of any indicator of the economic policy of subsidizing this industry doesn't reach limit level (neither in the case of total indicators, nor in the case of indicators rated per employee) and therefore couldn't be placed among her significant recipients. Industries of 322 (manufacture of transmitter, phone and telegraph apparatus) and 343 (manufacture of automotive parts) recorded loss on the domestic market (at the level of 0,36; resp. 0,21 percent point) and vice-versa gain of the competitiveness on the foreign market (at the level of 0,36; resp. 0,51 percent point). Both this industries by the way belonged in the watched period among the big receivers of state subsidies (1,0; resp. 2,8 percent). If we left the limit level of 0,2 percent point on both markets and broadened selection on any level of change of competitiveness (of course in the same direction on the both markets), then there would be 29 industries successful on both markets and 13 manufacturing industries unsuccessful on both markets.

Figure 6: Evolution of domestic and foreign competitiveness of the Czech manufacturing industries 2000-2002 (in p.p.)
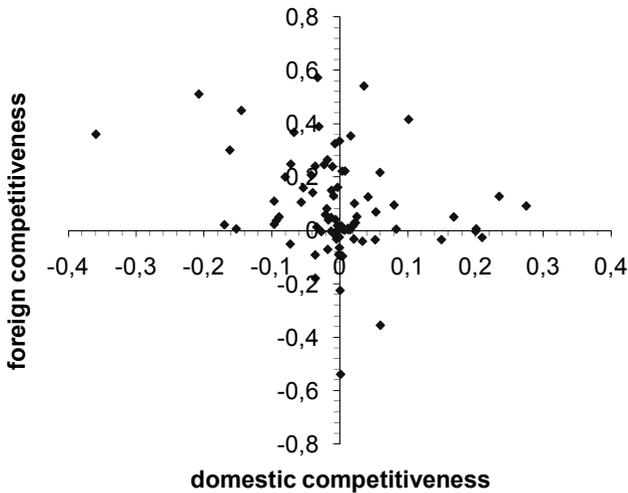
Notice: except of industries of 251 (0,56; 0,34), 271 (0,71; 0,13) and 341 (-0,60; -0,12).
Source*: Eurostat, CSO, MIT, own calculations*

Growth on the domestic market of more than 0,2 percent point and simultaneously any growth on the foreign market was recorded by industries of 159 (manufacture of beverages), 251 (manufacture of rubber products), 252 (manufacture of plastic products), 271 (manufacture of basic iron, steel, and Fe-alloys) and 332 (manufacture of measuring and navigating instruments), any growth on the domestic market and growth on the foreign market of more than 0,2 percent point was recorded by industries of 251 (manufacture of rubber products), 294 (manufacture of machine tools), 316 (manufacture of electrical equipment), 323 (manufacture of televisions, radios, video and audio recorders), 334 (manufacture of optical and photographic instruments), 361 (manufacture of furniture) and 365 (manufacture of games and toys). Fall on the domestic market of more than 0,2 percent point and simultaneously any fall on the foreign market was recorded by industry of 341 (manufacture of motor vehicles), any fall on the domestic market and fall on the foreign market of more than 0,2 percent point wasn't recorded by any industry of Czech manufacturing.

Table 32: Competitiveness on the both markets – industries with the biggest change of the competitiveness in years 2000-2002 (in p.p.) and their share on the economic policy of subsidizing in years 1998-2002 (in %)

NACE	cd 00-02	summa c_d 98-02	ceu 00-02	summa c_{eu} 98-02	s 98-99	s 00-02	s 98-02	delta s 98-02
159	0.20	8.10	0.01	0.50	6.20	4.20	4.70	3.50
251	0.56	2.07	0.34	5.51	0.10	0.40	0.40	0.60
252	0.28	3.75	0.09	1.54	3.60	3.00	3.20	2.90
271	0.71	15.63	0.13	3.40	1.40	1.10	1.10	1.70
294	0.01	1.09	0.22	4.99	0.50	1.10	0.90	1.20
316	0.04	1.92	0.54	5.56	0.60	2.50	2.00	6.10
322	-0.36	1.26	0.36	1.09	0.10	1.00	0.70	1.40
323	0.10	0.87	0.42	3.86	0.50	0.30	0.30	0.00
332	0.24	1.12	0.13	1.83	0.70	0.50	0.60	-0.30
334	0.02	0.18	0.35	2.88	0.00	0.10	0.10	0.10
341	-0.60	5.95	-0.12	2.71	0.50	0.40	0.40	0.70
343	-0.21	5.43	0.51	6.33	0.30	2.80	2.20	4.60
361	0.06	2.39	0.22	3.59	1.10	1.00	1.10	0.30
365	0.00	0.05	0.22	3.33	0.20	0.30	0.30	0.20

Source*: Eurostat, CSO, MIT, own calculations*

If we focused on the whole watched time period of the years 1998-2002, then there would exist nine industries, which recorded movement at the minimal level of 0,2 percent point on both markets, both on the domestic market and on the European market. Two of them (thereinafter mentioned industries of 251 and 291) then actually recorded simultaneous movement at the level of more than 0,4 percent point. Industry of 251 (manufacture of rubber products) and 323 (manufacture of televisions, radios, video and audio recorders) in the watched period strengthened on both markets (on domestic by 0,41 and 0,24 percent point, on foreign by 0,73 and 0,87 percent point). In the case of any indicator of the economic policy of subsidizing these industries don't reach limit level (neither in the case of total indicators, nor in the case of indicators rated per employee) and therefore couldn't be placed among her significant recipients (only industry of 323 in the period of years 1998-2002 received 2,67 percent of state subsidies per employee). Industries of 172 (textile weaving), 271 (manufacture of basic iron, steel, and Fe-alloys), 287 (manufacture of other non-fabricated metal products), 291 (manufacture of power-generating machinery, ex. transport), 292

(manufacture of other gen. purpose machinery), 295 (manufacture of other special-purpose machinery) and 312 (manufacture of electricity dist. and control apparatus) recorded loss on the domestic market (industry of 291 at the level of 0,41 percent point) and vice-versa gain of the competitiveness on the foreign market (industry of 291 at the level of 0,63 percent point). All of these industries (except industries of 172 and 287) by the way belonged in the watched period among the big receivers of state subsidies according to many indicators (industry of 291 received 2,0 percent from the total amount of subsidizes in the years 1998-2002). If we left the limit level of 0,2 percent point on both markets and broadened selection on any level of change of competitiveness (of course in the same direction on the both markets), then there would be 16 industries successful on both markets and 18 manufacturing industries unsuccessful on both markets.

Figure 7: Evolution of domestic and foreign competitiveness of the Czech manufacturing industries 1998-2002 (in p.p.)
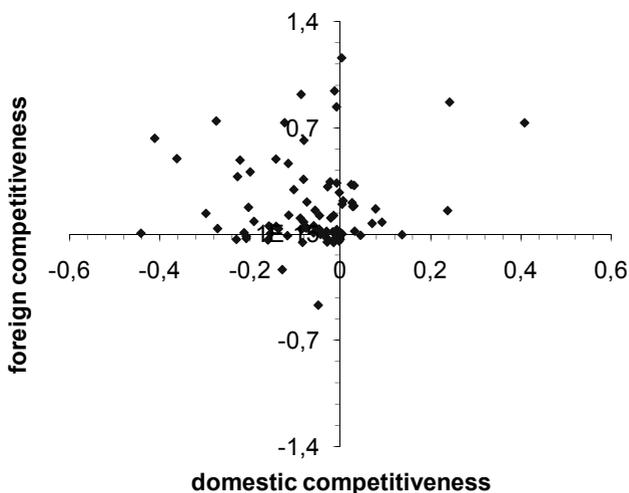
Notice: except of industries of 241 (-0,67; -0,02), 271 (-1,74; 0,29) and 341 (-0,74; 0,07)
Source: *Eurostat, CSO, MIT, own calculations*

Growth on the domestic market of more than 0,2 percent point and simultaneously any growth on the foreign market was recorded by industries of 251 (manufacture of rubber products), 323 (manufacture of televisions, radios, video and audio recorders) and 332 (manufacture of measuring and navigating instruments), any growth on the domestic market and growth on the foreign market of more than 0,2 percent point was recorded by industries of 251 (manufacture of rubber products), 294 (manufacture of machine tools), 323 (manufacture of televisions, radios, video and audio recorders), 334 (manufacture of optical and photographic instruments) and 361 (manufacture of furniture). Fall on the domestic market of more than 0,2 percent point and simultaneously any fall on the foreign market was recorded by industries of 154 (manufacture of vegetable and animal oils and fats), 241 (manufacture of basic chemicals), 272 (manufacture of tubes) and 273 (first-processing of iron, steel, and Fe-alloys), any fall on the domestic market and fall on the foreign market of more than 0,2 percent point was recorded by industries of 231 (manufacture of coke oven products) and 265 (manufacture of cement, lime, plaster).

Table 33: Competitiveness on the both markets – industries with the biggest change of the competitiveness in years 1998-2002 (in p.p.) and their share on the economic policy of subsidizing in years 1998-2002 (in %)

NACE	cd 98-02	summa c_d 98-02	ceu 98-02	summa c_{eu} 98-02	s 98-99	s 00-02	s 98-02	delta s 98-02
154	-0.21	1.91	-0.02	0.32	2.10	6.70	5.50	0.40
172	-0.27	2.27	0.75	8.05	0.20	0.40	0.40	0.10
231	-0.05	0.99	-0.47	40.93	0.00	0.00	0.00	0.00
241	-0.67	8.13	-0.02	1.47	1.60	1.00	1.10	2.50
251	0.41	2.07	0.73	5.51	0.10	0.40	0.40	0.60
265	-0.13	2.18	-0.23	1.35	0.10	0.00	0.00	0.00
271	-1.74	15.63	0.29	3.40	1.40	1.10	1.10	1.70
272	-0.21	1.31	-0.03	4.96	0.00	0.20	0.10	0.60
273	-0.23	1.49	-0.04	4.44	0.40	0.50	0.50	-0.10
287	-0.22	1.56	0.49	5.27	1.50	0.40	0.70	-0.30
291	-0.41	1.37	0.63	4.05	1.40	2.10	2.00	3.50
292	-0.23	1.75	0.38	3.03	0.40	1.20	1.00	1.90
294	0.01	1.09	0.22	4.99	0.50	1.10	0.90	1.20
295	-0.36	3.26	0.50	4.04	12.30	3.10	5.50	1.70
312	-0.20	2.23	0.41	3.71	1.30	1.90	1.70	3.90
323	0.24	0.87	0.87	3.86	0.50	0.30	0.30	0.00
332	0.24	1.12	0.15	1.83	0.70	0.50	0.60	-0.30
334	0.03	0.18	0.32	2.88	0.00	0.10	0.10	0.10
361	0.02	2.39	0.33	3.59	1.10	1.00	1.10	0.30

Source: *Eurostat, CSO, MIT, own calculations*

Evaluation of the cumulative domestic and foreign competitiveness of the single industries of the Czech manufacturing strongly depends on the selected critical level. In the case of limit of 2 percent there are nine industries, which on both markets reached this level from the point of view of the cumulative competitiveness. They're industries of 172 (textile weaving), 251 (manufacture of rubber products), 261 (manufacture of glass products), 271 (manufacture of basic iron, steel, and Fe-alloys), 295 (manufacture of other special-purpose machinery), 312 (manufacture of electricity dist. and control apparatus), 341 (manufacture of motor vehicles), 343 (manufacture of automotive parts) and 361 (manufacture of furniture). Note, that from these nine so-called big industries on the both markets belong simultaneously industries of 271, 295, 312 a 343 among the significant recipients of state subsidies (in the period of years 1998-2002 received more than 1 percent of the total amount of subsidizes).

If we set limit at the level of 6 percent, then this level from the hereinbefore mentioned so-called big industries on the domestic market would pass with 15,63 percent industry of 271 (manufacture of basic iron, steel, and Fe-alloys), on the European market with 8,05 percent industry of 172 (textile weaving) and with 6,33 percent industry of 343 (manufacture of automotive parts) – they're so-called very big industries. Add, that industry of 271 in all time periods passes level of 1 percent of the total amount of subsidizes in concerned time period and during the years 1998-2002 also received more than 1 percent of the total change of subsidizes. In the case of any indicator of the economic policy of subsidizing industry of 172 doesn't reach limit level (neither in the case of total indicators, nor in the case of indicators rated per employee) and therefore couldn't be placed among her significant recipients. Industry of 343 in the same sense belong among the big recipients of state subsidizes in the time period of 2000-2002 and also in the time period of 1998-2002 and from the total change of subsidizes in the years 1998-2002 received actually 4,6 percent.

Table 34: Competitiveness on the both markets – industries with the biggest cumulative competitiveness in years 1998-2002 (in p.p.) and their share on the economic policy of subsidizing in years 1998-2002 (in %)

NACE	cd 98-02	summa c_d 98-02	ceu 98-02	summa c_{eu} 98-02	s 98-99	s 00-02	s 98-02	delta s 98-02
172	-0.27	2.27	0.75	8.05	0.20	0.40	0.40	0.10
251	0.41	2.07	0.73	5.51	0.10	0.40	0.40	0.60
261	0.03	3.17	0.19	5.42	1.00	0.30	0.50	-0.50
271	-1.74	15.63	0.29	3.40	1.40	1.10	1.10	1.70
295	-0.36	3.26	0.50	4.04	12.30	3.10	5.50	1.70
312	-0.20	2.23	0.41	3.71	1.30	1.90	1.70	3.90
341	-0.74	5.95	0.07	2.71	0.50	0.40	0.40	0.70
343	-0.01	5.43	0.94	6.33	0.30	2.80	2.20	4.60
361	0.02	2.39	0.33	3.59	1.10	1.00	1.10	0.30

Source: *Eurostat, CSO, MIT, own calculations*

Competitiveness and state subsidies

In the next part of this analysis we have done the modification of correlation coefficients within the original database. Because of minimal, but nevertheless existing appearance of extreme, far-away values of variables,

further analysis proceed to the calculation of correlation coefficients on the base of adjusted database, from which was exempted extreme values. They could to a certain degree misrepresent the correlation and their exemption could then help to the more accurately characteristic of the reviewed relations.

First set of correlation coefficients revealed existence of following relationships: between domestic competitiveness in the entire time period and share on total amount of state subsidies in this time period (correlation coefficient of 0,38 at the level of significance 0,01 approved existence of moderate direct linear dependence of these two variables), between cumulated domestic competitiveness in the entire time period and percentual share on total change of state subsidies in this time period (correlation coefficient of 0,32 at the level of significance 0,01 approved existence of moderate direct linear dependence of these two variables), between cumulated domestic competitiveness in the entire time period and percentual share on total change of state subsidies per employee in this time period (correlation coefficient of 0,18 at the level of significance 0,1 approved existence of week direct linear dependence of these two variables) and finally between cumulated foreign competitiveness in the entire time period and percentual share on total change of state subsidies per employee in this time period (correlation coefficient of -0,19 at the level of significance 0,1 approved existence of weak indirect linear dependence of these two variables).

Second set of correlation coefficients (calculating with adjusted data) approved existence of following correlations: between evolution of domestic competitiveness in the first time period and percentual share on total amount of state subsidies in this time period (correlation coefficient of -0,19 at the level of significance 0,1 approved existence of weak indirect linear dependence of these two variables), between evolution of domestic competitiveness in the entire time period and percentual share on total amount of state subsidies in this time period (correlation coefficient of -0,18 at the level of significance 0,1 approved existence of weak indirect linear dependence of these two variables), between cumulated domestic

competitiveness in the entire time period and percentual share on total amount of state subsidies in this time period (correlation coefficient of 0,42 at the level of significance 0,01 approved existence of moderate direct linear dependence of these two variables), between cumulated domestic competitiveness in the entire time period and percentual share on total change of state subsidies in this time period (correlation coefficient of 0,38 at the level of significance 0,01 approved existence of moderate direct linear dependence of these two variables), between evolution of domestic competitiveness in the entire time period and percentual share on total change of state subsidies in this time period (correlation coefficient of -0,32 at the level of significance 0,01 approved existence of moderate indirect linear dependence of these two variables) and finally between cumulated foreign competitiveness in the entire time period and percentual share on total change of state subsidies per employee in this time period (correlation coefficient of -0,18 at the level of significance 0,1 approved existence of weak indirect linear dependence of these two variables).

The analysis was finally completed by calculation of Spearman correlation coefficient, which isn't dependent on the normal distribution and linear dependence of variables (in our case is his application benefitable for example with respect to existence of some extreme values). Spearman correlation coefficient is used for evaluation of relationship between two ordinal variables (original values of variables are transformed on their order and during the calculation coupled then). It revealed existence of following ordinal correlations: between the order of industries according to evolution of domestic competitiveness in the entire time period and order according to percentual share on total amount of state subsidies in this time period (correlation coefficient of -0,27 at the level of significance 0,01 approved existence of moderate indirect linear dependence of these two variables), between the order of industries according to cumulative domestic competitiveness in the entire time period and order according to percentual share on total amount of state subsidies in this time period (correlation coefficient of 0,58 at the level of significance 0,01 approved existence of potential strong direct linear dependence of these two variables), between the order of industries according to cumulative domestic competitiveness in

the entire time period and order according to percentual share on total change of state subsidies in this time period (correlation coefficient of 0,31 at the level of significance 0,01 approved existence of moderate direct linear dependence of these two variables), between the order of industries according to evolution of domestic competitiveness in the entire time period and order according to percentual share on total change of state subsidies in this time period (correlation coefficient of -0,23 at the level of significance 0,05 approved existence of weak indirect linear dependence of these two variables), between the order of industries according to evolution of domestic competitiveness in the second time period and order according to percentual share on total amount of state subsidies per employee in this time period (correlation coefficient of 0,20 at the level of significance 0,1 approved existence of weak direct linear dependence of these two variables), between the order of industries according to evolution of foreign competitiveness in the second time period and order according to percentual share on total amount of state subsidies in this time period (correlation coefficient of 0,26 at the level of significance 0,05 approved existence of weak direct linear dependence of these two variables), between the order of industries according to evolution of foreign competitiveness in the entire time period and order according to percentual share on total change of state subsidies in this time period (correlation coefficient of 0,21 at the level of significance 0,1 approved existence of weak direct linear dependence of these two variables), between the order of industries according to cumulative foreign competitiveness in the entire time period and order according to percentual share on total amount of state subsidies per employee in this time period (correlation coefficient of -0,38 at the level of significance 0,01 approved existence of moderate indirect linear dependence of these two variables) and finally between the order of industries according to cumulative foreign competitiveness in the entire time period and order according to percentual share on total change of state subsidies per employee in this time period (correlation coefficient of -0,24 at the level of significance 0,05 approved existence of weak indirect linear dependence of these two variables).

Table 35: Correlation analysis

Correlation	Pearson 1 (original data)	Pearson 2 (adjusted data)	Spearman (ordinal)
c_d 98-99 & s 98-99	-0.12	**-0.19***	-0.14
c_d 00-02 & s 00-02	0.14	-0.10	0.09
c_d 98-02 & s 98-02	-0.12	**-0.18***	**-0.27***
summa c_d & s 98-02	**0.38***	**0.42***	**0.58***
Summa c_d & delta s 98-02	**0.32***	**0.38***	**0.31***
c_d 98-02 & delta s 98-02	-0.11	**-0.32***	**-0.23***
c_d 98-99 & s/l 98-99	0.05	0.10	0.08
c_d 00-02 & s/l 00-02	0.08	0.10	**0.20***
c_d 98-02 & s/l 98-02	0.01	0.14	0.09
summa c_d & s/l 98-02	0.13	-0.04	-0.02
summa c_d & delta s/l 98-02	**0.18***	0.02	0.00
c_d 98-02 & delta s/l 98-02	-0.06	-0.14	-0.12
c_{eu} 98-99 & s 98-99	-0.04	-0.02	0.04
c_{eu} 00-02 & s 00-02	0.01	0.06	**0.26***
c_{eu} 98-02 & s 98-02	-0.02	0.12	0.17
summa c_{eu} & s 98-02	-0.10	0.11	-0.07
summa c_{eu} & delta s 98-02	-0.07	-0.03	-0.02
c_{eu} 98-02 & delta s 98-02	0.02	0.15	**0.21***
c_{eu} 98-99 & s/l 98-99	-0.07	0.04	-0.14
c_{eu} 00-02 & s/l 00-02	-0.11	-0.10	-0.04
c_{eu} 98-02 & s/l 98-02	-0.17	-0.11	-0.16
summa c_{eu} & s/l 98-02	**-0.19***	-0.15	**-0.38***
summa c_{eu} & delta s/l 98-02	-0.13	**-0.18***	**-0.24***
c_{eu} 98-02 & delta s/l 98-02	-0.10	-0.06	-0.08

Notice: * significance level 0,1; ** significance level 0,05; *** significance level 0,01.

Source: *Eurostat, CSO, MIT, own calculations*

If we focus on the relationships, which are approved by more correlation coefficients simultaneously, then among evident correlations belong relationship between evolution of domestic competitiveness in the whole time period and percentual share on total amount of state subsidies in this time period (weak indirect linear dependence approved by second correlation coefficient and moderate indirect ordinal dependence approved by Spearman correlation coefficient), between evolution of domestic competitiveness in the whole time period and percentual share on total change of state subsidies in this time period (moderate indirect linear

dependence approved by second correlation coefficient and weak indirect ordinal dependence approved by Spearman correlation coefficient), between cumulative foreign competitiveness in the whole time period and percentual share on total amount of state subsidies per employee in this time period (weak indirect linear dependence approved by first correlation coefficient and moderate indirect ordinal dependence approved by Spearman correlation coefficient) and finally between cumulative foreign competitiveness in the whole time period and percentual share on total change of state subsidies per employee in this time period (weak indirect linear dependence approved by second correlation coefficient and weak indirect ordinal dependence approved by Spearman correlation coefficient). This fact allowed us to formulate following economic interpretation (in the relationship with all industries of manufacturing generally):

manufacturing industry in the time period of the years 1998-2002 was weakly losing domestic competitiveness directly proportionally with the amount of state subsidies drifting towards it,
manufacturing industry in the time period of the years 1998-2002 was weakly losing domestic competitiveness directly proportionally with the growth of amount of state subsidies drifting towards it,
size of the long-term share of the manufacturing industry on the foreign market weakly indirectly proportionally relates with the amount of state subsidies per employee drifting towards it,
size of the long-term share of the manufacturing industry on the foreign market weakly indirectly proportionally relates with the growth of amount of state subsidies per employee drifting towards it.

Mentioned fact could be also interpreted as follows: the larger amount of state subsidies drifts towards industry, the more this industry loses domestic competitiveness; the faster grows the amount of state subsidies for industry, the more this industry loses domestic competitiveness; the smaller is the share of the industry on the foreign market, the larger amount of state subsidies per employee drifts towards this industry and the smaller is the stare of the industry on the foreign market, the faster grows the amount of state subsidies per employee for this industry. First two relationships are the

answer to the H (3) formulated in the introduction (the second part of the H (3) about foreign competitiveness is answered in the Table 35), second two relationships are the answer to the H (2) formulated ibidem (actually to its second part).

Moreover, no doubts are in the cases of existence of relationships, which were approved by all three correlation coefficients and all cases at the significance level of 0,01; therefore are evident and could be characterized as moderate, respectively potential strong. These are relationships between cumulated domestic competitiveness in the whole time period and percentual share on total amount of state subsidies in this time period (moderate direct linear dependence approved by first and second correlation coefficient and potential strong direct ordinal dependence approved by Spearman correlation coefficient) and between cumulated domestic competitiveness in the whole time period and percentual share on total change of state subsidies in this time period (moderate direct linear dependence approved by first and second correlation coefficient and moderate direct ordinal dependence approved by Spearman correlation coefficient). This fact allowed us to formulate following economic interpretation:

- size of the long-term share of the manufacturing industry on the domestic market moderately directly proportionally relates with the amount of state subsidies drifting towards it,
- size of the long-term share of the manufacturing industry on the domestic market moderately directly proportionally relates with the growth of amount of state subsidies drifting towards it.

Mentioned fact could be also interpreted as follows: the larger is the share of the industry on the domestic market, the larger amount of state subsidies drifts towards this industry and the larger is the stare of the industry on the domestic market, the faster grows the amount of state subsidies for this industry. These two relationships are the answer to the H (2) formulated in the introduction (actually to its first part).

Figure 8: Cumulative domestic competitiveness, manufacturing industries (in p.p.) and their share on total amount of state subsidies (in %) 1998-2002
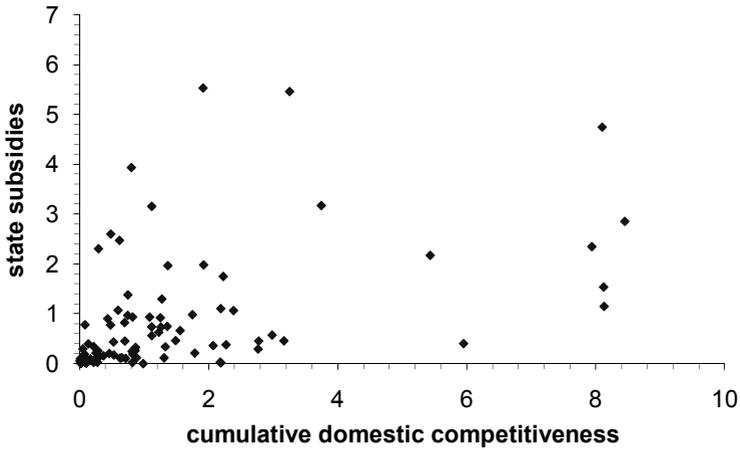
Notice: except of industries of 155 (7,34; 22,1) and 271 (15,63; 1,2).

**Source***: CSO, MIT, own calculations*

Figure 9: Cumulative domestic competitiveness of manufacturing industries (in p.p.) and their share on total change of state subsidies (in %), 1998-2002
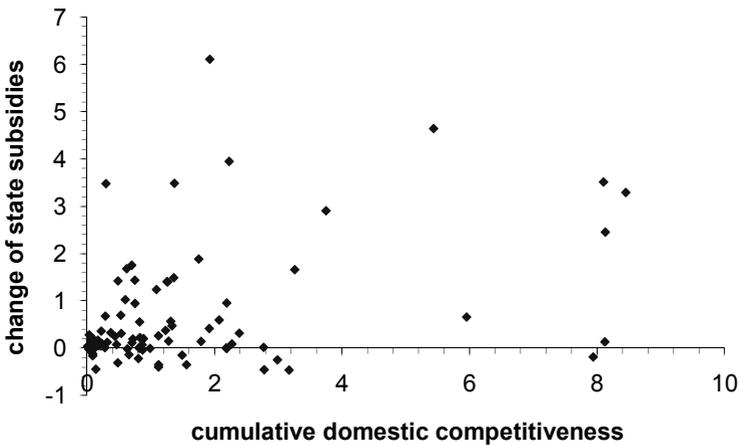
Notice: except of industries of 155 (7,34; 40,1) and 271 (15,63; 1,7).

Source*: CSO, MIT, own calculations*

Let us say, that analysis by first and second set of correlation coefficients and Spearman correlation coefficient approved existence of relationship between evolution of domestic competitiveness in the whole time period and cumulative domestic competitiveness in this time period (correlations of -0,67; -0,29 a -0,44; so there exists indirect dependence), between evolution of foreign competitiveness in the whole time period and cumulative foreign competitiveness in this time period (correlations of 0,07; 0,60 a 0,46; so there exists direct dependence) and between percentual share on total amount of state subsidies in the whole time period and percentual share on total change of state subsidies in this time period (correlations of 0,91; 0,53 a 0,52; so there exists direct dependence). It could be interpreted as follows: the larger is the share of the industry on the domestic market, the larger is the loss of its competitiveness; the larger is the share of the industry on the foreign market, the larger is the growth of its competitiveness and the larger is the share of the industry on the total amount of state subsidies, the faster is the growth of their amount (and the amount of state subsidies drifting towards it is larger).

Correlation analysis doesn't approve existence of any relationship between domestic and foreign competitiveness, neither in the case of their evolution, nor in the case of their cumulation. But of course with small exemptions: existence of the relationship between domestic cumulative competitiveness and foreign cumulative competitiveness in the whole time period approved first and second set of correlation coefficients, only Spearman correlation coefficient didn't (-0,21; -0,33 a -0,02); existence of the relationship between domestic cumulative competitiveness and evolution of foreign competitiveness in the whole time period didn't approved neither of first and second set of correlation coefficients, but Spearman correlation coefficient did (-0,11; -0,07 a 0,18). As more probable therefore seems existence of the first (linear) relationship (of indirect dependence), which according to Pearson correlation coefficients signifies contradictory relation of the size of share of Czech manufacturing industries on both markets. These facts are the answer to the H (1) formulated in the introduction

Table 36: Correlation analysis

Correlation	Pearson 1 (original data)	Pearson 2 (adjusted data)	Spearman (ordinal)
c_d 98-02 & c_{eu} 98-02	0.03	0.03	0.01
c_d 98-02 & summa c_{eu} 98-02	0.02	0.00	0.02
Summa c_d 98-02 & c_{eu} 98-02	-0.11	-0.07	**0.18***
summa c_d 98-02 & summa c_{eu} 98-02	**-0.21***	**-0.33***	-0.02

Notice: * significance level 0,1; ** significance level 0,05; *** significance level 0,01.

Source: *Eurostat, CSO, MIT, own calculations*

Finally let us instead of hitherto indicators of state subsidies consider index of percentual change of amount of state subsidies in the whole time period (so the rate of total change of amount of state subsidies received in the whole time period and the average amount of state subsidies received annually in this time period by the corresponding industry). More than 350percentual loss was recorded by industries of 176 (manufacture of knitted and crocheted fabrics) and 355 (manufacture of other transport equipment), vice-versa more than 350percentual growth war recorded by industries of 231 (manufacture of coke oven products), 242 (manufacture of pesticides and agro-chemicals), 272 (manufacture of tubes) and 351 (building and repairing of ships and boats). Correlation coefficient in the pair or even in the trio didn't approve existence of any relationship. It was approved by only the first (it means original) correlation coefficient in the case of foreign cumulative competitiveness (0,29) and only the second (it means without the extreme values) in the case of evolution of foreign competitiveness (0,19).

Table 37: The change of indicator of economic policy of subsidizing – industries with larger change of the amount of state subsidies in the years 1998-2002 (in %)

NACE	cd 98-02	summa c_d 98-02	ceu 98-02	summa c_{eu} 98-02	s 98-02	delta s 98-02	(s 02 - s 98)/ (s 98-02 / 5)
176	0.00	0.11	-0.02	2.10	0.00	-0.10	-392.50
231	-0.05	0.10	-0.47	40.93	0.00	0.00	500.00
242	0.00	0.70	-0.05	0.49	0.00	0.20	496.50
272	-0.21	1.28	-0.03	4.96	0.10	0.60	489.40
351	0.00	0.13	-0.03	0.38	0.00	0.10	500.00
355	-0.02	0.09	0.34	4.34	0.00	0.00	-491.10

Table 38: Correlation analysis

Correlation	Pearson 1 (original data)	Pearson 2 (adjusted data)	Spearman (ordinal)
c_d 98-02 & (s 02 - s 98)/(s 98-02 / 5)	-0.10	-0.04	**-0.07**
summa c_d & (s 02 - s 98)/(s 98-02 / 5)	-0.02	0.03	**0.00**
c_{eu} 98-02 & (s 02 – s 98)/(s 98-02 / 5)	-0.01	0.19*	**0.04**
summa c_{eu} & (s 02 - s 98)/(s 98-02 / 5)	0.29***	0.09	**0.10**

Notice: * significance level 0,1; ** significance level 0,05; *** significance level 0,01.

5.2 State aid and competition policy

Competition can be undermined not only by business practices but also by governments granting state aid to businesses.[45] State aid is therefore in principle prohibited by the EU Treaty Article 87 (1).[46] Despite the ban, governments continue to provide large amounts of state aid. This is possible because some types of state aid can be exempted from the ban by the European Commission and indeed recently the Commission exempts about 98% of all cases from the ban (Besley and Seabright, 1999).

The objective of EU state aid control is to prevent state aid that could distort competition and trade between member states; however, "state aid" is in most cases assessed by the European Commission with no or little respect to the effects on trade and competition. There are at least two reasons for this. First, the amount of governmental aid results in a large number of state aid cases to be controlled by the Commission. Secondly, the Commission lacks a simple method or test which would provide a basis for evaluating state aid in terms of economic principles.

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[45] Note that this subchapter is a shortened version of Zemplinerova (2010)

[46] Art 87(1) "…any aid granted by a Member State or through State resources in any form whatsoever which distorts or threatens to distort competition by favoring certain undertakings or the production of certain goods shall, insofar as it affects trade between Member States, be incompatible with the common market."

There have been however numerous private law cases related to EU state aid control that have raised arguments based mainly on economic expertise. Such expertise can be costly and requires resources (Neven 2006). Because the European Commission has to review more than 700 cases related to state aid every year, it lacks the capacity to carry out profound economic analysis of the effects of state aid.

The Treaty is complemented by an extensive number of legislative acts that provide for a number of rules for making decisions about state aid and its compatibility with the European market. It requires a certain expertise to know and understand the 800 pages of these often amended secondary rules. In addition, these rules have been amplified over the years by court decisions that established new precedents, which in turn spurred more modifications. The consequence is that the law is soft and flexible. The procedures necessarily have become bureaucratic and do not provide for effective administrative management. The implementation of EU state aid law is mainly about judicial procedures and the rationale for state aid prohibition has become blurred. This situation creates not only uncertainty for businesses that are granted state aid but also for state authorities with respect to their legal position as proved by law cases and international arbitrations.

Given the above reasons, the European Commission intends to simplify the agenda, reduce the administrative costs, and free capacity in order to concentrate on large cases in which an economic analysis of the effects would be carried out.[47] The need for and usefulness of including this economic approach in the process of state aid control has been stressed in numerous articles (Friederiszick H., W., L. R. Röller, 2007) and has been embodied in the State Aid Action Plan (SAAP), which was launched by the European Commission in 2005. SAAP addresses the above problems with state aid control – inefficient procedures and lack of economic approach

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[47] Art 88(1) "The Commission shall, in cooperation with Member States, keep under constant review all systems of aid existing in those States. It shall propose to the latter any appropriate measures required by the progressive development or by the functioning of the common market."

being exercised in the decisions about state aid control.[48] SAAP is an integral part of reform in the EU competition policy and should shift state aid policy closer to antitrust policy. Economic procedures developed for antitrust policy and merger control could be then applied when enforcing Article 87.

Scoreboard statistics indicate that the total volume of state aid has remained at the same level during the last few years; the number of state aid cases which the EC has to review, however, is radically increasing. This can be attributed not only to EU enlargement but also to the fact that EU internal policies are inducing state aid. EU Structural funds are potential state aid. The programs under the structural funds for 2007-2013 contain a clause indicating "any public support under this program must comply with the procedural and material state aid rules applicable at the point of time when the public support is granted."[49] It is the responsibility of the managing authorities in Member States to ensure that this condition is fulfilled.

Community state aid control is based on a system of ex ante notification by Member States of any plan to grant state aid. Member States are not allowed to implement state aid before it has been exempted from the state aid ban. (authorised as "compatible with the European market"). Under the present procedural rules, the Commission and national judges are competent to decide whether the notification procedures have been complied with and if not to order recovery of the aid.

For the evaluation of new cases, the Commission has a short period of two months following the notification of subsidized projects. In 2006, in 91% of all cases the Commission exempted the measures, concluding that the state aid was compatible with the state aid rules. The Commission initiates proceedings if it has doubts about the compatibility of the notified

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[48] State Aid Action Plan, Less and better targeted state aid: a roadmap for state aid reform 2005–2009, (Consultation document), SEC(2005) 795;
 http://ec.europa.eu/comm/competition/state_aid/reform/reform.cfm. The State Aid Action Plan is based upon the following principles: (i) less and better targeted state aid; (ii) greater emphasis on economic analysis; (iii) more effective procedures including better enforcement, higher predictability and enhanced transparency; and (iv) shared responsibility between the Commission and the Member States.
[49] Vademecum Community rules on state aid, http://ec.europa.eu/comm/competition/state_aid/legislation/.

aid measure with the common market. In such cases, the Commission opens a "formal investigation." It publishes a description of the aid in the OJ and on its website for third parties (other Member State and interested parties) to comment on. At the end of the enquiry, the Commission adopts a final decision. This may be either positive (aid can be implemented), negative (aid cannot be implemented) or positive but subject to stated conditions (aid can be implemented if certain conditions are met). The indicative maximum time-limit foreseen for such an enquiry is 18 months. In 2006, only in 5% of state aid cases did the Commission have doubts whether certain aid measures complied with the rules and carried out a formal investigation, out of which the Commission banned aid in only 14 cases.[50] All decisions of the Commission are subject to *review by the European Court of Justice under* Article 230 of the EC Treaty.

There are two ways how the EC aims to achieve *more effective procedures and better enforcement:* first, increase the minimum regulation level, and second, issue a general Block Exemption Regulation. In such a way, smaller amounts of aid are considered to fall outside EU jurisdiction. In December 2006, the EC adopted the new *de minimis Regulation* – doubling the threshold to €200,000 over 3 years, and setting a guarantee ceiling of €1.5 million. It is assumed that this will diminish the bureaucratic burden of state aid control as such aid does not have to be announced. An increase in the de minimis ceiling should reduce administrative costs connected with notifying the Commission about small regional aid schemes and properly assessing large cases. There is, however, a dangerous consequence that member states will divide the size of the cases and multiply the number of cases.

Specific categories of training aid, employment aid, and aid to small- and medium-size enterprises are exempted by the so-called block exemption regulations. These measures have to be announced only *ex post*, and notification requirements have been reduced. An estimated €3 billion was awarded in 2006 under the three block exemption regulations for SMEs in

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[50] Report on Competition Policy 2006, http://ec.europa.eu/comm/competition/annual_reports/.

the industry and services sector, training and employment.[51] The legislation to simplify and consolidate existing block exemptions is expected by the issue of a "general block exemption" as of 2008. The general Block Exemption Regulation will exempt environmental aid, aid in the form of risk capital and exempt research and development aid (R&D) for large enterprises. Block exemption regulations should simplify the agenda and reduce the administrative costs and allow the Commission to concentrate on large and important cases.

Non-transparent state aid contributes to the inefficiency of public aid and allows for corruption in political structures, in administration of funds and in state-owned enterprises. An institutional environment of *transparency* prevents lobbying, and accountability of the agency is another assumption of state aid distribution and allocation. Governments are, as a rule, not good at "picking winners" either because they lack the relevant information, or they follow mainly their own short-term goals and can be captured by interest groups, powerful businesses and labour union interests. The literature on political economy has produced a number of insights as to when informational problems lead to ineffective political decisions. Empirical evidence investigating the political economy of European state aid control finds that the allocation of state aid can be explained to a significant degree by political and institutional variables and not by economical factors (Neven and Röller (2000).

When a private business is not successful, it is punished by market law, and it exits the market. If government fails in an economic activity – if the subsidy or state aid provided would be ex post unsuccessful in meeting its aim – there is no immediate consequence for the state authority unless the state aid is *transparent and related to a responsible entity*. State aid is financed by taxpayer's money and there are opportunity costs of using state resources such as justice, education or security. Determination of state aid aims should be made transparently. There are costs involved in the enforcement of EU State Aid Control.

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[51] http://ec.europa.eu/comm/competition/state_aid/studies_reports/studies_reports.cfm.

While the rules for state aid control are the responsibility of the Commission, enforcement of the rules is mostly the responsibility of the Member States. The Commission's investigative powers to collect market information are rather limited in state aid. Before opening the "formal investigation procedure," information exchange is channeled through the aid-granting Member State by the notification process, or in some cases it may be initiated by a third party complaint. After opening the formal investigation procedure, consultations with third parties are carried out by publishing a request asking for third party comments in the EU's Official Journal. A more direct method of collecting information through hearings or proactive market inquiry is not common. (Crocioni 2006).

The European Commission as a supra-national authority may have more difficult access to information about market failures than the state aid has the ambition to correct, but it is in lower risks of regulatory capture by local interest groups. EU state aid control has thus a potential to significantly constrain the level of subsidies in the member states. Control of state aid ex ante can allow opportunity costs of state aid to be considered and re-direct state aid to activities where more positive externalities can be expected.

While the Commission has the competence to adopt detailed state aid rules, the enforcement of the rules and procedures depends to a large extent on Member States. Article 88(3) EC has a direct effect and gives national judges the power to suspend and provisionally recover aid granted illegally before its approval by the Commission. Private litigation in front of national courts could therefore provide increased discipline in the field of state aid. [52]

Hence the effects of state aid on the home country has to be assessed to determine if net effects are positive and if these net effects are sufficient to outweight the negative effects on trade and competition on the European market. If not, such aid has an adverse effect on the EU as a whole and is incompatible with the EU market – this is the basic idea of a balancing test of the effects of state aid. The test balances benefits to welfare from the correction of the market failure due to state aid and losses in welfare from

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[52] ibid Note 4.

state aid. The idea that state aid should be proportional to the market failure it is designed to alleviate is not new: the Commission has used cost-benefit analysis in some cases for decisions of compatibility in the past (Besley, Seabright et al. 1999).

There exist many instruments and mechanisms by which public support or a state resource can be channelled to enterprises such as grants, tax reliefs, alleviation from the social security system, write-offs of arrears, equity participation, soft credit, guarantees, selling assets, goods or services at below market value, or buying assets, goods or services at above market value.[53] A complication here is that such a transfer is not always transparent as it can be intermediated by one or more organizations.

State resources can be granted indirectly through a private entity, as for example by a private bank that manages state-funded support schemes and aid programs. State aid can be granted through voluntary and non-profit-making public or private bodies such as charities or universities when they engage in activities which have commercial competitors. If there is a market in comparable goods or services which the final receiver or beneficiary of state resources provides, it means there is competition which can be harmed.

Due to the liberalization and privatization of previously strongly regulated sectors like healthcare, education, transport infrastructure and communication, the conditions for the functioning of these sectors are being changed, and competitive markets are being established. Therefore state aid provided to undertakings operating in these sectors can be controlled by the EC. In the past, these sectors have been commonly financed by the state without any state aid control in these sectors.

Any measure constituting state aid must have *effects on trade between member states*. As long as the market or activity is local, it cannot harm trade between states as it cannot have any international spillovers. Thus, the subsidy is not important from the point of view of the EC. It is not state aid under the EU Treaty. The member state governments or local authorities are

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[53] In 2006 for more than 50% of total state aid accounted,, grants and tax exemptions made up almost 43% of total state aid. (State Aid Scoreboard 2007).

in charge regarding the effects of subsidies on their welfare or regarding assessment if they waste their public resources. In other words, if a subsidy distorts trade and competition only at a local level, it is not state aid at the EU level.[54]

Most activities however are related to up and down stream markets and the measure can *effect competition in relatively distanced markets* where international spillovers might exist. Therefore evaluating state aid proposals from an economic perspective requires analysis of the effects of state aid at all levels of the common market. In the past European Commission decisions applied only limited economic assessment of the effects of subsidies on trade between member states in the process of State aid control. Due to liberalization, lowering costs of transport and information due to internet and possibilities of communication, the number of such markets has increased and more and more markets have become international. The number of sectors that were previously considered not to be state aid under the EU Treaty now fall under the EU state aid jurisdiction as their markets became international. This is not only the case of mobile telephones, energy and banking.

If the firm receiving state aid operates internationally, the distortion spreads out to other countries. Besides that, the state subsidy can cause inter-governmental or inter-regional competition for subsidies or investment incentives designed to attract investors to a particular region or country, which leads to sub-optimal outcomes when several governments, or regions, are competing with each other. State aid must not be accepted by the rivals and competitors, and private litigation or international arbitration can follow that in turn increases the cost of state aid. The balance of costs and benefits from state aid is supposed to be the Commission's test for its decision on state aid's compatibility with the EU market.

Once a measure is defined as "state aid" under the EU Treaty, the Commission has to decide if this state aid is "compatible with the EU

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[54] This is why a "subsidy" is used here. Subsidy is a term which economists use for state aid, and it need not necessarily mean state aid under the EC Treaty.

market," hence if it can be exempted from the ban under the provisions of the EU Treaty Article 87 (3) before being implemented.[55] Appreciating the compatibility of state aid should be about balancing the negative effects of aid on competition with its positive effects in terms of common interest. State aid under the EU Treaty has, by definition, negative effects on competition and trade between member states. But state aid also has negative economic effects on competition in national markets. There are several ways in which state aid can harm competition. Government subsidies distort the strategic environment as they distort signals generated by the market for decisions of competitors and thus may have long lasting negative economic consequences and effects. As a result, state aid might also generate serious inefficiencies and consequences for the economy as a whole (Besley and Seabright 1999).

In addition, state aid allows less efficient firms to survive in the market at the expense of more efficient firms. By providing state aid, the market power of the selected undertaking can be created, maintained or strengthened by providing economic advantages to firms that benefit from state support. The distortion of competition will be more severe when state aid is granted to a firm or firms that already have a high market power. Hence, state aid can be a source of market failure. State aid to companies has negative spillovers on the other firms in the market, is likely to have a negative impact on the whole market, and to harm competitors – both existing as well as potential entrants – and ultimately consumers. Furthermore, state aid tends to reduce dynamic efficiency because it softens the recipient's budget constraint (Kornai, 1980).

Subsidisation might give rise to both allocative and technical inefficiencies and subsidisation of investments in long-term growth is ambiguous. Empirically, numerous studies suggest that government intervention has negative effects on productivity growth (Bergstrom, 1998). Theoretical models predict that granting of state aid causes pricing that is

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[55] Article 87(2) specifies three types of aid that it declares compatible:- social aid granted to individual consumers; aid to compensate for damage by natural disasters or exceptional occurrences; aid to certain areas of Germany affected by the division of Germany. In practice, state aid under the Article 87(2) occurs only rarely and is automatically exempted.

likely to distort competition; however, these models suggest that state aid may distort competition or harm competitors not only due to pricing but also due to non-price effects that seriously harm non-recipients. The distortion of competition arises because the recipient could use the aid to invest, for example, in R&D and become able to provide a higher quality product. Competing firms will be harmed and forced to reduce their price, output and investment (Mollegard, 2005).

Government providing state aid weakens incentives for firms to improve efficiency. The expectation that aid might be granted – government commitment to grant state funds – is changing the behaviour of firms. State aid provides incentives for firms to invest in wasteful rent seeking activities in order to obtain state aid rather than invest in productive activities. If "state aid" lasts long for a certain company, the company enjoys a monopoly situation and x-inefficiencies occur. The companies become dependant on state aid, claiming to get the state aid in the interest of the welfare state, e.g., to improve technology, etc.

In order to be authorized and approved by the EC, negative effects of state aid on welfare listed above must be outweighed by benefits from state aid, by positive effects from the correction of the respective market failure. Only in such cases does economic justification for granting state aid exist, namely to raise the efficiency by correcting market failures. There exist several open questions related to the economic analysis of state aid and to the measurability of state aid effects, especially in a long run. Not only are data and reliable information always available because of low transparency of provided subsidies to enterprises, but also the application of general principles in real actual cases might not be straightforward. In addition, quantifications of effects and externalities can be costly. However, administrative costs of the enforcement of state aid control ex ante can diminish the costs that arise ex post. Ex ante state aid control and estimations of its effects can help reduce the scope of state aid policies to cases where there exists the possibility to correct "government failures" ex ante.

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6. List of Tables

7. List of Figures

Appendix I: **Share of four the largest firms in the total sales, 3-digit manufacturing industries, 1998-2006**

NACE	1998	1999	2000	2001	2002	2003	2004	2005	2006
151	0.2134	0.1778	0.1719	0.1906	0.1957	0.1772	0.1838	0.1787	0.1978
152	1.0000	1.0000	0.9141	0.9673	1.0000	1.0000	0.8938	0.9623	0.8599
153	0.3545	0.4146	0.5002	0.4187	0.4012	0.3917	0.4487	0.3821	0.4060
154	0.9885	0.8903	0.9370	0.9950	1.0000	0.9851	0.9990	1.0000	1.0000
155	0.3465	0.3350	0.3264	0.3345	0.3291	0.3507	0.3872	0.3765	0.3525
156	0.4409	0.3996	0.3689	0.4373	0.2895	0.3593	0.3223	0.3597	0.3312
157	0.1868	0.1775	0.1688	0.2033	0.1543	0.1750	0.1866	0.1635	0.1711
158	0.4017	0.2731	0.2627	0.2510	0.2925	0.2679	0.2681	0.2391	0.2526
159	0.3377	0.2991	0.2813	0.3213	0.3449	0.4298	0.4337	0.4485	0.4528
160	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9935	1.0000	1.0000
171	0.4331	0.4042	0.4231	0.4784	0.5132	0.5160	0.5322	0.6212	0.6360
172	0.3501	0.3357	0.3418	0.3862	0.3707	0.3623	0.4017	0.3965	0.4291
173	0.8071	0.6653	0.7689	0.8110	0.8360	0.8419	0.8430	0.9278	0.9294
174	0.4630	0.3894	0.3736	0.4356	0.3971	0.2794	0.3441	0.3284	0.3058
175	0.5606	0.5576	0.5608	0.5117	0.5228	0.5748	0.5703	0.6481	0.6205
176	0.9664	1.0000	0.8736	0.9076	0.8778	0.9003	1.0000	1.0000	1.0000
177	0.6129	0.5830	0.6220	0.5948	0.5351	0.4968	0.4814	0.4649	0.4578
180									
181	0.9581	0.8063	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
182	0.3863	0.2993	0.3594	0.3674	0.3749	0.3760	0.4058	0.4787	0.4933
183	0.9766	0.8938	0.9495	1.0000	1.0000	1.0000	0.9498	0.9699	1.0000
190									
191	0.5794	0.5483	0.5816	0.7121	0.6551	0.6402	0.6807	0.8029	0.8053
192	0.4356	0.4274	0.5071	0.3359	0.3470	0.3173	0.3501	0.4327	0.5017
193	0.5548	0.5589	0.4955	0.5320	0.3963	0.3095	0.3200	0.4507	0.4029
200									
201	0.4377	0.4364	0.4179	0.4783	0.5144	0.5007	0.4634	0.5035	0.5132
202	0.6288	0.6715	0.7143	0.7352	0.7528	0.7522	0.7389	0.8206	0.8278
203	0.4719	0.2181	0.2061	0.2692	0.2246	0.2073	0.2349	0.2689	0.2192
204	0.7874	0.7844	0.6194	0.3980	0.4694	0.3953	0.4457	0.2938	0.3432
205	0.5029	0.2261	0.2817	0.3511	0.2937	0.2788	0.3318	0.2869	0.3503
211	0.5968	0.6141	0.6090	0.6366	0.6326	0.6753	0.6821	0.6672	0.6659
212	0.4307	0.3901	0.4008	0.3925	0.3823	0.3050	0.3250	0.3340	0.3432
220									
221	0.2969	0.2640	0.2789	0.3294	0.3637	0.3947	0.3856	0.3479	0.3523
222	0.3190	0.2165	0.2619	0.2630	0.2561	0.2385	0.2427	0.2682	0.2740
223	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9722	1.0000	1.0000

231	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
232	1.0000	0.9980	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
240									
241	0.6052	0.6458	0.5834	0.5950	0.5772	0.5621	0.6052	0.5833	0.5802
242	1.0000	1.0000	1.0000	0.9911	1.0000	0.9379	0.9420	1.0000	0.9506
243	0.7095	0.5583	0.5374	0.5244	0.5164	0.4582	0.4619	0.3972	0.4037
244	0.6771	0.6832	0.6678	0.6961	0.7238	0.6619	0.6564	0.6794	0.6609
245	0.7923	0.7799	0.7251	0.7600	0.7367	0.4881	0.3944	0.3286	0.3461
246	0.6699	0.6752	0.5434	0.5167	0.5031	0.3593	0.4190	0.4212	0.4434
247	1.0000	1.0000	1.0000	0.9673	0.9523	0.9529	0.9449	1.0000	1.0000
250				1.0000	1.0000				
251	0.7517	0.7118	0.6783	0.6835	0.7475	0.7041	0.6911	0.7101	0.6887
252	0.3009	0.1887	0.1522	0.1705	0.2139	0.1418	0.1367	0.1171	0.1143
260						1.0000			
261	0.4882	0.4427	0.4460	0.4797	0.4656	0.4457	0.4703	0.4704	0.4620
262	0.4281	0.3279	0.3699	0.3212	0.3382	0.3672	0.3326	0.3810	0.3467
263	1.0000	0.9776	0.9887	0.9826	0.9745	0.9780	1.0000	0.9986	1.0000
264	0.5770	0.6803	0.6375	0.7718	0.8025	0.8093	0.7611	0.8563	0.8691
265	0.7772	0.7483	0.6729	0.7457	0.7278	0.7044	0.7448	0.7293	0.7421
266	0.2118	0.1743	0.1804	0.1856	0.1746	0.1936	0.2028	0.2183	0.2069
267	0.7074	0.5892	0.7633	0.6892	0.7117	0.5923	0.5432	0.5798	0.5628
268	0.6812	0.6037	0.4600	0.5365	0.4383	0.5646	0.5911	0.7209	0.7113
270									
271	0.8687	0.9108	0.9157	0.9205	0.9083	0.8757	0.8828	0.8386	0.8551
272	0.9366	0.7856	0.7917	0.7834	0.7720	0.7733	0.8434	0.8050	0.6593
273	0.7120	0.6884	0.5936	0.6944	0.6403	0.6964	0.7286	0.7603	0.6588
274	0.7882	0.6845	0.7515	0.6610	0.6309	0.7072	0.6220	0.6419	0.5768
275	0.2727	0.2966	0.2842	0.3523	0.3258	0.2660	0.2601	0.2588	0.2697
280									
281	0.3552	0.2019	0.1864	0.2000	0.1573	0.1348	0.1552	0.1888	0.1681
282	0.4919	0.3717	0.3643	0.3536	0.3581	0.4008	0.3877	0.4546	0.4300
283	0.9456	0.9074	0.7994	0.8232	0.7924	0.8248	0.6982	0.8915	0.8737
284	0.5500	0.5556	0.4132	0.5380	0.5157	0.4580	0.4311	0.4121	0.4479
285	0.2930	0.1637	0.1904	0.0978	0.1970	0.2062	0.1321	0.2359	0.2421
286	0.2390	0.1791	0.2519	0.3287	0.3130	0.4141	0.4450	0.4912	0.4385
287	0.1729	0.1417	0.1575	0.1594	0.1509	0.2050	0.1877	0.2130	0.2159
290						1.0000			
291	0.3276	0.3094	0.2309	0.2323	0.1976	0.2428	0.2703	0.3196	0.3009
292	0.3663	0.2176	0.1763	0.1924	0.2111	0.1964	0.1793	0.3241	0.3465
293	0.6543	0.4208	0.3675	0.3994	0.4048	0.3874	0.5035	0.5740	0.5468
294	0.4795	0.3575	0.3332	0.3314	0.2642	0.2209	0.2362	0.2719	0.2865
295	0.2265	0.1934	0.1663	0.1614	0.1742	0.1586	0.1409	0.1743	0.1981
296	0.8388	0.7269	0.7870	0.8277	0.8877	0.9283	0.8970	0.9617	0.8878

297	0.8719	0.7861	0.7568	0.7013	0.6599	0.5469	0.5308	0.6258	0.5836
300	0.7984	0.8383	0.7841	0.9552	0.9883	0.9586	0.9084	0.9137	0.9040
310	1.0000								
311	0.6539	0.6188	0.5426	0.5039	0.5385	0.5509	0.5498	0.5645	0.5345
312	0.4541	0.4099	0.4156	0.3942	0.3921	0.3576	0.3599	0.3954	0.3830
313	0.7553	0.5786	0.5336	0.5640	0.4962	0.5260	0.5139	0.5873	0.6498
314	0.9049	0.8908	0.8420	0.8514	0.8599	0.9179	0.9565	0.9185	0.9614
315	0.7360	0.5330	0.4370	0.6433	0.4882	0.5736	0.6058	0.6448	0.6053
316	0.5537	0.4575	0.4718	0.4764	0.3994	0.4115	0.3930	0.4988	0.4636
320	1.0000								
321	0.6306	0.6441	0.6387	0.5613	0.5895	0.5912	0.6609	0.5694	0.5804
322	0.5934	0.5679	0.7632	0.8364	0.8155	0.8792	0.8860	0.9000	0.8120
323	0.9242	0.9004	0.9299	0.9770	0.9541	0.9211	0.9419	0.9567	0.9443
330									
331	0.5902	0.4494	0.4201	0.4683	0.4423	0.4131	0.4535	0.4675	0.4685
332	0.4534	0.5024	0.6035	0.6941	0.7239	0.6717	0.6828	0.7701	0.7546
333	0.6893	0.7737	0.6429	0.5718	0.5575	0.7417	0.8391	0.8896	0.7960
334	0.4937	0.5340	0.5457	0.5750	0.5870	0.6828	0.7335	0.8722	0.8922
335	1.0000	1.0000	1.0000	1.0000	1.0000	0.9492	1.0000	1.0000	1.0000
340	1.0000								
341	0.9729	0.9804	0.9699	0.9769	0.9801	0.9766	0.9758	0.9871	0.9860
342	0.6787	0.5793	0.5976	0.5562	0.4991	0.4676	0.5663	0.5256	0.6206
343	0.3329	0.3101	0.2338	0.2849	0.2977	0.2525	0.2469	0.2295	0.2198
350									
351	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
352	0.6329	0.5260	0.5086	0.4745	0.4760	0.4958	0.5035	0.5756	0.5608
353	0.6330	0.6851	0.6083	0.7667	0.7303	0.7787	0.7839	0.7270	0.7261
354	0.4606	0.4065	0.4071	0.5192	0.5818	0.4750	0.5480	0.6403	0.5547
355	0.9664	1.0000	1.0000	1.0000	1.0000	0.9429	0.9635	1.0000	1.0000
360	1.0000								
361	0.5604	0.3631	0.3746	0.3531	0.4129	0.4242	0.4432	0.4604	0.4496
362	0.8402	0.8043	0.8675	0.9327	0.9669	0.8550	0.8069	0.7722	0.9088
363	0.7280	0.7351	0.7592	0.6739	0.7532	0.7519	0.7125	0.8143	0.7493
364	0.9459	0.5604	0.6677	0.7174	0.6598	0.5918	0.7112	0.7447	0.6826
365	0.6268	0.4870	0.5250	0.5723	0.6534	0.7359	0.8325	0.8533	0.8952
366	0.4711	0.2979	0.3314	0.3743	0.3496	0.3019	0.2722	0.3515	0.3020
370									
371	0.5192	0.3989	0.4438	0.4613	0.4623	0.4945	0.4771	0.4917	0.5481
372	0.7848	0.8853	0.6357	0.6740	0.5409	0.5676	0.4753	0.5437	0.6501

Appendix II: **HHI by 3-digit manufacturing industries, 1998-2006**

NACE	1998	1999	2000	2001	2002	2003	2004	2005	2006
151	268	209	212	226	242	222	210	200	221
152	7115	4516	3573	7019	8426	5264	3900	5412	2277
153	588	784	897	727	681	663	775	637	693
154	3341	2886	2892	4529	4538	4181	3916	4828	4801
155	532	475	435	469	447	518	570	520	451
156	823	747	654	680	472	592	522	572	502
157	259	235	241	275	227	265	263	256	259
158	684	276	284	263	323	291	280	248	256
159	486	401	369	458	500	760	798	844	855
160	8306	7589	7023	7678	7507	7051	7548	7825	9861
171	661	671	737	876	979	999	1050	1435	1551
172	518	472	497	562	540	518	602	621	705
173	4014	1776	2530	2317	2582	2962	2413	3161	3252
174	892	577	589	647	586	358	446	520	497
175	1055	926	1073	1094	932	1281	1284	1291	1180
176	4539	3368	2163	2624	2392	2462	3158	4124	4012
177	1480	1343	1558	1296	953	860	883	802	864
181	3884	2082	4029	3276	9810	3524	5047	5090	6173
182	550	346	437	470	523	556	597	992	970
183	3327	2354	5010	3515	4168	3640	3036	2769	3972
191	1233	1100	1182	1603	1520	1361	1476	1900	1931
192	755	679	851	508	513	458	538	692	840
193	1202	1542	930	1029	524	403	432	727	627
201	716	730	667	864	1013	766	683	793	820
202	1248	1672	1601	1864	2084	2327	2289	2877	2469
203	875	246	260	341	253	266	284	336	281
204	1825	2243	1341	706	898	725	826	500	608
205	968	354	483	547	461	453	556	502	584
211	1321	1365	1312	1542	1489	1686	1694	1580	1633
212	682	530	559	549	559	396	449	460	460
221	401	366	370	439	509	547	534	509	528
222	447	254	307	288	276	254	250	304	298
223	10000	5649	5501	5994	5823	6050	3848	5861	6077
231	10000	10000	10000	10000	10000	10000	10000	10000	10000
232	7121	6309	7495	7740	7783	7765	4807	7899	8061
241	1364	1366	1206	1316	1203	1192	1468	1407	1366
242	9209	8122	8237	5312	6802	5038	5309	6337	5294
243	1465	1009	967	926	908	761	770	673	705
244	2157	1990	1618	2020	2032	1599	1592	1717	1686
245	4790	4518	3607	4264	4029	1109	625	465	493
246	1490	1754	1018	979	881	536	652	637	691
247	10000	5051	5029	4463	4223	3955	3741	4064	4947
251	2862	2549	1947	2291	2447	2270	2110	2049	1751
252	356	177	142	153	197	117	104	96	94
261	880	679	671	771	724	681	711	724	741

262	684	464	555	480	483	542	497	572	514
263	3074	2997	3010	2987	3060	2503	9425	9111	9317
264	1412	1614	1376	2178	2078	2223	2061	2220	2332
265	1987	1765	1478	1816	1792	1626	1798	1720	1784
266	284	230	236	221	225	246	256	251	239
267	1619	1197	1964	1622	1588	1258	1111	1179	1170
268	1386	1127	808	1003	744	1066	1237	1579	1440
271	2128	2338	2435	2524	2617	2675	2740	2070	2199
272	2865	1930	1962	1819	1716	1764	1891	1771	1295
273	2441	2279	1308	1645	1394	1749	1846	2384	1481
274	1930	1429	1749	1477	1458	1681	1427	1523	1172
275	361	412	359	455	396	312	302	304	322
281	549	229	184	197	147	136	128	170	160
282	922	574	564	512	530	589	558	685	647
283	5243	5663	2616	2738	3109	2358	1675	2724	2163
284	1052	1005	661	1067	937	744	664	697	857
285	346	171	183	115	201	210	123	252	255
286	288	180	280	472	489	828	915	974	773
287	207	159	172	177	173	210	193	219	225
291	549	500	278	287	240	273	309	395	381
292	441	240	187	191	210	198	175	412	409
293	2826	669	512	529	581	530	1113	1362	1333
294	782	524	467	416	327	278	296	358	365
295	252	180	164	156	166	140	130	169	193
296	2114	1681	1697	2461	2659	2766	2356	2778	2309
297	2766	2342	1888	1660	1341	928	980	1223	1077
300	1822	4314	3553	2707	4694	4775	3432	3597	4416
311	2075	1838	1300	1009	1232	1228	1300	1299	1164
312	757	596	551	570	579	515	463	558	552
313	1645	1143	995	1089	936	916	939	1129	1279
314	2595	2486	2310	2508	2578	2878	3403	3013	3970
315	2396	940	813	2192	857	1530	1414	1401	1243
316	1038	839	694	802	591	614	526	767	696
321	1259	1165	1257	1105	1114	1362	1829	1299	1085
322	1479	1186	2433	3230	2697	4226	3312	3698	4098
323	5792	5083	3937	4642	3789	7180	7831	6931	6962
331	1118	703	612	763	694	619	722	795	804
332	742	1250	1425	3339	3810	3150	2832	3922	3827
333	1393	1773	1321	1155	1061	1729	2269	4321	2043
334	921	984	1041	1041	1103	1454	1691	3075	3355
335	5059	3678	4674	2835	2954	2854	3606	5024	3978
341	7808	8338	8030	8338	8458	8432	8201	7298	5794
342	1406	1221	1143	959	844	837	980	867	1749
343	482	430	325	357	376	310	307	286	269
351	8912	4638	8006	8772	6379	7784	7349	8635	6783
352	1325	940	847	868	826	801	925	1194	1066
353	1269	1821	1366	3886	3210	3561	2636	1888	2039
354	831	724	775	965	1121	837	1045	1269	973
355	6612	9158	10000	3509	4487	5908	6068	2845	3122
361	1528	645	668	679	1091	1158	1211	1342	1258

362	2489	2342	2547	3348	3463	3053	2029	1944	2519
363	1898	2153	2421	1707	2245	2314	2093	2480	1961
364	5164	1208	1664	1600	1552	1367	1695	2367	1809
365	1245	902	1020	1124	2016	2001	2413	2771	3500
366	945	393	443	492	452	398	369	489	417

Appendix III: **Import penetration by 3-digit NACE, 1998-2002**

NACE	Import penetration (NACE name)	1998	1999	2000	2001	2002
151	Meat	0.139	0.129	0.162	0.151	0.160
152	Fish	0.844	0.765	0.789	0.810	0.794
153	fruits and vegetables	0.633	0.705	0.654	0.642	0.647
154	Vegetable and fats	0.467	0.452	0.573	0.576	0.567
155	dairy products	0.090	0.113	0.123	0.118	0.128
156	grain mill products	0.497	0.523	0.587	0.492	0.546
157	prepared animal feeds	0.184	0.182	0.214	0.206	0.219
158	other food products	0.359	0.375	0.402	0.408	0.381
159	Beverages	0.101	0.110	0.138	0.132	0.129
160	tobacco products	0.225	0.194	0.251	0.122	0.110
171	spinning of textile fibers	0.660	0.770	0.811	0.808	0.832
172	textile weaving	0.596	0.629	0.688	0.702	0.671
174	made-up textiles ex. apparel	0.959	0.861	0.929	0.840	0.859
175	other textiles	0.745	0.827	0.842	0.899	0.881
176	knitted and crocheted fabrics	0.919	0.932	0.946	0.915	0.914
177	knitted and crocheted articles	0.574	0.664	0.715	0.750	0.901
181	leather clothes	0.953	0.884			
182	wearing apparel and acces.	0.893	0.881	0.889	0.910	0.942
183	Fur	0.812	0.996	0.617	0.935	
191	Leather	0.885	0.910	0.934	0.958	0.974
192	luggage, handbags, etc.	0.807	0.885	0.935	0.975	0.974
193	Footwear	0.741	0.767	0.851	0.890	0.898
201	Wood	0.502	0.483	0.532	0.518	0.535
202	sheets, panels, and boards	0.511	0.566	0.644	0.645	0.641
203	builders' carpentry and joinery	0.559	0.544	0.547	0.479	0.480
204	wooden containers	0.966	0.959	0.954	0.891	0.999
205	other wood products	0.720	0.727	0.860	0.811	0.865
211	pulp, paper, and paperboard	0.659	0.699	0.765	0.751	0.799
212	articles of paper and paperboard	0.600	0.626	0.673	0.603	0.568
221	Publishing	0.291	0.349	0.311	0.342	0.398
222	Printing	0.560	0.600	0.648	0.627	0.651
231	Manufacture of coke oven products	0.213	0.284	0.453	0.435	0.407
232	refined petroleum products	0.402	0.483	0.581	0.496	0.490
241	basic chemicals	0.589	0.647	0.733	0.651	0.684
242	Pesticides and agro-chemicals	0.920	0.922	0.922	0.952	0.932
243	paints, varnishes, inks, mastics	0.875	0.868	0.905	0.870	0.870
244	pharmaceuticals, medicines	0.852	0.878	0.913	0.888	0.888
245	soaps, detergents, toilettries	0.781	0.846	0.853	0.850	0.822
246	other chemical products	0.899	0.966	0.947	0.969	0.962
247	man-made fibers	0.894	0.885	0.911	0.905	0.909
251	rubber products	0.712	0.807	0.828	0.735	0.598
252	plastic products	0.762	0.830	0.833	0.805	0.776
261	glass products	0.422	0.413	0.491	0.487	0.543
262	ceramic goods	0.672	0.685	0.691	0.664	0.747
263	ceramic tiles and flags	0.299	0.318	0.307	0.362	0.389

264	clay bricks, tiles, flags	0.086	0.107	0.150	0.132	0.145
265	cement, lime, plaster	0.124	0.149	0.174	0.196	0.214
266	articles of concrete and cement	0.172	0.143	0.140	0.124	0.108
267	cutting and finishing of stone	0.899	0.898	0.917	0.923	0.942
268	other non-metallic minerals	0.682	0.678	0.628	0.674	0.617
271	basic iron, steel, and Fe-alloys	0.312	0.352	0.515	0.405	0.423
272	Manufacture of tubes	0.558	0.668	0.707	0.746	0.718
273	iron, steel, and Fe-alloys	0.620	0.642	0.743	0.702	0.729
274	basic precious and non-Fe metals	0.807	0.862	0.857	0.863	0.875
281	structural metal products	0.507	0.577	0.548	0.581	0.631
282	tanks, resevoirs, containers of metal	0.496	0.542	0.529	0.520	0.582
283	steam generators	0.246	0.173	0.268	0.158	0.146
286	cutlery, tools, hardware	0.732	0.781	0.825	0.836	0.839
287	other non-fabricated metal products	0.773	0.811	0.869	0.884	0.905
291	power-generating machinery	0.802	0.890	0.906	0.878	0.965
292	other gen. purpose machinery	0.800	0.826	0.866	0.894	0.868
293	agricul. and forestry machinery	0.540	0.650	0.709	0.819	0.798
294	machine tools	0.850	0.852	0.870	0.859	0.846
295	other special-purpose machinery	0.744	0.795	0.801	0.844	0.834
296	weapons and ammunition	0.330	0.447	0.461	0.376	0.375
297	domestic appliances	0.882	0.879	0.889	0.891	0.901
300	office machinery and computers	0.997	0.958	0.996	0.992	0.997
311	electric motors, generators, transformers	0.844	0.885	0.904	0.912	0.898
312	Electricity dist. and control apparatus	0.770	0.762	0.825	0.844	0.841
313	insulated wire and cable	0.705	0.724	0.750	0.779	0.748
314	Accumulators,primary cells and batteries	0.903	0.918	0.921	0.957	0.907
315	lighting equipment and lamps	0.698	0.891	0.897	0.875	0.910
316	electrical equipment	0.623	0.685	0.683	0.706	0.665
321	Electronic valves, tubes, components	0.883	0.933	0.964	0.983	0.998
322	transmitter, phone, telegraph apparatus	0.867	0.858	0.819	0.735	0.963
323	TV, radios, video and audio recorders	0.979	0.985	0.883	0.740	0.798
331	medical and surgical equipment	0.905	0.913	0.924	0.954	0.957
332	Measuring and navigating instruments	0.900	0.877	0.913	0.758	0.760
334	optical and photographic instruments	0.924	0.881	0.901	0.893	0.860
335	watches and clocks	0.995	0.940	0.943		
341	motor vehicles	0.666	0.744	0.714	0.749	0.832
342	coachwork, trailers, semi-trailers	0.679	0.731	0.871	0.802	0.854
343	automotive parts	0.711	0.732	0.724	0.727	0.784
351	ships and boats	0.810	0.385	0.988	0.959	0.959
352	rail and tram locomotives	0.611	0.541	0.548	0.444	0.385
353	aircraft and spacecraft	0.879	0.859	0.851	0.729	0.764
354	motorcycles and bicycles	0.816	0.899	0.875	0.893	0.885
355	other transport equipment	0.396	0.799	0.996	0.989	1.000
361	Furniture	0.620	0.623	0.662	0.598	0.616
362	Jewelry	0.824	0.894	0.938	0.911	0.961
363	musical instruments	0.608	0.659	0.764	0.604	0.713
364	sporting goods	0.953	0.960	0.963	0.967	0.975
365	games and toys	0.935	0.972	0.968	0.930	0.959
366	miscellaneous manufacturing	0.585	0.628	0.557	0.718	0.788

Appendix IV: **Export performance by 3-digit NACE 1998 and 2002**

exp/S	Export performance (NACE name)	1998	2002
151	meat	1.64%	7.72%
152	fish	0.93%	0.00%
153	fruits and vegetables	8.42%	9.80%
154	vegetable and fats	19.45%	45.88%
155	dairy products	7.91%	6.27%
156	grain mill products	2.72%	12.48%
157	prepared animal feeds	3.17%	20.59%
158	other food products	15.38%	24.54%
159	beverages	11.54%	11.65%
160	tobacco products	45.89%	21.94%
171	spinning of textile fibers	42.18%	81.66%
172	textile weaving	45.37%	87.48%
173	finishing of textiles	41.77%	13.51%
174	made-up textiles ex. apparel	51.92%	92.80%
175	other textiles	51.52%	85.61%
177	knitted and crocheted articles	39.29%	76.39%
182	wearing apparel and acces.	65.63%	89.85%
192	luggage, handbags, etc.	59.95%	78.65%
193	footwear	44.91%	68.37%
201	wood	35.81%	78.04%
202	sheets, panels, and boards	40.26%	62.97%
203	builders' carpentry and joinery	63.24%	68.73%
204	wooden containers	77.54%	109.94%
205	other wood products	42.39%	82.14%
211	pulp, paper, and paperboard	51.95%	80.92%
212	articles of paper and paperboard	33.62%	29.12%
221	publishing	5.76%	5.74%
222	printing	9.63%	18.65%
223	reproduction of recorded media	82.09%	71.45%
241	basic chemicals	37.35%	49.06%
244	pharmaceuticals, medicines	44.39%	74.79%
245	soaps, detergents, toilettries	65.09%	78.46%
246	other chemical products	38.75%	79.03%
247	man-made fibers	35.26%	73.34%
251	rubber products	62.10%	61.57%
252	plastic products	36.07%	56.09%
261	glass products	56.13%	64.67%
262	ceramic goods	51.22%	73.57%
263	ceramic tiles and flags	47.34%	52.48%

264	clay bricks, tiles, flags	17.94%	18.93%
265	cement, lime, plaster	18.88%	9.86%
266	articles of concrete and cement	12.51%	16.53%
267	cutting and finishing of stone	16.68%	42.09%
268	other non-metallic minerals	31.39%	56.25%
271	basic iron, steel, and Fe-alloys	14.09%	14.80%
272	manufacture of tubes	21.51%	95.63%
273	iron, steel, and Fe-alloys	55.11%	74.79%
274	basic precious and non-Fe metals	36.64%	56.98%
275	casting of metals	46.20%	66.44%
281	structural metal products	28.33%	74.93%
282	tanks, resevoirs, containers of metal	36.03%	69.79%
283	steam generators	12.16%	61.70%
284	forging, pressing, stamping of metal	49.28%	82.90%
285	gen. mech. engineering	37.08%	84.71%
286	cutlery, tools, hardware	48.94%	80.65%
287	other non-fabricated metal products	51.71%	79.13%
291	power-generating machinery	82.89%	77.82%
292	other gen. purpose machinery	38.90%	72.33%
293	agricul. and forestry machinery	52.02%	87.13%
294	machine tools	69.08%	70.63%
295	other special-purpose machinery	44.38%	83.66%
297	domestic appliances	55.09%	68.07%
300	office machinery and computers	64.54%	99.47%
311	electric motors, generators, transformers	60.22%	85.65%
312	electricity dist. and control apparatus	30.12%	59.45%
313	insulated wire and cable	30.05%	56.38%
314	accumulators, primary cells and batteries	67.01%	75.86%
315	lighting equipment and lamps	48.18%	83.08%
316	electrical equipment	44.56%	82.41%
321	electronic valves, tubes, components	40.42%	112.80%
322	transmitter, phone and telegraph ap.	29.07%	65.62%
323	TV, radios, video and audio recorders	75.86%	77.84%
331	medical and surgical equipment	40.04%	97.67%
332	measuring and navigating instruments	37.92%	42.80%
333	industrial process control equipment	22.49%	89.22%
334	optical and photographic instruments	66.76%	91.10%
341	motor vehicles	77.71%	88.97%
342	coachwork, trailers, semi-trailers	43.64%	50.65%
343	automotive parts	58.82%	85.71%
352	rail and tram locomotives	53.27%	80.74%
353	aircraft and spacecraft	32.57%	57.58%
354	motorcycles and bicycles	57.94%	72.52%

361	furniture	46.43%	69.41%
362	jewellry	32.71%	103.78%
363	musical instruments	79.77%	100.00%
364	sporting goods	88.66%	96.79%
365	games and toys	28.63%	94.07%
366	miscellaneous manufacturing	53.37%	72.83%
371	recycling of metal	23.21%	69.22%

Appendix V: R&D intensity by employment and share of foreign firms on sales by 3digit manufacturing industries in 2006

NACE	NACE name	Share of R&D employees on the total number of industry empl.	Share of foreign firms on the industry sales
151	meat	0.03%	0.0116
152	fish	0.00%	0.0468
153	fruits and vegetables	0.09%	0.4469
154	vegetable and fats	0.63%	0.343
155	dairy products	0.33%	0.1659
156	grain mill products	0.36%	0.1817
157	prepared animal feeds	0.37%	0.0646
158	other food products	0.17%	0.5826
159	beverages	0.03%	0.6953
160	tobacco products	0.00%	0.9845
171	spinning of textile fibers	0.00%	0.7311
172	textile weaving	0.36%	0.4929
173	finishing of textiles	0.26%	0.175
174	made-up textiles ex. apparel	0.50%	0.1862
175	other textiles	0.38%	0.0757
176	knitted and crocheted fabrics	0.81%	0.049
177	knitted and crocheted articles	0.45%	0.3274
181	leather clothes	0.00%	0.6532
182	wearing apparel and acces.	1.21%	0.2379
191	leather	1.60%	0
192	luggage, handbags, etc.	1.03%	0.1826
193	footwear	0.70%	0.3081
201	wood	0.08%	0.673
202	sheets, panels, and boards	0.02%	0.6422
203	builders' carpentry and joinery	0.00%	0.2162
204	wooden containers	0.00%	0.2897
205	other wood products	0.00%	0.4685
211	pulp, paper, and paperboard	0.07%	0.647
212	articles of paper and paperboard	0.03%	0.5704
221	publishing	0.00%	0
222	printing	0.00%	0.7107
223	reproduction of recorded media	0.00%	0.2933
241	basic chemicals	1.55%	0.2469
243	paints, varnishes, inks, mastics	2.64%	0.4044

244	pharmaceuticals, medicines	5.17%	0.856
245	soaps, detergents, toilettries	1.51%	0.1962
246	other chemical products	4.79%	0.4871
247	man-made fibers	0.00%	0.8006
251	rubber products	1.25%	0.8175
252	plastic products	0.51%	0.5331
261	glass products	0.67%	0.5234
262	ceramic goods	1.27%	0.4631
263	ceramic tiles and flags	1.28%	0.9761
264	clay bricks, tiles, flags	0.00%	0.4952
265	cement, lime, plaster	0.30%	0.9449
266	articles of concrete and cement	0.42%	0.5414
267	cutting and finishing of stone	0.00%	0.1086
268	other non-metallic minerals	0.68%	0.5828
271	basic iron, steel, and Fe-alloys	1.59%	0.6711
272	manufacture of tubes	0.15%	0.5378
273	iron, steel, and Fe-alloys	0.37%	0.7529
274	basic precious and non-Fe metals	2.77%	0.6486
275	casting of metals	0.14%	0.1632
281	structural metal products	0.47%	0.2954
282	tanks, resevoirs, containers of metal	1.18%	0.4187
283	steam generators	1.17%	0.4195
284	forging, pressing, stamping of metal	0.41%	0.3515
285	gen. mech. engineering	0.17%	0.4392
286	cutlery, tools, hardware	1.36%	0.5203
287	other non-fabricated metal products	0.29%	0.6044
291	power-generating machinery	1.52%	0.4656
292	other gen. purpose machinery	0.99%	0.6716
293	agricul. and forestry machinery	0.64%	0.3422
294	machine tools	2.69%	0.4184
295	other special-purpose machinery	2.44%	0.3602
296	weapons and ammunition	1.67%	0
297	domestic appliances	1.18%	0.5651
300	office machinery and computers	0.66%	0.8554
311	electric motors, generators, transformers	1.23%	0.7617
312	electricity dist. and control apparatus	1.01%	0.5089
313	insulated wire and cable	0.54%	0.7406
314	accumulators, primary cells and batteries	0.22%	0.8841
315	lighting equipment and lamps	0.92%	0.3689
316	electrical equipment	1.29%	0.8013
321	electronic valves, tubes, components	1.06%	0.7475
322	transmitter, phone and telegraph apparatus	8.29%	0.8496
323	TV, radios, video and audio recorders	5.24%	0.9672

331	medical and surgical equipment	3.00%	0.5538
332	measuring and navigating instruments	3.70%	0.6785
333	industrial process control equipment	20.09%	0.4842
334	optical and photographic instruments	2.74%	0.5114
335	watches and clocks	2.29%	0.5695
341	motor vehicles	5.45%	0.2476
342	coachwork, trailers, semi-trailers	0.45%	0.3103
343	automotive parts	1.50%	0.8491
351	ships and boats	0.00%	0.0114
352	rail and tram locomotives	2.63%	0.3385
353	aircraft and spacecraft	8.94%	0.2231
354	motorcycles and bicycles	0.46%	0.6621
361	furniture	0.28%	0.2191
362	jewellry	0.00%	0.0448
363	musical instruments	0.37%	0.2128
364	sporting goods	0.47%	0.4271
365	games and toys	0.69%	0.6373
366	miscellaneous manufacturing	0.70%	0.3188

Appendix VI: **Subsidy by 3-digit NACE, 1998-2002**

NACE	Name	s98-02	q/Q98	q/Q02	cd 98	cd 02	ceu 98	ceu 02
151	Meat	0.03	0.03	0.03	1.98	1.55	0.03	0.03
152	Fish	0.00	0.00	0.00	0.04	0.04	0.00	0.00
153	Fruit	0.00	0.00	0.00	0.21	0.16	0.03	0.07
154	Oils	0.06	0.01	0.01	0.52	0.32	0.07	0.05
155	Dairy	0.22	0.03	0.03	1.68	1.48	0.03	0.04
156	Grain	0.02	0.00	0.00	0.15	0.11	0.01	0.01
157	Anim. feeds	0.00	0.01	0.01	0.64	0.49	0.00	0.01
158	Other food	0.02	0.03	0.03	1.70	1.56	0.02	0.07
159	Beverages	0.05	0.03	0.03	1.72	1.65	0.08	0.12
171	Textile fibres	0.00	0.01	0.00	0.21	0.08	0.44	1.17
172	Weawing	0.00	0.02	0.02	0.62	0.34	1.25	2.00
174	Apparel	0.00	0.00	0.00	0.01	0.03	1.00	1.21
175	Other textiles	0.00	0.01	0.01	0.28	0.13	0.29	0.79
176	Fabrics	0.00	0.00	0.00	0.02	0.02	0.39	0.37
177	Knitting	0.00	0.00	0.00	0.09	0.02	0.33	0.54
182	Other apparel	0.03	0.01	0.01	0.11	0.06	0.45	0.61
191	Leather	0.00	0.00	0.00	0.04	0.01	0.12	0.10
192	Bags	0.00	0.00	0.00	0.03	0.01	0.38	0.48
193	Footwear	0.01	0.01	0.00	0.16	0.05	0.45	0.44
201	Wood	0.01	0.00	0.01	0.15	0.14	0.78	0.74
202	Boards	0.00	0.01	0.01	0.23	0.15	0.44	0.39
203	Carpentry	0.01	0.00	0.00	0.07	0.10	0.34	0.36
204	Wooden containers	0.00	0.00	0.00	0.00	0.00	0.77	0.78
205	Other wood	0.01	0.00	0.00	0.02	0.01	0.28	0.41
211	Pulp, paper	0.00	0.02	0.02	0.60	0.30	0.30	0.44
212	Articles of paper	0.01	0.01	0.01	0.43	0.52	0.08	0.16
221	Publishing	0.01	0.01	0.01	0.65	0.52	0.04	0.07
222	Printing	0.01	0.00	0.01	0.25	0.26	0.10	0.30
231	Coke products	0.00	0.00	0.00	0.23	0.19	8.18	7.71
232	Petroleum products	0.02	0.03	0.03	1.61	1.54	0.06	0.17
241	Chemicals	0.01	0.05	0.04	2.09	1.43	0.29	0.28
242	Pesticides	0.00	0.00	0.00	0.02	0.02	0.12	0.07
243	Paints	0.00	0.00	0.00	0.10	0.09	0.05	0.07
244	Pharmaceuticals	0.00	0.01	0.01	0.33	0.27	0.05	0.06
245	Soaps	0.00	0.01	0.01	0.20	0.14	0.06	0.12
246	Other chemicals	0.02	0.00	0.00	0.12	0.04	0.09	0.17
247	Man-made fibres	0.00	0.00	0.00	0.05	0.05	0.27	0.61
251	Rubber	0.00	0.02	0.03	0.38	0.79	0.73	1.46
252	Plastics	0.03	0.02	0.03	0.83	0.92	0.23	0.40
261	Glass	0.00	0.02	0.03	0.60	0.64	1.00	1.18
262	Ceramic	0.01	0.01	0.01	0.19	0.11	0.97	1.33
263	Tiles	0.00	0.01	0.00	0.18	0.14	0.44	0.56
264	Bricks	0.00	0.00	0.00	0.17	0.14	0.19	0.14
265	Cement	0.00	0.01	0.01	0.50	0.38	0.36	0.12
266	Articels of concrete	0.00	0.01	0.01	0.52	0.66	0.13	0.13

267	Stone	0.00	0.00	0.00	0.00	0.00	0.14	0.10
268	Non-metalic	0.00	0.00	0.00	0.13	0.16	0.20	0.39
271	Basic iron	0.01	0.09	0.05	4.47	2.77	0.54	0.82
272	Manufacture of tubes	0.00	0.01	0.01	0.41	0.20	0.99	0.97
273	Iron, steel, Fe-alloys	0.00	0.01	0.01	0.41	0.18	0.88	0.85
274	Non Fe metals	0.00	0.01	0.01	0.45	0.29	0.36	0.42
281	Structural metal	0.01	0.01	0.01	0.36	0.18	0.34	0.43
282	Tanks, rezervoirs	0.00	0.01	0.01	0.22	0.12	0.56	0.85
283	Generators	0.01	0.01	0.01	0.44	0.18	0.03	0.07
286	Metal	0.01	0.01	0.01	0.27	0.20	0.53	1.15
287	Non-fabric.metal prod.	0.01	0.02	0.01	0.43	0.21	0.82	1.30
291	Power gen. machinery	0.02	0.02	0.01	0.49	0.08	0.53	1.16
292	Other machinery	0.01	0.02	0.01	0.51	0.28	0.44	0.82
293	Agric. machinery	0.01	0.01	0.00	0.26	0.10	0.39	0.35
294	Machine tools	0.01	0.01	0.01	0.21	0.22	0.92	1.14
295	Special machinery	0.05	0.02	0.02	0.86	0.51	0.60	1.10
296	Weapons	0.00	0.00	0.00	0.06	0.06	0.15	0.18
297	Domestic appliances	0.00	0.00	0.00	0.12	0.09	0.25	0.56
311	Motors	0.01	0.01	0.01	0.21	0.13	1.61	1.64
312	Control apparatus	0.02	0.01	0.01	0.54	0.35	0.54	0.95
313	Wire, cable	0.01	0.01	0.01	0.30	0.22	0.94	1.86
314	Accumulators	0.00	0.00	0.00	0.04	0.05	1.31	2.47
315	Lamps	0.00	0.00	0.00	0.15	0.03	0.36	0.49
316	Elect. equipment	0.02	0.01	0.02	0.43	0.42	0.73	1.57
321	Tubes, components	0.00	0.01	0.01	0.21	0.01	0.62	0.79
322	Phones	0.01	0.00	0.01	0.16	0.04	0.04	0.50
323	TV	0.00	0.00	0.02	0.02	0.26	0.21	1.08
331	Medical equip.	0.00	0.00	0.00	0.06	0.03	0.17	0.19
332	Measur. Instruments	0.01	0.00	0.01	0.11	0.35	0.30	0.45
334	Optical instruments	0.00	0.00	0.00	0.02	0.05	0.52	0.84
341	Cars	0.00	0.11	0.11	1.51	0.77	0.46	0.53
342	Trailers	0.00	0.00	0.00	0.13	0.05	0.40	0.44
343	Automotive parts	0.02	0.04	0.09	0.97	0.96	0.82	1.76
351	Ships	0.00	0.00	0.00	0.00	0.00	0.09	0.06
352	Rail, tram, locomotives	0.03	0.01	0.01	0.20	0.25	1.09	1.09
353	Aerospace	0.01	0.00	0.00	0.07	0.14	0.03	0.10
354	Motorcycles	0.00	0.00	0.00	0.04	0.02	0.40	0.35
355	Transport equipment	0.00	0.00	0.00	0.02	0.00	0.68	1.02
361	Furniture	0.01	0.01	0.02	0.45	0.48	0.57	0.90
362	Jewelry	0.00	0.00	0.00	0.02	0.00	0.04	0.05
363	Musical instruments	0.00	0.00	0.00	0.02	0.01	1.87	1.88
364	Sporting goods	0.00	0.00	0.00	0.01	0.00	1.07	1.07
365	Toys	0.00	0.00	0.00	0.01	0.01	0.55	0.83
366	Miscelan. manuf.	0.04	0.01	0.00	0.22	0.07	0.68	0.73
		1.00	1.00	1.00	**36.76**	28.19	**46.48**	62.58

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