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Impact of increasing returns to scale and imperfect competition on international trade in automotive industry: Czech republic – Germany intra-industry trade

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Abstrakt

Tato práce analyzuje vliv rostoucích výnosů z rozsahu a nedokonalé konkurence na mezinárodní obchod se zaměřením na automobilový průmysl a vzájemný obchod České republiky a Německa v tomto průmyslovém odvětví. Protože rostoucí výnosy z rozsahu nemůžou existovat v dokonalé konkurenci, podporují tím diferenciaci produktů a snahu výrobců odlišit své výrobky od těch ostatních a získat svůj podíl na poli mezinárodního obchodu. Tím vzniká vnitroodvětvový obchod, kdy země vzájemně obchodují se zbožím podobného charakteru, které se může lišit jednak kvalitou nebo zcela jinými vlastnostmi. Tyto podrobně rozebraná teoretická východiska se snažím aplikovat na případovou studii vzájemného vniotrodvětvového obchodu České republiky a Německa se zaměřením na automobilový průmysl. Ten tvoří asi čtvrtinu průmyslové produkce České republiky, na hrubém domácím produktu se podílí přibližně deseti procenty a vývoz silničních vozidel představuje zhruba 17% celkového vývozu. Německo jako nejvýznamnější obchodní partner České republiky a světová velmoc číslo jedna ve vývozu strojů a dopravních prostředků, dováží podstatnou část produkce českého automobilového průmyslu a zároveň do ČR vyváží své vlastní produkty v tomto odvětví. Tato práce si klade za cíl analyzovat tuto obchodní výměnu a do ní zapojenou produkci.

Abstract

This paper analyzes the impact of increasing returns to scale and imperfect competition in international trade with a focus on the automotive industry and trade between the Czech Republic and Germany in this sector . Because increasing returns to scale can not exist in perfect competition, they promote the differentiation of products and manufacturers attempt to differentiate their products from the others and get their share in international trade. This gives rise to intra-industry trade, where countries trade in similar goods that may differ either in quality or in completely different characteristics. These into detail analyzed theoretical bases I try to apply to a case study of mutual intra-industry trade between Czech Republic and Germany with a focus on the automotive industry, which makes up about a quarter of the Czech Republic industrial output, accounts for approximately ten percent of the gross domestic product, while exports of road vehicles represent about 17% of total exports. Germany as a major trading partner of the Czech Republic and the world's number one superpower in exports of machinery and transport equipment, imports a substantial part of the production of the Czech automotive industry and also exports its own products of the industry to the Czech Republic. This work aims to analyze this trade and involved production.

Klíčová slova

rostoucí výnosy z rozsahu, diferenciace produktů, vnitroodvětvový obchod, automobilový průmysl, export, jednotkové ceny, Německo

Keywords

increasing returns to scale, product differentiation, intra-industry trade, automotive industry, exports, unit values, Germany

Rozsah práce: 126 032

Prohlášení

1. Prohlašuji, že jsem předkládanou práci zpracoval/a samostatně a použil/a jen uvedené prameny a literaturu.
2. Prohlašuji, že práce nebyla využita k získání jiného titulu.
3. Souhlasím s tím, aby práce byla zpřístupněna pro studijní a výzkumné účely.

V Praze dne 5.8.2013 Ján Tomo

Poděkování

Na tomto místě bych rád poděkoval svému konzultantovi, panu Ing. Vilému Semerákovi, M.A., Ph.D., za jeho připomínky a rady a v neposlední řadě za trpělivost.

Též děkuji všem, kteří mě jakoukoliv formou podporovali.

Exploring relations between economies of scale, imperfect competition and growing volume of traded goods on international markets in the case of automotive industry based on empirical findings and their comparison with theoretical models focused on Czech republic and Germany intra-industry trade in automotive industry sector.

1. Introduction to theory
2. Returns to scale
3. Imperfect competition
3.1 General impact on international trade
4. Automotive industry in Czech republic
4.1 Historical development and production growth
4.2 Specifications of the industry
5. Analysis of the Czech foreign trade with Germany focused on automotive industry
5.1 Interpretation of statistical data
5.2 Comparison to theoretical models
5.3 Analysis of products, qualities and prices for both countries
5.4 Interpretation of results

Introduction

Many papers has been analyzing the impact of increasing returns and imperfect competition on international trade. This concept is somewhat different from the classical comparative advantage approach. Increasing income, advanced technologies and efforts to inovate and differentiate products leads to the gradually higher share of so called intra-industry trade. This involves the import and export of similar goods. What reason leads inhabitants of the country to buy a similar product from abroad? Is it quality or something else? And how to measure this differentiation?

In this paper I am trying to analyse these questions and more by reviewing the developed theoretical base and later applying it on the mutual trade of the Czech Republic and Germany in automotive industry, focusing on the nature of intra-industry trade within this sector.

The paper is organized as follows. Section 1 provides a theoretical background of the basic international trade theories. Section 2 is devoted to the theoretical analysis of impact of increasing returns to scale and imperfect competition on international trade in general, while giving a brief overview about varius imperfectly competitive models and their applications in trade theory. Section 3 is dealing with issues of product differentiation, competitiveness and quality measurement, as well as with various methods for analysing intra-industry trade. Section 4 describes automotive industry in the Czech Republic, it's importance for the domestic economy and role in country's foreign trade. Section 5 is a case study of Czech and German mutual trade mainly focused on intra-industry trade in automotive industry, particularly passenger cars and their parts and accessories. Section 6 concludes.

1. International Trade Theory

1.1 International Trade

One of the most important concepts in this paper is international trade. The literal interpretation brings an idea about the trade among nations. The term itself can be defined by following: *International trade is exchange of capital, goods and services across international borders and territories.*

Countries engage in international trade for two basic reasons, each of which contributes to their gain from trade. Nations can benefit from doing the things each can does relatively well. Second, countries trade to achieve economies of scale in production. That means, if country produces only a limited range of goods, it can produce each of these goods at a larger scale and hence more efficiently than if it tried to produce everything.

Subjects of international trade are individual producers and consumers. Producers seek to maximize their profits, consumers to maximize their utilities. International trade is then trade as the any other trade. It doesn't affect the exchange concept as a consequence of the division of labour.

Foreign trade and its structure are influenced by severe factors from both macroeconomic and microeconomic view. According to classical trade theories it depends on comparative advantage of the country. Modern theories emphasize significance of intra-industry trade among countries, specialization and product differentiation, technological progress or various types of imperfect competition. Major part of the paper attends to these features. Other important factors with significant impact on country's foreign trade are also it's currency exchange rate, terms of trade, productivity of labour or real wages. Big relevance have foreign direct investments, particularly trough their influence on technological development, innovation process also pattern, quality and volume of trade. For example in Czech republic it is the most obvious in automotive industry, which is the most important export sector. Definitely, we must not leave out also impact of economic growth in the country, it's trading partners and the related domestic and foreign demand. Last but not least, economic situation in the world and practised economic policy in the form of duties, tariffs or

other assessed and indirect distorting trade barriers.

The theory of international trade often divides economic subjects into groups according to the sector of production or consumption. The use of macroeconomic quantities, such as gross domestic product, export performance, but especially country's labour and capital endowment often leads us to the general equilibrium theories, whereas international trade theories show how the microeconomics is the base to understand functioning and equilibrium of the whole domestic economy.

Macro view on trade theory caused, that the parties involved in the international exchange, were somewhat distorted by this abstraction. It's proper to mention, that actually people and firms stay behind the economic aggregates. Decision about production, consumption, export and import make individuals, not the whole countries in some collective way. Macroeconomic character can be understood as some simplification of reality, which can be used for explanation of certain processes and international comparison.

The theory of international trade generally deals with these economic issues:

1. *Efficiency of allocation of the production resources* within worldwide possibilities of their alternative usage. Crucial task questions importance of productivity of labour and endowment of the certain country with production resources.

2. *Redistribution of income and wealth* in dependence on alternative trade with other countries. It's about analysis, who benefits or loses from the trade.

3. *Growth of domestic economy*, depending on development of economic potentials on the side of supply and demand in other countries.

4. *Mechanism of market performance*. Strategies of market negotiations depend on the difference of real market from the rules of perfect competition, for example if there are increasing returns, cartel domination, non-price competition, differentiated products etc.

5. *Institutional form of the country and its impact on the trade*. It can be about diverse economic policy (taxes, tariffs, quotas, subsidies, exchange rate), different level

of economic integration with other countries, organizing of home lobbyists, dissimilar level of multinational corporations' market power.

1.2 Reasons for the trade inception

There are two main questions of trade theory: First, what determine the pattern and terms of trade; what's the structure of the trade? Second, why should country enter the world market and is international trade beneficial?

International economics uses the same fundamental methods of analysis as other branches of economics, because the motives and behaviour of individuals and firms are the same in international trade as they are in the domestic transactions (P. Krugman, International economics, p. 3).

Theory of international trade founds one of its major use in explaining conditions and reasons of goods flowing among different countries. Why are countries trading among each other and what are another advantages of this process?

Voluntary exchange and division of labour are the manifestation of premeditated human behaviour, through which are people getting better and can easier satisfy their own needs. It happens especially as a result of natural peoples' inequality in the matter of doing several workings and in consequence of unequal distribution of natural production specifications.

The most important reasons for international trading are:

1) difference in production conditions

Individual countries are unequally endowed with natural resources and simultaneously they are located in diverse environmental and geographic conditions. Natural and climatic conditions influence production and consumption possibilities of society. The worse domestic production are, the higher costs occur or less quality the products usually have. For domestic production could be used materials, which doesn't run from domestic area or they appear in limited quantity only. Beside the difference in quality and amount of natural resources economies differs significantly also in

qualification and capabilities of economically active population, while there are several different combinations of natural and human resources.

2) difference in consumers' preferences

Inhabitants of different countries have generally diverse preferences in consumption. A part of domestic consumption became products that cannot be raised in domestic conditions. Also domestic consumption of some products doesn't necessarily need to exist at all, although despite of that these products can be produced there just for foreign consumption.

3) decreasing cost in large-scale production (increasing returns to scale)

In different countries are different goods produced with different costs. Due to specialization of country in producing of certain good increasing returns to scale in mass production appear, average costs are decreasing by raising the volume of production. It creates possibility to optimize the extent of output with respect to costs. Domestic market size is not limited factor anymore.

International trade enables product specialization simultaneously with wide range of consumption. Thanks to the specialization it's possible to reach higher grow of economy's performance and more favourable structure of consumption than domestic production offers. By involvement in international exchange are countries, that trade which each other, better off than if they would produced all the goods on their own.

1.3 Absolute and comparative advantage

For a very long time was as the main reason influencing the pattern of trade considered realization of absolute advantages. This principle, based on absolute labour costs differences, was formulated already by Adam Smith. On the contrary to (in his period quite popular) mercantilism, Smith argued for harmony in both individual and social interest and idea of natural freedom system, whose he supported also for international trade environment. Already in his work can be found strong promotion for free market economy against interest groups producers protection. As most effective tool against monopolistic efforts he considered large (international) market, which is far stronger than small and isolated markets. According to Smith, the main source of wealth

growing was the division of labour on the all-society and international level. He presented this approach through the absolute advantage concept.

Absolute advantage is ability of one country to produce certain commodity more effectively, with higher output on one unit of input, than other countries. If one of the countries has in some commodity lower labour costs per unit than in the rest of the world, it has an absolute advantage in the production of the commodity.

In specialization are used resources that became free after individual countries had stopped production in disadvantageous branches. Narrow focus of production proves grow of the product. International exchange makes higher level of consumption possible. Product consumption, in its production countries specialize, remains on the same level, other products consumption will raise.

Effect from international exchange can be reached also in the cases, when absolute advantage is on the side of one single country in all exchanging products. David Ricardo (1817) overcomes Smith's thoughts outgoing from the absolute advantage theory by formulating comparative advantage law. It meant further development of classical trade theory and a proof that possibilities of international trade are much bigger than Smith assumed. Economic reasons for international exchange exist despite the absolute advantage of one country in all goods and commodities, if other countries specialize in production of the good, which is relatively cheaper for each country.

We speak about comparative advantages in the case, when every country specializes in production and export of the goods, that can be produced with relatively lower costs (relatively more efficiently than other countries), and on the contrary import the goods, that are produced with relatively higher costs (relatively less efficiently than other countries). Comparative advantages make trade expansion among countries with different development level possible.

Comparative advantage principle is not an idea behind international trade theory only, however it was developed as such in the history of economic theory. It is much more general principle, no matter if participants are from the same country or not. It explains why the division of labour is happening when someone is better in certain work

than the other are. Although comparative advantage is a simple concept, experience shows that it is surprisingly hard concept for many people to understand or accept. (in Krugman: International Economics, p.13)

1.4 Theories and models of international trade

1.4.1 Classical and neoclassical models

Ricardian model of comparative advantage is a model based on different productivities of labour. Production possibilities of the country are given by the division of the only resource - labour, among individual sectors. Country has comparative advantage in the good, which costs expressed with opportunity costs of another good are lower than in other countries. Diverse opportunity costs of the countries make mutually beneficial order of world production. Thanks to the specialization of countries in production, where they have comparative advantage, world as a whole can produce more. The main prediction of the Ricardian model was validated: Country should focus on the export of good, in which it has relatively high productivity. It was also proved that trade depends on comparative, not absolute advantage[1]. Ricardian model is useful tool for considering reasons for existence of international trade and its effects on national wealth.

In the long-period economic theory is Ricardo's model evaluated as scientifically much beneficial, nevertheless following simplifying assumptions weaken validity of the conclusion:

1) **The approach to the model is static**. Appraisal of comparative advantages of the economy corresponds to the certain development stage of natural and economical conditions in individual country. If the country specializes according to the comparative advantages, then its output grows and it can afford to invest e. g. in better education or scientific research. In the future changes in factor endowment, in technology or consumers preferences might occur, so that potential comparative advantage can differ from the original one. If initial comparative advantages developing country are in

[1] References can be found in any textbook dealing with the trade. The main idea is that country will focus on goods in which it is relatively more competitive in comparison with other countries.

production and export of raw materials or agricultural products, then law of comparative advantage makes further development of industrial sector (as a carrier of technological progress) and by that also an economic growth.

2) Another remark to this is a fact that **original model of comparative advantage was based on an assumption of constant returns to scale**. Actually, a lot of sectors have increasing returns to scale, i.e. by raising the volume of production costs are generally decreasing.

3) Theory underestimates a **role of transportation costs** that can in the trade over the frontier influence overall costs in a crucial way.

In the model of endowment and factor proportions (Heckscher-Ohlin model) we speak about comparative advantage in a certain production factor based on its relative higher endowment, while in Ricardo's model we spoke only about comparative advantage in some commodity based on its relative higher productivity of labour. It was developed by the Swedish economists Eli Heckscher and Bertil Ohlin at the Stockholm School of Economics[2]. It builds on David Ricardo's theory of comparative advantage by predicting production and patterns of trade based on the factor endowments of a trading region. Every country faces the same technological frontiers and has productive factors with the same qualities. The only difference between countries is in terms of the physical quantities of the factors of production.

The model assumes perfect mobility of several factors among the economic sectors, not only labour. Difference in endowment of production factors, i.e. land, labour and capital, is considered as a crucial factor of countries specialization and international trade. Country's endowment of certain production factors (in different extent and ratio) has impact on the price of commodity. Price of the factor, of which is country well endowed, is low and price of the scarce factor is high, respectively. The price of the production factors then influences country's foreign trade and its commodity structure.

Heckscher-Ohlin model construes from its assumptions that countries move

[2] The theory was first explained in Ohlin's book *Interregional and International Trade* (1933). Although he wrote the book alone, Heckscher was credited as co-developer of the model, because of his earlier work on the problem.

towards specialization in goods, whose production is intensive in the factor, whereby are these countries relatively well endowed. And vice versa, country focuses on import of the commodities, whose productions is intensive in relatively scarce factors. If the country's endowment in one of the factors increases, production of commodity relatively intensive in this factor rises and production of the commodity relatively intensive in the factor, whose amount remained unchanged, decreases.

Neoclassical theory of factor endowments was a subject of criticism for a number of reasons. It assumes perfect competition on domestic and even foreign markets (i.e. non-existence of government's intervention, monopolies, oligopolies, etc.), full exploitation of resources in countries, equal level of scientific and technological knowledge, negligible impact of tariffs, other trade barriers and transportation costs. It fails to explain requirement that the same goods must be exactly labour or capital intensive under any price relations of production factors in different countries. Another problem is a claim that countries aren't different enough in factor endowments to produce the same good just by diverse proceedings. In fact, there is a significant difference in factor intensities for certain good and there is a possibility of factor substitution. Theory assumes that different countries use same technologies and have access to same technique. Beside that, the theory is static, because it expects that its basic parameters and scientific-technical know-how doesn't change over the time. Its application would mean that the inequalities in economic development levels of individual countries weren't removed, but maintained.

1.4.1.2 Models with some modification

At this part of the paper I shall briefly mention some of the trade models that are close to the neoclassical theory, despite they violate some basic assumptions or they discuss some new crucial ideas, which were never taken into account before.

The specific factor model was originally discussed as a variant of Ricardian model by J. Viner and later was more developed and derived by P. Samuelson and R. Jones. The base for the discussion was re-thinking of the original Ricardian model. In that model, labour is the only factor of production in the model and it's assumed to be able to

move freely from one industry to another, there is no possibility that individuals will be hurt from trade[3]. Thus the model suggests not only countries benefit from the trade, but every individual is better off, because trade doesn't affect the distribution of income. While trade may benefit nation as a whole, it often hurts significant groups within the country for two main reasons: First, resources cannot move immediately or without costs from one industry to another. Second, industries differ in the factors of production they demand: A shift in country's production will reduce the demand for some factors, while raise the demand for others.

Model results from the assumption that while labour as a production factor is perfectly mobile among the industrial sectors, there are also some specific factors usable only in particular industry. Specific production factors aren't able to move immediately and without additional cost among sectors. The general outcome of the model is simple: Trade benefits the factor, which is specific to the export sector of each country, but has harmful effect on the factor specific for sectors that must compete with imports. Impact on mobile factors depends whether they belong to export or import industrial branch. Model explains income distribution but it's not so suitable for the pattern of trade interpretation.

Author of *The opportunity-cost theory* applied on international trade is Gotfried Haberler, who reformulated comparative advantage principle in retrospective. He replaced classical Ricardian labour theory of value by boundary approach. Price of commodity is given by marginal costs that are formulated as a ratio between marginal production increase of one good and induced decrease in production of another good. We can formulate opportunity-cost by following: Number of the good that could have been produced with the resources used to produce a given number of the second good. Trade between two countries is beneficial for both of them, if their national substitution costs and corresponding national exchange ratios differ and international exchange ratio move between them. Principle of opportunity-cost is usually explained by production possibility curve.

Comparative cost theory is associated with British economist G. D. A. Mac Dougall. Its crucial point is an opinion that country's competitive standing is determined

[3] to the contrary with so called Stolper-Samuelson theorem as one of the conclusions of the Heckschcer-Ohlin model

by two factors: productivity of labour and wage level. Together they represent the main costs that influence production of the goods. One country's productivity of labour could be significantly higher than another's, although its average wage is higher, too. If overall difference in productivity of labour is higher than total difference in wages, the first country is still in preferable position. Problem of this theory is its restriction. Labour isn't the only input and international trade is influenced by another factors beside it.

1.4.3 Theories taking into account of differences in technique and technology

Linder hypothesis about similarity in demand structure renders new meaning and reasoning of international trade. The theory itself focuses mainly on the patterns of trade. It's based on the thought that country will export those industrial products, which are used in domestic market. Linder's explanation doesn't refer to agricultural products and raw materials. For these theses he adduced these reasons:

β) home market enables producers to be aware of reaching profit through the certain product,

χ) firms proceed research and development in order to satisfy obvious needs that are domestic market,

δ) even if the firm accept importance of foreign market, adjustment of the product to unknown market is quite difficult.

According to this concept the exported goods will be in principle similar to the goods produced for domestic market. By the same mail, the imported goods will be similar to those produced in importing country and consumer will decide according to price. Mentioned opinion leads to the conclusion, which is in contradiction with traditional trade theory, i.e. the more coincidence the products will have, the bigger are the possibilities for international trade. The hypothesis was proposed as a possible resolution to the Leontief paradox[4], which questioned the empirical validity of the Heckscher-Ohlin model. The Linder hypothesis presents a demand based theory of trade in contrast to the usual supply based theories involving factor endowments. Linder hypothesized that nations with similar demands would develop similar industries. These

[4] Leontief found that the United States (then the most capital abundant nation) exported primarily labour-intensive goods. See e.g. Duchin, Faye. *International Trade: Evolution in the Thought and Analysis of Wassily Leontief* (2000)

nations would then trade with each other in similar but differentiated goods.

In direct opposite with Linder's opinions stands *technological gap theory,* which was formulated by the British author V. Posner in 1961. According to it, the innovations are very important for the export. Producer is developing new products that is yielding profit and putting innovating firm in the position of temporary monopoly, which allows advantageous access to the foreign markets. At the beginning is export increasing, but higher profits of original producer lead others to imitate and original producer is gradually losing comparative advantage. Once such a situation happens, the producer will endeavour through innovations to produce a new differentiated commodity and recapture ascendancy over the others. Innovating country will have during some time an absolute advantage, but after that another producers in several countries can produce the same good more effectively. By the effect of innovations time-limited technological gap between original producer and all the others occurs.

At the end of 60s, American professor R. Vernon picked up on the technological gap theory and broadened it, elaborated and made it more general. This theory was named *product life-cycle theory*. Vernon stated that long-term patterns of international trade are influenced by product innovation and subsequent diffusion. According to him, production of new goods experiences three stages. At the first period, the producer has power of monopoly advantage, based on the technological predominance. Firstly, it will sell its goods to the domestic market, then to other technically advanced countries. In time, developing countries will import and later manufacture these goods, by which stage the original innovator will have produced new products, as the demand is growing up abroad and technical know-how connected with production is gradually widening to potential foreign competitors. Then the phase of maturity comes, at which the original producer loses comparative advantage incumbent on technical superiority. On the contrary, a producer in a developing country can take the advantage, mainly because he has lower production costs, especially of labour force. Standardized stage of production is the third phase. The production became common and comparative advantage is carrying over to the economies with relatively less qualified labour force and lower wages. Developing countries gain relative advantage in the production of commodities, whose research is taking place in advanced countries. It means that developing countries are reliant on developed ones and their willingness to provide technological knowledge.

American economist Simon Kuznets claims that international trade is influenced by many complex factors, like e. g. technological changes, society inventions, economic advantages, political revolutions and also heterogeneous structure and endowment of individual nations.[5]

1.4.3 New trade theory - reconsidering reasons for opening up

Most of the previous discussed models gives us an explanation, how diversities in national resources, endowments, technologies or preferences lead countries to specialization in production and involvement in mutually beneficial exchange. Upon the conclusion of these models we can expect mainly that countries with biggest differences should trade more with each other than countries, which are more similar[6]. Trade should lead to specialization. Products that are imported or exported are assumed to fall within diverse group of commodities or industrial sectors.

Nevertheless, the real trade flows, empirically observed and statistically computed, weren't fully consistent with the mentioned behaviour. Contribution of world trade with goods, which proceeded between countries that are similar in the one or more aspects mentioned above, was actually much bigger than participation of the trade between countries with heterogeneous endowment and resources structure.

That brings an idea that there should be another reasons why countries trade and increase their national wealth. The following debate consider another reasons than comparative advantages that leading countries to trade. At first, we will briefly discuss role of increasing returns to scale in trade. Trade enable countries to specialize in less production lines and use advantages of increasing returns through that. Direct connotation about existence of increasing returns to scale is necessity of transition from increasing to decreasing opportunity costs, which shifts production possibility frontier. If we consider internal economies of scale, we must leave also an assumption about perfect competition.

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[5] see: S. Kuznets. *Six Lextures on Economic Growth* (1959)

[6] on the other hand, there is an exception of Linder hypothesis

2. Economies of scale and international trade

There are two main reasons why countries specialize and trade. First, countries differ either in their resources or in technology and specialize in the things they do relatively well; second, economies of scale (or increasing returns) make it advantageous for each country to specialize in the production of only a limited range of goods and services. In previous text we've been dealing mainly with the trade based on comparative advantage principle; that is, differences between countries are the main reason for trade. This chapter introduces the role of economies of scale.

Krugman (2002) comments: *"that view* [on the role of increasing returns] *remained hidden in plain sight for nearly 50 years: in the late 1970s ... few trade theorists thought of increasing returns as a potential independent source of trade"*.

Exploration of increasing returns to scale was motivated by the need of explanation the distinction between the conclusion of standard trade model and real international trade flows character. So called *New trade theory* is dealing again with reasons why countries trade among themselves. Economists were looking for some other reasons beside the comparative advantages. The basic knowledge is, that for the trade existence is not necessary to differ significantly in the sense of countries. Even almost identical countries would produce differentiated products and will trade with each other.

The analysis of trade based on economies of scale presents certain problems that we have so far avoided. Until now we have assumed that markets are perfectly competitive, so that all monopoly profits are always competed away. When there are increasing returns, however, large firms usually have an advantage over small, so that markets tend to be dominated by one or, more often, by a few firms. When increasing returns enter the trade picture, then, markets usually become imperfectly competitive.

The chapter starts with an overview of the economies of scale concept and the theory of imperfect competition. Then we turn to the model of international trade in which economies of scale and imperfect competition play a crucial role, but still it's not too difficult to understand: the monopolistic competition model.

Already presented theories of international trade were based on the premise of constant returns to scale. We assumed that if inputs to an industry were doubled, output would also double. However, in practice, for many industries are typical economies of scale (increasing returns), so that production is more efficient the larger the scale of manufacturing is. If there are economies of scale, doubling the inputs to an industry will more than double the industry's production.

These new theories give the reasons for profitable trade among similar or even identical countries. *Model of increasing returns to scale* explains flows of goods particularly in industries, which require extensive capital investments. Big concerns are taking advantages of large-scale production to obtain increasing returns to scale trough the specialization in machinery and equipment, engineering, technologies, labour force and discounts from subcontractors, from which they purchase a large quantity of commodities. Initial point of this theory is an idea that large domestic market makes export of the goods produced with lower costs possible and these are further decreasing proportionally with increasing sale of the products.

Economies of scale bring an important findings about trade advantages. International trade in terms of scale economies offers more benefits than trade based on comparative advantages usage. Krugman (1996) claims that *"In the new trade theory, the basic point was that increasing returns are a motive for specialization and trade over and above conventional comparative advantage, and can indeed cause trade even where comparative advantage is of negligible importance ... among industrial countries with similar resources and technology"*.

It allows to produce more kinds of products and therefore consumers can choose from greater variety of goods. To take advantage of economies of scale, each of the countries must concentrate on producing only a limited number of goods. If each country produces only some of the goods, then each good can be produced at a larger scale than would be the case if each country tried to produce everything, and the world economy can therefore produce more of each good. Returns set in, when trade increases production of goods with increasing returns to scale over the production level, which would be in the country without trade.

According the standard theories of comparative advantages, international trade

and specialization cannot occur, if countries are likewise endowed with factors and resources or when they have the same technical abilities. Incurred trade should generally be of inter-industry character. Nevertheless, the data about world trade are implying that largest volume of exchange fulfil just between countries, which have similar economic conditions on the supply side. Major part of the trade is then intra-industry. It means, two likewise countries can trade with each other with almost identical products. Standard comparative advantage theory would by identical costs and prices of the commodity in both countries lead to result that specialization and trade between them has no foundation. Increasing returns to scale imply that there will often exist gains from trade even if two countries are absolutely identical in all respects. More specifically, trade under conditions of increasing returns may permit cost savings through increased specialization even though there does not exist any natural pattern of comparative advantage.

What economic phenomenon could lead to explanation of depth causes of intra-industry trade? Partial answer on that question could be found in raising importance of increasing returns to scale and differentiating products in modern advanced economies. Common feature of such a production is tending to natural oligopolies creation. These are forced to overcome demand limitations on the domestic market and expand abroad.

2.1 Economies of scale – an overview

Idea of increasing returns appeared already in the times of Adam Smith's *Wealth of Nations*, where the first chapters put great emphasize on this topic.

Despite this fact, classical and neoclassical theories are built on constant returns to scale, i.e. doubled input means doubled output. In fact it could be much bigger output due to decreasing of costs per unit. In reality, increasing returns to scale naturally means increasing competitiveness especially of big companies, so the opportunities of small firms from developing countries to get in the world market in particular is usually relatively smaller than those of some big multinational corporations.

Formal mathematical definition of returns to scale is following:

Let **F (K, L)** be the production function, where **K** stands for *capital* and **L** stands for *labour* as the production factors. Then we speak about

- *constant returns to scale* if (for any constant $a \geq 0$) **F (aK, aL) = a.F (K, L)**
- *increasing returns to scale* if (for any constant $a > 1$) **F (aK, aL) > a.F (K, L)**
- *decreasing returns to scale* if (for any constant $a > 1$) **F (aK, aL) < a.F (K,L)**.

We know that in a world of constant returns and perfect competition gains from trade are ensured. Once increasing returns and imperfect competition are introduced, there are both extra sources of potential gain and risks that trade may be harmful. There are several problems of original international trade theories.

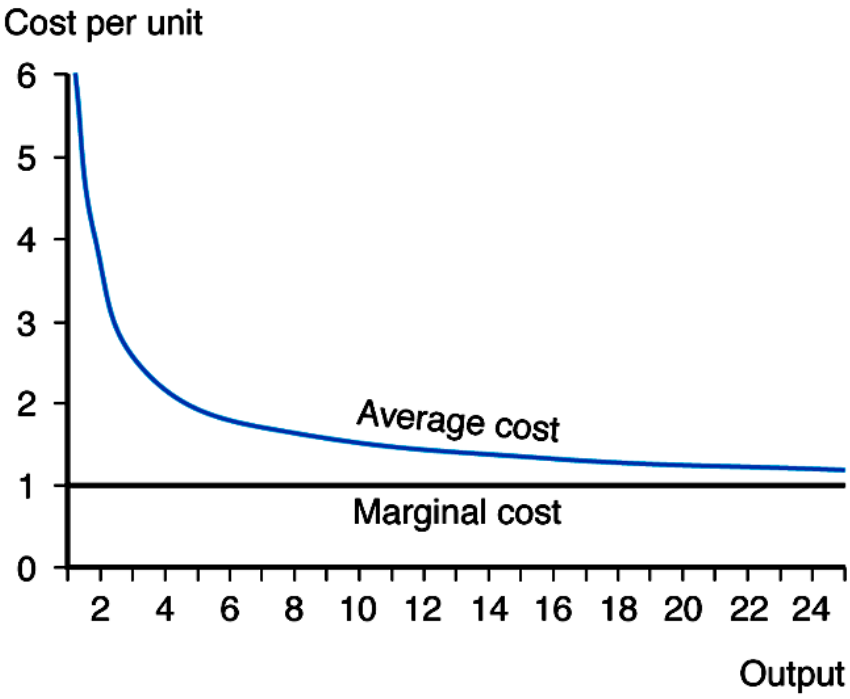
- If there are no returns to scale, then size does not matter neither for specialization nor for the direction of trade.
- In the case of perfect competition trade cannot increase competition more.
- They predict exchange of different goods between different countries only.

Models of international trade based on increasing returns have been studied intensively in the last decades. In the literature, the source of increasing returns may be external or internal. Both have very different consequences and models, so it's better to deal with them separately.

Increasing returns to scale, in principle, are about decreasing average costs of production by increasing its volume. We did not say how this production increase was achieved – whether existing firms simply produced more, or whether there was instead an increase in the number of firms. To analyse the effects of the economies of scale on market structure, however, one must be clear about what kind of production increase is necessary to reduce average cost. **External economies of scale** occur when the cost per unit depends on the size of the industry but not necessarily on the size of any one firm. **Internal economies of scale** occur when the cost per unit depends on the size of an individual firm but not necessarily on that of the industry.

External and internal economies of scale have different implications for the structure of industries. An industry where economies of scale are purely external (there are no significant advantages to large firms) will typically consist of many small firms and be perfectly competitive. Internal economies of scale, on the contrary, give large firms a cost advantage over small and lead to an imperfectly competitive market

structure.



2.1.1 External increasing returns to scale

For models based on external returns to scale, a firm's cost decreases with increase of total industry level of output. A firm is assumed to be too small to affect the industrial level of output significantly. Productivity depends upon a set of factors external to the firm; mainly on the output of the industry. Firms still set their price at the apparent marginal product. This can be the case, and very often is, even under perfect competition[7].

According to Marshall definition, there are different types of external economies of scale:

- local skilled labour force: A cluster of firms can create a pooled market for workers with highly specialized skills. It is an advantage for both producers that are less likely to suffer from labour shortages and workers which are less likely to become unemployed.

[7] Authors who allow for increasing returns in trade by assuming that scale economies are external to firms include Chacoliades (1970), Melvin (1969), Kemp (1963), and Negishi (1969).

- technological spillovers: Knowledge is one of the important input factors in highly innovative industries. The specialized knowledge that is crucial to success in innovative industries comes either from research and development efforts, reverse engineering or informal exchange of information and ideas.
- specialized suppliers: In many industries, the production of goods and services and the development of new products requires the use of specialized equipment or support services. An individual company does not provide a large enough market for these services to keep the suppliers in business. A localized industrial cluster can solve this problem by bringing together many firms that provide a large enough market to support specialized suppliers. This phenomenon has been extensively documented in the Silicon Valley.

In all cases, market size influences performance, productivity and production costs.

2.1.2 Internal increasing returns to scale

Internal increasing returns to scale come from spreading fixed costs of production. With a constant marginal cost, a firm's average cost decreases with its output as the fixed cost can be distributed over a larger level of output. Declining average costs can arise if there are large fixed costs in establishing an industry.

Let *total costs TC* be defined as: $TC = F + VC$, where F are the *fixed costs* and VC are some *variable costs* of production.

Average costs AC then can be written as: $AC = TC / Q = FC / Q + VC / Q$.

Let's just for demonstration of increasing returns to scale define the variable costs as some linear function of output Q: $VC = c.Q$, where c is the *marginal cost* per output Q.

Then $AC = TC / Q = FC / Q + c$, so it's obvious overall costs are declining with growing volume of production, especially if there are large fixed costs, as mentioned above.

A larger firm is more efficient because average cost decreases as output Q increases and we speak about internal economies of scale.

When there are increasing returns to scale, large firms usually dominates market either by one firm as monopoly or by few firms in form of oligopoly, both cases are validation of imperfect competition. Under increasing returns to scale output grows proportionately more than the increase in all inputs and simultaneously average costs (costs per unit) decline with the size of the market.

The presence of internal increasing returns to scale violates assumption of perfect competition. Firms are aware that they can influence the price of their product and at the same time they know that they can sell more only by reducing their price. Each firm views itself as a price setter, choosing the price of its product, rather than a price taker. Mathematically derived it means following: In the presence of internal increasing returns to scale we need to consider imperfect competition, because increasing returns means that average costs are higher than marginal costs. The crucial condition for perfect competitive firm means price equal to the marginal costs, but due to increasing returns it is lower than average costs and it would cause losses. That's why we need price higher then marginal costs to have non-negative profits and such a price definitely means some kind of imperfect competition, as large firms have a cost advantage over small firms, which leads to an imperfectly competitive market.

2.2 Imperfect competition as a consequence of internal increasing returns

In a perfectly competitive market with many buyers and sellers firms are *price takers.* Sellers of products believe that they can sell as much as they want at the current price and cannot influence the price they receive. When only a few firms dominate market, things are different, though. In **imperfect competition** firms are aware that they can influence the prices of their products and that they can sell more only by reducing their price. Imperfect competition is characteristic both of industries in which there are only a few major producers and of industries in which each producer's product is seen by consumers as strongly differentiated from those of rival firms. Under these

conditions each firm see itself as a *price setter,* choosing the price of its product, rather than a price taker.

2.2.1 Monopoly: An overview

The simplest imperfectly competitive market structure is that of a **pure monopoly**, a market in which a firm faces no competition.

The firm faces a downward sloping **demand curve**, shown in the figure as D^8. The downward slope of *D* indicates that the firm can sell more units of output only if the price of the output falls. As we know from microeconomics, a **marginal revenue** curve corresponds to the demand curve. Marginal revenue is the extra the firm gains from selling an additional unit. Marginal revenue for a monopolist is always less than the price because to sell an additional unit the firm must cut the price of *all* units (not just the last one). Thus for a monopolist the marginal revenue curve (*MR)* always lies below the demand curve.

For the further analysis of the monopolistic competition model later it's important to specify the relationship between the price the monopolist receives per unit and marginal revenue. How much is marginal revenue less than the price? This relationship depends on two things. First, how much output the firm is already selling: A firm that is not selling many units will not lose much by lowering the price it receives on those units. Second, the gap between price and marginal revenue depends on the slope of the demand curve, which shows how much the monopolist has to lower the price to sell one more unit of output. If it is very flat, then the firm can sell an additional unit with only a small price cut and will therefore not have to lower the price on units it would have sold otherwise by very much, so marginal revenue will be close to the price per unit. On the other hand, if the demand curve is very steep, selling an additional unit will require a large price cut, implying marginal revenue much less than price.

We can be more specific about the relationship between price and marginal revenue if we assume that the demand curve the firm faces is a decreasing linear

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8 D_{dom} stands for domestic demand and D_w for world demand.

function of the price[9]. When this is so, the dependence of the monopolist's total sales on the price *it* charges can be represented by an equation of the form

$$Q = a - b \, . \, P,$$

where Q is the number of units the firm sells, P the price it charges per unit, and a and b are constants. Then the marginal revenue is

$$MR = P - Q/b,$$

implying

$$P - MR = Q/b.$$

Second equation shows how the gap between price and marginal revenue depends on the initial sales Q of the firm and the slope parameter b of its demand curve. If sales quantity is higher, marginal revenue is lower, because the decrease in price required to sell a greater quantity costs the firm more. The greater is b, the more sales fall for any given increase in price and the marginal revenue is closer to the price of the good. This equation is crucial for our analysis of the monopolistic competition trade model.

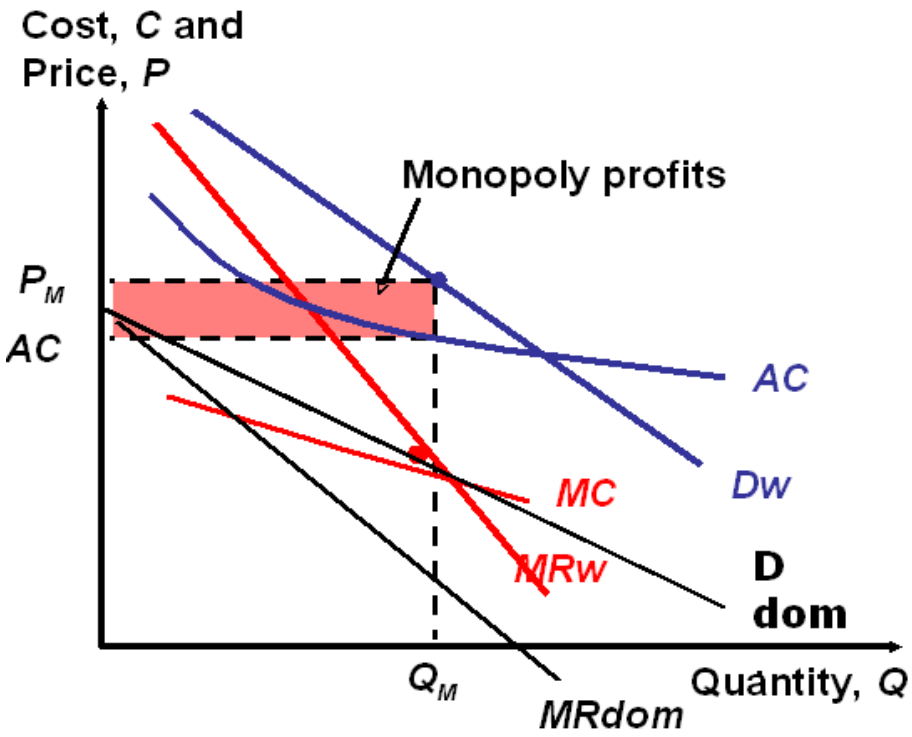
Average and Marginal Costs. Returning to the mathematical definition of increasing returns, we remind once again assumed linear cost function of the firm, which take the form

$$C = F + c.Q,$$

where F is a fixed cost that is independent of the firm's output, c is the firm's marginal cost, and Q is once again the firm's output. The fixed cost in a linear cost function gives rise to economies of scale, because the larger the firm's output, the less is the fixed cost per unit. Specifically, the firm's average cost (total cost divided by output) is

$$AC = C/Q = F/Q + \text{c}.$$

[9] In fact, that is a straight line.



Monopoly pricing and production decision (Source: I. Petsas (2008))

This average cost declines as Q increases because the fixed cost is spread over a larger output. *AC* represents the firm's **average cost** of production, that is, its total cost divided by its output. The downward slope reflects our assumption that there are economies of scale, so that the larger the firm's output is the lower are its costs per unit. *MC* represents the firm's **marginal cost** (the amount it costs the firm to produce one extra unit). We know that when average costs are a decreasing function of output, marginal cost is always less than average cost. Thus *MC* lies below *AC*. Average cost approaches infinity at zero output and approaches marginal cost at very large output.

The profit-maximizing output of a monopolist is that at which marginal revenue equals marginal cost**,** that is, at the intersection of the *MC* and *MR* curves. At the figure above we can see that the price at which the profit-maximizing output Q_M is demanded is P_M, which is greater than average cost. When $P > AC$, the monopolist is earning some monopoly profits

A standard result of international trade theory is that free trade limits the abuse of domestic monopoly power. The conclusion of new trade theories, which suppose the presence of economies of scale is that free trade could help reduce the production costs

of monopoly and thus monopolist can sell more goods for lower price on the world market. The case of domestic monopoly entering the world market was heavily debated in the past mainly by trade policy-makers, as the firm may not be able to face foreign competitors, especially in the case of small country.

For internal increasing returns, with the trade opening up, a firm producing manufactures located in the larger country may not have a cost advantage over firm located in the smaller country since a firm's average costs depend solely on its own level of output. Thus, with trade, manufactures can be still produced in both countries. There are two channels through which the opening of trade increases a country's welfare. First, the number of firms producing manufactures in the world after the opening of trade will not be smaller than the number of manufacturing firms in each country before trade since the size of the world market for manufactures is higher than that of every single country. This may decrease a firm's monopoly power and is welfare enhancing (Brander, 1981). Second, as firms produce higher levels of output, they will choose more advanced technologies, leading to lower average costs and an increase in welfare.

2.2.2 Oligopoly: A brief overview

Nevertheless, internal economies usually generate an **oligopoly** market structure, which is more common in real economy than pure monopoly. There are several firms, each of which is large enough to affect prices, but none with an uncontested monopoly. The general analysis of oligopoly is a complex and controversial subject because in oligopolies the pricing policies of firms are *interdependent.* Each firm in an oligopoly will, in setting its price, consider not only the responses of consumers but also the expected responses of competitors. These responses, however, depend in turn on the competitors' expectations about the firm's behaviour – and we are therefore in a complex game in which firms are trying to second-guess each others' strategies.

Strategic interactions among oligopolies have become the most important feature of oligopoly market models. Each firm decides its own actions, taking into account how that decision might influence its rival's actions. The classical oligopoly models used in

microeconomics till now were developed and described especially in the works of A. A. Cournot (1838), J. L. F. Bertrand (1883) ans H. F. Stackelberg (1934) and nowadays are also much discussed in so called game theory.

In the **Cournot duopoly model**, both firms with the same marginal costs try to take into account the decision of the competitor and then choose their own production quantity, but both are deciding simultaneously. They react until they reach so called Nash equilibrium point, which means that neither firm can be better off, ceteris paribus.

The **Bertrand model** is quite similar to Cournot's, but both producers try to maximize their profits by deciding on prices instead of the quantities. In this case, game results in each firm charging the price that would be charged under prefect competition, i.e. in the end, both firms will produce for the price equal to their marginal costs.

Theoretical model of two-country world's trade inception, when in both countries dominate monopolies in produced commodity, usually ends as one of above mentioned situations. Bertrand predicts a duopoly is enough to push prices down to marginal cost level, so that duopoly will result in perfect competition prices and zero profits for both players. The accuracy of the predictions of each model will vary from industry to industry, depending on the closeness of each model to the industry situation. If capacity and output can be easily changed, Bertrand is generally a better model of duopoly competition. Otherwise, if output and capacity are difficult to adjust, then Cournot is generally a better model.

The **Stackelberg leadership model** is a strategic game in which the leader firm moves first and then the follower firms move sequentially. They compete on quantity. Firms may engage in Stackelberg competition if one has some sort of advantage enabling it to move first. Moving first may be possible if the leader was the incumbent monopoly of the industry and the follower is a new entrant.

2.2.3 Monopolistic competition: theoretical background

However, there is a special case of imperfect competition market structure that can be considered as oligopoly, known as monopolistic competition, which is relatively

easy to analyse. The "founding father" of the theory of monopolistic competition was Edward Hastings Chamberlin in his pioneering book on the subject *Theory of Monopolistic Competition* (1933). Joan Robinson also receives credit as an early pioneer on the concept. Since 1970s monopolistic competition models have been widely applied to international trade[10].

In **monopolistic competition** models two key assumptions are made to get around the problem of interdependence. First, each firm is assumed to be able to *differentiate its product* from that of its rivals. That means, the firm's customers will not rush to buy other firms' products, due to a slight price difference because they want to buy this firm's particular product. Product differentiation assures that every firm has some kind of monopoly in its particular product within an industry and is therefore somewhat insulated from competition. Second, each firm is assumed to take the prices charged by its rivals as given and it ignores the impact of its own price on the prices of other firms. As a result, the monopolistic competition model assumes that even though each firm is in reality facing competition from other firms, it behaves as if it were a monopolist.

The main appeal of the monopolistic competition model is not its realism, but its simplicity. As we will see in further text of this chapter, the monopolistic competition model gives us a very clear view of how economies of scale can give a rise to mutually beneficial trade.

Before we can examine trade, however, we need to develop a basic model of monopolistic competition. Let us therefore imagine an industry consisting of a number of firms. These firms produce differentiated products, so the goods are not exactly the same but they are substitutes for one another. Each firm is therefore a monopolist in the sense that it is the only firm producing its particular good, but the demand for its good depends on the number of other similar products available and on the prices of other firms in the industry.

Marketed products have real or perceived non-price differences. However, the

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[10] This approach to international trade is suggested by Gray (1973). Negishi (1972) develops a full general-equilibrium model of scale economies. monopolistic competition and trade which is in some features similar to this paper model, though far more complex. Scale economies and product differentiation are also suggested as caused of trade by Barker (1977) and Grubel (1970).

differences are not so great as to eliminate goods as substitutes. Technically the cross price elasticity of demand between goods would be positive. Goods in the environment of monopolistic competition are best described as close but imperfect substitutes. They usually perform the same basic functions. The differences are in "qualities" and circumstances such as type, style, quality, reputation, appearance and location that tend to distinguish goods. For example, the function of motor vehicles is basically the same: to get from point A to B in reasonable comfort and safety. Yet there are many different types of motor vehicles, motor scooters, motor cycles, trucks, cars.

The model of monopolistic competitive industry

We begin by describing the demand facing a typical monopolistic competitive firm. In general, we would expect a firm to sell more the larger the total demand for its industry's product and the higher the prices charged by its rivals. On the other hand, we expect the firm to sell less the more firms are in the industry and the higher is its own price. A particular equation for the demand facing a firm that has these properties is

$$Q = S \,.\, [1/n - b \,.\, (P - \bar{P})]$$

where Q is the firm's sales, S is the total sales of the industry, n the number of firms in the industry, b a constant term representing the responsiveness of a firm's sales to its price, P the price charged by the firm itself, and $\bar{P}$ the average price charged by its competitors. If all firms charge the same price, each will have a market share $1/n$. A firm charging more than the average of other firms it will have a smaller market share, a firm charging less a larger share.

We also assume that total industry sales S are unaffected by the average price charged, so firms can gain customers only at each others' expense. This is an unrealistic assumption, but it simplifies the analysis and helps concentrate on the competition among firms. In particular, it means that S is a measure of the size of the market and that if all firms charge the same price, each sells S/n units. Now turn to the costs of a typical firm. Here we simply assume that total and average costs of a typical firm are described by equations discussed in monopoly review.

Market Equilibrium. To model the behaviour of this monopolistic competitive industry, let all firms in the industry be *symmetric,* so the demand function and cost function are identical for all firms[11]. Then the state of the industry can be described without enumerating the features of all firms in detail. We just need to know how many firms there are and what price the typical firm charges. To analyse the industry, for example to assess the effects of international trade, we need to determine the number of firms n and the average price they charge P. Once we have them determined, we can ask how they are affected by international trade.

The number of firms and average cost. As a first step toward determining n and P, we ask how the average cost of a typical firm depends on the number of firms in the industry. Since all firms are symmetric in this model, in equilibrium they will all charge the same price. But when all firms charge the same price, so that $P = \bar{P}$, it means that $Q = S/n$; each firm's output Q, is a $1/n$ share of the total sales S. But as we saw, average cost depends inversely on a firm's output. We therefore conclude that average cost depends on the size of the market and the number of firms in the industry:

$$AC = FC/Q + c = n \,.\, FC/S + \text{c}.$$

The more firms there are in the industry the higher is average cost. The reason is that the more firms there are, the less each firm produces and thus the higher its cost per unit of output.

The number of firms and the price. Meanwhile, the charged price of the typical firm also depends on the number of firms in the industry. The more firms there are, the more intense will be the competition among them, and hence the lower the price.

Each firm faces a straight-line demand curve of the form we showed in monopoly theory, and then determine prices. First recall that in the monopolistic competition model firms are assumed to take each others' prices as given; each firm ignores the possibility that if it changes its price other firms will also change theirs. If each firm treats P as given, we can rewrite the demand curve in the form

$$Q = \{S/n + S \,.\, b \,.\, \bar{P}\,) - S \,.\, b \,.\, P,$$

[11] even though they are producing and selling somewhat differentiated products

where b is the parameter in equation that measured the sensitivity of each firm's market share to the price it charges. Now this is in the same form as the equation we had in monopoly overview, with $S/n + S \,.\, b \,.\, P$ in place of the constant term *a* and S . *b* in place of the slope coefficient *b.*

Then is not so difficult to determine formula of marginal revenue for a typical firm, which has a form $MR = P - Q/(S \,.\, b)$.

Profit-maximizing firms will set marginal revenue equal to their marginal cost *c,* so that

$$MR = P - Q/(S \,.\, b) = c,$$

which can be rearranged to give the following equation for the price charged by a typical firm: $P = c + Q/(S \,.\, b)$.

If all firms have the same price, each will sell an amount $Q = S/n$. This gives us a relationship between the number of firms and the price each firm charges:

$$P = c + 1/(b \,.\, n).$$

Algebraically it means that *the more firms there are in the industry, the lower the price each firm will charge.*

The equilibrium number of firms. We have summarized an industry that the more firms there are in the industry, the lower the price each firm will charge and the more firms there are in the industry, the higher the average cost of each firm. The more firms there are, the more competition each firm faces and if the number of firms increases, each firm will sell less.

Long-run equilibrium number of firms determined by satisfying both conditions mentioned above is the *zero-profit* number of firms in the industry. When there are *n* firms in the industry, their profit-maximizing price is *P,* which is exactly equal to their average cost *AC.* Over time, firms will enter an industry that is profitable, exit one in which they lose money. The number of firms will rise over time if it is less than *n,* fall if it is greater. This means that *n* is the equilibrium number of firms in the industry and *P* the equilibrium price.

We have now developed a model of a monopolistic competitive industry in which we can determine the equilibrium number of firms and the average price that firms charge. We can use this model to derive some important conclusions about the role of economies of scale in international trade. But before we do, we should take a moment to note some limitations of the monopolistic competition model.

Limitations of the monopolistic competition model

The monopolistic competition model captures certain key elements of markets where there are economies of scale and thus imperfect competition, but only few industries are well described by the theory. Instead, the most common market structure is one of small-group oligopoly, where only a few firms are actively engaged in competition. In this situation the key assumption of the monopolistic competition model, which is that each firm will behave as if it were a true monopolist, is likely to break down. Instead, firms will be aware that their actions influence the actions of other firms and will take this interdependence into account.

Two kinds of behaviour arise in the general oligopoly setting that are excluded by assumption from the monopolistic competition model. The first is *collusive* behaviour. Each firm may keep its price higher than the apparent profit-maximizing level as part of an understanding that other firms will do the same; since each firm's profits are higher if its competitors charge high prices, such an understanding can raise the profits of all the firms at the expense of consumers. Collusive price-setting behaviour may be managed through explicit agreements or through tacit coordination strategies, such as allowing one firm to act as a price leader for the industry.

Firms may also engage in *strategic* behaviour; they may do things that seem to lower profits, but that affect the behaviour of competitors in a desirable way. For example a firm may build extra capacity not to use it but to deter potential rivals from entering its industry. These possibilities for both collusive and strategic behaviour make the analysis of oligopoly a complex matter. There is no one generally accepted model of oligopoly behaviour, which makes modelling trade in monopolistic industries problematic. The monopolistic competition approach to trade is attractive because it

avoids these complexities. Even though it may leave out some features of the real world, the monopolistic competition model is widely accepted as a way to provide at least a first cut at the role of economies of scale in international trade.

2.3 Monopolistic competition and trade

The traditional theory in its modelled version failed to explain fully the causes of trade. After a peak in the 1960s, it reached a dead end. It was only after Spence (1976) and Dixit and Stiglitz (1977) introduced manageable models of monopolistic competition that in the 1980s Krugman (1979, 1980, 1981), Ethier (1982), Helpman and Krugman (1985) proceeded to build up a "new" theory of international trade. They noted that increasing returns, transport costs and the asymmetric distribution of resources prevented backyard capitalism and were the main determinants of the concentration of economic activity.

Underlying the application of the monopolistic competition model to trade is the idea that trade increases market size. In industries where there are economies of scale, both the variety of goods that a country can produce and the scale of its production are constrained by the size of the market. By trading with each other, and therefore forming an integrated market that is bigger than any individual national market, nations are able to loosen these constraints. Each country can specialize in producing a narrower range of products than it would in the absence of trade and by buying goods that it does not make from other countries, each nation can simultaneously increase the variety of goods available to its consumers. As a result, trade offers an opportunity for mutual gain even when countries do not differ in their resources or technology.

The monopolistic competition model can be used to show how trade improves the trade-off between scale and variety that individual nations face. In this model, larger market leads to both a lower average price and the availability of a greater variety of goods. Applying this result to international trade, we observe that trade creates a market larger than any of the national markets that comprise it. Integrating markets through international trade therefore has the same effects as growth of a market within a single country.

2.3.1 The effects of increased market size

The number of firms in a monopolistic competitive industry and the prices they charge are affected by the size of the market. In larger markets there usually will be both more firms and more sales per firm; consumers in a large market will be offered both lower prices and a greater variety of goods than consumers in small markets.

As we showed before, average costs per firm are higher the more firms there are in the industry.

$$AC = FC/Q + c = n \,.\, FC/S + c.$$

Examining this equation, we see that an increase in total sales S will reduce average costs for any given number of firms n. The reason is that if the market grows while the number of firms is held constant, sales per firm will increase and the average cost of each firm will therefore decline.

We also proved, that the market price is determined in the form

$$P = c + 1/(b \,.\, n) \,.$$

The size of the market does not enter into this equation, because of absence of S in it.

We used this information to show the effect of an increase in the size of the market on long-run equilibrium. An increase in the size of the market, measured by industry sales S increases the number of firms while the price falls.

Clearly, consumers would prefer to be part of a large market rather than a small one, because a greater variety of products is available at a lower price than before the opening up.

2.3.2 Economies of scale and comparative advantage

The above model of a monopolistically competitive industry says little about the pattern of trade that results from economies of scale. The model assumes that the cost of production is the same in all countries and that trade is costless. These assumptions mean that although we can determine how much firms will be supported by integrated market, we cannot say where they will be located.

To say more, it is necessary to go behind the partial equilibrium framework that we have considered so far and think about how economies of scale interact with comparative advantage to determine the pattern of international trade.

We now suppose that there are some imperfectly competitive industry with several firms producing differentiated products. *Due to economies of scale, neither country is able to produce the full range of these products by itself; thus, although all countries may produce some, they will be producing different things.* Because some consumers will prefer varieties of goods produced abroad, countries will import as well as export within the particular industry[12].

We can think of world trade in a monopolistic competition model as consisting of two parts. There will be two-way trade *within* the sector. Exchange of differentiated products in the same industry is called **intra-industry trade.** The remainder of trade is called **inter-industry trade.**

Points about the pattern of trade:

1. *Inter-industry* (e.g. textiles for automobiles) trade reflects mainly comparative advantage. The pattern of inter-industry trade is that the capital-abundant country is a net exporter of capital-intensive cars and a net importer of labour-intensive textiles. There is comparative advantage a major reason of the trading.

2. *Intra-industry* trade (automobiles for automobiles, automobiles for car engines

[12] This suggests an affinity between this model and Linder's views, although Linder does not explicitly mention economies of scale.

or car engines for car engines) does *not* reflect comparative advantage. Even if the countries had the same overall capital-labour ratio, their firms would continue to produce differentiated products and the demand of consumers for products made abroad would continue to generate intra-industry trade. It is economies of scale that keep each country from producing the full range of products for itself; thus economies of scale can be an independent source of international trade.

3. The pattern of intra-industry trade itself is quite difficult to predict. All we know is that the countries will produce different products, but we don't which country produces which good because there is nothing in the model to tell us. However, the unpredictability is not total. While the precise pattern of intra-industry trade is arbitrary, the pattern of inter-industry trade is determined by underlying differences between countries.

4. The relative importance of intra-industry and inter-industry trade depends on how similar the countries are. If they don't differ significantly in their capital-labour ratios, then intra-industry trade, based ultimately on economies of scale, will be dominant and there will be only a little inter-industry trade. On the other hand, if the capital-labour ratios are very different[13], there will be no intra-industry trade based on economies of scale. All trade will be based on comparative advantage.

2.3.3 The importance of intra-industry trade

A significant part of world trade consists of intra-industry trade, that means, two-way exchange of goods within standard industrial classifications. Intra-industry trade plays a particularly large role in the trade in manufactured goods among advanced industrial countries, which accounts for most of world trade. Over time, the industrial countries have become increasingly similar in their levels of technology and in the availability of capital and skilled labour. Since then, there is often no clear comparative advantage within an industry, and much of international trade therefore takes the form of two-way exchanges within industries (probably driven in large part by economies of

[13] It is meant in the sense that one country is highly developed and the other is developing. However, as we'll show further, this is not the case when analysing trade between developed and less developed countries.

scale) rather than inter-industry specialization driven by comparative advantage.

Industries with high levels of intra-industry trade tend to be sophisticated manufactured goods, such as machinery, transport equipment, chemicals, pharmaceuticals, and power-generating equipment. These goods are exported principally by developed countries and are usually subject to important economies of scale in production. At the other end of the scale, the industries with very little intra-industry trade are typically labour-intensive products, such as raw materials, agricultural products, textiles, footwear and apparel. These are goods that the advanced nations import primarily from developing countries, where comparative advantage is clear-cut and is the primary determinant of trade with these countries.

It is obvious that intra-industry trade produces extra gains from international trade, over and above those from comparative advantage, because it allows countries to benefit from larger markets, specialisation, increased production and investments into technology, research and development. As we have seen, by engaging in intra-industry trade a country can simultaneously reduce the number of products it produces and increase the choice of goods available to its consumers. By producing fewer varieties, a country can produce each at larger scale, with higher productivity and lower costs. At the same time, consumers benefit from the increased range of differentiated goods.

In our earlier analysis of the distribution of gains from trade, we were pessimistic about the prospects that everyone will benefit from trade, even though international trade could potentially raise everyone's income. In the models discussed earlier, trade had all its effects through changes in relative prices, which in turn have very strong effects on the distribution of income.

Suppose, however, that intra-industry trade is the dominant source of gains from trade. This will happen

(1) when countries are similar in their relative factor supplies, so that there is not much inter-industry trade,

(2) when scale economies and product differentiation are important, so that the gains from larger scale and increased choice are large. In these circumstances the income distribution effects of trade will be small and there will be

substantial extra gains from intra-industry trade. The result may well be that despite the effects of trade on income distribution, everyone gains from trade.

From previous remarks it's obvious that intra-industry trade tends to be prevalent between countries that are similar in their capital-labour ratios, skill levels, and so on. Thus, intra-industry trade will be dominant between countries at a similar level of economic development. Gains from this trade will be large when economies of scale are strong and products are highly differentiated. This is more characteristic of sophisticated manufactured goods than of raw materials or more traditional sectors such as textiles or footwear. Trade without serious income distribution effects, then, is most likely to happen in manufactures trade between advanced industrial countries.

Some authors, especially Balassa (1967) and Kravis (1971), have argued that scale economies play a crucial role in explaining the postwar growth in trade among the industrial countries. In 1957 the major countries of continental Europe established a free trade area in manufactured goods, the Common Market, or European Economic Community. The result was a rapid growth of trade within the area. It grew twice as fast as world trade as a whole during the 1960s. One might have expected this rapid growth in trade to produce substantial dislocations and political problems. This growth, was almost entirely intra-industry rather than inter-industry, though; drastic economic dislocation did not occur. Instead of, all countries gained from the increased efficiency of the integrated European industry. The growth in trade within Europe presented far fewer social and political problems than anyone anticipated.

There is both a good and a bad side to this favourable view of intra-industry trade. The good side is that under some circumstances trade is relatively easy to live with and therefore relatively easy to support politically. On the other hand, trade between very different countries or where scale economies and product differentiation are not important, remains politically problematic. In fact, the progressive liberalization of trade that characterized the 30-year period from 1950 to 1980 was primarily concentrated on trade in industrial products among the advanced nations. If progress on other kinds of trade is important, the past record does not give us much encouragement.

3. Competitiveness and importance of the production quality

In the traditional approach to intra-industry trade, models of monopolistic competition with increasing returns to scale, combined with homogeneous consumer preferences in the partner countries, explain the presence and significance of it. The combination of monopolistic competition and factor proportion theory generates the co-existence of intra and inter-industry trade (Helpman and Krugman, 1985). Moreover, it concludes the more similar the factor endowments of each country, the greater the extent of intra-industry trade and, therefore, the lesser the extent of inter-industry trade. Thus, this theory predicts a negative relation between comparative advantage and intra-industry trade. The countries in the model trade mainly with differentiated products of comparable quality that somehow occur in the sense of imperfect substitutes to each other. Therefore we speak about horizontal intra-industry trade in this case.

3.1 Role of quality in product differentiation

The existence of vertical intra-industry trade challenges this view. The essence of the theoretical models developed by Falvey (1981), Falvey and Kierzkowsky (1987) and Shaked and Sutton (1984) can be summarized as follows: Vertical product differentiation means that varieties in two-way trade in similar goods differ in quality[14]. On the supply side, the distinguishing feature of each variety is the capital-labour ratio used in its production, with high-quality products requiring more capital-intensive production technologies and having higher prices. On the demand side, goods are distinguished by perceived quality. Although all consumers have the same preferences, each individual demands only one type of differentiated product which is determined by individual income. Given that the aggregate income is not equally distributed, there is an aggregate demand for a variety of differentiated products. The country which is relatively labour abundant will tend to export the lower-quality (labour-intensive) varieties of the differentiated product (demanded abroad by low-income consumers) and to import the higher-quality (capital-intensive) varieties (demanded by high-income consumers in that country). The fact, which is long time observed and empirically

[14] In fact, in these models variety is referred to as quality and quality the most important feature when dividing intra-industry trade into vertical and horizontal.

proved[15] is, that high-income consumers demand not only increased volume of products, but rather wide varieties of products that posses high quality.

3.2 Recent theory overview in analysing intra-industry trade

Some interesting extensions to the theory have been recently made. Davis (1995) developed a model to explain intra-industry trade on the basis of comparative advantage deriving from differences in technology between countries. This model also possesses the challenging feature, unlike the earlier models, that increasing returns are not necessary to explain it. Moreover, recent modelling efforts in the area of endogenous growth and on the relationship between trade and technological progress5, have reinforced the idea of the essential importance of human and technological capital not only for productivity growth but also as a key driving force in the international pattern of specialisation and trade.

Other authors focused on the role of foreign direct investment. These models account for the existence and expansion of multinational companies and their growing influence in trade, via intra-firm transactions. Markusen (1984), Helpman (1984, 1985), and Motta (1994) provide an explanation for a positive relationship between foreign direct investment and intra-industry trade, both vertical and horizontal.

Although an emphasizing model is not available, the existing theoretical framework provide valuable ideas for further modelling. The first is the need to properly distinguish vertical and horizontal intra-industry trade. Second, the need to use differences in factor endowments as well as measures for product differentiation and economies of scale. Finally, also the foreign direct investment shouldn't be omitted.

Recent literature focused on trade has managed to distinguish between intra-industry trade that is based on horizontal product differentiation from the one based on vertical product differentiation, pointing to the different factors that determine these trade flows. An interesting and somewhat surprising fact is that in general vertical intra-industry trade represents a significantly larger share in the total intra-industry trade (Greenaway, 1994 and 1995). As Schott (2004) demonstrated, this type of trade is also

[15] ECE UN (2004), p. 153

consistent with the Heckscher-Ohlin kind of specialisation but within products varieties, where the producers from a capital and skill-intensive country use their advantage to produce vertically superior varieties, varieties that are relatively capital- or skill-intensive and possess higher quality. This approach is new in specialisation occurring within products rather than (as previously assumed in traditional Heckscher-Ohlin model) across products.

According to Ricardian theory is expected that trade between disproportionally developed countries should show also the difference in productivity, which is supposed to be higher in industries using particularly skilled labour and developed technologies. Lower productivity of less developed firms in such industries should also bring lower revenues than in the case of firms producing in developed country.

Vertical intra-industry trade seems to be a typical pattern in trade between developed countries and less developed countries (Clark and Stanley, 1999). Both groups of countries are relatively high-income, although they still have significantly different level of development. According to the work of Aiginger and Wolfraym-Schnitzer (1996), the less developed ones will specialise in lower-quality and lower-cost products that are able to produce and developed economies (usually with greater concentration of high-tech industries and high investments in R&D) will particularly produce in higher quality segments.

Thus, a trade between developed and less developed countries is characterised by the different product qualities that are offered in the same market[16]. For example, U.S. firms export high-quality and high-value products to Mexico (U.S. International Trade Commission, 1996) and compete there with the Mexican firms that offer the corresponding product varieties of lower quality. At the same time, Mexican firms export similar lower-quality products to the U.S. (U.S. International Trade Commission, 1996), competing with high-quality products of the American firms in the U.S. Market.

The same phenomenon holds (or at least used to hold) for transition countries as well. Thus, for instance, Landesmann and Burgstaller (1997) observe quality differences between Western and Eastern European intra-industry trade. Even more striking, Aturupane (1999) find that vertically differentiated intra-industry trade accounts for 80

[16] For references and empirical evidence see e.g. tables in Greenaway, 1994

to 90 percent of the total intra-industry trade between the EU[17] and advanced Central European transition economies. Similarly, Van Berkum (1999) analyses the pattern of intra-industry trade in agricultural products between the Western and and Central European countries, and finds that vertical product differentiation dominates this trade. Finally, Greenaway (1995) showed that in the United Kingdom over two thirds of all intra-industry trade is vertically differentiated, which seems to be just a mirror image of the above described phenomenon.

3.3 Distinguishing the nature of intra industry trade

3.3.1 Grubel and Lloyd Indexes

Grubel and Lloyd (1975) define intra-industry trade of country *j* as the difference between the trade balance of industry *i* and the total trade of the same industry. In order to make comparisons easier between industries or countries, the index is presented as a ratio, where the denominator is total trade.

$$IIT_{it} = 1 - \frac{|X_i - M_i|}{(X_i + M_i)} \Leftrightarrow IIT_{it} = \frac{(X_i + M_i) - |X_i - M_i|}{(X_i + M_i)}$$

The index is equal to 1 if all trade is intra-industry. If IIT_{it} is equal to 0, all trade is inter-industry trade. Grubel and Lloyd (1975, p. 22) proposed an adjustment measure to the country IIT index (IIT calculated for all individual industries), introducing the aggregate trade imbalance. Aquino (1978, p. 280) also considered that an adjustment measure is required, but to a more disaggregated level, but for this, the Grubel and Lloyd method is inadequate. Following Aquino, we require an appropriate imbalance effect. The imbalancing effect must be equi-proportional in all industries. So, the Aquino at the 5-digit level estimates "what the values of exports and imports of each commodity would have been if total exports had been equal to total imports".

[17] At the time it was a group of European countries nowadays known as EU 15.

3.3.2 Overlap Index

Another method how to measure presence of intra-industry trade in the total trade is so called „overlap index“ (Fontagné et al., 1997, p. 30), defined as:

$$OI_{ijkt} = \frac{Min(X_{ijkt}, M_{ijkt})}{Max(X_{ijkt}, M_{ijkt})}$$

If *OI* is greater than 10% (smaller value of export *X* or import *M* between countries *i* and *j* represents at least 10% of the opposite direction trade flow), the trade with commodity *k* in the year *t* can be considered as intra-industry.

3.3.3 Unit values

To determine the nature of intra-industry trade, Grubel and Lloyd indexes and the methodology of Abed-el-Rahman (1991) and Greenaway et al. (1994) and relative unit values per kilogram of exports and imports, calculated at the same level of disaggregation are used.

According to Aiginger and others, unit value is defined as nominal value of exports (eventually imports) divided usually into physical volume measure (in our case kilograms) of these exports (imports):

$$P(X)_{ijkt} = \frac{X_{ijkt}}{Q_{ijkt}}, \text{ or } P(M)_{ijkt} = \frac{M_{ijkt}}{Q_{ijkt}},$$

where X_{ijkt} (M_{ijkt}) is an overall export (import) value of commodity *k* from country *i* to country *j* in a year *t* expressed in a used currency. Q_{ijkt} stands for overall export (import) volume of the commodity in the year *t* measured in kilograms.

Unit value measures the interpretation of prices and costs in the goods production, but is also often applied as an indicator in attempts to measure quality and vertical product differentiation (Aiginger 2001, p.13). It is considered as a proxy for prices, assuming that prices properly reflect quality.

3.3.4 Relative unit values

One of the possibilities how to analyse relative qualitative level of two products competing with each other on one market, is to calculate their relative unit values index. In this case values of exports of commodity *k* in the year *t* from country *i* to country *j* are compared to values of imports from *j* to *i*.

$$RP_{ijkt} = \frac{P(X)_{ijkt}}{P(M)_{ijkt}}$$

The segments of quality are usually estimated by this ratio with ± 15%. Intra-industry trade can thus be divided into the horizontal and vertical:

$$IIT_{it} = HIIT_{it} + VIIT_{it},$$

where $HIIT_{it}$ and $VIIT_{it}$ stand for shares of horizontal and vertical intra-industry trade in total intra-industry trade, respectively.

Relative unit values can be used to distinguish vertical and horizontal differentiation. If in the measures of intra-industry trade (OI > 0.1) holds that[18]

$$0.85 \leqslant \frac{P(X)_{ijkt}}{P(M)_{ijkt}} \leqslant 1.15,$$

quality of both exports and imports of given commodity is similar, thus it stands for trade with horizontally diferentiated products. Difference in quality is not crucial, despite both countries participate in trade with the commodity. The unit value difference in this case reflects different product features and increased range of goods available, although we still speak about a kind of imperfect substitutes, thus the unit value difference is relatively small (Fontagné et al (1997), p. 23).

If the ratio is more than 1.15, exports can be marked as of better quality in comparison to imports; and opposite, if the ratio is less than 0.85, exports are qualitative inferior to imports. In both cases the differences in unit values show the presence of intra-industry trade with vertically differentiated products.

[18] See for example Greenaway et al. (1995), p. 1509

Unit values and their applications are not the best estimates of countries' product quality, but they are easily available since the data on value and quantity imported and exported are so. They are also easy to calculate and to understand what they say. Rising unit values might reflect the rising quality, but don't necessarily have to. They can, for instance, capture the rising production, transportation costs or appreciating currency. Unit values reflect product quality only when the assumption that products possess only vertical attributes for which all consumers agree to pay more hold (Schott, 2008).

4. Automotive industry in the Czech Republic

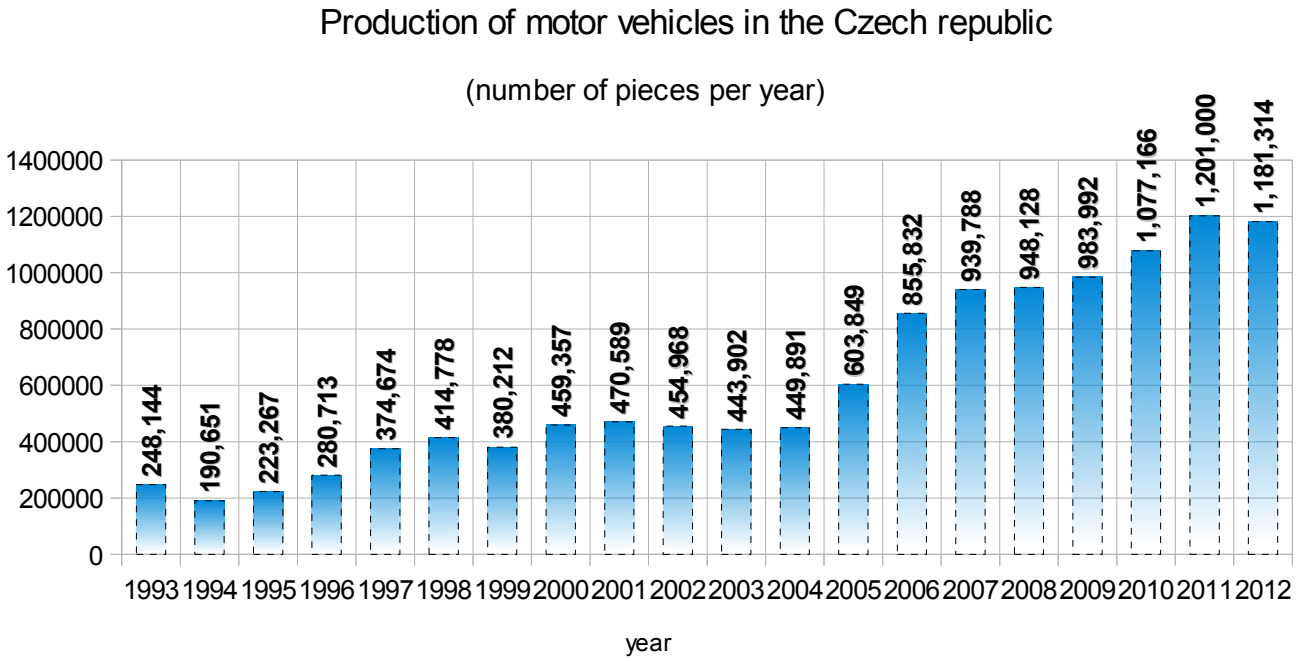
Automotive industry in the Czech republic I have chosen as a representative industrial sector, which possesses features described in previous chapters: high degree of product differentiation and good conditions for economies of scale. In this chapter I will try rather briefly describe this section of the Czech economy. Source for most of the figures and numbers is either Czech Statistical Office, Association of the Automotive Industry (AUTOSAP), Car Importers Association or Czech National Bank.

4.1 Overview

The Czech automotive industry represents one of the pillars of the domestic economy. It is the country's leading manufacturing sector, its share in total industrial production is almost one-fifth and share on the GDP is about one-tenth[19]. In the period 2005 – 2009, manufacturing of machinery and transport equipment was one of the the fastest growing sectors of industrial production with high above average growth in comparison to the total industrial production. Until 2008, industrial production steadily grew, although its annual growth has been slowing down. In 2009, the annual decline in industrial production (13.6%) occurred, which affected also the automotive industry. Compared to 2005, in 2009 the total industrial production increased by 1.6%, of which the manufacturing sector by 2.7%, while production of motor vehicles (except motorcycles), trailers and semi-trailers by 21.8% and other transport equipment by 79.2%. This industrial sector is strongly oriented towards exports (around 80% of the industry production is exported, of which approximately 89% to EU countries). Exports of road vehicles accounted for more than 17% share on total exports in the last six years. According to the Association of the Automotive Industry, despite the economic recession, total production of motor vehicles in 2010 exceeded 1 million units, particularly due to a production of passenger cars. This record was surpassed already in 2011 and in 2012 this production slightly decreased by 1.64%. In 2009, compared to 2005, production of road vehicles increased by 61.1%, between 2008 and 2009 by almost 3%, but only because of the growth in car production. Production of light commercial vehicles, buses, trucks, motorcycles, trailers and superstructures dropped

[19] Source: Czech Statistical Office

significantly.



The automotive industry in the Czech Republic comprises three largest producers of final vehicles and several smaller manufacturers of passenger cars, trucks, buses, trailers and motorcycles and approximately 200 - 300 suppliers of parts and accessories for motor vehicles.[20] The largest producers of passenger cars are Škoda Auto, which has, in addition to the main plant in Mladá Boleslav two branch factories, in Kvasiny and Vrchlabí, then Toyota Peugeot Citroën Automobile (TPCA Czech) in Kolín and Hyundai Motor Manufacturing Czech (HMMC) in Nošovice. Beside the Czech Republic, Škoda cars are manufactured also in Russia, Ukraine, Kazakhstan, Bosnia and Herzegovina, China and India. In these countries cars are assembled mainly from parts and components that are shipped from the Czech Republic. However, as the share of passenger-car production accounts for more than 98% of all final road vehicles production since 1999[21], most of the time I will discuss issues concerning them. The mentionable manufacturers of parts and accessories for motor vehicles are Škoda Auto, Lucas Varity, Continental Teves Czech Republic, Valeo Auto Air, Benteler, TRW Carr, Dura Automative CZ, Ronal CR, Bosch CR and many others. Due to the ongoing economic recession industry's direct employment declined to around 120,000 people, while it is estimated to employ at least another 140,000 people indirectly[22].

[20] Source: CzechInvest

[21] Source: Czech Statistical Office

[22] Source: Association of the Automotive Industry

4.2 Development and production growth

Activity and growth in the automotive industry were encouraged by foreign direct investments. According to the Czech National Bank, to December 31st 2008, foreign direct investment (equity capital, reinvested earnings, other capital) in the manufacturing sector reached 757.4 billion CZK. The largest part (more than one quarter) was allocated in the production of motor vehicles and transport equipment. With the help of these investments the industry implemented construction of new capacities and extension of production of some existing ones, especially those that produce components, spare parts and accessories[23]. In early 2005, TPCA (Toyota Peugeot Citroën Automobile), which is a joint venture of Toyota Motor Corporation and PSA Peugeot Citroën, started to produce passenger cars in Kolín. Construction of TPCA was realized with the help of investment funds, which totalled more than EUR 750 million[24]. Almost the entire production (99%) of the factory is intended for export[25]. TPCA is therefore one of the biggest exporters in the Czech Republic. The prevailing proportion of parts and components (about 80%) needed for the manufacturing of passenger cars comes from the Czech Republic. In November 2008, the factory of Hyundai Motor Manufacturing Czech (HMMC) started its production in Nošovice. It was built with an investment of roughly EUR 1 billion. The predominant part of HMMC is also intended for export.

Association of the Automotive industry states, that among all three car producers, Škoda Auto maintains its long-time dominant position, when its current share accounts for about 55% of total production. TPCA peaked at 2009, when it exceeded its planned annual capacity of 300,000 vehicles by 32,497 units. However, because of the complicated economic situation in the target countries, the production gradually declined to the last year's 214,000 cars, which is the worst outcome so far, if we don't consider the incomplete first year of production in 2005. HMMC reached its planned capacity already in 2012 when it produced 303,703 vehicles and as it is growing steadily even in times of recession, it appears to be a very competitive.

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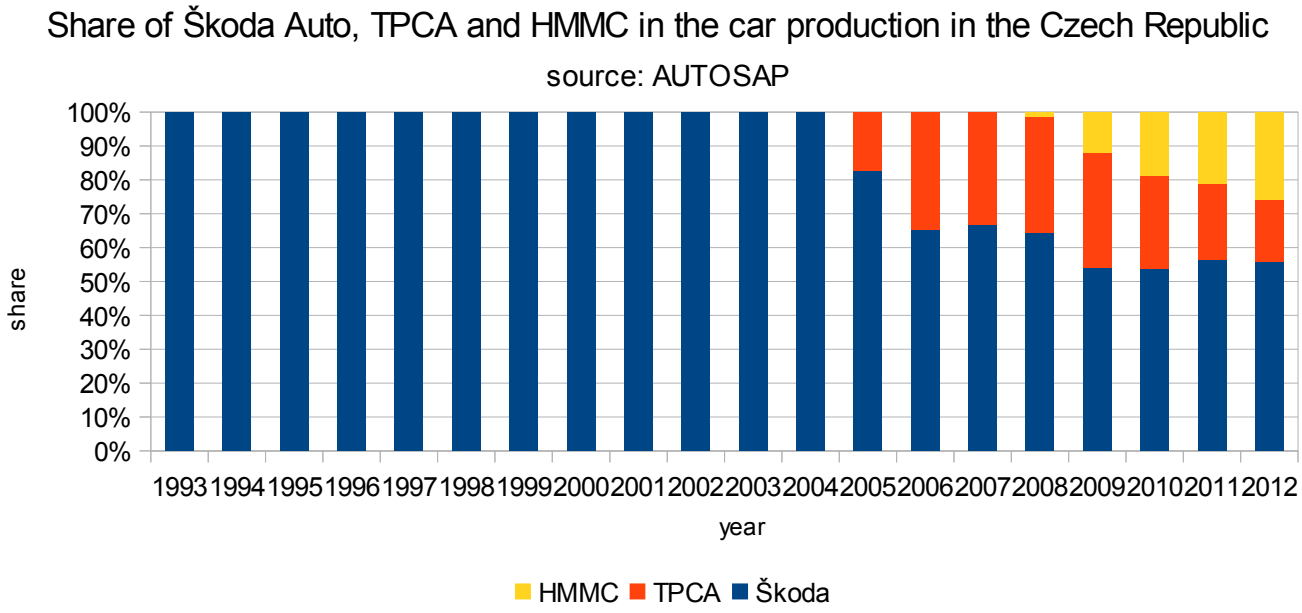
[23] Source: Association of the Automotive Industry

[24] Source: CzechInvest

[25] Source: Czech Statistical Office



4.2.2 Domestic market

Domestic demand, especially for passenger cars, has raised higher requirements for the importation of motor vehicles. Demand was supported mainly by the growth of real wages, the wider use of all types of loans and different kinds of promotion, such as discounts or supply of accessories at a bargain price. Overall lower transportation of goods, which accompanies economic recession led to a reduction of investments in renewing the firms' fleets and therefore decreased demand for new commercial vehicles. The sales of trucks, trailers and semi-trailers fell significantly in the last few years[26].

On the website of AUTOSAP you can find out, that the domestic passenger cars market gradually rose from 1993's 159,547 until 2008's pre-crisis peak of 374,635 to drop back to 298,352 in 2012. Position of domestic producers on the market is quite interesting. The overall share of domestically produced new cars decreased from 36,73% in 1993 to 12,23% in 2008, then grew a little to the current 20%. This is caused mainly by unusually large imports of used cars, as well as the increasing competition of the foreign brands importing new cars.

[26] Source: Czech Statistical Office

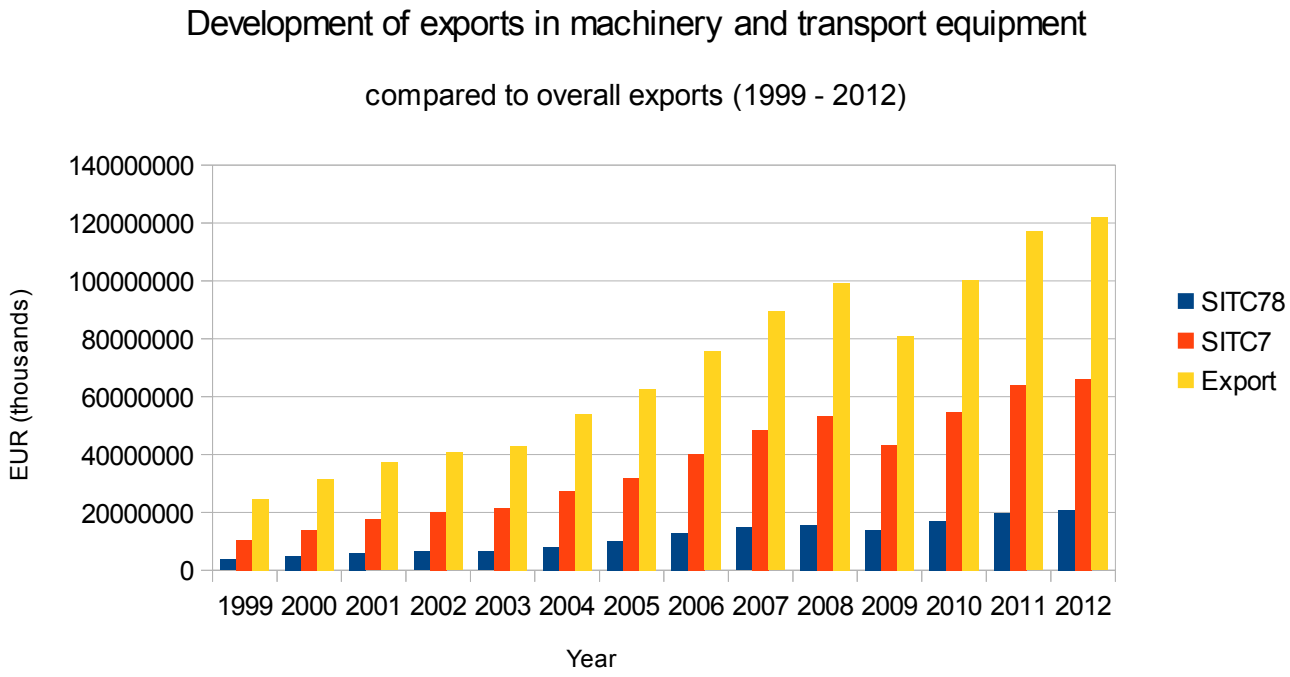
4.3 Czech automotive industry and foreign trade

As the domestic market is relatively small, the whole sector is highly export-oriented. Based on the data of Czech Statistical Office, since 2007, almost 95% of the passenger-car production has been exported and their production rose despite the ongoing recession. The increase in external demand was significantly enhanced by supporting government action in some states, for which the term "scrappage" became common. Without these measures the deterioration of the situation in key export markets for Czech firms would have been more drastic. Various forms of "scrappage premium" were introduced already during 2009 in the number of EU Member States, but also in the United States, Japan and Canada, in order to stimulate demand for cars in response to the financial and economic crisis. For the production of cars and their export from the Czech Republic it was particularly important the introduction of subsidies in Germany and the Slovak Republic. In most countries, the bonus paid was in the range of EUR 1,000 – 2,500. Later on, the organic growth of HMMC, which is the first and so far the only factory of the Hyundai company in Europe, contributed, as well as economic recovery in Germany, higher demand in emerging markets such as Russia and China or higher demand for more efficient and cheaper cars in the times of uncertainty.

4.3.1 Foreign trade in road vehicles

Foreign trade in road vehicles rather significantly determines its overall dynamics and the resulting trade balance. Excluding the foreign trade with road vehicles would cause an overall trade balance deficits instead of fairly substantial surpluses in several years. Especially the link between exports of machinery and transport equipment and exports of road vehicles has been relatively strong. Since 2006, percentage share of machinery and transport equipment on Czech exports is oscillating around the value of 54, while share of road vehicles moves between 16 and 17% for the mentioned period. Road vehicles have substantially weaker effect on the development of total imports and imports of machinery and transport equipment, but still quite significant. This development of exports and imports of road vehicles has a significant effect on the trade balance in machinery and transport equipment, and thus on the overall trade balance. In the period 1999 - 2012 a positive surplus of trade in road vehicles contributed to the

surplus of trade in machinery and transport equipment around 70% on average. The position of road vehicles in total imports and imports of machinery and transport equipment rather gradually weakened. This weakening took place in favour of imports of other engineering products, especially imports of electrical machinery, apparatus and appliances and office machines and equipment.



Territorial structure of foreign trade in road vehicles is determined by the principal orientation on the member states of the European Union. Dominant position of the EU countries is given by their largest share in the total export as well as total imports of road vehicles, that make up for 90% and 85% respectively. The other groups of countries account for an insignificant share in this trade, despite the fact that in the reference period they recorded a slight increase at the expense of the EU. The most important long-term partner with more than one-third share of Czech road vehicles exports and more than 40% share of the imports is Germany. The largest trade surplus regarding this sector is also realized in the trade with Germany.

4.3.2 Foreign trade in passenger cars

Exports of passenger cars, as of the most significant subgroup of the group road vehicles, grew continuously until 2007. In 2008, they declined, but revival started already in 2009, although the performance was still lower compared to 2007. Growth in exports of cars then continued, particularly due to the increase in domestic production and still persistent "scrappage" in some countries. The exports of passenger cars have a decisive share of new cars, used cars exports are negligible.

Imports of cars were substantially lower compared with their exports. In the reporting period, the ratio of imports of cars over their exports ranged from less than 17% in 2012 to more than 45% in 2004. While the exports of passenger cars had a decisive share of exports of new cars, for the imports of cars the situation was somewhat different. Throughout the period, although imports of new cars prevailed, the share of used cars in total imports of cars was quite significant. This means that, compared to their share in exports of passenger cars (less than 1%) was substantially higher. Czech statistical office data say, that share of used cars in imports was somewhat around 15% of their overall value. Car Importers Association and Association of the Automotive Industry present much higher figures ranging from 41% in 2012 to 61% in 2008 but in the term of total number of cars imported, regardless of their trade value. Data of these two associations are based on so called “first registrations”, i.e. on the number of imported new and used cars registered in the Czech republic for the first time in a given year, unlike the data of Czech Statistical Office, that are based on the information from Customs Administration. Anyhow, the fact is that the import of used cars significantly determined the dynamics of total imports of cars.

Foreign trade in passenger cars ended in high surplus throughout the whole period, as it reached around 70% of exports of passenger cars. The resulting surplus positively influenced the overall trade surplus and was its main carrier. The predominant share of the positive balance of trade in passenger cars had a trade balance of new passenger cars trade. Foreign trade in used vehicles showed deficit for the entire period, thus reducing the overall positive balance of trade in passenger cars. The negative balance of trade in used passenger cars deepened until 2008, since then it decreased a little.

Territorial structure of foreign trade in passenger cars is very similar to the one of road vehicles. Share of the EU countries in the total export and total imports of passenger cars is 90% and 80% respectively. Particularly Germany's share on both exports and imports is stunning, as in 2012 it's accounted for more than 42% and almost 19%, respectively. The largest trade surplus regarding this sector is traditionally also realized in the trade with Germany. In 2012 it reached more than EUR 2 billion. An interesting fact is, that according to the data of Czech Statistical Office, around 20% of imported cars trade value from Germany comes from the trade with the used ones.

5. Analysis of the Czech foreign trade with Germany focused on automotive industry

The Czech economy is closely integrated with the EU, especially since the country's EU accession in 2004. Small, open, export-driven Czech economy remains sensitive to changes in the economic performance of its main export markets, especially Germany. When Western Europe and Germany fell into recession in late 2008, demand for Czech goods plunged, leading to double digit drops in industrial production and exports. For a long time, the foreign trade with Germany has been one of the most important overall foreign trade relations of the Czech Republic. The share of trade with Germany on total foreign trade turnover was around 30% in the period 1995 - 2011. Due to its importance for the Czech economy it deserves a special attention.

5.1 Characteristics of the foreign trade with Germany

The German economy - the fifth largest economy in the world in PPP terms and Europe's largest - is a leading exporter of machinery, vehicles, chemicals, and household equipment and benefits from a highly skilled labour force. The German economy has a trade surplus vis-à-vis all its major trading partner countries except China. This merely confirms Germany’s status as the “export engine” of the Euro area, i.e. its key role on the European scale. The strongly export-oriented Czech economy’s links with the German economy are therefore crucial.

In the last five years, Germany has accounted for more than 29% of Czech foreign trade turnover. Out of all its trading partners, the Czech Republic’s trade surplus with Germany has also been the highest in the same period. This surplus has risen steadily and now exceeds the Czech Republic’s overall trade surplus. The interdependence of Czech goods exports and German goods imports and exports is very high. The same can also be observed for Czech goods imports as a result of strong collaboration imports. The share of goods exports to Germany was 31.6% on average, with the highest share (32.5%) having been recorded in 2009, i.e. during the deepest phase of the financial crisis.

The strong link between German and Czech exports is also reflected in their structure. Machinery and transport equipment is the largest item of German exports, accounting for around 50% of the total. Exports from the Czech Republic to Germany have a similar structure and are also dominated by machinery and transport equipment.

Given the Czech economy's strong links with Germany and other EU countries, economic developments in these countries feed through rapidly to the Czech economy via exports. A downturn in external demand has an immediate downward effect on domestic GDP growth.

5.2.1 Development of the foreign trade with Germany

The high degree of interdependence between Czech and German economies has a long-term impact on the development of foreign trade in both countries. Removing the last administrative barriers after the Czech Republic joined the European Union affected the further expansion of mutual trade. In 2000, foreign trade turnover with Germany reached EUR 24 billion, in 2005 already EUR 39.6 billion and in 2011 EUR 65.4 billion. After the gradual growth in the years 1993 - 2007, in 2008 for the first time in the history of the Czech Republic the annual decline occurred (by 2.1%, or EUR 1.2 billion). This was due to the global financial crisis followed by economic recession, and the already mentioned very strong interdependence of Czech and German economy. This decline even deepened in 2009 (by 12.8%, or EUR 6.8 billion). In 2010 and 2011, mutual trade with Germany started to grow again. In 2011, foreign trade turnover with Germany reached the highest value in the independent Czech Republic era, in comparison with 2000, the value almost doubled and compared to 2005 was higher by more than one-third (36.4%).

The German market has long been an important outlet for Czech products as the largest part of total Czech exports goes there. The foreign trade turnover with Germany was dominated by exports for entire period. Although the role of imports in the total foreign trade with Germany was weaker compared to the proportion of exports, it was still significant for the Czech economy. Imports from Germany, which in recent years accounted for more than two-fifths of the total foreign trade turnover with Germany,

covers a substantial part of import needs of the Czech Republic. Higher growth rate of exports to Germany than the growth rate of imports from Germany was typical for almost the whole period 1993-2012 and thus it had favourable effect on the trade balance. Given that the decline in foreign trade with Germany between 2008 and 2009 was more significant on the import side, this had a positive impact on the trade balance with Germany as well. In 2012, a positive trade balance represented more than a quarter of Czech exports to Germany, while 7 years before it was only 12.4%.

The biggest share of foreign trade with Germany on overall foreign trade was in 2005, in the following years the position of Germany slightly declined and in 2011 was 2.9 percentage points lower, as compared to 2005. Throughout the reporting period there was evident more significant share of exports to Germany than imports from the country. Germany's share in total exports, as well as its share in total imports gradually weakened. More substantial reduction, however, was evident in the share of imports. While in 2005 the difference between the proportion of exports and imports amounted to 3.5 percentage points in favour of exports, in 2011 the difference was 6.5 percentage points.

5.2.2 Position of the Czech Republic in the foreign trade of Germany

On the other side, Czech Republic can be considered as an important trade partner for Germany as well, however not the major one. This is determined mainly by the difference in size of both economies, as German economy is 17,4 times bigger in nominal terms and 11,1 times bigger in terms of PPP, while in terms of population/labour force is only approximately 8 times bigger. With the share of 2.9% on German exports, the Czech Republic is the 13th most important trade partner, with regards to German imports, it occupies 9th position with the share of 4.1%.

5.2.3 Foreign trade with Germany in machinery and transport equipment

In the years 1999-2012 growth of exports to Germany was recorded by all SITC sections. Above average growth of exports recorded especially exports of machinery

and transport equipment. Compared to 1999 the 2012 these exports increased by EUR 17,2 billion and the growth of total exports to Germany by almost EUR 30 billion, thus increased exports of machinery and transport equipment accounted for almost 62% of this growth. Furthermore, machinery and transport equipment were the only SITC class, which in 2012 compared to 1999 significantly strengthened its position in the total exports to Germany by more than 11%, accounting for almost three-fifths of Czech exports to this country.

The most important class of SITC imports from Germany were machinery and transport equipment as in the opposite case. Compared to 1999, the 2012 these imports increased by EUR 8.1 billion and the growth of total imports from Germany by EUR 18.6 billion, so increased imports of machinery and transport equipment accounted for more than 43% of this growth. Machinery and transport equipment were one of three classes SITC, which in 2012 compared to 1999 weakened its position in the total imports from Germany, as their share decreased in 2012 compared to 1999 by 1.8 percentage points, however still holding the share of 44% of total German imports to the Czech Republic.

5.3 Analysis of the Czech-German intra-industry trade in road vehicles

In this part I try to examine the extent and nature of intra-industry trade between the Czech Republic and Germany with focusing on the trade in SITC78 Road Vehicles. I will deal mainly with SITC781 Passenger Cars mutual exports and partly also with SITC784 Parts and Accessories of Motor Vehicles, because these two subgroups together of the group SITC78 currently participate on its export of more than 95% in the case of Czech Republic and almost 90% in the case of Germany[27].

As resulted from previous section, both countries are highly oriented on production of Machinery and Transport equipment, export of which accounts for about 50% share in their exports. I focus on mostly on the passenger cars, as the extent of intra-industry trade is typically much higher across categories of manufactured goods machinery and transport equipment, electrical equipment and electronics. This is

[27] Czech republic is importing a considerable amount of buses, trucks, lorries, etc. from Germany

because sophisticated manufacturing products are more likely to benefit from economies of scale in production and are easier to "differentiate" to the final consumer, and so facilitate trade in similar products. More complex manufactured products which rely on many components and processes may also benefit more readily from splitting up production across countries. This is exactly the case of passenger cars, that all have quite similar purpose, but they differ significantly not only by quality, but also by other features that one can imagine.

5.3.1 Methodology

At first I will examine to what extent is the trade in SITC781 and SITC784 intra-industry by calculating the Grubel-Lloyd indices for both products in the period 1999 – 2012. Then I try to answer the question, whether the supposed intra-industry trade in passenger cars is vertical or horizontal, i.e. whether cars produced by both countries differ in terms of quality. As a benchmark for this I will calculate the unit values in the reported period first for passenger cars in general, but further distinguish them by more detailed trade classification to reveal the differences. As for the SITC784 Parts and Accessories of Motor Vehicles, I will not split them further, as their more detailed classification is very idiosyncratic.

At the beginning I will recall the formula for calculation of Grubel-Lloyd index once again.

$$IIT_{it} = 1 - \frac{|X_i - M_i|}{(X_i + M_i)} \Leftrightarrow IIT_{it} = \frac{(X_i + M_i) - |X_i - M_i|}{(X_i + M_i)},$$

where X_i and M_i are exports and imports for industry i in the year t. If index is equal 1, all trade is intra-industry, if it's equal to 0, all trade is inter-industry. It is known that level of aggregation matters for the value of the index; the higher the level of aggregation, the higher the index value. Nevertheless, I decided to use 3-digit SITC sections, that are considered as some kind of standard in this case.

5.3.2 Grubel-Lloyd index for SITC781 Passenger Cars:

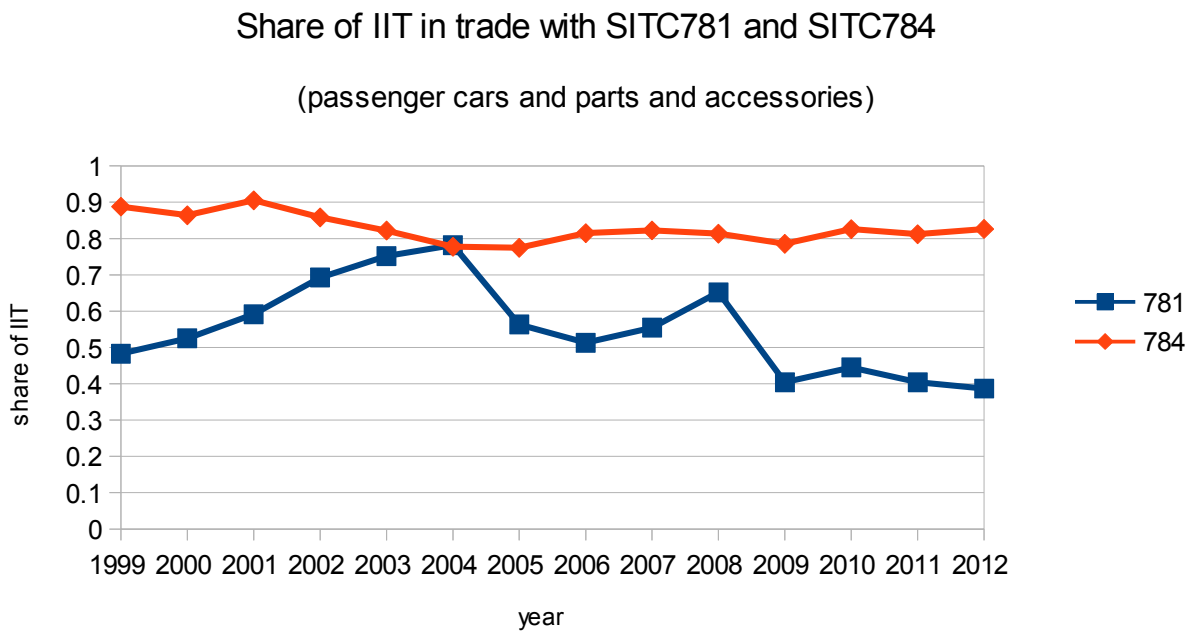
1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
0.48	0.53	0.59	0.69	0.75	0.78	0.56	0.51	0.55	0.65	0.40	0.44	0.40	0.39

The index throughout the reported period shows that trade in passenger cars between the Czech Republic and Germany has rather intra-industry nature and was growing until 2005 with the peak of 0.78 in 2004, in latter years the index has much lower values, indicating that rise in exports was much higher than rise in imports.

5.3.3 Grubel-Lloyd index for SITC784 Parts and Accessories of Motor Vehicles

1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
0.89	0.86	0.9	0.86	0.82	0.78	0.77	0.81	0.82	0.81	0.79	0.83	0.81	0.83

The Grubel-Lloyd index for parts and accessories shows that the trade in this section for the entire period is undoubtedly almost exclusively of intra-industry



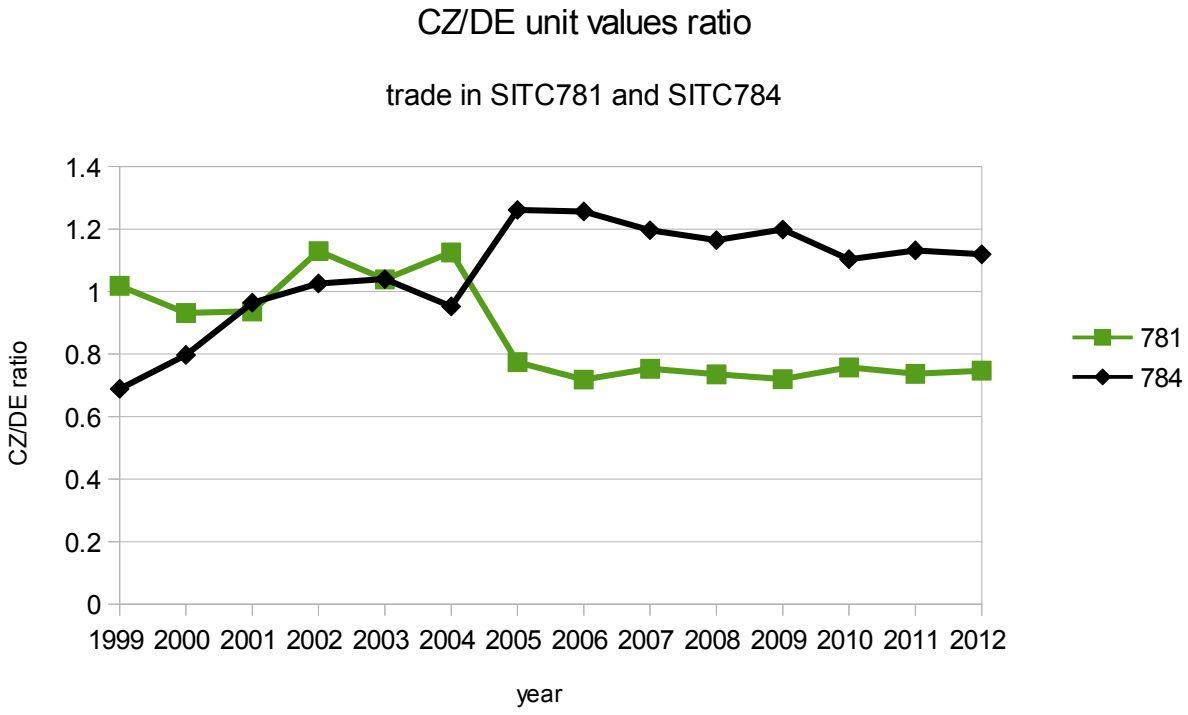
character.

5.3.4 Computed unit values for SITC781 and SITC784

Unit values are computed as defined by Aiginger and others; nominal value of exports divided usually into (in our case) kilograms of these exports, so the values in the table are measured in EUR per kilogram, while in the third row, there is a ratio of Czech unit values dived into the German ones, i.e. the so called relative unit values.

1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
8.56	8.55	9.20	9.69	9.34	10.03	9.50	9.52	9.78	9.93	8.51	9.42	9.57	9.62
8.40	9.18	9.82	8.58	8.99	8.91	12.26	13.26	12.99	13.51	11.82	12.43	12.99	12.87
1.02	0.93	0.94	1.13	1.04	1.13	0.77	0.72	0.75	0.74	0.72	0.76	0.74	0.75

1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
3.71	3.96	4.88	5.49	5.60	4.91	6.59	6.38	6.08	5.95	6.52	6.37	6.57	6.30
5.38	4.97	5.06	5.35	5.38	5.15	5.23	5.08	5.08	5.11	5.44	5.77	5.81	5.63
0.69	0.80	0.96	1.03	1.04	0.95	1.26	1.26	1.20	1.16	1.20	1.10	1.13	1.12



According to the above shown figures, it seem there was horizontal intra-industry trade in passenger cars in the period 1999 – 2004, which has changed in 2005, when the German unit values experienced a substantial burst, while Czech remained almost the same and this difference persists until nowadays. In the case of intra-industry trade in parts of accessories of motor vehicles it is exactly opposite story with the happy ending in favour of Czech exports.

On the other hand, these figures should be considered just as a first step before proceeding a deeper analysis. As the unit values of both German and Czech passenger cars exports are probably distorted by high level of aggregation and trade in used vehicles, I decided to analyse the nature of intra-industry trade in passenger cars on the basis of the most detailed international trade classification called CN8, which is the eight-digit very detailed common nomenclature system of goods classification, which includes cca 10,000 codes and simultaneously also the only one that can distinguish trading in new cars and used cars.

5.3.5 Analysis of the Czech-German intra-industry trade in passenger cars using CN8 trade classification

In Eurostat, where the data I use come from, in CN8 system passenger cars are under the group of G_87: Vehicles other than railway or tramway rolling-stock, and parts and accessories thereof. I decided to use for analysis these 14 groups of Motor cars and other motor vehicles principally designed for the transport of persons:

a) with spark-ignition internal combustion reciprocating piston engine, of a cylinder capacity

1. <1000 cm^3, new
2. <1000 cm^3, used
3. >1000 cm^3 but <1500 cm^3, new
4. >1000 cm^3 but <1500 cm^3, used
5. >1500 cm^3 but <3000 cm^3, new
6. >1500 cm^3 but <3000 cm^3, used
7. >3000 cm^3, new
8. >3000 cm^3, used

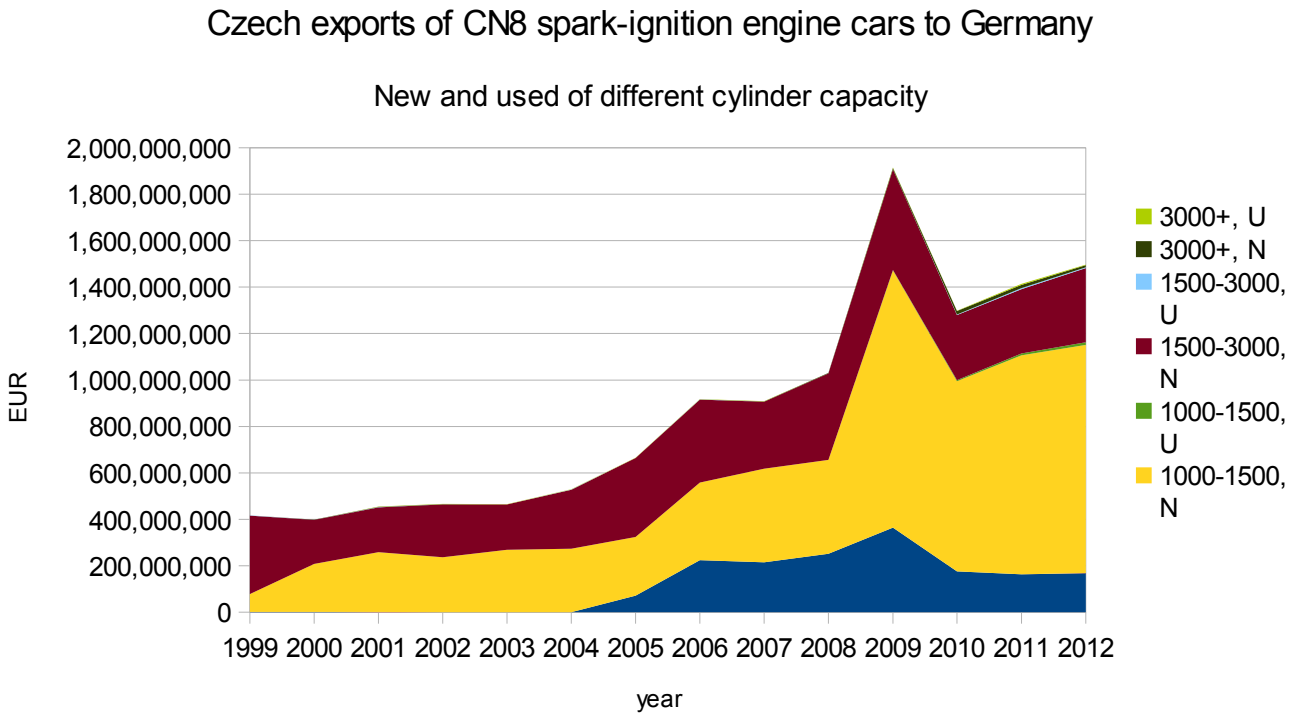
b) with compression-ignition internal combustion piston diesel or semi-diesel engine, of a cylinder capacity

1. <1500 cm^3, new
2. <1500 cm^3, used
3. >1500 cm^3 but <2500 cm^3, new
4. >1500 cm^3 but <2500 cm^3, used
5. >2500 cm^3, new
6. >2500 cm^3, used

5.3.5.1 Mutual trade in spark-ignition engine cars

First, I will start with analysis of spark-ignition engine cars exports from both Czech republic and Germany to the other country and their comparison.

CZ – DE	1000, N	1000, U	1000-1500, N	1000-1500, U	1500-3000, N	1500-3000, U	3000+, N	3000+, U
1999	1,384,083	68,169	76,344,627	340,639	337,958,430	1,054,443	76,981	103,350
2000	1,086,472	123,304	206,432,259	809,564	188,689,107	878,285	251,311	453,319
2001	632,212	89,897	257,995,605	341,790	192,433,696	1,113,011	1,109,024	914,366
2002	14,519	63,531	236,255,572	195,163	227,259,378	774,776	950,357	692,983
2003	12,951	38,351	269,251,833	70,917	194,312,543	777,515	189,350	1,106,651
2004	202,311	15,271	272,672,416	255,922	253,662,666	1,467,598	496,886	599,135
2005	70,872,628	0	252,770,119	323,376	339,971,879	207,563	525,636	591,892
2006	223,922,048	28,779	334,009,549	84,082	357,598,869	515,277	815,295	1,099,817
2007	215,024,668	227,418	402,391,959	106,802	288,774,995	184,218	1,351,617	1,043,677
2008	251,633,135	99,422	404,151,547	31,382	372,062,567	191,675	2,342,889	315,167
2009	364,473,010	94,313	1,106,870,819	2,299,784	432,722,672	630,556	5,542,709	1,819,105
2010	175,873,874	83,489	819,024,502	3,732,725	280,267,746	3,354,069	15,017,893	1,030,813
2011	163,524,458	54,152	942,513,295	8,697,555	276,335,459	4,465,320	13,680,049	4,667,502
2012	168,072,849	598,252	982,718,066	10,948,864	319,889,412	3,173,696	9,073,141	1,960,152

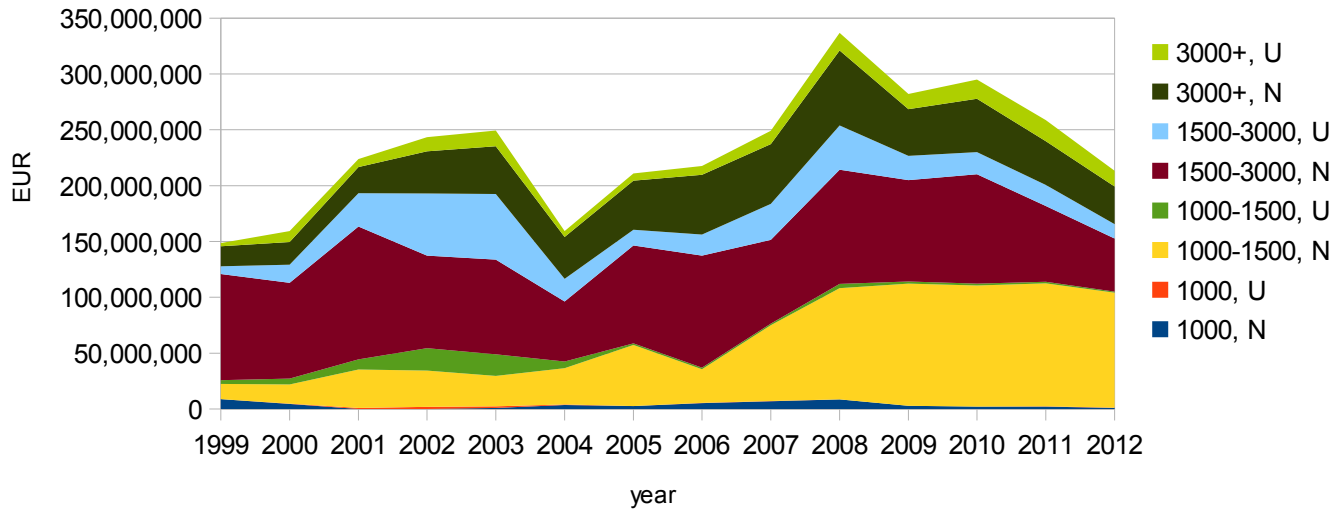


As it's obvious from the table and related graphic figure, the most important Czech spark-ignition engine passenger cars exports to Germany are new cars with cylinder capacity between 1,000-1,500 cm^3, together with those with cylinder capacity between 1,500-3,000 cm^3. From 2005 also the share of smallest cars with capacity up to 1,000 cm^3 gained some significance, as they were major exports of TPCA joint venture factory, however due to the economic recession on their main export markets their share considerably declined. The big and luxury cars plus all types of used cars had only a very negligible share on overall exports; they even almost aren't visible on the graph.

DE – CZ	1000, N	1000, U	1000-1500, N	1000-1500, U	1500-3000, N	1500-3000, U	3000+, N	3000+, U
1999	8,757,879	49,033	13,721,990	3,331,202	94,984,452	6,954,646	17,903,224	2,904,229
2000	4,478,919	322,671	17,269,787	5,116,038	85,806,029	16,094,849	20,447,628	9,825,241
2001	54,996	780,344	34,457,924	9,094,090	119,063,101	29,891,892	23,252,310	7,272,232
2002	35,785	1,877,485	32,421,682	20,132,429	82,958,294	55,513,249	37,664,922	12,693,243
2003	871,615	1,582,345	27,179,993	19,269,943	84,778,876	58,897,713	42,682,143	14,079,020
2004	3,567,292	424,759	32,502,246	6,112,988	53,735,580	20,235,013	37,421,365	5,226,851
2005	2,646,853	70,097	54,610,365	1,477,842	87,562,192	14,198,728	43,825,656	6,491,013
2006	5,302,633	121,482	30,288,205	1,318,370	100,317,896	18,899,956	53,559,982	7,668,150
2007	6,933,130	168,539	68,016,096	1,430,615	74,800,771	32,318,762	53,419,233	12,003,291
2008	8,577,890	152,204	99,400,902	3,902,819	102,123,824	39,658,064	67,274,868	15,695,625
2009	2,786,269	43,895	109,361,950	2,053,777	90,631,827	21,864,218	41,696,277	13,611,886
2010	2,153,438	31,027	108,492,402	1,536,897	98,024,439	19,855,527	47,674,340	17,170,760
2011	2,296,669	51,623	110,253,769	1,357,685	67,905,845	18,649,685	39,299,426	18,782,828
2012	1,062,321	58,585	103,032,171	940,857	47,434,136	13,042,164	33,506,172	14,188,418

German exports of CN8 spark-ignition engine cars to the Czech Republic

New and used of different cylinder capacity (see legend)



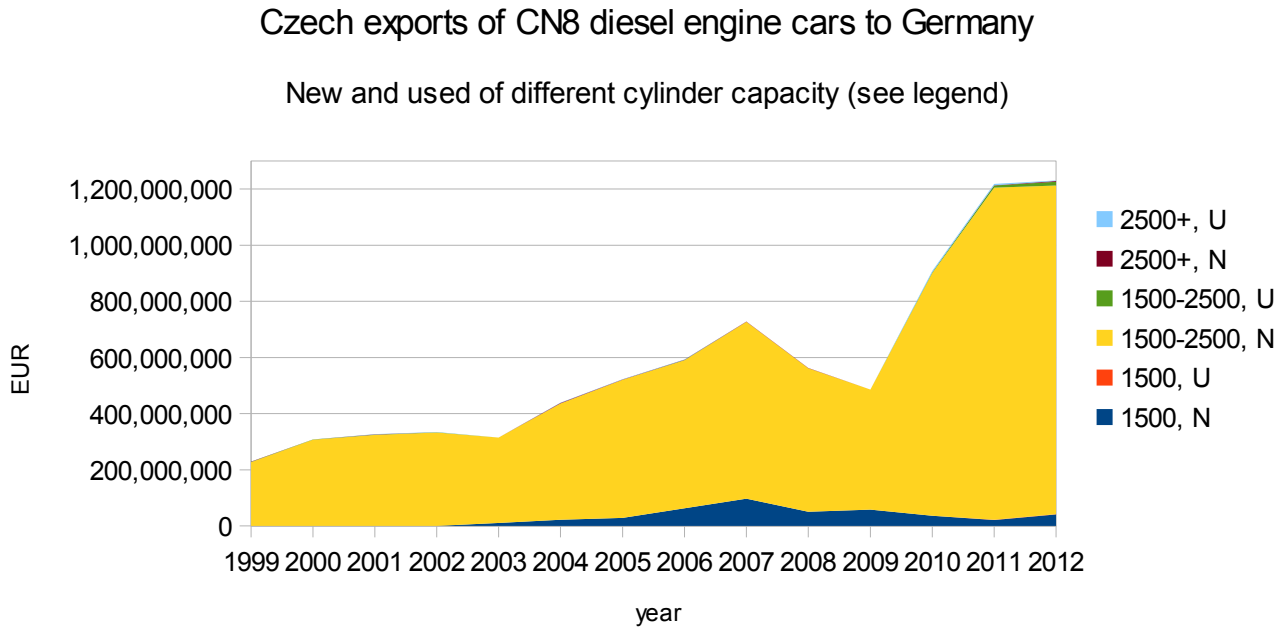
On the other hand, situation with German spark-ignition engine passenger cars exports to the Czech Republic isn't that simple. In the last five years they mostly export new cars of cylinder capacity between 1,000-1,500 cm^3 as well, while new 1,500-3000 cm^3 capacity cars were predominant group before 2007. In German case are also significant new luxury cars with the biggest capacity, as well as the same but used ones together with used cars of capacity between 1,500-3000 cm^3. Exports of the smallest cars regardless of their condition as well as of used cars of 1,000-1,500 cm^3 capacity were negligible, although the latter named type experienced an episode of marginal significance between 2000 – 2004.

5.3.5.2 Mutual trade in diesel engine cars

As for the cars with diesel or semi-diesel engine regard, there is one interesting fact beside the others. While overall exports of these vehicles from the Czech Republic to Germany were much lower compared to the exports of the spark-ignition engine cars, the German case was exactly the opposite.

CZ – DE	1500, N	1500, U	1500-2500, N	1500-2500, U	2500+, N	2500+, U
1999	242,886	91,470	227,105,775	834,342	774,905	69,777
2000	101,358	4,171	307,326,371	836,894	126,965	40,908
2001	70,120	0	324,352,621	450,243	1,209,875	1,083,452
2002	0	0	333,200,284	205,050	840,597	207,342
2003	10,750,217	20,564	303,547,789	232,731	327,630	228,350
2004	21,582,568	42,496	414,532,817	526,848	1,195,824	1,072,190
2005	28,435,782	0	492,551,039	457,767	770,258	67,646
2006	62,666,042	36,504	527,313,122	1,295,086	1,427,334	82,190
2007	97,523,511	42,130	629,056,285	231,394	1,333,476	122,480
2008	50,495,062	0	511,092,019	238,543	592,837	49,928
2009	58,242,032	402,090	427,063,238	240,450	106,695	50,340
2010	36,640,017	159,750	863,721,158	3,027,044	608,521	4,470,944
2011	21,414,154	221,083	1,183,181,038	7,462,433	944,420	5,114,947
2012	41,710,217	276,354	1,170,959,014	13,274,687	2,574,944	1,880,403

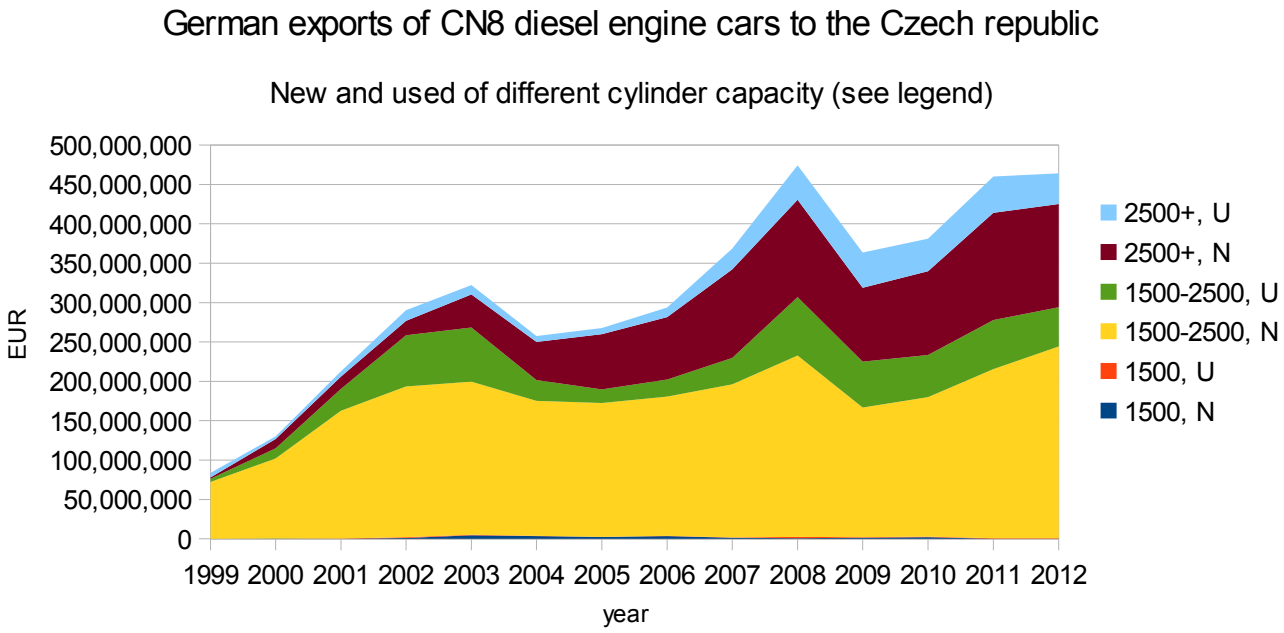
Source: EUROSTAT, own computations



Although there are some values missing in the table, it shouldn't be considered as a big issue, as Czech diesel cars exports consist almost solely of new vehicles of capacity between 1,500-2,500 cm^3. The only other class with rather marginal significance worth mentioning are up to 1,500 cm^3 capacity cars. The other classes are nothing but negligible.

DE – CZ	1500, N	1500, U	1500-2500, N	1500-2500, U	2500+, N	2500+, U
1999	0	77,983	72,135,113	3,850,298	1,989,728	5,711,338
2000	305,297	211,232	101,363,374	13,036,759	11,883,667	3,181,681
2001	134,161	290,866	162,032,387	27,780,430	15,720,384	6,713,944
2002	1,187,865	844,945	191,528,312	64,873,964	18,165,264	13,577,016
2003	4,402,416	832,486	194,310,953	68,716,801	41,944,708	11,847,410
2004	3,511,498	388,425	171,148,207	26,424,684	48,524,801	7,473,718
2005	2,259,456	277,502	169,713,952	17,490,613	70,041,640	7,714,080
2006	3,305,777	496,409	176,821,321	21,572,032	79,225,097	12,363,001
2007	1,417,944	241,192	194,594,604	33,551,269	112,446,309	26,125,074
2008	599,928	1,845,337	230,362,863	74,241,601	123,627,294	43,435,476
2009	1,409,969	758,114	164,557,883	58,025,769	94,033,906	44,586,279
2010	2,120,815	488,158	177,240,443	53,553,123	106,516,538	41,138,588
2011	127,068	599,971	214,848,458	62,132,594	136,232,247	46,055,385
2012	126,948	473,892	243,459,799	49,991,930	131,004,958	39,157,608

Source: EUROSTAT, own computations



The German case is again more varied. Although the new cars of 1,500-2,500 cm^3 capacity has the highest exports share, followed by the new cars with capacity higher than 2500 cm^3, used version of both classes acquired a considerable share throughout the years. The exports of the small cars are negligible.

5.3.5.3 Grubel-Lloyd indexes for CN8 disaggregated passenger cars trade

As the next thing, I will show values of Grubel-Lloyd index measuring extent of intra-industry trade for all 14 classes of mutually traded cars to see, how intensive is intra-industry trade is in a particular class. Computations are based on the previously acquired data from EUROSTAT.

G-L index	1,000, N	1,000, U	1,000-1,500, N	1,000-1,500, U	1,500-3,000, N	1,500-3,000, U	3,000+, N	3,000+, U
1999	0.27	0.84	*0.30*	0.19	*0.44*	0.26	0.01	0.07
2000	0.39	0.55	*0.15*	0.27	*0.63*	0.10	0.02	0.09
2001	0.16	0.21	*0.24*	0.07	*0.76*	0.07	0.09	0.22
2002	0.58	0.07	*0.24*	0.02	*0.53*	0.03	0.05	0.10
2003	0.03	0.05	*0.18*	0.01	*0.61*	0.03	0.01	0.15
2004	0.11	0.07	*0.21*	0.08	*0.35*	0.14	0.03	0.21
2005	0.07	0.00	*0.36*	0.36	*0.41*	0.03	0.02	0.17
2006	0.05	0.38	*0.17*	0.12	*0.44*	0.05	0.02	0.25
2007	0.06	0.85	*0.29*	0.14	*0.41*	0.01	0.05	0.16
2008	0.07	0.79	*0.39*	0.02	*0.43*	0.01	0.07	0.04
2009	0.02	0.64	*0.18*	0.94	*0.35*	0.06	0.23	0.24
2010	0.02	0.54	*0.23*	0.58	*0.52*	0.29	0.48	0.11
2011	0.03	0.98	*0.21*	0.27	*0.39*	0.39	0.52	0.40

Source: EUROSTAT, own computations

The only considerable intra-industry trade in spark-ignition engine cars is regarding those new of cylinder capacity between 1,500-3,000 cm^3 and between 1,500-3,000 cm^3. There were occasional bursts of IIT in some other classes throughout the reported period, but it was nothing stable. The only mentionable class, is the one of the new luxury cars with the highest cylinder capacity, where the share of intra-industry trade seemed to grow considerably in the last three years. It could be a matter of recent years production of SUV in Czech factories of Škoda Auto and Hyundai.

G-L index	1500, N	1500, U	1500-2500, N	1500-2500, U	2500+, N	2500+, U
1999	0.00	0.92	*0.48*	0.36	0.56	0.02
2000	0.50	0.04	*0.50*	0.12	0.02	0.03
2001	0.69	0.00	*0.67*	0.03	0.14	0.28
2002	0.00	0.00	*0.73*	0.01	0.09	0.03
2003	0.58	0.05	*0.78*	0.01	0.02	0.04
2004	0.28	0.20	*0.58*	0.04	0.05	0.25
2005	0.15	0.00	*0.51*	0.05	0.02	0.02
2006	0.10	0.14	*0.50*	0.11	0.04	0.01
2007	0.03	0.30	*0.47*	0.01	0.02	0.01
2008	0.02	0.00	*0.62*	0.01	0.01	0.00
2009	0.05	0.69	*0.56*	0.01	0.00	0.00
2010	0.11	0.49	*0.34*	0.11	0.01	0.20
2011	0.01	0.54	*0.31*	0.21	0.01	0.20
2012	0.01	0.74	*0.34*	0.42	0.04	0.09

Source: EUROSTAT, own computations

In diesel engine cars trade, there is only one class with significant share of intra-industry one. It's the kind of new car of cylinder capacity between 1,500-2,500 cm^3. In all the other classes the share of long-term intra-industry trade is rather negligible.

5.3.5.4 Unit value analysis

For further analysis of intra-industry trade nature I decided to use only the three classes that show it's high share for the entire explored period. Because they are three classes of seven regarding the new traded cars, I consider it as a proof of high degree of IIT in motor vehicles. Yet, the used cars are not appropriate for unit value analysis, as their prices are affected by many factors such as age, condition, demanded price of individual who is selling it etc., that statistics cannot capture. Also, their yearly amount sold is not stable enough for worthwhile analysis. Nevertheless, it's important to separate and exclude them, because in case of their considerable share, they affect prices a lot.

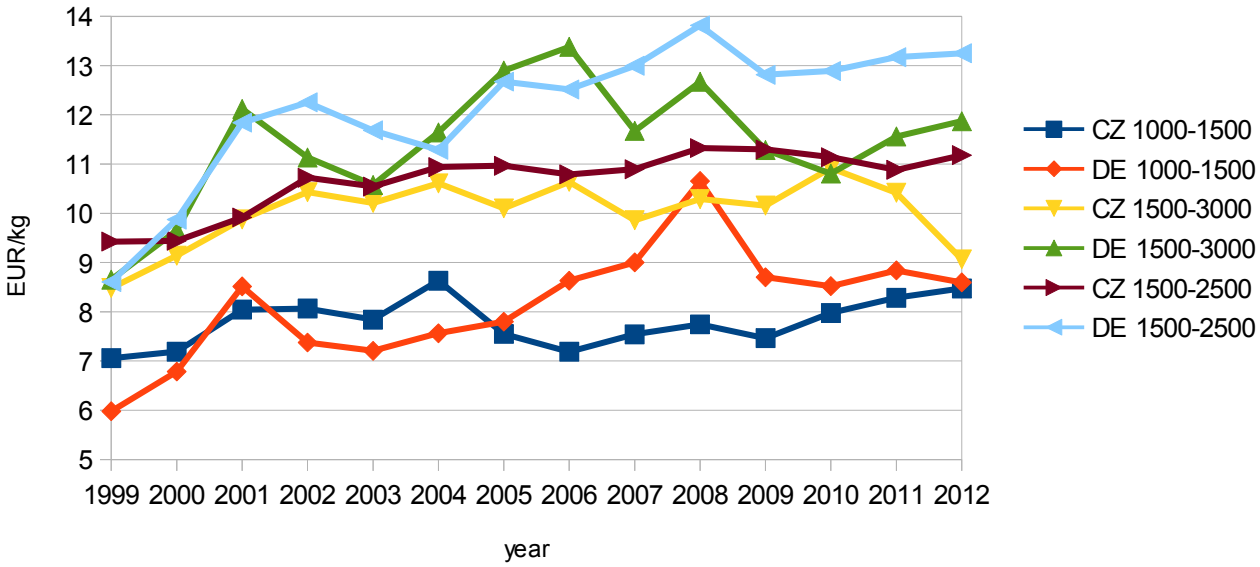
The following table shows development of unit value prices for the three chosen passenger classes in both the Czech Republic and Germany from 1999 to 2012.

Unit values	CZ 1000-1500	DE 1000-1500	CZ 1500-3000	DE 1500-3000	CZ 1500-2500	DE 1500-2500
1999	7.05699	5.97960	8.48259	8.65367	9.42418	8.60380
2000	7.18978	6.78550	9.13952	9.65262	9.44182	9.87091
2001	8.04306	8.51528	9.87726	12.12023	9.91640	11.84118
2002	8.06504	7.37594	10.42890	11.13265	10.72235	12.25248
2003	7.83971	7.20592	10.21010	10.57608	10.54395	11.68464
2004	8.63161	7.56447	10.60724	11.64418	10.93731	11.28819
2005	7.54896	7.79881	10.10101	12.89614	10.96507	12.67458
2006	7.18741	8.63084	10.63630	13.37911	10.79027	12.51522
2007	7.54190	9.00160	9.85907	11.67321	10.89707	12.99524
2008	7.74412	10.65390	10.29059	12.67045	11.32524	13.81636
2009	7.46409	8.70023	10.15640	11.28665	11.29483	12.81444
2010	7.97631	8.51896	10.91708	10.80743	11.13931	12.88975
2011	8.28423	8.83982	10.41557	11.56021	10.88246	13.17087
2012	8.47411	8.59640	9.06577	11.87100	11.18065	13.24937

Source: EUROSTAT, own computations

Comparison of unit values development for chosen passenger cars classes

based on export prices of the Czech Republic and Germany

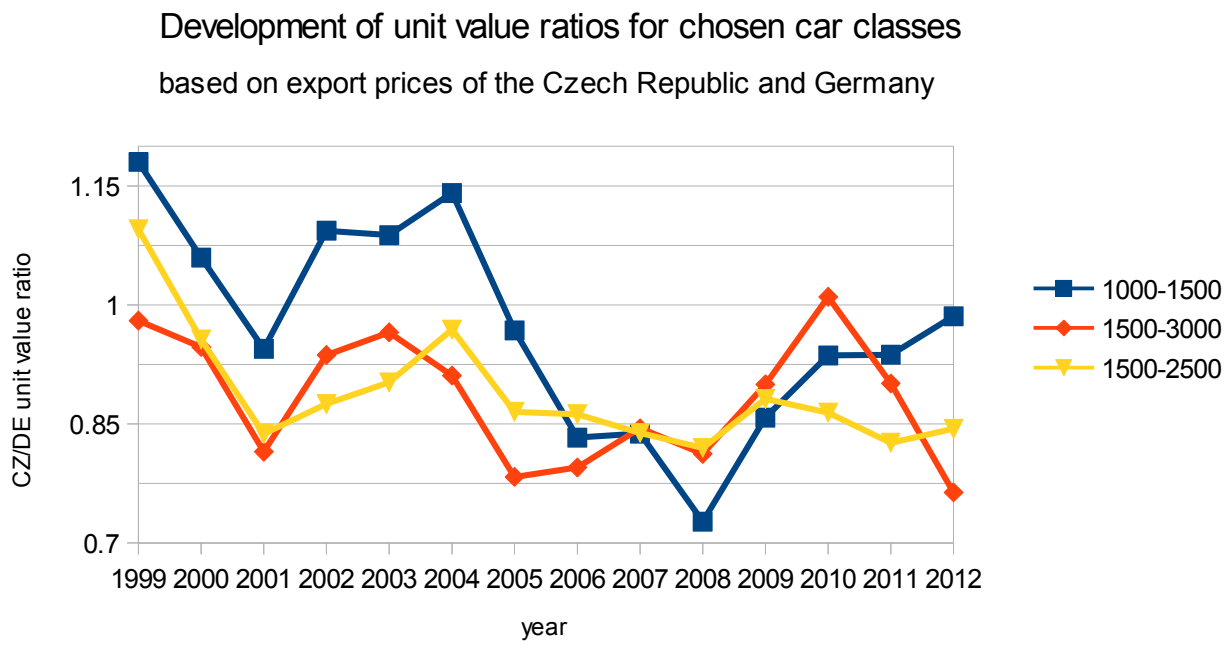


As can be seen from the table as well as from the graph, the German unit values were almost always higher than a Czech unit value for corresponding car class. Differences among particular car classes in individual countries are also quite interesting.

Finally, we need to calculate the relative unit values of the above computed unit values to tell of what kind of intra industry trade is going on in the given car classes.

UV ratios	1000-1500	1500-3000	1500-2500
1999	1.180	0.980	1.095
2000	1.060	0.947	0.957
2001	0.945	0.815	0.837
2002	1.093	0.937	0.875
2003	1.088	0.965	0.902
2004	1.141	0.911	0.969
2005	0.968	0.783	0.865
2006	0.833	0.795	0.862
2007	0.838	0.845	0.839
2008	0.727	0.812	0.820
2009	0.858	0.900	0.881
2010	0.936	1.010	0.864
2011	0.937	0.901	0.826
2012	0.986	0.764	0.844

Source: EUROSTAT, own computations



Figures above indicate, that for most of the years the mutual Czech-German intra-industry trade in the particular car classes is horizontal. The only class oscillating around the unit value is with spark-ignition engine with cylinder of capacity between 1,000-1,500 cm^3. The other two are beside the one exception closer to the lower boundary of the 15% tolerance range for horizontal IIT as commonly used as promoted by Greenaway et al. (1995, p.1105).

6. Conclusion

First part of this paper attempts to provide all necessary theory needed to understand the principles of working of contemporary international trade system. Predominantly, this paper investigates the connection between increasing returns to scale, from that resulting imperfect competition and international trade.

Second part tries to propose various approaches to trade in similar but differentiated products. It also brings some suggestions how to measure the extent of intra industry trade and what methods to use in order to analyse its nature. Description of Grubel-Lloyd index, overlapping index and usage of the (relative) unit values is provided in order to apply them in the second, quantitative part.

This part begins with detailed analysis of the Czech automotive industry, it's overall performance and product differentiation and it's crucial role in country's foreign trade. The available data show that industry is as large as it is mainly because of the trade in passenger cars and their parts and accessories. These two subgroups accounted for more than 95% share in export of the SITC group road vehicles.

The last and most complicated part is about Czech-German intra-industry trade in automotive industry. After the analysis of trade in both three-digit SITC groups 781 passenger cars nad 784 parts and accessories of motor vehicles, provided by using Grubel-Lloyd indexes as well as (relative) unit values, it revealed that the results are not satisfactory and further, more detailed disaggregation of passenger cars is necessary. After division of passenger cars into 14 groups according to the most detailed CN8 trade nomeclature system, while distinguishing between used and new traded cars, we identified three car categories with the high degree of intra-industry trade by using Grubel-Lloyd index once again. After computation and comparison of the unit values for these three mutually traded car types, we reached more credible results, which show that the intra-industry trade in these particular car classes is more or less of horizontal nature, however, with the Czech products having lower unit values in a long term.

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