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BACHELOR THESIS

Increasing returns to scale and international trade. Role of multinational corporations in the world economy.

Author: Vyacheslav Lypko

Tutor: doc. ing. Vladimír Benáček, Csc.

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Prohlašuji, že jsem bakalářskou práci vypracoval samostatně a použil pouze uvedené prameny a literaturu.

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Vyacheslav Lypko

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Abstract

The aim of this thesis is to analyze increasing returns to scale as one of the important reasons that can affect market structure and pattern of international trade. Analysis id focused on theoretical models describing increasing returns to scale and it is explained how these returns affect the pattern of international trade. First part of the thesis is devoted to internal economies of scale, intraindustry trade and dumping, including empirical part. Second part is devoted to the external economies of scale and pattern of international trade. Third part is about the multinational corporations – characteristic of MNC's and their structure and their role in modern world economy.

Abstrakt

Práce analyzuje rostoucí výnosy z rozsahu jako jednu z nejdůležitějších příčin, které ovlivňují tržní strukturu a povahu mezinárodního obchodu. Analýza se soustřeďuje na teoretické modely popisující rostoucí výnosy z rozsahu a vysvěltuje, jak tyto výnosy ovlivňují mezinárodní obchod. První část práce je zasvěcena vnitřním úsporám z rozsahu, vnitro-odvětvovému obchodu, dumpingovému obchodu a zároveň obsahuje empirickou část práce. Druhá část se zabývá vnějšími úsporami z rozsahu a s tím související povahou mezinárodního obchodu. Třetí část se zabývá mezinárodními korporacemi, jejich charakteristikou, strukturou a úlohou v moderní světové ekonomice.

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1. Introduction: some definitions and theoretical background of returns to scale.

The term "increasing returns to scale", or "economies of scale", refers to a situation in which increase in the output produced implies the decrease in average costs[1]. Although those two terms are often treated as similar ones in the economic theory literature[2], they are of the different nature.

Basically, there are different types of economies of scale, or I would say sources of economies of scale, which can give rise to the increasing returns to scale.

The term "economies of scale" means, that average costs are decreasing function of the firm's output, that basically means that they depend on the firm's size and can be defined as follows:

$$AC = \frac{TC}{Q}$$

where AC stands for average costs, TC stands for total costs and Q for the firm's output.

According to T. Scitovsky (1954), this kind of economies of scale can be seen as *internal* economies of scale. Internal here means that decrease of average costs depends on the level of production of the firm itself. The more firm produces the better it can profit from the scale economies and the higher its cost advantage over smaller firms[3]. Market structure usually underlying internal economies of scale is imperfect competition, because internal economies of scale imply particular kind of market power of the firm.

T. Scitovsky also defines *external* economies of scale. Here we should distinguish between *pure* and *pecuniary* external economies. Generally, *external economies of scale* mean that decrease in average costs is brought by an increase of output of the industry as whole.

[1] *Brakman, Garretsen, C. van Marrewijk, 2009*
[2] *see also Carbaugh, 2008, p. 85*
[3] *Brakman, Garretsen, C. van Marrewijk, 2009*

"Increasing returns to scale" (on the microeconomics level) is the situation, when some factors can influence the production function of the company and alter the relationship between input and output. This situation can be defined as follows:

$$f(s*z) > s*f(z)$$

where $f(z)$ stands for production function of vector of inputs z , and **s** stands for the scale of production. If increasing returns to scale are present in some firm's production process it means that if we multiply all inputs by s, output will increase more than s times.

Another way how to look at the relationship between returns to scale and economies of scale is provided by E.R. Berndt[4]. Let's assume a production function

$$y = f(x_1, x_2, ..., x_n)$$

and let all inputs increase by 100%, then if output increases by 115%, 100%, or 85% than returns to scale are increasing (1.15), constant (1.00) or decreasing (0.85). Further, economies of scale typically are computed as returns to scale minus 1. In our case economies of scale are positive (0.15), constant (0.00) or negative (-0.15) respectively.

This particular case can be seen as *pure* (or *technological*) *external* economies of scale.

Pure external economies can be caused by different factors, where very important factors are R&D activities of the firms and information spillovers. Increased industry output increases the stock and availability of knowledge through positive information spillovers and hence leads to an increase in firm's productivity. Because such economies of scale are not dependent on the firm's size the market structure underlying this situation can be *perfect competition* (Brakman, Garretsen, C. van Marrewijk, 2009). Existence and role of positive information spillovers will be discussed later in the section devoted to multinational corporations.

In contrast to pure external economies, pecuniary external economies have nothing to do with change in productivity of individual firms. It is necessary to note that spillovers, such as informational or technological, are necessary for existence of external economies of scale.

For my analysis, however, I will adopt the following philosophy of increasing returns to scale: I will look at these increasing returns through the relationship

[4] *Berndt, 1990*

between average and marginal costs of production. It is quite logic and useful definition. From microeconomic analysis we know, that AC are relatively large for relatively small output and are decreasing up to the level of output which is so-called breakeven point (there is minimum of AC); MC, on the other hand, reach its minimum (if they are not constant) for the level of output smaller than breakeven, thus for particular interval of output when AC are still decreasing, MC are increasing, and intersect with AC exactly when output is equal to breakeven[5]. Hence, till the point of breakeven, AC will be decreasing and will be higher than MC. Since I adopted the definition of internal economies of scale as a decreasing AC, this definition just make sense.

The index that can express economies of scale using AC and MC on the level of an individual firm is constructed as follows:

$$\theta(w,x) = \frac{C(w,x)/x}{C_x(w,x)}$$

Where $C(w,x)$ is a cost function that gives us a minimized costs for a given level of output x and vector of input prices w, $C(w,x)/x$ is average cost, and $C_x(w,x) = \frac{\partial C(w,x)}{\partial x}$ is a marginal cost of production.

Now it is necessary to discuss in more details this index of economies of scale.

1. *Increasing MC and decreasing AC*[6]. In that case till the point of break even, AC is higher than MC, thus theta will be higher than one but decreasing to value of 1 ($\theta \geq 1$). It is obvious, that theta is convex function in this case, thus such production function reveals relatively large economies of scale when small amount is produced, and these economies of scale are decreasing according to properties of convex function.
2. *Constant MC and decreasing AC*. Again, AC > MC, theta is larger than one but converging to value of 1. In this case theta is decreasing slower with increasing output than in previous case.
3. *Enormous fixed costs and decreasing MC*[7]. In this case firm experiences the largest economies of scale. It is certainly clear, that production of aircrafts, cars or steel requires high initial setup costs (investment in buildings, machinery etc.), thus enormous fixed costs. Due to it, our theta will be large

[5] *See derivation and proof in Varian, 1992*
[6] *I assume that AC is decreasing up to the point of break even, e.g. up to its minimum*
[7] *This case is typical for modern manufacturing (for example car industry, aircraft industry etc.)*

and greater than unity, thus firms in such industries with such production functions will experience the most "powerful" economies of scale.

Before I will start looking at the increasing returns and analyze them as the factor that affects the pattern of international trade, I think it is good to get a certain appetite for it. And to do so let's take a brief look at what was the theory of international trade earlier and why there were recently a lot of very interesting and demanded research, works and books regarded to New Economic Geography, or New Geographical Economy[8].

Two core approaches to international trade that were and still are very powerful tool of analysis – Comparative advantage theorem (D/Ricardo) and Factor endowment theorem (Heckscher-Ohlin theorem). There is no sense in describing these in details; let's just get a main massage from them. Both theorems say that there will be country specific specialization in production of goods based either on comparative advantage (country will specialize in production of goods which it can produce relatively more efficient) or factor endowments (if county is better endowed with capital than with labor, it will specialize in production of capital intensive products and vice versa) with constant returns to scale. The structure of international trade will be defined than by the specialization of the countries and theoretically there should be no bilateral trade between countries with similar factor endowments and efficiency of production techniques. However, it is obvious that today's world is far more complicated and cannot be explained by these simple setups. Many markets are imperfectly competitive, there are economies of scale of different scope and origin in many industries, there are powerful concentration forces that determine the existence of spatially concentrated industry structures instead of spatially dispersed (assumed by CA and H-O) and there is intensive intra-industry trade between many countries within almost every industry (especially intensive between countries with close levels of development of technologies and close factor endowments). So, obviously, it is necessary to try to look at factors that determine pattern of international trade from the different angle and highlight some of them which might be of particular importance (which are increasing returns to scale in my case).

In the chapter 2 I will focus on the sources, or origins, of increasing returns to scale that originate from internal economies of scale and will try to explain how they affect the pattern of international trade.

[8] *The word NEW is of particular interest, because modern economic literature devoted to economic geography proposes new ways how to look at international economic processes and new methods how to estimate and model them.*

2. Internal increasing returns to scale and intra-industry trade issues.

It is of crucial importance which type of economies of scale is present, because it will affect a market structure. As I will discuss below, internal economies of scale are not consistent with competitive equilibrium on the market (in contrast to external economies that allow preserving an assumption about perfectly competitive market).

Another important thing – is price setting behaviour of the firm. Since the market structure is not perfectly competitive, there is no general theory for the case. Thus it is necessary to discuss different possible options.

As I've mentioned above, internal economies of scale is a situation when firm can benefit from an increase of its size, e.g. cost per unit depends on the size of firm itself. If some firm experience internal economies of scale, than it has a competitive cost advantage over smaller firms and this usually leads to imperfectly competitive market structure[9].

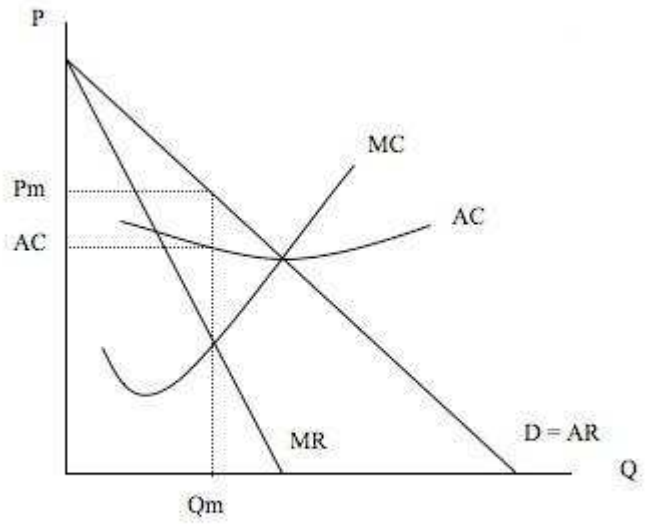
2.1 Forms of market imperfections

Market imperfections can take different forms: monopoly, oligopoly or form of monopolistic competition. In case of monopoly market structure, firm is, to some extent, e.g. on regional or country level, the only producer of a particular good or service which have no close substitutes (usually such products/services are utilities or energy resources – electricity, oil/gas, telecommunications etc.) and there are high initial costs to enter the market (for example, electricity production and distribution: firm which has control over electricity grid and other facilities for distribution of electricity can establish high prices of use of such facilities for other firms, thus making it difficult for competitors to get on the market, and other firms won't be able or won't be willing to build their own network of such facilities because of extremely high costs). In that case, quantity of goods/services available on the market and their prices are determined by the costs/revenues structure of a

[9] *Krugman, 2003*

monopolistic firm and also by an extent to which such firm can discriminate its customers, e.g. perfect vs. imperfect discrimination.

Figure 2.1 Monopolist firm graphical representation.



In long run, if monopolist cannot perfectly discriminate it will produce the amount $Q_{M,}$ which is equal to a quantity where marginal costs of monopolist (MC) are equal to its marginal revenues (MR) and price will be equal to $P_{M.}$. Now, for the analysis are relevant two facts:

1. Firm is producing on the decreasing part of average cost curve, e.g. AC is decreasing function of quantity Q, hence internal economies of scale are present.
2. Quantity Q_M is given for profit maximizing monopolist, e.g. for given functions of MR and MC for particular monopolist the quantity is unique. Monopolist will not produce more than Q_M even though there is larger demand than monopolistic supply.

Thus pattern of trade in industry with monopolistic firm will be determined by the quantity which monopolist will be willing to produce. If this quantity is an equilibrium one, than there will be neither exports nor imports, if there is a deficit – country will import these goods, and if there is surplus, e.g. monopolist produces more than country consumes – exports will take place.

With oligopolistic market structure things are more complicated. This market structure is characterized by presence of several big producers and their decision making is interdependent, e.g. decision about quantity produced made by one firm will affect the price level in industry and hence decision about quantity which will be produced by other firms (or in case of decision making about price setup) such a decision of one firm will affect the quantity of industry's output and level of output per firm. Hence when firms are deciding on their quantities/prices they take into account possible decisions of competitors. There are different models which try to analyze behaviour of oligopolistic firms. First two models (Cournot model – simultaneous decision about quantity, Bertrand model – simultaneous decision about price) are models of one-round game, in which firms meet on the market once and make their decisions about quantities to be produced or about prices to be charged. Basic equations for Cournot model are following[10] (for Bertrand model they are different because firms are optimizing their prices, but for our analysis this fact is not very important, important is the essence of interconnected decision making):

1. General equation for profit (for two-firms industry):

   $\prod_i = p(q_1 + q_2) * q_i - C(q_i), i = 1,2$,

   where q_i is a quantity is produced by firm i and $p(q_1 + q_2)$ is a price as function of quantity produced by firm 1 and 2, $C(q_i)$ is a function of costs of production.

2. Industry output is Q:

   $Q = q_1 + q_2$

3. Demand for industry output is:

   $D(p) = \alpha - \beta * p = Q$,

   where α is a constant term expressing the autonomous demand for good and β is a demand sensivity on price.

4. Price as a function of quantity:

   $$p = (\alpha - Q)/\beta = \frac{\alpha}{\beta} - \frac{1}{\beta}Q = a - b * Q, a = \frac{\alpha}{\beta}, b = \frac{1}{\beta}$$

[10] *Varian, 1992*

From all these equations I can now derive an equation for a profit of individual firm:

$$\prod_i (q_1, q_2) = (a - bq_1 - bq_2) * q_i - C(q_i)$$

Profit-maximising producer will set up its quantity as a reaction on a quantity of its competitor:

$q_2 = \frac{a-c}{2b} - \frac{q_1}{2} = R_2(q_1)$, it is so called reaction function.

What is important for our analysis is the fact that since decision making process of individual firms is affected by competitors, it is extremely difficult to make any general conclusion about equilibrium on such market and pattern of trade.

These models can give an essence of what is going on in oligopolistic market, but they say nothing about a real world situation when firms meet on the market repeatedly and can arrange different type of agreement about cooperation and mutual profit maximisation. Thus such interactions are mostly the subject of game theories analysis and are, at least for this time, behind the borders of our interest.

I will focus on analyzing monopolistic competition market structure, because of several reasons. I will show that assumption about monopolistic competition is strong and useful, allows avoiding some difficulties in analysis and can be justified as appropriate one.

Monopolistic competition is characterized by following features:

First, firms produce differentiated products. They experience some kind of monopolistic power within particular industry, because their product differs from other products on market thus products from different producers are not close substitutes. If price changes, it is not an immediate reason for a customer to buy a product from another company (demand curve for product of such firms is less price elastic due to lower cross-substitution, uncertainty and transaction costs than demand curves for industries which tend to be perfectly competitive).

Product differentiation is crucial for the analysis of international trade using internal economies of scale as one of the factors. Products are not homogeneous and there will be certain amount of varieties produced. For example, pen is well defined product; however there are pens with black and red ink, hence there are varieties of product. It is combination of how much varieties will be produced in each country and of consumer preferences that defines the pattern of international trade.

Second, firms take prices of their rival as given – they ignore an impact of their price change on the prices of rivals. Thus even though each firm is facing a competition from other firms, it behaves as it were a monopolist.

One more assumption about the consumer's behaviour in differentiated product markets is to be made. Due to internal economies of scale, each firm will produce les varieties[11], but larger quantities of each variety. Hence, if we look at closed economy with some industries revealing internal economies of scale, there will be certain loss in welfare in this economy due to reduced number of varieties. This trade off is described in Dixit-Stiglitz model of Monopolistic Competition and Optimum Product Diversity[12], where each consumer prefer more variety. Another model concerning demand side of such economy is one developed by K. Lancaster, called "Socially Optimal Product Differentiation"[13], where each consumer consumes preferred (or optimal) variety. In the framework of both models, reduction in the number of varieties will represent decrease in consumers' utility, thus certain decrease in welfare of the economy. For the needs of further analysis I will formalize both cases and show the demand side of such economy.

2.2 Product differentiation

2.2.1 "Love of variety approach"

Formalization of "love of variety approach" to the demand side of the economy with differentiated products is not new but still gives a quite useful tool of analysis. I will adopt approach of formalization given by Krugman and Helpman[14]. There is no need of detailed description of the whole thing, let me just state some fundamental equations.

As it was stated, level of utility of a consumer depends on varieties available for consumption. Since there is certain number of products, utility function is two-dimensional:

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[11] In most of the models with increasing returns and monopolistic competition each firm is producing one variety. Since firm is limited with its production possibility, there is a certain trade-off between number of varieties and quantities of each variety that being produced. In presence of internal economies firm will choose the quantity.

[12] Dixit, Stiglitz, 1977

[13] Lancaster, 1975

[14] Krugman and Helpman, 1985

$$U = U\left[u_1(...), u_2(...), ..., u_K(...)\right]$$

Where u_k is utility from consuming product k, and U is utility from consuming K products. Thus such definition corresponds with the logic of love of variety approach.

Since utility derived from consumption of particular product is dependent only on the quantity consumed[15], and quantity being consumed equals to the demanded quantity (I adopt theoretical, thus not always realistic assumptions), I can define the utility from consumption of good k as follows:

$$u_k(D_k) = D_k$$
$$u_k = (D_{k1}, D_{k2}, ...)$$

Second definition is for the case when the product k is differentiated; hence utility is derived from consumption of varieties of product k available to consumer. Number of varieties available is finite, because it is constrained, for example, by limited amount of factors of production in the country.

I can find a real example of such approach to the utility of consumers in world history. This example is former USSR. Planned economy in USSR was characterized, along with other inefficiencies, by the lack of varieties available for consumption. Yes, consumers in Soviet Union could buy goods like clothes, cars, electronics etc., but number of varieties available was relatively small (relative to the number of varieties of each good available for the Western consumer). In the end of 1980's a lot of so-called "shadow" or "black" markets appeared, selling illegally imported goods from Europe and even United States. The most of such market were specialized on clothes and electronics, prices were several times higher than prices of similar goods produced in USSR[16] (due to transportation costs, transaction costs connected with getting the product on the market and willingness of consumer to pay for differentiated product), but despite this consumers were willing to buy these "different" products, which means that loss of their utility and welfare was much higher that loss of utility due to high prices. Success of such markets (they persisted till the fall of an "iron curtain" in 1991) proves the fact that relatively small number of varieties available for consumption caused substantial loss of utility of consumers.

[15] *I assume, that customer is perfectly informed about the qualities and properties of particular product and is able to assign for certain self-defined value of utility function each unit of the product. Thus in the function, level of utility depends only on the quantity being consumed.*

[16] *Obviously, there is not any statistical evidence of this fact*

Now, the question is why the number of varieties available for consumption on the territory of UUSR was relatively small? I see two main reasons:

1. Producers of goods in the Soviet Union did not have any incentive to differentiate their products. Due to absence of competition on the market soviet producers didn't have to be cost effective and they didn't have to compete with their products on the market (so, no incentive to differentiate their products).
2. Absence of trade also added to low number of available varieties.

Few years after the fall of USSR markets of former soviet countries were flooded with imported goods, which were sold for much higher than their actual prices. Imported was almost everything that was missing during the absence of trade. And the quality wasn't an issue. It was all about varieties. It may sound naive, but one of the possible reasons of dissatisfaction of soviet people was exactly the lack of varieties available for consumption.

Turning back to the theory, using CES utility function[17] we arrive to the first important result – utility function expressed through the expenditure level, prices (under assumption that all varieties are priced equally[18]) and *number of varieties* is defined as follows:

$$u_k\left(\frac{E_k}{n_k p_k}, \frac{E_k}{n_k p_k}, \ldots\right) = n_k^{1/(\sigma_k - 1)} \frac{E_k}{p_k}, \sigma_k > 1$$

where E_k is given level of expenditure on product k, p_k is the price of each variety of product k, and σ_k is the elasticity of substitution. First conclusion is that utility increases with increasing number of varieties available for consumption. Considering the example of USSR consumers and "black" markets we can see, that increase of utility of the consumer due to increase of number of varieties available on the market was able to overweight the decrease of utility caused by higher price.

Demand function in that case would be[19]:

$$D_{k\mu} = \frac{p_{k\mu}^{-\sigma_k}}{\sum_{\mu'=1}^{n} p_{k\mu'}^{1-\sigma_k}} E_{k,} \mu \in \Lambda,$$

[17] *Helpman and Krugman, 1985*
[18] *If it is not so, it would just complicate the obtaining appropriate form of utility function, however result will be similar*
[19] *Helpman and Krugman, 1985*

where $p_{k\mu}$ is price of variety μ, and Λ is a set of available varieties. Using these notions I arrive to the demand function of product k, dependent on aggregate expenditure level, prices of products and number of varieties[20] (remember that I adopted somewhat unrealistic assumption about equally priced varieties of product k):

$$D_k = \phi_k(p,n)E$$

Where $p = (p_1, p_2, ...)$ is vector of prices of products; $n = (n_1, n_2, ...)$ is vector of number of varieties of each product; E is aggregate expenditure level and elasticities of substitution are built in functions ϕ_k. Than share of spending on product k is defined as follows:

$$\alpha_k(p,n) = p_k\phi_k(p,n),$$

which is important property, because expenditure share on product k depends only on the number of varieties available to consumers and their prices[21].

2.2.2 Ideal variety approach

Second approach to the demand side of economy with differentiated products is one proposed by Lancaster[22]. Again, there is no need in detailed explanation of the model. For the purposes of my analysis I'll state just few notions.

The idea behind this approach is that consumer has an ideal variety that he or she prefers to consume. Variety is considered to be ideal, or unique, in a way that it has a set of particular, ideal from the point of view of the consumer, properties[23]. For consumer than, this variety is a certain benchmark. While evaluating other varieties, different from the ideal one, consumer evaluates the "distance[24]" between ideal properties and available properties. Hence, ideal variety for consumer means maximum utility, and consumption of variety that is different from the ideal one

[20] *For detailed derivation see Helpman and Krugman, 1985, p.120*
[21] *Krugman and Helpman, 1985*
[22] *For detailed explanation of the model reader can look at Lancaster, 1975 or Krugman and Helpman, 1985*
[23] *These properties can be either physical (like colour and engine of the car) or spatial (like location of the restaurant).*
[24] *It can be real distance (for example distance from "ideal" French restaurant to its substitute – Chinese one), or it can be subjective distance (like what subjective loss I will experience if I buy green car instead of red one).*

represents certain loss in his or her utility. Formally it can be represented by following utility function[25] of consuming variety μ:

$$u_k[D_k(\mu), \mu, \tilde{\mu}] = \frac{D_k(\mu)}{h_k[\tilde{\delta}(\mu, \tilde{\mu})]}$$

where $D_k(\mu)$ is consumption of variety μ, $\tilde{\delta}(\mu, \tilde{\mu})$ is a distance between ideal variety and consumed variety, and $h_k[\tilde{\delta}(\mu, \tilde{\mu})]$ is so-called compensation function (h_k is increasing in $\tilde{\delta}$ and convex). Thus the larger is distance from ideal set of properties, the larger value of h_k we obtain, and, obviously, utility of consuming such a variety μ is decreasing.

The utility of consuming n available varieties is a sum of utilities from consuming individual varieties:

$$u_k[D_k(\mu), \mu, \tilde{\mu}] = \sum_{k=1}^{n} \left(\frac{D_k(\mu)}{h_k[\tilde{\delta}(\mu, \tilde{\mu})]} \right)$$

Important implication of this result for my analysis is, that increasing number of varieties available to consumer will increase the probability of matching with ideal variety, or in other words, the distance between ideal and available variety will be reduced, hence consumer will achieve higher utility level.

In my further analysis I will accept an assumption, that demand side of an economy is characterized by one of the stated above approaches, hence "more varieties is better" (with respect to varieties available on the market).

2.3 Internal economies of scale and international trade: theory

Before one arrives to some general conclusion that can be in some extent tested on statistical data, it is necessary to establish theoretical framework. I will take a closer look at model of internal economies of scale and monopolistic competition proposed by Paul R. Krugman[26]. This model allows describing first important issue in international trade that can be also addressed to multinational corporations' operations – intraindustry trade. This setup is simple but it gives useful tools for my

[25] *See for example Krugman and Helpman, 1985*
[26] Krugman, P., 2003

analysis. I will analyze the supply side of the economy described by this model. It is important to keep in mind, that consumers prefer more varieties.

Firstly, like in every model of international trade, closed economy is assumed. Demand and supply sides of economy are analyzed and then, with opening for trade, conclusions about benefits or loses from trade are made.

Demand for the firm's output can be formalized as follows:

$$Q_i = S \cdot [1/n - \sigma(p_i - \overline{P})]$$

Where Q_i are sales of firm i, S is the total sales of industry[27], n is the number of firms in the industry, σ is a constant term representing the price elasticity of demand, p_i is price charged by the firm i for variety and $\overline{P}$ is average price charged by its rivals on the market. Took in consideration the variables of this equation, firm is expected to sell more the higher is demand for industry output and the higher are prices of its competitors; individual firm is expected to sell less the higher is number of firms in industry. Hence there will be three main ways how to increase the sales of an individual firm – charge price lower than is competitors' average price, reduce the number of firms in the industry or increase the market size.

Now let's turn to the average costs of individual firm (for analysis simplicity firms are assumed to be symmetric):

$$AC = TC/Q = (FC + c*Q)/Q = FC/Q + c$$

where FC stands for firm's fixed costs and c is firm's marginal cost of producing additional unit of output.

In equilibrium all firms charge the same prices thus $P = \overline{P}$ and Q = S/n. Hence we can derive an equation for AC as follows:

$$AC = (n*FC)/S + c$$

so we can see that AC depends positively on the number of firms (n) in the industry and negatively on the size of the industry itself[28]. Model suggests that the larger is market size the more firm can benefit from a decrease of its average costs for any given number of firms n. Now, does it matter, whether each firm is producing

[27] Size of an industry is given, thus firms can gain new customers only at expense of each other.
[28] That means that for given number of firms larger market will allow to benefit better form internal economies.

several varieties or just one variety? Actually, it does not. I can assume that each firm in the beginning can produce more than one variety, but in presence of internal economies of scale it will then turn to the production of one variety in order to maximize its benefits from increasing returns. And there is a number of firms in the industry, for which profits of firms are non-negative, but driven to zero by increasing number of firms, and there is an equilibrium number of firms in the industry, starting with which entrance of new firm will make profits negative.

Let's take a look at the price setting behaviour of the firms. I can assume that formalization of this behaviour can be following[29]:

P = c + 1/(b*n), thus with increasing number of firms in the industry, price setting behaviour take form of marginal cost pricing; however, due to the limited number of firms in the industry, as it was mentioned above, prices in such industries are usually higher than MC. But on the other hand, larger international market allows larger number of firms than national one, thus prices are expected to decrease in the presence of international trade.

It is now clear that in case of larger market, which international trade can give, any given number of firms can benefit better from reduced average costs. Now, let's see what happens if our country starts to trade with other country and market size increase.

So, increased market size will allow both to reduce average cost of individual firms (due to increased market size) and there will be more firms than were initially in closed economy, which will reduce the price and increase the number of varieties available on the market. Now, I assume (for the simplification of analysis), that every firm will specialize on producing one variety in order to maximize benefits from increasing. Hence if internal economies of scale are present firms can benefit from increased scale of production which larger, or integrated, market will allow to achieve.

Let's turn to the index of internal economies of scale:

$$\theta(w,x) = \frac{C(w,x)/x}{C_x(w,x)}$$

[29] See addition derivation of the price setting formula

$C_x(w,x)$ are constant, and AC are decreasing, thus till the point of break even, economies of scale in this setup are positive, scope of economies of scale, however, is decreasing.

Now, let's turn to the case if the country can trade with other countries. Let's assume there are several industries (for example X and Y) producing different types of products. More, let's assume that products of X and Y are produced under constant returns to scale. Plus every country is endowed with two available production factors – capital and labour. Let industry X be capital intensive (producing some sort of manufactured products). For the moment, let's leave transportation costs aside (I will return to them later on).

Basically, there are two possible cases for how the pattern of trade will look like. If increasing returns are not present, Industry X will be located in capital abundant country, and trade will (in case of trade between two countries) take form of inter-sectional (or interindustry) trade, e.g. exchange of goods from industry X for products of industry Y.

On the other hand, if manufactures sector is a sector where increasing returns are present and there is incentive for product differentiation, all countries will be producing differentiated manufacturing goods, because each firm will produce fewer varieties but larger quantities of each variety, and supply side of economy is characterized by preference of more varieties. Thus there will be also exchange in goods from same industry, or intraindustry trade. I expect IIT to be more intensive between countries with close factor endowments and technologies (or close levels of GDP per capita).

Over last decades developed economies have equalized their technologies and have opened for trade. Many industries in almost every economy (I mean developed and developing countries) are characterized by increasing returns, differentiated products are produced (take for example car industry) and markets are imperfectly competitive. So it is obvious that according previous setup there should be intraindustry trade observed in trade flows of the countries. I also expect the pattern of intraindustry trade be stronger (or larger) for trade between developed countries, which do not differ too much in their technologies or production and factor abundance, and we expect to see insignificant fraction of intraindustry trade in total trade volume between developed and less developed (or developing) countries.

Now, let's turn again to the index of scope of increasing returns.

$$\theta(w,x) = \frac{AC(w,x)}{MC(w,x)}$$

Main point is that it is heavily dependent on the relation of AC and MC, what particular cost advantage the firm can experience. And it will affect its competitiveness and thus the trade pattern as well. I the scope of increasing returns is relatively large (relatively to the competitors), firm can better exploit its costs advantage. For example, its sales will be less affected by transportation costs, e.g. more distant markets are available to the firms[30]; or it can charge lower prices, hence gain consumers by price advantage of its products.

As it was mentioned above, differentiated product is a key factor for a firm to experience a monopolistic power at some degree. Basically, differentiated product makes its demand less price elastic, e.g. consumers are willing to accept higher prices in order to be able to consume this "unique" product with set of qualities which is different from others.

There are two basic types of product differentiation:

1. **Horizontal differentiation.** Products which are differentiated horizontally have the same or close level of quality and are differentiated by features unique for every product. As the definition of quality I will accept the philosophy of it close to one proposed by Aiginger[31], that is that good has one or more additional features, which represent for consumer, producer or investor a higher value. Consumers choose between the products with different features. In this case of differentiation, consumers do not treat products as close substitutes, hence with slight price change they don't turn to the product of competitor because they accept higher price in order to be able to consume such features. Cross price elasticity of demand in this case is lower than in case of close substitutes.
2. **Vertical differentiation.** Products have different quality. Consumers will choose from two products the product with higher quality if prices are equal. Firms are producing the same products or close substitutes, but they are competing with the quality of their products. But higher quality of a product requires more inputs in production (such as labour – if there is an increase in

[30] *Let's take again the car industry as an example. Over last 15 years, a lot of car manufacturing companies have established their plants in countries different from their home countries (Korean and Japanese car manufacturers established plants in EU countries, VW has its own plant for assembling cars in Russia, China and Latin America). It is dictated by a lot of reasons, but one of the most important is, that strong competition is driving prices down, and scale of increasing returns is not sufficient to cover transportation costs without affecting its competitiveness.*

[31] *Aiginger, 2000*

time of assembling, or more expensive materials used in order to improve the quality of a final product) and there will be an increase in costs of production, e.g. if there are two products on the market we expect the product with higher quality to cost more (for example let's take new Mercedes S-class and Rolls-Royce, both of the same size and category, but rolls costs more than two times more than merc, because it is hand-made and the labour input in rolls production is much more than one for the Mercedes). So again, due to the difference in quality, consumers will not treat such products as a close substitutes and as long as consumers will be willing to pay higher prices for higher quality (e.g. as long as consumer's utility is increasing), such type of differentiation will make the company successful on the market.

It is necessary to note, that for firms which are specializing on the products with higher quality the competition on the market will be lower, because the demand of such products is less price elastic[32].

In both cases it is important for the firm to be cost effective in order to improve its overall competitiveness, thus increasing returns play important role in production. In both cases cross price elasticity of demand is low, but not zero, which means that there is a particular critical price level starting with which consumers will turn to the competitors' products. In that sense economies of scale are important for the firm under the monopolistic competition.

Since internal economies of scale give the firm a cost advantage which is a competitive advantage as well, and since we live in a world where distance between economic agents is present, we should take into account a transportation cost when analyzing the pattern of trade. The idea is that if we observe an intraindustry trade with horizontally differentiated products or with vertically differentiated products with low quality, we can expect to see that intensity of intraindustry trade in this case is negatively related with the distance between countries because the cost advantage given by economies of scale is reduced by the transportation costs included in the price of product.

Another issue connected with IIT which was mentioned above is an empirical hypothesis stated by Krugman and Helpman[33]: on average the more similar countries are in per capita income, the larger share of IIT in their trade volumes. This idea can be formalized as follows:

[32] *Horaková, T., Bachelor thesis, IES FSV UK, 2004/2005, p.19*
[33] *Krugman and Helpman, 1985, p.173*

$GDP^j = \Pi(\vec{p}, L^j, K^j)$,

which is formalization of gross domestic product for country j in the model of trade (Krugman and Helpman, 1985), where $\vec{p} = (p_1, p_2, ..., p_n)$ is vector of prices of n commodities produced in the country j, L and K are factor endowments of country j, and Π is usual restricted profit function derived from production functions. Now the formula implies that the more capital per worker has the country j, the higher level of GDP it can achieve:

$$\frac{GDP^j}{L^j} = \Pi(\vec{p}, 1, \frac{K^j}{L^j})$$

2.4 Empirical evidence on intraindustry trade.

In order to support my theory based conclusions, I have conducted a research aimed to discover whether there is an empirical evidence of it. The structure of research is following.

Firstly, I will show that intraindustry trade is present in trade flows of different countries. The empirical researches of intraindustry trade have a long tradition, starting with Balassa (1966) and Grubel and Lloyd (1975) and till present days. So I will leave aside discussion of the techniques that can be used in order to measure IIT, because my intention is to show that IIT is present, and there are these two types of differentiation. I will use Grubel-Lloyd index adjusted for trade imbalances and Unit Value indicators in order to distinguish between vertical and horizontal IIT.

The next step is to interpret computed result. For our analysis is important type of differentiation of products. I will accept the classification of industries based on kilogram prices proposed by Aiginger[34], according to which we can define where kilogram price is an indicator of quality (vertical differentiation), and where it is an indicator of price itself (horizontal differentiation).

[34] *Aiginger, 1997, p.576*

Table 2.4.1: Industry classification based on dominant type of competition

Sector	Kilogram price	Volume of trade	Dominant type of competition	
I.	P(X)>P(M)	Q(X)>Q(M)	Quality competition	
II.	P(X)<P(M)	Q(X)>Q(M)	Price Competition	Successful
III.	P(X)>P(M)	Q(X)<Q(M)	Price Competition	Unsuccessful
IV.	P(X)<P(M)	Q(X)<Q(M)	Non-atraktive sector	

Based on this classification, I will define the type of specialization of a country in international trade.

Then I will run regression analysis in order to find if intensity of the IIT is dependent on GDP level. Formalization of this case is given above.

For the IIT measurement, I've selected Germany as a reporter country, because of its size and location, and gathered data about its trade with EU 27 countries (except Cyprus)[35] plus USA, Canada, Mexico, Brazil, Russia, Ukraine, China, Thailand and Japan and collected data about Germany's exports and imports to these countries for year 2007 (volumes of trade in 2008 and 2009 were affected by the crisis) both in Euros and tons within particular industries: road vehicles, medicinal and pharmaceutical products, iron and steel, power-generating machinery and electrical machinery. I took data from Eurostat website, EU27 trade data since 1995 by SITC, SITC 5 digit code[36]. Level of aggregation of 5 digit codes was selected due to further computation of kilogram prices, which requires certain degree of homogeneity of the products which have been compared[37], as well as due to the fact, that aggregation level affects the value of IIT[38], it is necessary to be more precise.

It is necessary to justify the selection of such industries as representatives of internal economies of scale under the conditions of monopolistic competition. First, in such industries there are several companies in each selected country producing differentiated products (whether horizontally or vertically which will be shown later in this thesis). Companies in selected industries have to make a significant initial investment in capital in order to be able to produce (it obvious, that production of medicaments, cars or power generating machines requires large production facilities, e.g. buildings, equipment etc). So, there are high fixed costs of production, which are part of total costs, and as it was shown above in this case AC is decreasing function

[35] *Data for Cyprus is not available for several selected industries*
[36] *http://epp.eurostat.ec.europa.eu/newxtweb/setupdimselection.do*
[37] *See Additions, table "SITC classification of industries"*
[38] *Andersen, 2003*

of Q or total output per firm. Robert J. Carbaugh in his book of *International Economics* says following[39]:"[ ]… *nations with similar factor endowments, and thus negligible comparative advantage differences, may nonetheless find it beneficial to trade because they can take advantage of massive economies of scale, a phenomenon prevalent in a number of industries. In the automobile and pharmaceutical industries … the first unit is very expensive to produce, but each subsequent unit costs much less … because the large setup costs can be spread across all units*…[ ]" He also claims, that large automobile firms reduce costs by specializing in machinery and labor and obtaining quantity discounts in the purchase of inputs[40]. Hence we can assume with high probability that there are internal economies of scale in production process of such companies. P. Krugman[41] uses similar industries (but on the more aggregated level) to show presence of intraindustry trade in monopolistically competitive industries with internal economies of scale.

Usual Grubel-Lloyd index is calculated like this:

$$I = 1 - \frac{|\mathrm{X} - M|}{\mathrm{X+M}}$$

where exports and imports are within one industry. Absolute value of an expression (exports-imports) shows, basically, difference between trade inflows and outflows of the goods within particular industry. If there is intensive intraindustry trade between countries, this difference between exports and imports will tend to be small relatively to the total amount of goods traded (expressed by [exports+imports]). Hence, the more intensive is intraindustry trade, the higher value of *I* we expect to observe.

On the other hand, if there are imbalances in subgroups' trade (e.g. one subgroup is net exporter and other is net importer), the value of GLI will be biased[42]. So I will use GLI adjusted for trade imbalances for industry ***j***:

[39] *Carbaugh, 2008, p. 85*
[40] *This situation is also subject to external economies of scale (in particular polled labour market and specialized suppliers) that can give rise to increasing returns to scale, see next chapter of this thesis.*
[41] *Krugman, 2003*
[42] *Greenaway and Milner, 1983*

$$GLI_j = 1 - \frac{\sum_{i=1}^{n} \left| X_{ij} - M_{ij} \right|}{\left(X_{ij} + M_{ij} \right)}$$

where ***i*** is a subgroup of industry ***j***.

Then unit values were computed in order to discover what type of differentiation is present in the pattern of trade between the countries. Unit values are computed as:

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

where $X_{ijkt}(M_{ijkt})$ is total value of export (import) of good i from country k to partner country j in period t, this value is in Euros. Q_{ijkt} is total volume of exports (imports) of particular good in selected year in physical units, which are kilograms in this thesis[43].

The next step is to interpret computed result and divide IIT in vertical and horizontal.

The results I've received are given in table showing values of Grubel-Lloyd Index (GLI) for particular industries with different countries (computed on basis of data for exports and imports for year 2007, eurostat database, category EU27 Trade Since 1995 By SITC):

[43] *Nešvera, 2003, p.4*

Table 2.4.2 GL index for selected countries

	Industry (SITC 3)				
Country	Medical products (541)	Iron and steel (674)	Power-generating machin. (714)	Electrical machinery (771)	Road vehicles (781)
AUSTRIA	0.898	0.724	0.972	0.843	0.747
BELGIUM	0.824	0.277	0.650	0.851	0.890
BULGARIA	0.654	0.008	0.060	0.623	0.006
BRAZIL	0.049	0.639	0.926	0.158	0.451
CANADA	0.536	0.070	0.591	0.529	0.022
CHINA	0.414	0.779	0.652	0.905	0.026
CZECH REPUBLIC	0.807	0.043	0.337	0.890	0.560
DENMARK	0.801	0.113	0.142	0.875	0.365
ESTONIA	0.027	0.842	0.343	0.577	0.095
SPAIN	0.484	0.083	0.283	0.247	0.529
FINLAND	0.028	0.513	0.187	0.976	0.651
FRANCE	0.804	0.939	0.704	0.555	0.720
UNITED KINGDOM	0.724	0.190	0.765	0.903	0.175
GREECE	0.313	0.438	0.722	0.557	0.001
HUNGARY	0.973	0.117	0.758	0.857	0.835
IRELAND	0.466	0.001	0.859	0.536	0.002
ITALY	0.793	0.972	0.831	0.707	0.262
JAPAN	0.443	0.105	0.247	0.504	0.295
LITHUANIA	0.001	0.010	0.069	0.135	0.067
LUXEMBOURG	0.071	0.076	0.115	0.308	0.180
LATVIA	0.007	0.000	N/A	0.002	0.140
MALTA	0.003	0.113	0.863	0.136	0.158
MEXICO	0.399	N/A	0.788	0.665	0.425
NETHERLANDS	0.905	0.629	0.867	0.904	0.714
POLAND	0.624	0.051	0.193	0.683	0.573
PORTUGAL	0.196	0.060	0.091	0.803	0.192
ROMANIA	0.087	0.135	0.922	0.647	0.034
(RUSSIA)	0.004	0.575	0.408	0.014	0.008
SWEDEN	0.625	0.173	0.850	0.563	0.505
SLOVENIA	0.029	0.331	0.495	0.626	0.277
SLOVAKIA	0.181	0.898	0.244	0.953	0.442
THAILAND	0.094	0.002	0.024	0.977	0.212
UKRAINE	0.376	N/A	0.003	0.218	0.006
UNITED STATES	0.937	0.390	0.644	0.601	0.417

Now it is quite clear from the values of GLI that theoretical conclusions can be supported by empirical evidence in following way: the values we can observe can tell us whether industry in particular country is less developed or the distance is substantial in the way it can reduce the competitive cost advantage gain by economies of scale. The lowest values of GLI in each industry we can observe for less developed (or developing countries) which is then revealed comparative advantage and for distant developed countries (such as USA, Canada or Japan)

which is a sign of cost structure of price (if transportation costs are a significant fraction of price than the volume of trade will be lower). However, one more important thing is that such industries as iron industry or industry producing different types of machines reveals increasing returns of relatively large scope (it is the case of enormous fixed costs and decreasing marginal costs). If we take a look at trade with China in industries 674, 714 and 771, we can observe relatively high values of GLI despite the great distance between Germany and China.

2.5 Interpretation of unit values

According to the Aiginger classification, we can now define the type of differentiation and type of competition (with price or quality) in selected industries with selected countries.

Results are following: Germany tends to be competitive with price, e.g. firm are using horizontal differentiation of their products (whether successfully or not) within all industries except Road vehicles and cars, where dominant type of differentiation is vertical, e.g. competition with quality, which is not a surprise, because Germany is one of the leading car-manufacturing countries in the world. Following table can give better look at the types of differentiation of products (once again, vertical – competition with quality, horizontal – with price).

Table 2.5.1: Types of differentiation of products

Industry	Dominant type of competiton	Number of partners with I type	Number of partners with IV type	Number of partners[44]
Medicinal and pharm.	II or III	8	1	35
Iron and steel	II or III	9	3	32
Engines and motors	II or III	5	4	34
Electric power mach.	II or III	9	2	37
Road vechicles and cars	I	Dominant	0	36

In the trade within every industry with all countries there are patterns of vertical and horizontal interindustry trade, However, German firms find it profitable to

[44] *Note: for some of selected countries it was not possible to compute kilogram prices due to availability of statistical data. Source: http://epp.eurostat.ec.europa.eu/newxtweb/setupdimselection.do*

compete with many industries by the price, however, in industries, where dominant type of competition is II or III, German firms compete with quality with less developed or developing countries, which means that scope of economies of scale gives them an opportunity exploit better technologies and apply costs advantage more effectively.

2.6 Dependence of IIT on GDP p.c. levels

In order to test this hypothesis I conducted regression analysis[45] of dependence of intraindustry trade on difference between GDP per capita levels of selected countries. The model used is following[46]:

$$IIT = \alpha + \beta(INEQ_{ij}) + \varepsilon$$

where IIT is Grubel-Lloyd index of intraindustry trade constructed as was discussed above, $INEQ_{ij}$ is inequality in GDP per capita between reporter country i and partner country j, β obviously is the sensivity of intraindustry trade on difference of GDP per capita. IIT expresses the share of intraindustry trade in total trade volume. Index $INEQ_{ij}$ was constructed as follows[47]:

$$INEQ = 1 + \frac{[w \ln w + (1-w)\ln(1-w)]}{\ln 2}$$

where $w = GDP_j / (GDP_j + GDP_i)$, i stand for reporter country and j for partner country.

Again, I selected Germany as a reporter country and used data of trade of Germany with other 31 countries[48] within 15 selected industries[49] for two years: 2006 and 2007. Selection of these particular 2 years is simple: I expect pattern of intraindustry trade to be relatively stable over the periods of economic stability. Hence, IIT should be stable since 2000 till 2007, for example. Data of 2008 and, especially, 2009 is affected by a world economic crisis, thus I selected data for 2006-07. This assumption rests on stability of composition of trade flows and stability of GDP p.c. levels. I understand

[45] *OLS method; software – Gretl.*
[46] *I assume linear model. Assumption is based on the plot of actual values of IIT against GDP p.c. difference.*
[47] *Balassa, 1986b*
[48] *For the list of countries see addition... Selection of countries was dictated mainly by availability of data. Source: Eurostat web-site*
[49] *See Appendix B for industries with significant Betas*

that this assumption is rather controversial; however I accept it at this point. Data for GDP p.c. levels (in current US$) is gathered from World Bank database[50].

What I'm looking for is the negative relation of intraindustry trade intensity and difference between levels of GDP, e.g. less is the difference between GDP p.c. level of Germany with the partner country, the higher intensity of IIT is expected (thus beta is expected to be negative). I understand, that R^2 for such model will be relatively low, because there are many other factors that affect IIT (distance is also very important factor, because cost advantage gained by increasing returns can be lost if the fraction of transportation cost in overall cost becomes substantial; or tariff and non-tariff barriers to trade, etc.), however, it is important to me to see if the difference in GDP level is statistically significant factor that influence IIT intensity.

Results obtained for regression analysis for 15 selected industries:

1. $INEQ_{ij}$ is statistically significant for following industries: Heating and cooling equipment, Inorganic chemicals, Machine tools, Medicinal and pharmaceutical products, Motor cars, Motorcycles, Motor vehicles, Road motor vehicles and Rubber tyres.
2. R^2 of this model for different industries (mentioned above) lies in interval from smallest 0.049133 for rubber industry to highest 0.234065 for heating and cooling equipment.
3. The most interesting part is values of Beta's. All Betas' (even those non-significant) are negative with values lay in interval from (0.2) to (0.6).

Although this model is not sophisticated and for many cases one of the assumption of OLS (normality of residuals; most weakest assumption, but still) is violated, it gives some support to the theoretical findings. It is a subject to further research to create more sophisticated model and use advanced methods of data transformation for obtaining more solid results (in terms of R^2 and Betas).

[50] http://data.worldbank.org/indicator/NY.GDP.PCAP.CD

2.7 Internal economies of scale and market imperfections: trade and price discrimination.

It is necessary to note, however, that in industries where internal economies of scale are present and firms are experiencing certain monopolistic power, there can be different forms of consumers' discrimination. As we know from microeconomic analysis[51], there are three degrees of price discrimination that can be applied by a monopolistic firm: first-degree price discrimination, or perfect price discrimination, is a situation when producer charges different prices for each unit of product (in the way that price for each unit is equal to willingness to pay that is revealed by demand function); second-degree – situation when prices differ depending on the number of units of the good bought, but not across consumers[52]; third-degree – situation when different purchasers are charged different prices, but each purchaser pays a constant amount for each unit of the good bought[53]. In reality, monopolistically competitive firms can apply certain price discrimination by charging different prices for the same good if it is exported or sold domestically. The most common form of price discrimination in international trade in case of such firms is dumping, when firms charge lower prices for exported goods then they do for the same goods sold domestically[54]. This is caused by two main reasons (which are at the same time assumptions for dumping to be possible):

1. Firms are price setters (which require the imperfectly competitive market structure).
2. Markets are segmented, e.g. firms distinguish between home and foreign markets and their profit-maximizing decision takes into account amount for both home and foreign markets. Consumers are considered to not be able to repurchase exported goods.

Firms are charging lower prices for the foreign customers due to the fact, that there are positive transportation costs and different forms of barriers for trade, thus usually firms have large share on domestic market than on foreign. Thus firms consider that they have less monopolistic power on the foreign market which can make them to keep prices low than on domestic market. In that case foreign markets are assumed to have highly price responsive demand for the imported goods from

[51] *Varian, 1992*
[52] *Ibid, p. 242*
[53] *ibid*
[54] *Krugman, 2003, p.142*

the "home" country. From microeconomic analysis we know, that if monopolist is applying price discrimination of third-degree and firm assumes that foreign demand is more price elastic than domestic one, than it will charge lower price for foreign market than for domestic one.

Reasons for dumping may be different, like need to sell out the stock of goods (lower price should stimulate the sales, it is a tactic action) or strategic actions aimed to increase the share of foreign market or even get a dominant position. Latter can be a part of legible business strategy to charge lower prices on some markets.

Generally it is said that dumping can give rise to international trade, but since nation states can treat such practices as anti-competition, firms can be punished for it (for example with dumping duties) and antidumping activities can start to have a protectionism features.

As for the trade policies, dumping is controversial question. The main point is how to distinguish between low prices as a result of dumping and low prices as a result of costs effectiveness and good strategy? It is quite clear, that it is difficult to estimate the production costs of foreign companies (especially large producers, like car companies, chemical and pharmaceutical companies etc.), so there should be other ways how to recognize the dumping. Such commonly recognized criteria are[55]:

1. *Comparable prices.* If the price is lower on foreign market of the like product also sold domestically then it is can be considered as dumping.
2. If prices of the product cannot be compared with domestic price, *prices of products exported to third countries* are taken (the highest one).
3. Recognition based on evaluating *costs of production, transportation and distribution costs and normal profit margins* level.

Actions against dumping according to the WTO anti-dumping agreements can be applied by the government of "foreign" country in order to protect its own domestic competing industry. However, measurement of dumping itself is not enough for the government to be able to apply any anti-dumping actions[56]:"[ ] ... *WTO agreement allows governments to act against dumping where there is genuine ("material") injury to the competing domestic industry. In order to do that the government has to be able to show that dumping is taking place, calculate the extent of dumping (how much lower the export price is compared to the*

[55] WTO online: http://www.wto.org/english/thewto_e/whatis_e/tif_e/agrm8_e.htm
[56] ibid

exporter's home market price), and show that the dumping is causing injury or threatening to do so... [ ]"

One of the models describing economic side of the dumping is one developed by Brander and Krugman (1983). It is based on the strategic interaction between oligopolistic firms and shows basically that dumping can be a cause of international trade even in absence of increasing returns in production and differentiated products.

Basic setup of the model is following. There assumed to be two countries with one monopolistic firm in every country producing identical good Z. The transportation costs are positive and firms are assumed to behave according Cournot model's decision making about profit maximizing amount produced (as long as we have valid assumption of segmented markets producers treat each market separately and chose for profit maximizing quantity for both domestic and foreign markets).

Profit functions for home and foreign producers are derived from the Cournot type interaction of the oligopolistic competition (x and y are quantities of Z produced, * always denotes variable describing foreign market, c denotes marginal costs, $0 \le g \le 1$ is an iceberg type transportation costs when only fraction g of unit of good arrives to the foreign market, thus marginal cost of export is c/g), production is assumed to take place under constant returns to scale:

$$\pi(z, x, p) = xp(Z) + x^* p^*(Z^*) - c\left(x + \frac{x^*}{g}\right) - FC$$

$$\pi^*(z, y, p) = yp(Z) + y^* p^*(Z^*) - c\left(y^* + \frac{y}{g}\right) - FC^*$$

Solving usual profit-maximizing problem and using the first order conditions[57] we arrive to the equations solving price setting and market share of foreign producer in the domestic market (since the problem in model is symmetric equations are given for the home producer):

$$p = \frac{c\varepsilon(1+g)}{g(2\varepsilon - 1)}$$

$$\sigma = \frac{\varepsilon(g-1)+1}{1+g}$$

[57] *Brander and Krugman, 1983*

where $\sigma = y / Z$ is the share of foreign producer in the domestic market, and $\varepsilon = -p / Zp'$ is price elasticity of domestic demand. Conditions of equilibrium also require the decreasing own marginal revenue with increasing output of other firm:

$$MR_{xy} = xp'' + p' < 0$$
$$MR^{*}_{yx} = yp'' + p' < 0$$

In the context, two-way trade will arrive if equations for price and market share have positive solution (e.g. when price exceeds marginal costs of export: p > c/g, and $\sigma > 0$).

It is possible to show in this setup that in equilibrium market share of foreign firms will be lower in the domestic market. Let's turn once again to the equation for the market share of the firm:

$$\sigma = \frac{\varepsilon(g-1)+1}{1+g}$$

It is obvious that with positive transportation costs σ will be lower for foreign company than for domestic one, because share in the foreign market is dependent on g (for domestic market we can assume transportation costs to be zero, plus we can incline in g distribution costs) and price elasticity of demand is negative. It was mentioned above already that in real world imperfectly competitive firms have smaller shares in the foreign markets due to transportation and selling costs. Model suggests, that perceived marginal revenue of [producers is higher for foreign market than for domestic, and this higher MR can overweight the transportation costs. On the other hand in equilibrium companies can their MR equal to MC. And firms have smaller markup over costs in the foreign market. It is important suggestion for my analysis, because prices of Z of home producer will be lower on foreign market than at home.

So, we have arrived to the point that even in absence of increasing returns there will be dumping of some degree, e.g. it makes sense to firms to charge lower prices for exported goods. Since the markup over costs is crucial for dumping, increasing returns can cause the dumping as well, because along with all issues discussed above they bring about lower costs than constant returns.

3. External economies of scale and international trade.

Difference between internal and external economies of scale, as it was discussed in the first chapter of this thesis, is that in case of external economies increase in productivity (or cost reduction) is subject to total industry output. It is important to distinguish between these types of economies of scale because of several reasons:

1. Since cost reduction is a function of industry output, market structure can take a form of a perfect competition[58].
2. Existence of external economies of scale can affect the agglomeration of industries[59] and hence a pattern of trade.
3. Due to external economies of scale, initial location of an industry can be the equilibrium one even though it is not efficient[60].

While models of internal economies of scale assuming imperfect competition emerged in a late 1970's[61], all models assuming external economies of scale are much older. Analysis of external economies of scale has its roots back in nineteenth century. British economist A. Marshall first started to analyze this type of economies of scale because of "industrial districts" phenomenon[62] - geographical concentration of industry that could not be easily explained by natural resources. Back in the Marshall's time the most famous examples of such concentrated industries were the cluster of cutlery manufacturers in Sheffield and the cluster of hosiery firms in Northampton[63].

Main three sources of external economies of scale that can give rise to increasing returns are following: *specialized suppliers, labour market pooling and knowledge spillovers*.

According to the classification of external economies of scale, that was given in the first chapter, information spillovers are pure technological spillovers[64] (because they alter the relationship between inputs and output), while specialized suppliers and

[58] *Brakman, 2009*
[59] *Krugman, 1991*
[60] *see for example Brakman, 2009*
[61] *Winthrop Jones, 1995, p. 1251*
[62] *Krugman, 2003, p. 147*
[63] *ibid*
[64] *Information spillovers are one of the most important type of spillovers, will be discussed in this thesis in more details later on.*

pooled labour market are pecuniary external economies, because they don't interact directly with production function and transmitted through prices of the inputs for individual firms.

1. *Specialized suppliers.*

In certain industries production of goods and services requires specialized inputs (e.g. specialized goods and services, as for example it is in production of high technology computer devices). Individual firm can hardly generate sufficient demand for such specialized inputs in order to support suppliers of these inputs. Industrial cluster, on the other hand, brings together many firms and can support large market of such inputs (in some cases non-tradable) in the region. In that case improves range and availability of such specialized supplies and costs of inputs are reduced, thus firms in the industrial cluster can benefit from it. Other firms which then try to establish production in regions that don't have market of specialized inputs due to absence of comparable cluster will experience problems with availability of suppliers and will face higher costs of specialized inputs, which is a disadvantage for them[65].

2. *Pooling of specialized labour market*

Industrial cluster of many firms can also support a localized market of highly specialized labour force. From existence of such market can benefit both firms and workers. Firms will benefit from it mainly because of increased availability of workers with specialized skills. Workers will benefit from concentrated market in the way that if one of the firms reduces the demand for labour and hence increases the level of unemployment, it can be compensated (at least in some cases), by high demand from the other firm. In other words, pooled market for workers with industry specific skills lowers the probability of labour shortages and unemployment.

[65] *Krugman, 2003. Examples of specialized suppliers case are given in Krugman, 2003, p.147, or Eicher, 2009, p.108*

3. *Knowledge, or informational, spillovers*

One of the most important and interesting factors of external economies of scale, especially in highly innovative industries. In general, informational spillovers can both increase productivity of firms in the cluster or improve cost efficiency of production (as it was mentioned above, informational spillovers are classified as pure technological).

The way how to incorporate possible external economies in the production function is following: let's have a production function

$$x = f(z, v)$$

where z is a vector of all inputs used in production and v is a vector of possible external economies that can affect production function and give rise to the increasing returns to scale.

In models of international trade with external economies of scale, markets are considered to be perfectly competitive and firms have close or same technologies. Thus firms are involved in marginal cost pricing (as we know from the microeconomic analysis firms under perfect competition charge prices p = MC). Marginal costs of production are derived from production functions, and since production functions of firms in presence of external economies are dependent on the external factors, MC are dependent on external factors as well, thus:

$$MC = c(z, v)$$

Both, labour force and specialized inputs (denoted by vector z) are used in production process and MC are dependent on the prices of such inputs, thus pecuniary external economies will reduce the prices of these (along with increased availability of the production factors), and reduce MC. On the other hand, information spillovers (are part of vector v) can improve production function and thus affect MC. In both cases cost efficiency of the firm will be improved and is dependent on the market size.

Generally, all models about international trade based on external economies to scale give a conclusion that it is hard to predict any particular pattern of international trade in such setup. This pattern depends on the factor endowments, comparative efficiency of production and concentration of industries, caused also by externally generated economies to scale.

First model to consider is the one considering production factors endowments and industry-specific external effects that can give rise to increasing returns[66]. In the beginning an "integrated" economy is considered with three industries, one of which is subject to external economies of scale (for example good X is produced under external economies of scale), given factor endowments (capital K and labour L) and given prices of goods and production factors. Furthermore, let's assume that X is capital-intensive good.

Let's then divide this integrated economy in two countries and randomly distribute the production factors. In this step we accept the assumption about external effects – we assume that external economies do not spill-over internationally and are present only at the level of industry producing X in every country. It is also important to mention, that in the integrated economy industry producing good X had particular size. Now, after we have divided production factors between countries, we create a possibility that production of good X will take place in both countries. However, in this case the size of industry X in each country will be smaller than the initial size of the same industry in integrated economy. And since external economies of scale are dependent on the size of an industry, it is possible to assume that the level of output of integrated economy can be achieved only if production of X is still concentrated in one country (e.g. size of an industry is preserved).

Let's step aside from the model for a moment and take a look at the problem of industry location from another angle. In real world distribution of production factors is given. Since external economies require the industry of particular size in order to support sources of increasing returns, location can be determined by historical location of the industry. If in one country there is an industry which is subject to external economies, then firm established in other country where the same industry is smaller or don't exists at all, is under cost disadvantage from the very beginning. This historical determination of industry location can lead to the equilibrium which is not efficient. If in some country products can be produced with lower costs due to some reasons (like better production function of the firms), but there is no industry (e.g. there are no firms at all producing these products, or the number of firms is not sufficient to support external economies), then production of these products will be located in the country with an industry, even though in this case costs of production will be higher.

[66] *Winthrop, Grossman, Kenen, Rogoff, 2007*

External economies of scale are important factor of industry concentration. It was showed in the model of P. Krugman (1991), where he included increasing returns as a concentration force.

The idea is following. In modern economy we can observe the core-periphery structures rather than spatially dispersed producers. And market itself is important for industry to end up concentrated, because in real world transportation costs are positive and can become a large fraction of overall costs, thus transportation costs minimization is important. Production of particular goods will then take place there, where there are both existing industry (allowing for external economies) and relatively large market for the goods (it is also known as a home market effect).

Now, let's turn back to the model. In this setup there two possible outcomes in terms of factor abundance: whether countries are similarly endowed with production factors or factors are distributed unequally. In the first case, production of X will end up concentrated in one country and this will determine the pattern of trade. In that case result is similar to one proposed by models of internal economies of scale (in a sense that trade will occur even though there isn't any comparative advantage). In the second case pattern of trade is not determined unambiguously: there will be two patterns of production (in both countries) dependent on factor-abundance and thus two patterns of trade. Although there isn't unique equilibrium, capital abundant country is assumed to be net exporter of the good X.

Another way of formalization of the problem of international trade in presence of external economies to scale is proposed by Helpman and Krugman (1985).

In order to predict pattern of trade sufficient conditions of predictability are proposed. Labour is supposed to be the only factor of production and production functions are formalized as follows:

$$f(L,v) = \frac{\bar{c}(v)L}{a}$$

where L denotes labour, v is a vector of external factors, $\bar{c}(v)$ is a productivity of external factors, and a is constant per unit output use of L ($a(z,v) = \frac{\partial c(z,v)}{\partial z}$). Under the strong assumption, that productivities of external factors in given industry are similar in all countries, we arrive to the comparative advantage situation, in which comparative advantage of the country will depend on a.

In two industries setup relative costs perceived by companies are:

$$\frac{a_1^i}{a_2^i} \cdot \frac{\bar{c}_2^i(v)}{\bar{c}_1^i(v)}$$

where 1,2 denotes industry in country *i*. So, since industry-specific external effects are assumed to be the same in given industry in all countries, country which has lower a_1^i / a_2^i ratio has comparative advantage in production of good 1. Thus specialization and trade pattern can be determined by the model of comparative advantage.

It is, however, true only under the strong and unrealistic assumption of similar external effects, e.g. if we suppose some German industry which is producing good X (for example cars) under the external economies of scale and we want external factors to be similarly effective in same industries in all other countries.

Thus it is clear that external economies of scale are important in determining industry location and patter of trade and should definitely be taken into account while analyzing international trade. However, it turns out that it is quite hard to predict the pattern of trade based on these conceptual models analyzing supply side of economy.

Demand side of economy can be characterized by one of the two approaches discussed in previous section, thus again it is possible to assume that consumers will prefer more varieties available for consumption. That can be one of the possible causes of trade. Also there can be trade in intermediate inputs. The varieties that are produced under external economies of scale can be used in the production of other goods as well as they can be final goods. It make sense to split the production of a particular good in several countries, thus some countries will be producing intermediate inputs and one country will concentrate on assembling the final good. This case is the case of multinational corporations. They split their production processes and are exploiting different types of external (in a combination with internal) economies of scale. As an example we can take a look at the Seagate Company[67], world's leading producer of hard drives for companies and individual consumers. Seagate's production process takes place in 7 different American, Latin American and Asian countries, and flows of inputs are not one-way directed, there are simultaneous two-ways flows, that can also be seen (in the statistical trade data

[67] http://www.seagate.com/www/en-gb/?countrycode=GB&countryName=GB&newRole=All_GB,All_EMEA&regionCode=EMEA

at least) as intraindustry trade. The company is then engaged in the trade in intermediate inputs. Internal economies then are achieved by the large scale of production and external economies originate from different sources, such as presence of specialized suppliers (which are there, because they choose to concentrate around large high-tech firms in order to have larger market and minimized transportation costs as well as the available information about technologies), skilled labour force (when it comes to R&D and assembling of sophisticated micro chipsets etc.) and relatively cheap labour force in Asian and Latin American countries.

4. Role of multinational corporations in the world economy.

4.1 Basic definitions and theoretical background

In today's globalized world markets are more open and trade costs have decreased over last decades. Thus international trade has grown. Fewer barriers to trade along with differences in factor endowments between countries have led, among other things, to increasing activity in FDI field. Among all economic actors there is a special group of biggest economic entities – multinational corporations. These entities are important players in modern economy. As it was mentioned in the UN statement few years ago[68], "[ ]... *among 100 entities with the largest gross national product (GNP), about half were multinational corporations. This meant that by this measure these big MNCs were larger and wealthier than 120 to 130 nation-states...* [ ]"

Definition of the multinational corporation[69] is following: "*A corporation that has its facilities and other assets in at least one country other than its home country. Such companies have offices and/or factories in different countries and usually have a centralized head office where they co-ordinate global management. Very large multinationals have budgets that exceed those of many small countries*".

One of the particularly interesting facts about multinationals is that these economic actors are the most active in the field of Foreign Direct Investment and R&D activities[70]. The importance of FDI in the world economy has grown over last 30 years and world FDI was growing faster than world GDP and trade[71]. GDP grown more than 7% per year between 1970 and 1997, whereas international trade, measured by worldwide nominal imports, grew more than 12% and nominal FDI grew almost 31%. Another issue connected with FDI change over the period is the change of the FDI structure[72]. In 22% of cases FDI takes form of the Greenfield investments, while in 78% of cases it takes form of mergers and acquisitions (Mergers – 3% of M&As, cross-border acquisitions – 97% of M&As). Multinationals are most active actor in cross-border acquisitions. MNCs are actively acquiring

[68] *Chandler, A., 2005*
[69] *http://www.investopedia.com/terms/m/multinationalcorporation.asp*
[70] *See for example Brakman and Garretsen, 2008*
[71] *Brakman, 2009*
[72] *van Marrewijk, 2007*

smaller firms because of different tactic and strategic reasons (like creating vertically or horizontally integrated production-distribution structures etc.).

In order to understand the process of multinational production let me explain couple of ideas behind this process. Multinational company need two basic types of services for its production: headquarter services and plant services. Headquarter services are usually associated with managerial, financial, and R&D activities. While plant services are needed for the production process itself. Then it is a question of a plant location choice how the multinational production process will be organized: whether plant will be located only in foreign country or in foreign as well as in home country. Choice where to locate depends on several factors: reason why firm is willing to become multinational (more profitable servicing of foreign market or exploiting low-cost inputs provided by foreign market, e.g. horizontal or vertical organization of production), costs of establishing the production plant abroad and transportation costs.

Not all firms in the industry can become multinational. It is usually argued that very few companies, more likely these most cost efficient, can establish foreign plants and get involved in FDI process. According to Brakman (2009) there are *four basic characteristics of multinationals*:

1. They appear to be concentrated in industries that are characterized by a high ratio of R&D relative to sales.
2. They tend to have high value of intangible assets (in forms of assets they get from R&D activities and assets in associated companies which they acquire trough the M&A).
3. Are often associated with new or technologically advanced and differentiated products.
4. Are often relatively old, large and established firms within their sector.

One of the ways how to look at multinational corporations and explain their existence is so-called **OLI approach** proposed by Dunning (1977)[73], where O stands for *ownership advantage*, L stands for *location advantage* and I for *internalization advantage*. Ownership advantage means that firm has a product that experiences certain degree of monopolistic power in foreign market (differentiated or unique product). Location advantage means that production located in the foreign market is more cost-efficient, or profitable, than one located at home. And finally

[73] *Dunning, 1977*

internalization advantage means that it is more profitable to the firm to produce a product itself than license it to other firm and then internalize the profits.

M. Porter[74] has extended such OLI approach and suggested further assumptions about MNCs, such as that multinationals can compete only when they have a strong position in their home market, because sales are most easy to multinationalize then R&D. It is necessary to mention at this point, that headquarters are usually established in the home country and R&D activities are usually associated with headquarters services.

As it was already mentioned above, there are two basic reasons for the firm to become multinational[75]:

1. More effective serving of foreign market from the foreign location. This type of organizing the production is associated with *horizontal multinationals*. They just duplicate their business abroad in order get more profits from the foreign market.
2. Exploiting of low-cost inputs provided by the foreign market. This type of production organization is associated with *vertical multinationals*. The idea is simple – locate single steps of production in the markets that can provide the multinational with low-cost inputs, thus making production more cost efficient.

Second type of organization of multinational production is trade-creating, because intermediate goods have to be shipped to other country in order to be assembled. Distinction between these types of production organization is not very clear, because vertical multinationals, for example, can sell to foreign markets as well.

[74] *Porter, 1985*
[75] *Brakman, 2009*

4.2 Multinationals and trade theory

The existence of multinationals influences such economic variables as volume of trade and share of intraindustry trade. In order to make this point more clear, let me introduce a model describing multinational production and trade. One of the most often used models explaining multinational production organisation and trade pattern was developed by Helpman and Krugman (1985)[76]. The main decisive factor in the decision whether become multinational or not is difference in factor endowments between countries.

In the model setup there are assumed two countries, two factors of production – capital and labour, and two products – food, which is produced under constant returns to scale, and manufactures – differentiated products produced under increasing returns to scale. Food is produced with use of labour and capital. Differentiated manufactures are produced with use of both factors of production as well; however manufacturing production requires "headquarters" services. These services are produced with use of capital and labour, are used in different plants (actually, they are servicing plants from the home country), but once established they become a firm specific asset and are tied to an entrepreneurial unit[77]. In production of such services capital and labour are used as well, and headquarter services is assumed to be the most capital-intensive. Food is less capital intensive, thus manufacturing production has intermediate capital intensity.

Let's turn to the manufactures production. Because they are produced under increasing returns to scale it makes sense to concentrate their production in one plant. But main idea of the model is that different stages of production can have different factor intensities.

Free trade can make factor price equalization possible if factor endowment between countries are not to different. In that case there no incentive for the firm to become international. However, if countries differ in their factor endowments, than prices of these factors will not equalize, and there will be an incentive for a firm to become multinational and split its production process in several locations. Since production of headquarter services is capital intensive, it will be located in capital abundant country and such country will become net exporter of headquarter services. Stages

[76] *Helpman and Krugman, 1985; revisited by Brakman, 2009*
[77] *Williamson, 1981*

of production process that are more labour intensive obviously will be located in labour-rich country, thus such country becomes net exporter of labour-intensive products. This specialization will lead also to the increase of price of capital in capital-abundant country and increase of price of labour in labour-abundant country.

Now, it is quite clear that such separation of production process, e.g. establishment of production plants abroad, will affect both volume of trade (the volume of trade between countries where different parts of MNC are located will be higher than in absence of trade) and the share of intraindustry trade if the products of multinationals are traded.

4.3 The role of multinational corporations: productivity, knowledge and market access spillovers.

There are several types of externalities connected with the operations of MNCs. There have been a lot of populist controversies over multinational production and FDI, both from the side of home and foreign (host) countries. The main arguments for negative perception of MNCs operation are: erosion of technology leadership of domestic firms, weaker and smaller companies in host countries are not able to compete with strong multinationals etc. However, let's leave aside such arguments and concentrate on the externalities that are associated with multinationals' operations.

Probably the most important reason why countries are attracting FDI is the possibility to get access to new advanced technologies from MNCs' arsenal. The idea is that even though MNC's production can take place in fully-owned affiliate, the information about new technology will spill over to the domestic firms (e.g. domestic firms can hire workers trained by MNC or apply so-called reverse engineering in order to get to know how the product is produced)[78]. Such spillovers connected with availability of new technologies for firms in host countries are called productivity spillovers. They can occur when entrance to the host-country market of MNC brings about new technology and multinational firm is not able to fully internalize the benefits coming from the use of this technology (for example in case when local firms just copy the technology of production).

[78] *According to Blomstrom and Kokko, 1996, technology to some extent is a public good.*

Now, it is necessary to mention, that entrance of MNC affiliate to the host-country market disturbs existing equilibrium and increases degree of competition. Most of host-country firms are usually less effective than MNCs and do not possess such financial and technological resources as MNC does. So, such disturbance in existing equilibrium will make firms to become more cost-efficient in order to be able to compete with MNC affiliate.

Why positive production spillovers are expected to occur. There are three main reasons for this[79]:

- Technologies of MNC are not always available on the market, and often the only way for host-country firms to acquire such technologies is whether reverse engineering or hiring the workers trained by MNC, e.g. through some spillover. The probability of such spillovers increases with presence of multinational company in the host-country.
- Limited information of innovative product or service. Before product actually gets on the market, users have limited information on advantages and benefits of the product, thus the demand is weak and local firms are not implementing such technology or not producing such product, even though they can get access to the production techniques. Entrance of MNC with such product or service, however, shows that this is profitable to produce it and thus local firms can get engaged in the production as well.
- If there is a monopolistic industry in the host country with substantial barriers to entrance, local firms are less likely to enter such industry. MNC, on the other hand, has all resources to overcome such entrance barriers (especially if economies of scale represent such barrier, for large multinational company it is relatively easy to establish the production with high degree of economies of scale). And again, entrance of foreign multinational company will disturb existing equilibrium on the market and will bring more intensive competition. Thus, by decreasing the degree of monopolistic power of existing firms, presence of MNC is likely to reduce some of the monopolistic inefficiencies, on the one hand, and local firms will have to improve their productivity, on the other. Resource allocation is also expected to improve

[79] *ibid*

Another group of spillovers connected with MNCs' operations is so-called market access spillovers. Main idea is that multinationals are in a better position than companies from host, especially developing, countries in questions of international marketing, product distributing and servicing its products (MNCs are assumed to have not only financial or production resources, but also managerial resources and can benefit from existing distribution network). Due to their size, MNCs can afford to establish new distribution chains and promote new export channels, which require high fixed costs. In general, market access spillover is assumed to occur if the local company gathered the knowledge of export operations while working as MNC supplier and then established its own export connection with foreign market. However, while local firms do not conduct export activities by themselves and are acting as MNC's suppliers, there is no certainty in whether positive spillovers will occur. Even though by increasing their output (because they have access to the larger market trough the MNC) local firms can achieve economies of scale and thus reduce their costs of production, MNC can internalize almost all such positive effect by negotiating lower prices[80].

Another issue in the field of MNCs are R&D spillovers, which is likely to occur in developing countries and is connected with MNCs' operations (since multinationals are considered to be the most active economic actors involved in FDI).

Coe, Helpman and Hoffmaister (1995) conducted empirical research aimed on examination of the extent to which less developed countries than invest little in R&D themselves benefit from the R&D that is performed in the industrial countries.

Main idea behind that study is that results of R&D performed in the foreign countries, can then be brought to the market of developing country through two basic channels: international trade and FDI. When developing country is opened for trade or is actively attracting foreign direct investment, it can benefit from such activities because of following reasons: country can employ larger variety of intermediate products and capital equipment; communication with developed countries through the trade or FDI stimulates cross-border learning of production methods, product design and market conditions. Both of these help developing countries to use domestic resources more efficiently and to copy foreign technologies. Basically, by communicating with developed industrial country through the trade or direct foreign investment, developing countries are increasing their R&D stock without carrying out any substantial R&D activities be themselves.

[80] *Blomstrom, Kokko, 1996*

Regression model which were constructed in order to test the hypothesis have following log0linear form:

$$\log F_{it} = \alpha_i^0 + \alpha_i^S \log S_{it} + \alpha_i^M M_{it} + \alpha_i^E E_{it} + \alpha_i^T T_t + \varepsilon_{it}$$

where i and t index countries and time periods, F is total factor productivity, the α_i s are country specific parameters, S is foreign R&D capital stock, M is the share of imports from industrial countries in developing country GDP, E is secondary school enrolment rate (theory also suggests that productivity also depends on country's quality of labour force), T is a time trend, and ε_{it} is white noise error term.

Detailed description of the data used and numerical results are presented in the paper[81] , so there is no need to describe it here. However, conclusions made by researchers are of particular interest of this analysis:"[ ] ... estimates suggest that the R&D spillovers from North to South[82] are substantial, implying that developing countries derive substantial benefits from research and development in the industrial North. ... estimates suggest, that the spillover effects from R&D in the industrial countries in 1990 may have boosted output in the developing countries by about 21 billion U.S. dollars, which compares with total official development aid of about 50 billion U.S. dollars".

[81] *Coe, Helpman, Hoffmaister, 1995*

[82] *Developed industrial countries in this study are those of Europe (North), while developing countries are those of Africa and other South countries.*

Conclusions

The main goal of this thesis was to theoretically analyze increasing returns to scale as a factor that can affect international trade. I started with analyzing basic theoretical background of increasing returns and showed that there two basic types of economies of scale that can give rise to the increasing returns to scale: internal (dependent on the size of the firm) and external (are constant subject to firm but depends on the size of industry).It was shown that under internal economies of scale firm is experiencing certain degree of monopolistic power (due to cost advantages over smaller firms). Thus competitive market structure is inconsistent with internal economies of scale. It was shown, that strategic interaction between oligopolistic firms makes it difficult to predict any persistent pattern of trade. Further analysis was focused on internal economies under the monopolistic competition assumption. It is important to keep in mind that under this assumption about market structure firms are considered to produce differentiated products. Demand side of the economy can be described by two main approaches to differentiated products – "love of variety" approach and ideal variety approach. Conclusion based on both approaches was that regardless the type of consumer preferences in this setup decrease in number of varieties available for consumption will decrease utility of consumers.

It was also shown that internal economies of scale can cause so-called intraindustry trade, e.g. trade in similar products within particular industry. Empirical evidence was collected and modified Grubel-Lloyd index was computed in order to show that intraindustry is present and its intensity is different for trade between countries with close levels of development and for trade between developed and developing countries. Regression was run in negative relation of IIT on differences in GDP p.c. levels was revealed. These two empirical tests supported conclusions based on previous theoretical analysis.

Further analysis was focused on external economies of scale, which arise at the level of industry. It was shown that external economies are important factor of determining the location of industry and thus pattern of international trade. However, it is difficult predict the pattern of trade in absence of strict assumtions of the model.

Last part is devoted to the analysis of multinational corporations – larger economic entities in modern world economy. Analysis has shown that entrance of MNC in the host country market can affect overall effectiveness of an industry (both through the spillovers and more intensive competition). However internalization of such benefits by host country firms is questionable, since MNC has stronger negotiation position. It was also shown, on the example of empirical research, that since MNCs are active in the field of FDI, they can add-up to improvement of the efficiency of developing countries.

Appendix A

SITC classification of industries

541	MEDICINAL AND PHARMACEUTICAL PRODUCTS, OTHER THAN MEDICAMENTS OF GROUP 542
674	FLAT-ROLLED PRODUCTS OF IRON OR NON-ALLOY STEEL, CLAD, PLATED OR COATED
714	ENGINES AND MOTORS, NON-ELECTRIC (OTHER THAN THOSE OF GROUPS 712, 713 AND 718); PARTS, N.E.S., OF THESE ENGINES AND MOTORS
771	ELECTRIC POWER MACHINERY (OTHER THAN ROTATING ELECTRIC PLANT OF GROUP 716) AND PARTS THEREOF
781	MOTOR CARS AND OTHER MOTOR VEHICLES PRINCIPALLY DESIGNED FOR THE TRANSPORT OF PERSONS INCLUDING STATION-WAGONS AND RACING CARS

Appendix B

Industries (by SITC classification) and Betas

SITC code	Industry	Beta	R-squared
522	Inorganic chemical elements	*-0.319945*	*0.083458*
541	Medicinal and pharmaceutical products	*-0.426816*	*0.133327*
625	Rubber tyres	*-0.274581*	*0.049133*
731	Machine tools working by removing metal or other material	*-0.273421*	*0.065604*
741	Heating and cooling equipment	*-0.521924*	*0.234065*
781	Motor cars and other motor vehicles	*-0.297624*	*0.058788*
782	Motor vehicles for the transport of goods and special purposes	*-0.532394*	*0.222796*
783	Road motor vehicles	*-0.296067*	*0.094056*
785	Motor cycles	*-0.579254*	*0.226605*

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