3

ECONOMIES OF SCALE AND THE HOME MARKET EFFECT

By Ch.Khashchuluun

1. DEFINITION OF THE "HOME MARKET EFFECT"

The "home market effect" is a hypothesis, originally presented by P.Krugman (1980) to explain trade in differentiated goods, linking it to industrial structure and market scale. The most established interpretation (Krugman, 1980, 1991, Davis, 1998) of the "home market effect" hypothesis posits that when countries with sufficiently uneven sized markets engage in trade, increasing returns to scale industry will concentrate in a larger country. The industry comprises a large number of monopolistically competing firms producing varieties of manufactured goods with increasing returns to scale production functions. Each firm in industry produces only one kind of variety from a very large set of possible varieties.

Another sector is a production of homogeneous good, produced with constant returns to scale, which is tradable internationally without trade costs. The concentration process requires Spence-Dixit-Stiglitz preferences of the "love of variety"-type for consumers and transportation costs for trade in manufactures.

The idea of the "home market effect" is that firms in the increasing returns industry would prefer a location where a smaller part of their output is a subject to transportation costs. Consequently, firms, producers of varieties, tend to concentrate in the larger country. Krugman and Helpman (1985, p.208) define it this way: "if countries are sufficiently unequal in size, whichever country the larger will produce all increasing returns to scale products". Notice that industry does not have to move to one country completely if the difference in sizes is not large; the key point is that the country with larger market will have a larger than proportional share of world production of varieties, produced with increasing returns to scale, than its share of world population.

Later the approach was detailed in the "Foreign trade and Market structure" (Krugman, Helpman, 1985). Subsequent articles by Krugman and Venables (1995), Krugman (1991), Puga and Venables (1996), Venables (1998), Davis (1998) have investigated applications and related issues of the "home market effect", such as industrial agglomeration, spatial distribution of firms, specialisation of developed and less developed countries (core-periphery effect). More recent papers extend the original model by including CES production of assembled final goods, where the manufactured varieties are intermediate inputs and essentially share the industrial structure of varieties with increasing returns to scale with the original model of Krugman. Fujita, Krugman and Venable have systemised the "home market effect"-related findings in "The Spatial Economy" (Fujita, M., P.Krugman and Venables, MIT Press, 1999), with a wide array of economic issues that the hypothesis is employed to explain.

A second and less used definition of the "home market effect" is as follows: under transportation costs, wages are higher in the larger country (Krugman, 1980, 1991). This result is explained in a following way: workers in the large country enjoy majority of differentiated goods, being produced in the large country because of transportation costs and increasing returns. Therefore, for bilateral trade between large and small countries to be balanced this must be offset by wage differential.[1]

In general, as Krugman and Helpman (1985) put it: "If there are some goods produced with economies of scale... countries... will engage in specialisation and trade because of increasing returns. Second, transportation costs... can introduce additional complications. One is... of market size: increasing returns industries will tend to concentrate in countries with large domestic markets." ("Foreign Trade and Market Structure", ch.14, "Summary and conclusions", p.262).

Summarising it can be outlined from Krugman and Helpman (1985) that 2 independent conditions are essential for the "home market effect" to arise:

Condition 1. Transportation costs for differentiated goods and costless trade for homogeneous goods.
Condition 2. Increasing returns to scale in the production of differentiated goods.

Davis (1998) argued that the assumption of costless trade in homogeneous goods, while greatly simplifying a derivation of final results, is actually "far from innocuous". He has shown that given positive trade costs for homogeneous goods, the home market effect will tend to disappear. This means that in this case the symmetric or proportional equilibrium doesn't break down and industrial concentration doesn't occur. Davis also stated that contrary to the assumption of costless trade in manufactures empirically trade costs are probably larger for homogeneous goods than for differentiated goods, varieties.

In this paper, we shall investigate the hypothesis of the "home market effect" from another point of examination: to what extent the home market effect requires increasing returns in production and does it exhibit economies of scale in general?

Because the differentiated goods are produced with increasing returns to scale, it can be expected that this Krugman's model (1985) will theoretically exhibit following economies of scale:

1. Economies of scale, internal for a manufacturing firm and related with a production function.
2. Properly, a question also arises whether the industrial concentration in a large market leads to realisation of economies of scale, external for a firm in the "home market effect" hypothesis.

Structure of the paper is as follows: section II deals with analysis of increasing returns in the original model (Krugman, 1985). Section III is devoted to the analysis of alternative production settings in the model. Section IV is concluding remarks.

2. ECONOMIES OF SCALE IN THE CASE WITH IRS INDUSTRY.

A. The basic model.
The model's setting follows original models, described in Krugman (1980), Helpman and Krugman (1985). There are 2 countries with exogenously given and fixed labor endowments, and it is assumed that one, which variables and parameters are denoted by asterisk*, has a larger labor endowment:

$$L < L^*$$

There is only one production factor-labor. It is assumed that labor domestically is perfectly mobile. This implies that wages in both production sectors whithin a country are same. Internationally, the production factor is immobile.

Each country can produce 2 kinds of goods: a homegeneous good Y, which can be called agricultural good or services and is costlessly tradable, and varieties of manufactures x, subject to transportation costs. Consumers and firms in both countries have identical preferences and production functions.

All consumers are assumed to share identical Cobb-Douglas preferences:

$$U = C_Y^{1-m} C_X^{\mu} \varepsilon \qquad (1)$$

where mO(0,1) and represents the share of consumers' expenditures on manufacturing goods x. Similarly, 1m- is share of expenditures on agricultural goods Y. C_x and C_y denote consumption of manufactures and agricultural goods. Agricultural homogeneous good Y is produced according to following constant-returns-to scale production function:

$$Y = L_Y \qquad (2)$$

L_Y stands for total labor employed in agriculture. Wages are determined on perfectly competitive labor markets. We assume that the market for agricultural goods is a perfectly competitive one, which, given the technology of (2) and average cost pricing, implies that the price p_A of agricultural good is determined by wages w as follows:

$$p_A = \omega \qquad (3)$$

Prices of homogeneous goods are assumed to be numeraire. The sub-utility function for the consumption of manufactures is of Dixit-Stiglitz type and is defined as:

$$C_x = (\sum_{i=1}^{n} x_i^p + \sum_{i=1}^{n^*} x^* i^p)^{1/p} \qquad (4)$$

where $\rho=\sigma/\sigma-1$, the elasticity[2] of substitution $\sigma>1$, and x_i and x_i^* are amount of consumed manufactures, produced by domestic and external monopolistically competing firms (asterisk* denotes foreign-produced varieties).

B. Internal Economies of Scale
The issue of industrial concentration and scale economies was studied empirically in various ways; we shall apply a recent study of scale economies in the U.S. manufacturing industry by Morrison Paul and Siegel ("Scale Economies and Industry Agglomeration", AER, vol.89, 1999)
The study discovered substantial internal scale economies, using NBER's 4-digit ISIC data for 450

industries for 1958-1989 years. In this study, total scale economies in industry are classified by components as follows (Morrison Paul and Siegel, 1999):

1. Short-run utilisation of factors as movement to the short-run cost curve.
2. Movement to the long run cost curve due to adjustment of fixed factors.
3. Increased cost efficiency due to external factors (agglomeration or "thick" market effects).

First two are essentially internal[3] economies of scale, and third is an external effect, using Ethier's (1982) classification. The study also has substantiated a notion of economies of scale effects, arising from the industry agglomeration in a large (thick) market, proposed by Hall (1990). It discovered that economies of scale are "more significantly explained by external effects", and that the "substantial industrial short- and long run scale economies…can be attributed at least in part, to the direct and indirect impacts of agglomeration externalities". So we directly concentrate on the production (of manufactures) side of original Krugman's model and analyse scale economies in the case.

The varieties of manufactured goods are produced by firms, which compete as Chamberlinian monopolies producing differentiated goods. All firms are assumed to utilise identical technology. There is free exit and entry in the X sector, which drives profits of each firm to zero profit point. Production of a variety x_i, where i=1 ,…, η and η is a total number of varieties produced in the smaller country and η^* indicates number of varieties of a larger country, takes place according to a increasing returns to scale production function. Firms incur following costs when producing a variety i :

$$l_i = F + \beta x_i \qquad (5)$$

where l_i stands for total required labor, b is constant marginal cost and F is a fixed cost, all in terms of labor units. Notice that then with homogeneous goods being produced by CRS technology, the production of varieties is the only possible source of economies of scale.

The production function, employed by the monopolistic enterprises, is a function with average costs decreasing in output as expressed by the (5).

All varieties x of differentiated goods enter the sub-utility of a consumer symmetrically. Given identical technologies of all firms and symmetry, we can drop subscripts. Marginal revenue of firms-monopolists is given by:

$$MR = p(x)\left(1-\frac{1}{\sigma}\right) \qquad (6)$$

where σ is elasticity of demand by definition. Finding marginal cost from the cost function (5), and equating marginal costs and marginal revenue, we can express the typical monopolistic mark-up rate over costs as:

$$\frac{p}{w} = \beta\left(\frac{\sigma}{\sigma-1}\right) \qquad (7)$$

Firms face free entry, which drives their profits to zero. The-profit condition in turn implies that cost function parameters and the common price elasticity of demand σ, identical for all varieties, define output *x*:

$$x = \frac{F}{\beta}(\sigma-1) \qquad 8$$

Notice, that since cost parameters β and F and demand elasticity σ are common for all firms, it means that all firms produce same volume of output, as mentioned in Krugman and Helpman (1985, p.206)

However, what is also important here is that neither costs β, F nor demand elasticity σ depend on output of a single firm of industrial output in general. Since the cost and demand parameters are exogenously given and are fixed, they essentially establish output of each firm independent of demand side. Since fixed costs F are invariable in long-run time period either, it means that irrevelant of time span, wages, country and demand levels, output of each differentiated good x is *constant*

Average costs AC are given as:

$$AC = \frac{F+\beta\bar{x}}{\bar{x}} = \frac{F}{\bar{x}} + \beta \qquad (9)$$

With output X being constant, average costs of each firm are constant as well. With a market equation (7), prices of each variety are effectively fixed.

Recall that the "home market effect" implies concentration of industry in larger country. From (9) we can see that even if industry concentrates in one (larger) market because does not enter the Eq (9), there will be no movement along or to the average cost curve, so no internal economies of scale actually work in the model.

Therefore, we are justified to conclude the analysis of internal economies of scale in the orginal Krugman's model (1980,1985) as follows.

RESULT1:
Economies of scale are represented by increasing returns to scale prodauction function in industry. However, volumes of output and average production costs of firms remain constant independent of the degree of industrial concentration so these increasing returns to scale are not realised . Therefore the "home market effect"does not exihibit internal economies of scale.

C. External Economies of Scale in the model
Since the economies of scale and the home market effect at least at a firm level are unrelated the remaining possibilty is that increasing returns of scale contribute somehow to the industral concentration or that industral concentration leads to realising the economies of scale. To find how the economies of scale on the industry level and concentration are related we shall first derive the home market effect similar to the orginal model.

The homegeneous agricultural good Y is traded internationally without trade costs. Therefore its price is same in both markets which also equates wages in both countries so that $\omega=\omega^*$. With identical technology and wages prices p and quantities x of manufactured varieties are same in both countries as well.

It is assumed that all traded manufactured varietes are subject to Von Thunen Samuelson–type "iceberg" transportation costs. When a domestic firm exports volume *q* of the differentiated good *i*, only q/t $(t>1)$ lands on the destination market. Consequently to sell abroad amount q of the good i at price p and realise revenue pq the domestic firm must ship amount tq/t at price p which increases its destination market price from p to pt^*.

Wage ω is the only source of income for consumers. Share of expenditures that each consumer in a smaller country allocates to manufacturing varieties is:

$$\mu\omega = \sum_{i=1}^{n} p_i x_i + \sum_{i=1}^{n^*} tp^* x^*_i \quad (10)$$

Notice that domestic price of a foreign produced variety x^* has to be multiplied by t (transportation costs) to incorporate trade costs which a foreign firm bears entering the domestic market. Foreign consumer's expenditures for manufactures in analogy to home one are defined as:

$$\mu\omega^* = \sum_{i=1}^{n} tp\chi_i + \sum_{i=1}^{n^*} p_i \chi^*_i \quad (11)$$

From the (4) and (10) it is straightforward to calculate demand functions for differentiated goods. Since all varieties enter the utility function symmetrically and are identically produced dropping subscripts we can find the demand for a variety x in the domestic market (superscript d denotes domestic sales, f – foreign market sales)

$$\chi^d = \frac{p^{\sigma}}{np^{-\sigma} + n^*(tp^*)^{1-\sigma}} \mu\omega Lt \quad (12)$$

In similar fashion we can find the relevant expression of how much foreign-produced variety $x\ d^*$ is sold in a domestic market (note that it is multiplied by t to incorporate transportation costs)

$$x^{d^*} = \frac{(p^* t)^{-\sigma}}{np^{1-\sigma} + n^*(tp^*)^{1-\sigma}} \mu\omega Lt \quad (13)$$

Domestic producers face foreign-market demand:

$$x^f = \frac{(tp\ )^{-\sigma}}{n\ (tp\ )^{1-\sigma} + n^* p^{*1-\sigma}} \mu\omega^* L^* t \quad (14)$$

Finally, x^{f^*} determines how much of foreign produced variety x^*_i, is sold in a foreign market:

$$x^{f^*} = \frac{p^{*-\sigma}}{n\ (tp)^{1-\sigma} + n^* p^{*1-\sigma}} \mu\omega^* L^* \quad (15)$$

It is convenient to calculate price elasticity of demand σ here It is assumed that firms perceive total demand and number of firms as given. Using the domestic and foreign demand for a variety as given in (13) and (15) we can marginal demand and average demand for a variety. Combining the results gives the standard price elasticity of demand per variety x as $\varepsilon p=\sigma$. With the constant price elasticity σ, therefore as was shown earlier by (8) and (9) we see again that any changes in geographical

structure of industry have no impact on average costs.

Total demand for each variety is given by a sum of domestic and foreign demand.

$$x = x^d + x^f \quad (16)$$

Equating the demand and supply for varieties gives the broken symmetry equilibrium in which for sufficiently unequal sizes of L and L* production of all varieties x will shift to the larger country (for a detailed derivation see Helpman, E. and Krugman, P., 1985, or Krugman, P., 1980). First, we find[4] total industrial output of manufactures in the home country:

$$X = nx = \frac{np_i^{-\sigma}}{np^{1-\sigma} + n^*(tp^*)^{1-\sigma}} \mu\omega L + \frac{n(tp_i)^{-\sigma}}{n(tp)^{1-\sigma} + n^* p^{*1-\sigma}} \mu\omega^* L^* \quad (17)$$

Similarly, total industrial output of foreign-produced varieties is found:

$$X^* = n^* x = \frac{n^*(p_j t)^{-\sigma}}{np^{1-\sigma} + n^*(tp^*)^{1-\sigma}} \mu\omega Lt + \frac{n^* p_j^{*-\sigma}}{n(tp)^{1-\sigma} + n^* p^{*1-\sigma}} \mu\omega^* L^* \quad (18)$$

The notation is changed to allow for more compact solutions, as we find n and n* from the equations 19 and 20. Since in both countries wages are equal due to costless trade in homogeneous goods and prices of manufactures are given by identical mark-ups over wages Krugman and Helpman select units of measure such that:

Assumption 1.Equations (17) and (18) can be simplified, using Equations (7) and (10), and by selecting appropriate units of measure such that $p^*=\omega^*=p=\omega=1$.

Then from (17) and (18) it is easy to derive expressions for n and n*:

$$n^* = \frac{\mu}{(1-t^{1-\sigma})x}(L^* - t^{1-\sigma}L) \quad (19)$$

$$n = \frac{\mu}{(1-t^{1-\sigma})x}(L - t^{1-\sigma}L^*) \quad (20)$$

Then, we introduce s_n as a share of domestic industry n in total world industry:

$$s_n = \frac{n}{n+n^*}$$

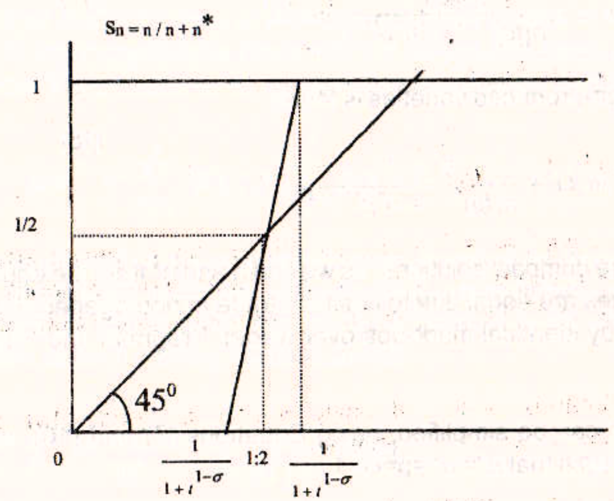
and s_L as a share domestic population in the world:

$$s_L = \frac{L}{L+L^*}$$

After some calculations, we can derive the final expression of the Krugman's "home market effect" for a case when both countries produce industrial goods:

$$s_n = \frac{(1+t^{1-\sigma})s_L - t^{1-\sigma}}{(1-t^{1-\sigma})} \qquad (21)$$

The equation (21) is in fact identical to the "home market effect" equation in Krugman and Helpman (1985). Graph 1 illustrates the "home market effect": the 45-degree line depicts symmetric equilibrium without trade costs. Even with trade costs, the symmetric equilibrium will exist when labor endowments of both countries are equal at a point (1/2). However, when labor endowments (markets) differ in sizes, both to the left and right from the point (1/2), the symmetric equilibrium breaks down and industry concentrates in a larger country.



Graph1.

The Equation (21) is a main equation of the "home market effect". Indeed, as a country's size deviates from the symmetric equilibrium size (1/2) by more than $t-1/2(1+t^{1-\sigma})$, depending on a direction of the deviation, all industry will concentrate in a larger country.

As the Result 1 shows, the production concentration or the "home market effect" does not result in realising *internal* economies of scale. However, industrial concentration will not lead to scale economies at industry level either, because,

1. The cost structure of firms doesn't experience any external impact as a result of the concentration and the average cost equation (9) remains valid.
2. The Assumption 1 states that prices and costs *w* will remain unchanged for any outcome of industrial relocation process. Thus, it is justified to state the Result 2 below as:

RESULT 2:
Concentration of industry in a larger market does not result in emergence of external economies of scale to reduce average costs.

Given the Results 1-2, stating that the industrial concentration does not lead to changes in costs and output, a remaining possible source of scale economies is an increase in number of available varieties as a result of industrial concentration. Such an increase would raise consumers' utility, although their incomes or goods' prices will not change. Recall that the "home market effect" implies that depending on relative sizes, there can be only two outcomes for production of differentiated

goods:

The countries are sufficiently unequal in size so that all industry is concentrated in a larger country. Since by assumption L*>L, in this case all available varieties are given by n*, such that n=0 and n*>0. Total number of available varieties in this case is found from Eq.(17) and (18) and it is equal to:

$$n^* = \frac{\mu}{x}(L + L^*) \qquad (22)$$

2. Another possibility is that sizes of countries are sufficiently close for given transportation costs, so that the smaller country also produces manufactures, although a less than proportional share of them: n>0 and n*>0. In this case, total number of available varieties is sum of n and n*:

$$n^* + n = \frac{\mu}{(1-t^{1-\sigma})x}(L^* - t^{1-\sigma}L) + \frac{\mu}{(1-t^{1-\sigma})x}\left[L - t^{1-\sigma}L^*\right] = \frac{\mu}{x}\left[L + L^*\right] \qquad (23)$$

The equations 22 and 23 show that in both cases, with complete and incomplete industrial concentration, the number of available varieties is same. Therefore, it is possible to formulate the result 3 as follows:

RESULT 3:
The "home market effect" does not result in increase in the number of available varieties n+n*

Since the concentration process does not change average costs, output volumes, wages, prices and number of available varieties, it can be summarized that external economies of scale are absent. Proposition 1, stated below, combines results 1-3, derived above:

PROPOSITION 1.
The "home market effect" does not exhibit internal or external economies of scale in terms of decreasing production costs, lower prices and wider variety of manufactures.

3. ALTERNATIVE INDUSTRIAL STRUCTURE AND THE HOME MARKET EFFECT

The result 1-3 derived above and the Proposition1 show that the "home market effect" does not result in economies of scale for a firm or industry. Examining the Eq. (21) demonstrates that production function parameters or scale economies are not present in the equation (21). One can see that the share of industry s_n, which the country owns, ultimately depends only on its relative market size and transportation costs t . Therefore, increasing scales have no role in the concentration process itself.

Then, if the "home market effect" is not related to increasing returns to scale, it is possible that it arises purely from the existence of transportation costs t for manufactured goods? In this case, the "home market effect" must appear even if no increasing returns to scale industry is present in the economy. Thus, we state in the proposition 2 that:

PROPOSITION 2.
Increasing returns of scale in manufacturing does not cause the "home market effect". The "home market effect" arises only due to existence of transportation costs for manufactures and difference

in market sizes.

Proof.
Assume that industrial firms do not employ increasing returns to scale technology as in Krugman's case, but instead describe production of a variety *i* in a smaller country (if it produces them) by the equation 24, where

$$x_i = f(l_i),\ f'(l)>0 \tag{24}$$

x_i is output of variety *i*
l_i is total labor employed for production of the variety *i*

Other basic equations of original model, namely Eqs. (1-4) and (10-11) remain unchanged. Consumers' utility is given by (1), sub utility by (4), and consumers spend their income *w* as to maximize (1). As before, consumers will spend a constant share μ of income on differentiated goods.

Total labor requirements for production of a variety *i* is

$$l_i = \psi(x_i),\quad \psi'(x) > 0 \tag{25}$$

Assume that total cost function ψ is not homothetic and does not exhibit external economies of scale (wages remain fixed by the Assumption 1). A homogeneous good Y, is produced by a CRS function, so then in general this economy does not have any sources for possible economies of scale if the production function (24) is not IRS function.

Firms incur total wage bills C_i to produce a variety *i*, where , given the labor requirements (25), total costs are represented as:

$$C_i = wl_i = w\psi(x_i) \tag{26}$$

Total revenues of a firm are given as TR = $p_i(x)x_i$. Firms produce up to the point where their marginal revenue and marginal costs are equal:

$$p_i(x_i)\left(1-\frac{1}{\sigma}\right) = w\psi'(x_i) \tag{27}$$

The zero-profit condition leads to:

$$x_i = \frac{\psi(x_i)}{\psi'(x_i)}\left(1-\frac{1}{\sigma}\right) \tag{28}$$

Note that (28) describes output determination for industry with Chamberlinian monopolistic competition in general, for all cases of possible technologies. Krugman's cases with increasing returns to scale (1980, 1985) as well as other aforementioned models of industrial agglomeration with similar industrial structure are specific cases of general setting of (28). If we assume that ψ is defined as in Eq. (5), then output *x* is determined similarly with Eq.(8).

In order to see whether the "home market effect" can arise with alternative production settings, we shall analyze cases with constant returns to scale.

First, recall that all firms are symmetric, utilize similar technologies and face symmetric demand curves. Therefore, if for a given demand, technology and costs a firm's output is determined and is positive, then volume of output of all produced varieties is determined similarly (and the subscripts are not necessary). In (17) and (18) total industrial output is determined as X=*nx* and X*=*n***x* , so if *x* is determined from the Eq.(28), then we can apply the same procedure as described in (17) and (18) to determine *n* and *n**.

The proof then simplifies to finding whether the output of a variety *x* can be determined from (28) for different types of cost function associated with different technologies.

But for constant returns to scale the problem is that output per variety is generally undetermined given the SDS preferences, free entry and no-profit condition in the monopolistic industry. We shall try first to determine upper and lower boundaries for output of varieties under constant returns to scale.

For the increasing returns to scale, output of each variety is defined, and with the assumption of very large set of possible *n* each firm perceives demand and consumer expenditures as given (Krugman, Helpman, 1985), and price elasticity of demand, which each firm is facing, is given from the sub-utility SDS function. For increasing returns to scale it was precisely given by σ, elasticity of substitution between varieties.

However, the assumption of constant elasticity of substitution, usual for the Dixit-Stigliz preferences, may not be applicable for the case where production is a subject to constant returns to scale. With constant returns to scale, where hypothetically output of a firm may be as large enough as to influence the total price index of varieties, price elasticity of demand each firm faces, can be modified. For simplicity, assume that a country is in autarky state. For very large firms, price elasticity of demand ε will look like:

$$\varepsilon = \sigma + (1-\sigma)\frac{p^{1-\sigma}}{\sum_1^n p^{1-\sigma}} \tag{29}$$

Usually for very large set of n, the second term is assumed to be zero. But if n is small, all firms are symmetric and set identical prices p, the second term simplifies to:

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

On the other side, because of the market clearing condition for goods, it must be true that total sales of varieties are equal to the total expenditures for them:

$$\mu wl = xn \tag{30}$$

Using the Eq.(30) we can see that given wages, population and Cobb-Douglas tastes,

$$n = n(x),\ n'(x) < 0 \tag{31}$$

we can establish that diversity of varieties n and output of each variety are inversely related. The price elasticity of demand, which each monopolistic firm faces, is modified as:

$$\varepsilon = \sigma + \frac{(1-\sigma)}{n(x)} \qquad (32)$$

Meaning of the Eq. (32) is that elasticity of demand for firms is no more constant, but varies with output of a firm. Recall that by assumption >1 for monopolistic competition, since for =1 marginal revenue becomes zero. Increase in output of a firm under constant returns to scale will lead to lower number of varieties and lower elasticity of demand it faces. We can assume that there exits $\tilde{x}$ such that for it ε =1. A firm will not increase its output since for any x, exceeding $\tilde{x}$ elasticity of demand will become less than unity and its marginal revenue will turn negative. A consequence of it is that output will be bounded from above.

Turning to the lower bound, a natural assumption is that while a firm can produce and sell 1,2... m units of variety, it can not sell 1/2 of it, since 1/2 of a TV set or a pair of shoes does not make much sense and varieties are not homogeneous goods.

Suppose that each firm in industry employs a following production function:

$$x = kl,\ x'(l)>0,\ 0<k<1 \qquad (33)$$

where x stands for output of a variety, k is a constant positive technological parameter and *l* is employed labor. Compared to the agricultural production, this is more labor-intensive production function. Production of unit 1 of variety (minimal possible output, if produced) will require at least 1/k units of labor. Then it is minimal size of a firm in industry.

Summarizing, output of each variety i, i=1,2,... ,n if produced, will lie between:

$$x_{\min}(1/k) \le x \le \tilde{x}_{\max} \qquad (34)$$

Although output of each is not determinate, nevertheless, to derive "home market effect" it's only needed that all varieties are symmetric and produced with identical technologies. Since all industrial output in a smaller country is given by $X=xn$, and in large country $X^*=xn^*$, and only ratio of shares of total output matter for the "home market effect", we again can apply the equations (19) and (20). Then, again shares of industry are given by:

$$s_n = \frac{n}{n+n^*}$$

and we again can express the industrial concentration for constant returns to scale in analogy to increasing returns to scale:

$$s_n = \frac{(1+t^{1-\sigma})s_L - t^{1-\sigma}}{(1-t^{1-\sigma})}$$

CONCLUSION

Since the first article of Krugman (1980) on the "home market effect" it was believed that international trade, with increasing returns to scale and with "iceberg" transportation costs, will result in

industrial agglomeration. While arguably increasing returns to scale are convenient way of presenting the derivation of the concentration effect, it is clear that fundamentally the effect is not caused by economies of scale and by increasing returns in particular.

We have shown that in presence of transportation costs, the industrial concentration will take place irrelevant of economies of scale. Increasing returns to scale are not necessary for the "home market effect" to arise. Indeed, the main condition is that all varieties are produced by identical technologies and symmetrically enter sub-utility function of consumers.

The "home market effect" can then as well arise under constant returns to scale.

In this 1980 paper of Krugman, homogeneous goods are not featured. Hovewer, Krugman (1991) extends the definition of the hypothesis for a model with homogeneous goods.

In case of n approaching infinity, σ is also a price elasticity of demand for the firm (see Helpman and Krugman, 1985)

With industrial goods traded internationally, problems of national and world market scale appear. In Ethier (1982) the internal to a firm economies of scale are called traditional and defined as "national" ones, while the "international" economies of scale are those realised on industry (world market) level. Ethier's model features firms, producers of final goods, which are assembled by SDS production function from intermediate inputs.

Here we employ the original technique, employed by Krugman and Helpman (1985), to check location of the industries.

In general, with love of varieties preferences, there is no need to worry about upper boundaries for output of a variety. Consumers will want more diversity, preferring it to quantity. However, with varying demand elasticity the outcome is not so clear.

REFERENCE

1. Davis.R., *"The home market, trade and industrial structure"* AER, Vol.88, 1998, No.5 1264-1275
2. Dixit.A, Norman.V., *"Theory of international trade"* 1980, Cambridge university Press
3. Ethier.W., *"National and international returns to scale in the modern theory of international trade"*, AER,72, 1982, 950-959
4. Fujita.M, Krugman.P., Venables.A *"The Spatial Economy"* MIT Press, 1999
5. Krugman.P., *"Increasing Returns and Economic Geography"*, JPE, 1991, no.31, 483-499
6. Krugman.P., Helpman.E, *"Market Structure and Foreign Trade"*, MIT Press, 1985
7. Krugman.P., Venables.A, *"Globalization and the Inequality of Nations"*, QJE, 1995, 4, 857-880
8. Martin.P., Rogers.C *"Industrial location and public infrastructure"* JIE, 39, 1995, 335-351
9. Martin.S., "Applied Industrial Economics", Blackwell, 1993
10. C.Morrison Paul and Siegel.D., *"Scale Economies and Industry Agglomeration"* AER, Vol.89, 1999, 272-290
11. Puga.D., Venables.A., "The Spread of Industry: Spatial Agglomeration in Economic Development" Journal of Japanese and International Economics, 10, 440-464, 1996
12. Venables.A, *"Geography and specialisation: industrial belts on a circular plain"*, in ed.Baldwin R., Cohen, D.,Venables.A., (eds), *"Market Integration, regionalism and Global Economy"*, 1998, Cambridge University Press, 154-273