DOES DISTANCE TO BORDER DETERMINE EXPORT INTENSITY: EVIDENCE FROM UKRAINIAN MICRO DATA

by

Oleksii Zagidullin

A thesis submitted in partial fulfillment of
the requirements for the degree of

MA in Economics

Kyiv School of Economics

2009

Approved by _____
KSE Program Director

_____

_____

_____

Date _____

Kyiv School of Economics

Abstract

DOES DISTANCE TO BORDER DETERMINE EXPORT INTENSITY: EVIDENCE FROM UKRAINIAN MICRO DATA

by Oleksii Zagidullin

KSE Program Director: Tom Coupé

Currently existing literature pays a lot of attention to investigation of export using such explanatory factor as distance between countries. In contrast, this paper uses internal distances (proxy for transportation costs) for similar purpose. It contributes to the literature the developed theoretical model which links export intensity and internal distance to the border. The model was empirically tested on micro level data for Ukrainian manufacturing firms. Estimations resulted in significant quadratic relationship between physical distance and export intensity. This result may be used both by entrepreneurs and policymakers to improve efficiency of export performance in Ukraine due costs restructuring.

TABLE OF CONTENTS

LIST OF FIGURES

ACKNOWLEDGMENTS

The author wishes to thank Volodymyr Vakhitov, his adviser, for the constant supervision, help with the data collection and invaluable comments. He is also grateful to all professors, who has read and commented the paper on all the stages of the writing process, namely, Hanna Vakhitova, Olena Nizalova, Sergiy Maliar, Pavlo Prokopovich, Olesia Verchenko and especially Tom Coupe. The author fails the words to thank his fellows Valeria Zhydko and Sergiy Gienko for the constant support and encouragement.

GLOSSARY

Export intensity. Ratio of amount of goods exported in money terms to total output of the firm.

Physical (internal) **distance**. In current paper length of segment between to points measured in kilometers (inside the country). The shortest length is taken not actual road distance.

Chapter 1

INTRODUCTION

The contribution of international trade to economic growth is often illustrated using the example of Eastern Asian countries. Many experts have argued that recovery in these countries and subsequent boom became possible due to the focus on export oriented sectors (Edwards and Alves, 2006). Because of the importance of export for economic growth economists have studied its different aspects for quite a while. In particular, scholars are looking for the explanation of why some firms export while others do not.

For Ukraine export creates a valuable part of GDP. For example, in 2003 gross export accounted for 46.0% of GDP of Ukraine, in 2004 – for 50.3%, in 2005 – for 39.7%, in 2006 – for 35.63% and for 34.5% in 2007. Although in the current study we are not using the data for 2008-2009, we stress the importance of export for Ukraine in today's economic situation. During the crisis reduction of exports worsen the situation in the country immensely, even more than it was expected.

Export activity demand firms to meet additional sunk costs during launching period and of cause costs for transportation which are variable. Microeconomic theory suggests the hypothesis about costs decreasing behavior of firms. For exporting firms delivering of produced goods to destination is an essential part of internal expenditures. Transportation cost can be restructured to increase effectiveness of firms' performance. In particular, firms may create affiliates closer or farther from their customers' location, add new or drop old customers from their portfolio or even move whole capacities to another location. Location

in our case is determined by straight physical distance (inside the country) of the production place to transportation hubs, points where goods actually cross the border of the country (ports, airports, auto and railway customs stations).

So, the question is whether internal physical distance from a firm to a transportation hub (proxy for internal transportation costs) partially explains firm's export intensity.

Similar relationships were addressed in works of Gries et al. (2008) and Naudé1 et al. (2007). Both studies used data for Southern Africa. Though Ukraine has many in common with Southern Africa (e.g. difficult political situation during the considered time period and complicated procedures of registration and doing business, in particular, of export oriented one). But simple extrapolation of results obtained for Southern Africa should not be applied to Ukraine as transportation systems of the countries are quite different. Ukraine historically is located on the cross of trade routes and intensively uses all kinds of transport for international trade. In contrast, Southern Africa located far from potential partners and mainly uses sea ships for carrying goods to final destinations. Moreover, Ukraine has good relationships with CIS countries. That gives a lot of opportunities to trade within comparatively short distances, spending less on transportation. Thus, the question of importance of internal distances for Ukraine still remains open.

As economy of Ukraine is in the transition period from closed Soviet economy to open market economy this research can be valuable for entrepreneurs as it may provide additional knowledge about export determinants in general and internal transportation costs in particular. Policy makers who are advocates of an export oriented economy can learn how to provide support to market participants, i.e. how to expand transportation network or which regions provide with subsidies

(creating free economic zones to encourage location of firms in particular places) to reduce transportation costs.

Based on the theoretical model provided in Gries et al. (2008) we have developed our own model which proposes a link between export intensity and distance to hubs. Transcendental functional form is used to model costs as it possesses all properties of cost function. This approach leads to a non-linear relationship between export intensity and physical distance in the model and thus, can not be directly used for estimations. But nevertheless, it forms the basis for our empirical estimates.

For empirical testing we use unbalanced longitudinal data on Ukrainian exporters performing in production sector. This feature of the data potentially could lead to bias but suggested estimation is the best we can do for available data. Our sample contains information about annually aggregated export performance at a firm level. The usual estimation frameworks used for similar problem are fixed effect (FE), random effect (RE) and pooled ordinary least square (OLS) estimations. Robustness check is provided through comparing results on separate estimations for different industry sectors, for different groups of firms with respect to size and forms of property.

Estimations resulted in significant quadratic relationship between internal physical distance and export intensity, taken in natural logarithm. In particular, we found that, given current distributions of firms' characteristics, positive change in distance up to 1000 kilometers results in positive growth of export intensity, getting maximum of 45% at increase on over 500 kilometers. Increase in more than 1000 kilometers or any decrease in distance results in fall of export intensity.

These results can be used for development of export activities. So, policymakers can use distance as an instrument to control export intensity of firms. Depending

on goals distances may be increased (creating new hubs) or decreased (removing or relocating old hubs). Entrepreneurs also may benefit from our paper using model for planning future location of production facilities for determined beforehand expectations about export intensity.

Chapter 2 reviews relevant literature on the topic distinguishing theoretical and empirical works. Chapter 3 describes the model developed in this paper and provides theoretical background on which estimations are based. Chapter 4 sheds light on data composition, empirical estimation, shows results of estimation and discusses them. Final conclusions, practical implementations and directions for further researches are provided in Chapter 5.

Chapter 2

LITERATURE REVIEW

Correlation between export and huge amount of other factors were studied by now. Among those factors are economic, political, sociological, psychological, legal, etc. Relevant literature provides us with models of different complexity giving background for further empirical investigations. But data availability still appears to be the most severe problem for researchers.

We start with a theoretical work by Melitz (2003) as in recent time it has become a base and benchmark for substantial amount of both theoretical and empirical works. Then empirical works are reviewed some of which contain theoretical backgrounds. In turn, they are divided into three parts. First pattern deals with suitable for our research mathematical tools. Second one contains different papers which discuss export relationship with different factors suggesting different directions of causality. Literature is grouped according to similarities of the used empirical models. Finally, attention will be focused on the partial model investigating correlation between transportation and other costs (as well as their approximations with distances) and export.

Melitz (2003) formulated a dynamic industry model explaining the relationship between firms' performance and decisions to enter or exit foreign markets, increase or decrease market share, enter or exit the domestic market. Firms in the model are assumed to be heterogeneous and grouped by industries. The paper states that entry into the export markets is costly but the firm's decision to export occurs after it gains knowledge of its productivity. Thus concluding

that exposure to trade will induce only the more productive firms to enter the export market (while some less productive firms continue to produce only for the domestic market) and will simultaneously force the least productive firms to exit. It then shows how further increases in the industry's exposure to trade lead to additional inter-firm reallocations towards more productive firms. The paper also shows how the aggregate industry productivity growth generated by the reallocations contributes to a welfare gain, thus highlighting a benefit from trade that has not been examined theoretically before.

Helpman et al. (2003) mentioned in their paper three ways for firms to reach foreign markets. Each firm may contract with foreign firms to produce and sell their products. Wider discussion in the paper is devoted to export and foreign subsidiaries by engaging in foreign direct investment (FDI).

The authors concentrated their discussion on firms' choice between export and horizontal FDI. The multicountry, multisector general equilibrium model was suggested to explain choice of heterogeneous firms to serve foreign markets through exports or local subsidiary sales. The paper stresses that intraindustry firm heterogeneity in terms of performance plays an important composing role for international trade. Final theoretical results of the paper are:

- the most productive firms only participate in export activities (this result goes in line with the results reported in Melitz (2003));
- of those firms that serve foreign markets, only the most productive engage in FDI.

Both theoretical models argue that activities on foreign markets require firms additional sunk costs which can be easier internalized by firms with higher performance. Moreover, adjustment to these costs is a gradual process.

Emphasis on discussion of previously used determinants and results of estimation are done in the following overview of empirical studies.

Cross country variation of export orientation of US affiliates was investigated by Kumar (1994). Structural Characteristics of host countries assumed to be important for US multinational enterprises. Especially the author marked average wage rate, which is important to investors during organizing export oriented affiliates. Wage rates in Ukraine are not very high compared to other CIS countries, so in can be sought as quite a strong competitor among developing countries thus being an attractive place for potential investors.

Policy environment is another group of determinants discussed by the author. One of the factors tested was international orientation of the host economy measured by the share of international trade in GDP. The most influential factor according to the conclusions from the article is the presence of export processing zones which provide more efficient infrastructure, port facilities and privileges, tax holidays, freedom to import intermediate goods and raw materials duty free (without any tariffs).

Among other discussed factors are the presence of incentives provided by the government, internal requirements for export performance, the presence of FDI from other investors and OPEC member dummy.

Sridhar and Wan (2007) explored location choice of firms. Their research considered China, India and Brazil (CIB) as substantial growth of these countries can serve to improve situation in many developing countries and positive evidence could be shared. They employed a multichoice model with the explained variable for a firm located in a particular city or town.

There was explored a dummy variable indicating whether a firm was established before the reformation wave (series of reforms started in 1978 and directed to improve political and economic stability in the countries) or after. For all three countries it was found to have significant impact at 10 per cent level of significance. That can be useful for our work to follow analogical technique as Ukraine also had similar structural changes after becoming independent in 1991 and after reformation period in 1996 (monetary reform: new currency). Results also underline importance of wage, resource base and level of education for allocation choice of firms.

It was mentioned that one of the most important conclusions from the research concerns policies of local governments of large cities: providing additional incentives it is not needed to attract firms to large cities as mostly they tend to operate there due to accessible amenities, agglomeration effects, and political clout.

Holzmüller and Stöttinger (1994) suggested a structural model which contains a lot of explanatory factors divided into five groups: objective business characteristics, organizational culture, objective manager characteristics, subjective manager characteristics and environment. The authors found that "hard as well as soft factors have an impact on export performance"[1].

Suggesting explanatory factors the authors mainly follow their intuition rather than any sound theory. Arguing that the investigated model is structural and contains factors that previously were used in partial models only, researches demonstrated that different areas of research can be tied together in order to check their contribution to the explanation of export performance

simultaneously. Such an approach guarantees that the influence of single factors is not overestimated.

Wagner (2002) using panel data set for Germany tried to match causal effects of starting to export on firm performance. Relationship found to be positive between export and growth of employment, labor productivity, and wages.

Causality was discussed. On the one hand there are theoretical explanations of why export can imply better performance:

- performing on a large market, the firm is able to use the effect of economies of scale or provide reduction in variation in domestic demand;

- exporting firms encounter higher competition and thus should improve performance faster not to exit the market.

On the other hand starting export can be treated in the following way:

- there exist additional cost of export and they are hardly can be covered by small firms or ones with low performance.

Causality direction was under consideration. For this purpose the control group of non-exporters was created with as similar characteristics as possible in comparison with the treatment group (export starters) prior to the point in time when export started. Results: starting export has significant effect on growth of employment and wages, and weaker on labor productivity.

---

[1] "Soft factors like the psychical stress tolerance, the manager's foreign orientation, and the dynamic organizational culture show a large influence on export performance, as do hard factors such as firm size, the line of industry, or the international market position" (from the article Holzmüller and Stöttinger, 1994).

Summarizing this article we can stress that one should be very cautious interpreting causality in relationships of such type.

The research by Zhao and Zou (2002) was focused on export performance of Chinese firms. The authors conjectured that each firm's export behavior is composed of two separate decisions:

- whether to became an exporter;
- which portion of output to export.

Industry concentration and location of the production capacities were chosen as main factors to explore in the study. Authors stressed the importance of looking at external determinants because of the lack of available evidence of their impact. Frequently studied factors such as firm size, capital intensity and technology innovation were also included into the list of determinants.

The obtained results showed a negative impact of industry concentration both on export propensity and export intensity. Such conclusion is opposite to the common view that firms operating in highly concentrated markets are willing to export and tend to export more than similar firms in competitive industries.

The second finding is in line with intuitive expectations of the authors. Location advantages have positive effect on export propensity as well as on export intensity. Among present advantages closeness to ports, availability of skilled labor and free economic zones were mentioned.

One more study by Mittelstaedt et al. (2006) was dedicated to propensity of US firms to export. The effects of firm size, urbanization and industrial concentration were investigated. For this purpose all firms were divided into four groups by size (< 20 – micro, 20-99 small, 100-499 – medium, > 500 –

large). Logistic regression approach was employed. Determinants were all found to be significant and positive effects on the propensity to export were detected. The firm size was concluded to have the greatest effect. Thus, results imply that larger firms are more likely to export than smaller ones and with increase of urbanization or concentration of particular industry the likelihood of export activity increases. Among the features of the paper investigation of industry specific factors should be mentioned. Authors noted that in some cases industry specific determinants add additional explanation to the results observed, while in other cases they do not. That implied that the effects of internal and external scale economies are different across industries.

The next pattern of works is extremely important for the current research. These works explore export activity with respect to internal distances to transportation hubs, providing evidence of other countries.

Naudé1 and Matthee (2007) studied export-oriented manufacturing firms of South Africa. We should mention that Ukraine have many similar problems to those in South Africa in terms of difficulties of manufacturing and trade (e.g. high taxes, complicated procedures of start-ups, corruption and others). The authors marked that trade liberalization was significant after starting the reformation processes in 1995.

They proposed to employ cubic spline functions to construct the urban population density. The researchers concluded that most export oriented firms who produced more than 70 per cent of manufacturing exports in South Africa are located within 100 km area from the ports. The second band of firms is located between 200 and 400 km from the ports.

Observations revealed that between 1996 and 2004, manufactured exports in the band between 200 and 400 km from the nearest port increased. Several explanations of this fact were suggested in the paper:

- changes in international and domestic transport costs;
- an increase in manufactured exports that depend on natural resources due to demand factors;
- inflation in land-rents or wage rates in the vicinity of hubs;
- increasing productivity of export plants due to scale effects.

It would be interesting to construct a similar density function and try to trace the dynamic of export oriented locations with respect to hubs at least for available data. This can be useful to investigate distribution of exporting firms with respect to location of transportation hubs, and can be used for improvement of Ukraine's transportation network.

Actual road distances in kilometers are used in the paper. In contrast we are going to use direct distance calculated using the "great circle" formula. The argument for this choice is the following: territory of Ukraine is mostly "convex", thus, direct distances are reasonable approximations for actual road distances, given the data availability.

Valuable evidence can be got from recent paper by Gries, Naudé and Matthee (2008). This work also uses data for South Africa. Distance is used by the authors as explained variable. Factors to explain are Exports, Imports, Human Capital which was approximated by the number of people per locality with the school degree matriculation and higher, Primary Share represents resource intensity of production in each magisterial district, authors used share in gross

value added from primary production (mining and agriculture). Several different models were empirically tested. First, both export and import were included separately. Then the model without import and another one without export were estimated. And finally, in the last model summation of import and export was included as determinant. As results were similar in all four models with expected signs of estimated coefficients and with appropriate level of significance authors concluded that results were robust.

In 67 magisterial districts (out of 354) no export was reported, in 37 districts no import was reported, and in 28 districts both export and import were are absent according to report. That implies that "access to imported inputs is important for firms to export in South Africa" which goes in line with research by Edwards and Alves (2006).

Evidence on the related topic is rich enough. In the paper we are going to use and check findings on firms' scale parameters as explanatory factors of export.

Why is Ukraine interesting for investigation? First, Ukraine is the country in transition what means the presence of different economic imperfections which are worth to study for future improvements. Second, geographical location of Ukraine allows resident firms to export goods in all directions using different modes of transportation. Thus, question of optimal location in terms of distances is important for efficiency increasing. Finally, Ukraine is a large country with strong resource base and production capacities which should be used in optimal way to let Ukraine be competitive on the world markets.

Important feature of the research is that straight physical distances would be used as determinants of export intensity to capture the effect of transportation cost. Thus, current research would contribute into sparse literature with distance taken as determinant of export characteristics.

Chapter 3

THEORETICAL MODEL

According to previous findings it can be concluded that export and export intensity is affected by numerous factors. So, first we are going to develop a theoretical model to explain export intensity decision taking into account most relevant determinants. As a base the model by Gries et al. (2008) is taken.

Suppose a finite number of firms located in one country which operate in two markets: domestic and foreign. In our model we conjectured all firms to be homogeneous in terms of cost structure.

We assumed cost minimization behavior of firms. Thus, it is important to identify cost structure in a clear way. Following types of costs are taken into account: labor cost (wages), human capital cost (effective costs for employing skilled labor in the region) and transportation cost (cost of carrying produced goods to internal and foreign markets).

Transportation (carrying) cost is one of the essential parts of total cost of any product which is export oriented. But one can think about at least tree stages of transportation: to transportation hub, between two hubs, from hub to final destination on the territory of firm-importer. Stages to be considered as parts of total cost in each particular case we can learn from purchase contracts using Incoterms 2000 standards[2]. But this information hardly could be obtained. Thus, the considered model is simplified with several assumptions:

[2] Additional information is available on website: http://www.iccwbo.org/incoterms.

- transportation cost for trade on domestic markets are different from transportation costs to foreign markets;
- only internal carrying cost matters for export (to transportation hub inside the country);
- competition between different kind of transportation and among firms providing the same transportation services. This means that prices of carrying of one unit of good (kilogram) per unit of distance (kilometer) are equal;
- time of carrying is equal for all types of transport.

The third and fourth assumptions are very strict. But only taking all four assumptions together we can approximate transportation cost with distance to particular transportation hub. So, relaxing two last assumptions seems to be impossible.

One way to concern this problem is to divide goods into several groups (by industry) inside which assumptions are relevant. Thus, for our model we assumed the following cost structure:

$$C_{i,t} = w(DIST_{ij,t}) \cdot L_{i,t} + v(DIST_{ij,t}) \cdot H_{i,t} + tr_{domestic}(DIST_{ij,t}) \cdot (1 - \frac{Ex_{i,t}}{Y_{i,t}}) + tr_{foriegn}(DIST_{ij,t}) \cdot \frac{Ex_{i,t}}{Y_{i,t}}$$

$C_{i,t}$ denotes total cost of firm i at period t. $Y_{i,t}$ stands for amount of goods produced by firm i at period t. $L_{i,t}$ – labor employed by firm I at period t. $H_{i,t}$ – human capital available for firm i in the region of location (considered constant in short run for particular region) at period t. And $\frac{Ex_{i,t}}{Y_{i,t}}$ – share of produced goods for export by firm i at period t, for which internal

transportation costs matter. We assumed wages, cost of human capital and transportation costs to be function of physical distances, $DIST_{ij,t}$, from firm i to transportation hub j at period t.

As theoretical model use static (one period) approach we do not use subscript t in following derivations.

Wage paid to employees of firm I at particular period t, $w(DIST_{ij})$ and human capital costs for employing skilled labor in the region $v(DIST_{ij})$ are:

$$w(DIST_{ij}) = DIST_{ij}^{\eta_L}$$

$$v(DIST_{ij}) = DIST_{ij}^{\eta_H}$$

Transportation costs of firm i to carry goods to destination j on domestic and foreign markets are assumed to have the following forms:

$$tr_{domestic}(DIST_{ij}) = DIST_{ij}^{\eta_d}$$

$$tr_{foriegn}(DIST_{ij}) = DIST_{ij}^{\eta_f}$$

where η_L, η_H, η_d, η_f - constant factors of different costs of firms.

Transcendental functions were chosen to describe cost functions because of several reasons. First, independently of constant factors these functions take positive values. Second, first derivatives of these functions can be negative, zero or positive. Thus, costs may depend on distances positively, negatively or be independent. Third, rate of dependence, sign of second derivative, is determined by magnitude of constant factor. Finally, functions are continuous and may easily be analyzed.

From this point on we develop our model in the way different from Gries et al. (2008). Now we can calculate costs of the firm. Cost minimization assumption is used to state mathematical problem for each firm. Substituting variables with functions of distance we end up with the following problem:

$$\min_{DIST_{ij}} C_i = \min_{DIST_{ij}} [DIST_{ij}^{\eta_L} \cdot L_i + DIST_{ij}^{\eta_H} \cdot H_i + DIST_{ij}^{\eta_d} \cdot (1 - \frac{Ex_i}{Y_i}) + DIST_{ij}^{\eta_f} \cdot \frac{Ex_i}{Y_i}]$$

Solution for the problem of maximization, F.O.C.:

$$0 = [\eta_L \cdot DIST_{ij}^{\eta_L} \cdot L_i + \eta_H \cdot DIST_{ij}^{\eta_H} \cdot H_i + \eta_d \cdot DIST_{ij}^{\eta_d} (1 - \frac{Ex_i}{Y_i}) + \eta_f \cdot DIST_{ij}^{\eta_f} \frac{Ex_i}{Y_i}]$$

Expressing $\frac{Ex_i}{Y_i}$:

$$\frac{Ex_i}{Y_i} = f(DIST_{ij}, L_i, H_i)$$

$$\frac{Ex_i}{Y_i} = \frac{\eta_L \cdot DIST_{ij}^{\eta_L} \cdot L_i + \eta_H \cdot DIST_{ij}^{\eta_H} \cdot H_i + \eta_d \cdot DIST_{ij}^{\eta_d}}{\eta_d \cdot DIST_{ij}^{\eta_d} - \eta_f \cdot DIST_{ij}^{\eta_f}}$$

We obtained simple model. One can easily see that influence of determinants on export intensity depends on corresponding factors for labor and human capital and on all factor for distance to destination.

Deriving theoretical model we obtain non-linear export intensity function with respect to $DIST_{ij,t}$. But following similar to Gries et al. (2008) technique we use linear in $DIST_{ij,t}$ model for empirical purposes. The following model is used for basic estimation:

$$\ln(ExIntensity_{i,t}) = \beta_0 + \beta_1 \cdot DIST_{i,t} + \beta_2 \cdot L_{i,t} + \beta_3 \cdot H_{i,t} + \gamma \cdot CONTROLS_{i,t} + u_i + \varepsilon_{i,t}$$

CONTROLS is set of variables which includes PUSSR, FS and industry and time dummies.

$$\text{PUSSR} = \begin{cases} 1 & , \text{ if firm was created after 1991} \\ 0 & , \text{ otherwise} \end{cases}$$

Intuition behind including this control is that during existing of the Soviet Union many decisions were made without strong economic reasoning instead that was some strategic plan from center of planning which miss many factors.

$$\text{FS} = \begin{cases} 1 & , \text{ private} \\ 0 & , \text{ state owned} \end{cases}$$

This dummy states for Ownership Status. State owned firms and plants are expected not to participate in more risky activity (export is usually considered as more risky then domestic trade). Thus, positive sign of this dummy is expected.

Chapter 4

DATA

We used the data on Ukrainian firms from manufacturing sector which had export activity during the period of 2000 - 2005. The data itself originates from different sources. Firm location, employment (proxy for firm size), sales, output, capital were obtained from reports submitted by firms on annual basis to the National Statistics Office[3]. Content of statements from Customs Offices were used to form data on export and import for firms. This data was also aggregated on annual basis.

From the raw data sample of available firms in each year we took only those which had export activity. Moreover, only firms which exported self-produced goods (not services), sectors A (agriculture, hunting and forestry), B (fishing and fishery), C (extractive industry), D (reclamation industry), E (manufacturing and distribution of electricity, gas and water) according to Ukrainian industry sector classification[4], were added to the final sample.

All mentioned data was kindly provided by the KSE data depository. As a result we managed to compile an unbalanced panel data set with observations for six years..

Amount of export of each firm was calculated as total revenue of exported goods on annual basis. Dependent variable, export intensity, was calculated as the ratio of export amount to total output. Thus, export intensity is non-

[3] National Statistics Office (Derzhkomstat) – Державний комітет статистики (Держкомстат).
[4] КВЕД – Класифікація видів економічної діяльності.

negative variable and can be greater than one if total annual output was exported together with inventories accumulated during previous years. Export intensity was taken in natural logarithm to decrease the bias effect of outliers. Due to some data imperfections (set forth below) strong outliers were in data set. We define strong outliers as those firms for which export intensity exceeded value 1.3 as such firms should have huge inventories what is unusual. They were dropped from further consideration.

Figure 2 in Appendix A the distribution of overall average export intensity by districts is presented.

State classification of territory of Ukraine[5] was used to determine location of customs (transportation hubs) and firms accurate within districts and regional cities. Geographic coordinates of districts (or cities) was used to calculate physical distances between firms and hubs. For those firms which exported goods through different hubs during the year distances was averaged weighted on net weights of goods sold abroad. This variable is the main independent determinant to answer the question of current research.

To control for time and firm individual factors we use following variables.

We use employment to proxy the size of each firm. Without a doubt, labor intensity varies between industries. But within each industry greater amount of employed workers indicates greater scale of firms' operations. Industry effect would be captured using dummy variables during robustness check.

Total output (or total sales before excise) and capital were used to calculate capital intensity for each particular firm. This variable varies between industries but within industry serves as an indicator of operational scale.

Human capital available for particular firm was measured as share of people with university degree on the territory of the region where firm is located. Data for this factor were taken from "All Ukrainian population census 2001". Year of census is within the investigated time period. Thus, this variable is constant during observed period for each region. Variation of human capital for each firm is small due to the fact that firms almost never move across regions of Ukraine.

Date of firm creation was used to calculate age. Age and PUSSR dummy variable indicating the creation of firm after USSR collapse were constructed. Any action after which a firm changed state registrar number (changing structure, merger or separation) was considered as a creation of a new firm. This variable has a huge drawback of exact measuring impossibility, thus its explanatory power is questionable.

Six years from 2000 to 2005 are presented in time dimension of the data. This period was chosen due to several reasons. First, period of the independence of Ukraine is it self not so long to catch long run effects of changes of locations (distances). Thus, short run effects are under consideration. In other words we measure the effect of distances given current distribution of firms. Second, economic situation during this period was relatively sound and thus our estimations are expected to be free from the bias due to macroeconomic shocks. Finally, some variables are not available for other years.

Following problems with raw data should be taken into account:

- cases of discrepancy sings of values to specification of the statistical methodology (possibly misprinting);

[5] КОАТУУ – Державний класифікатор об'єктів адміністративно-територіаального устрою України.

- cases when several variables was not reported by firms.

In mentioned cases observations were dropped from the sample. Mistakes of these types are not systematic and do not lead to the bias in estimation. Thus, the sample remained representative after data corrections.

Descriptive statistics for explained variable and set of explanatory variables is presented in Table 1.

Table 1. Data summary

Variable		Mean	Std. Dev.	Min	Max
Intensity	overall	.246715	.2820441	3.01e-07	1.299365
(using output)	between		.2688517	9.43e-06	1.299339
	within		.1406797	-.6525473	1.202783
DISTANCE	overall	378.6902	232.4644	0	1290
	between		221.9543	0	1290
	within		105.4641	-420.8755	1105.183
Employment	overall	593.1259	2291.203	1	77982
	between		1663.798	1	62770
	within		257.3856	-12573.87	15805.13
Market Share	overall	.005506	.0263642	1.10e-07	1
	between		.0193271	3.12e-07	.9994814
	within		.0066288	-.1576086	.3950556
Capital Intensity	overall	281.3012	31129.8	.0006012	4145855
(using output)	between		16155.41	.0013717	1384959
	within		25388.63	-1382195	2761177
Human Capital	overall	.1816431	.0562294	.1086285	.3253727
	between		.0571472	.1086285	.3253727
	within		.0031273	.0420996	.3211866

Table 2 contains information on number of observations in each year.

Table 2. Number of observations by year

	2000	2001	2002	2003	2004	2005	Total
N	2811	4106	4454	4506	1522	1328	18727

EMPIRICAL RESULTS

A lot of explanatory factors of export intensity were investigated in the existing literature. However, the lack of available data for Ukraine strongly restricts current research. Thus, we consider the presence of unobserved individual and time effects. As time dimension consists of six years only we decided to capture time (year) effects by direct inclusion of annual dummy.

The problem of catching firms' individual effects is more complex for our research as we should make an assumption about the extent to which available explanatory variables correlate with individual characteristics of firms. Initially, we assume correlation of unobserved firm effect with explanatory factors (random effect (RE) estimation is impossible due to violation of assumption of no correlation) and estimate our model using fixed effect (FE) framework. But this assumption is worth to check as FE estimation is consistent only but not efficient (Woolridge, 2002, pp. 408-460).

In contrast, RE framework may provide us with coefficients for determinants which are both consistent and efficient but under assumption of no correlation between unobserved firm effect and explanatory factors.

Although estimation was made using polled OLS framework, Breusch and Pagan Lagrangian multiplier test for random effects (H0: zero variation in individual firm effect, p-value = 0.00) and F-test after FE estimation (H0: all individual effects are equal zero, p-value = 0.00) gave results in favor of presence of individual firm effect and, thus, rejected correctness of pooled OLS estimation. Results of this technique are in the Table 4 for further comparison.

Adjustment for data heteroscedasticity is taken into account by using cluster robust estimation.

For further specification analysis, in particular, for making choice between FE and RE Hausman test is used. Results of Hausman test are provided in Table 3. Decision in favor of FE is suggested as outcome of the test (H0: absence of statistical difference between sets of estimated coefficients, p-value = 0.00). Thus, we are going to end up with consistent but not efficient coefficients.

For further analysis we proceed with robustness check. Estimations for each industry sector separately (results are not reported) were done. Results are quite similar to presented for whole sample, sign of estimated coefficients are the same.

Table 3. Hausman test (FE vs. RE)

	Coefficients			
	(b) FE	(B) RE	(b - B) Difference	sqrt(diag(V_b - V_B)) SE
DISTANCE	.0018384	.0006966	.0011418	.0002534
$DISTANCE^2$	-1.93e-06	-8.26e-07	-1.10e-06	2.56e-07
Employment	-.0001756	-.0000566	-.0001191	.0000587
Market Share	3.098691	.7502642	2.348427	1.335053
Capital Intensity	-6.11e-06	1.29e-07	-6.23e-06	3.25e-06
Human Capital	-1.254035	-4.28254	3.028505	3.173702
y2000	847.2147	2.046947	845.1677	110.1449
y2001	305.6303	2.012668	303.6176	39.50715
y2002	109.131	2.070316	107.0607	13.88329
y2003	37.66712	2.005307	35.66181	4.587408
y2004	9.628122	.1348478	9.493274	1.219186
b = consistent under Ho and Ha; obtained from xtreg B = inconsistent under Ha, efficient under Ho; obtained from xtreg				
Test: Ho: difference in coefficients not systematic				
chi2(6) = (b - B)'[(V_b - V_B)^(-1)](b - B) = 653.10 Prob > chi2 = 0.0000				

Test for serial correlation was performed (H0: no serial correlation of order one, p-value = 0.00). Being found autocorrelation was taking into account implementing the methods developed by Baltagi and Wu (Baltagi, 1991).

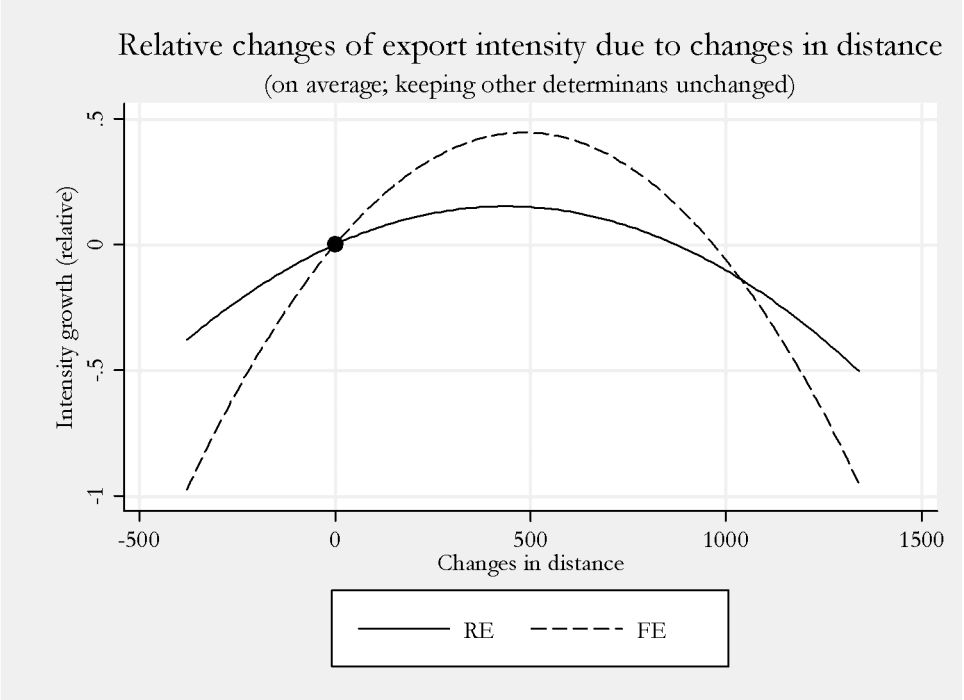
Thus, Table 4 contains results of FE, RE (both corrected for autocorrelation of order one) and pooled OLS (adjusted for heteroscedasticity) estimations.

Table 4. Estimation results

ln(Export Intensity) (using Sales)	POOLED OLS Coefficient (se)	RE Coefficient (se)	FE Coefficient (se)
DISTANCE	-0.0004493*	0.0006966***	0.0018384***
	(0.0001876)	(0.0001769)	(0.0003090)
$DISTANCE^2$	0.0000003	-0.0000008***	-0.0000019***
	(0.0000002)	(0.0000002)	(0.0000003)
Employment	-0.0000212*	-0.0000566***	-0.0001756**
	(0.0000094)	(0.0000109)	(0.0000597)
Market Share	-0.6535073	0.7502642	3.0986908*
	(0.8094024)	(0.8100154)	(1.5615672)
Capital Intensity	-0.0000000	0.0000001	-0.0000061
(using Output)	(0.0000000)	(0.0000004)	(0.0000033)
Human Capital	-4.31***	-4.28***	-1.25
	(0.2434331)	(0.3332264)	(3.1911474)
y2000	1.8094579***	2.0469472***	8.47e+02***
	(0.0685641)	(0.0473376)	(1.10e+02)
y2001	1.8463260***	2.0126680***	3.06e+02***
	(0.0656890)	(0.0451783)	(3.95e+01)
y2002	1.8793452***	2.0703161***	1.09e+02***
	(0.0648997)	(0.0442929)	(1.39e+01)
y2003	1.8108208***	2.0053065***	3.77e+01***
	(0.0645765)	(0.0434350)	(4.5876136)
y2004	0.1467564	0.1348478**	9.6281219***
	(0.0802164)	(0.0452444)	(1.2200254)
y2005	(dropped)		
_constant	-2.90***	-3.40***	1.1290473***
	(0.0824739)	(0.0799833)	(0.2525213)
R-squared		within 0.3102	within 0.3921
		between 0.0426	between 0.0184
	0.1253	overall 0.1222	overall 0.0444

Results themselves are quite unexpected. As direct verbal interpretation of marginal increase in distance is not possible we decided to present graphical form of interpretation (Figure 1).

Figure 1. Relative changes of export intensity due to changes in distance



The reader should be cautioned that Figure 1 do not show correspondence of distance and export intensity. It shows how level change in distance affects relative change in export intensity (logarithmic change) given current distributions of distances and intensities for firms.

As explanatory variable, export intensity, were taken in natural logarithm we interpret its change as relative growth[6]. This variable is on the vertical axis.

Change in distance to hub is on the horizontal axis level. Each firm initially has zero change. Change in distance of any sign leads on average to change in export intensity (growth or fall).

Given the current distribution of distances we can see the following result for FE estimation. Any decrease in distance on average leads to fall in intensity of export. Increase in distance in range from 0 to approximately 1000 kilometers on average would result in increasing export intensity (keeping other determinants constant). Increase in distance on approximately 500 kilometers creates the maximum effect on intensity of export growth, up to 45%. Increase in distance on more than 1000 kilometers leads to negative value of growth.

This result seems to be contrary to general intuition. But appropriate explanation of this fact is implied from the theoretical concept of economy of scope. Firms, starting to increase their variable carrying costs and corresponding sunk costs (in terms of distance), tend to cover them increasing sales in new destination and, thus, end up with higher intensity of export.

In Appendix B the reader can find possible ways of manipulating distances by each firm. Thus, policies for export intensity performance may be developed. And firms themselves or policymakers can affect export intensity in order to follow chosen policies.

Estimated coefficient for employment is significant. This result goes in line with work by Mittelstaedt et al. (2006) and several older papers. It implies that

[6] Taylor first order approximation: $\Delta \ln(y) = \Delta y/y$. Thus change of variable in natural logarithm may be interpreted as growth relative to initial value or, multiplied by 100%, may be interpreted as percentage growth.

smaller firms are more intensive in terms of export. Such finding is explained by fact of higher possibility for large firms to internalize sunk costs, in turn, small firms are forced to cover their costs by more intensive trade with foreign buyers to use economy of scope (transporting more by same export transaction).

Market share has a significant positive impact on export intensity according to the obtained result. The same result was obtained by many other studies. Research on firms' performance by Wagner (2002) ended up with the conclusion that export decisions of firms let them use experience got from trade on other markets as well as force them to develop in order not to lose competitive positions. Thus, performance on domestic market is expected to be improved and additional market share to be conquered.

We found insignificant influence of capital intensity both in general estimation and during robustness check estimating results for each industry separately.

Human capital was found to be insignificant. That happened due to low variation as only twelve firms in our sample have changed their location. And only three of them have changed the region (we have in our data set human capital constant for all years in the same region) during the considered period.

Controls for time effects are found to be significant implying presence of unobserved year effects.

Chapter 5

CONCLUSIONS

In our research we have developed theoretical model explaining relationship between export intensity and physical distance inside the country. We started with assumption of cost minimization behavior of homogeneous firms which trade both on the domestic and foreign markets. Costs were assumed to be transcendental functions of distance. And solving minimization problem with respect to distance we obtained in general non-linear effect of distance on export intensity. For some values of constant factors in the model this relation can be linear or quadratic.

For empirical estimation we include both linear and squared distance as explanatory variable for export intensity. The latter were taken in natural logarithm to reduce effect of outliers.

Unbalanced data set containing information on Ukrainian exporters of goods was used. Only firms performing in the production sector according to Ukrainian classification were considered. Observations were collected on annual basis for years from 2000 to 2005.

The paper results in significant quadratic relationship between export intensity in natural logarithm and internal physical distance (both distance and square of distance are significant). Taking the current distribution of distances as given, following interpretation is relevant: increase in distance in range from 0 to approximately 1000 kilometers on average would result in increasing export intensity (keeping other determinants constant). Increase in distance on

approximately 500 kilometers creates the maximum effect on intensity of export growth, up to 45%. Increase in distance more than on 1000 kilometers or any decrease in distance on average leads to fall in intensity of export.

Explanation to this fact is implied from the theoretical concept of economy of scope. Firms start to increase their transportation costs (in terms of distance) and corresponding sunk costs which should be covered by increasing sales in new destination. Thus, firms end up with higher intensity of export.

Ukraine is the country with transition economy and, thus, experiences a lot of changes. Results of current research can be used to increase efficiency in performance of firms.

In particular, this research may become useful for those firms which are planning to move to new location or launch new affiliates having in mind improving their export performance. But distance can be changed not only through changing of location. Entrepreneurs can also increase or decrease distances to the border changing hubs (mode of transportation, direction of transportation).

Policymakers may find it useful to use results of the research to force firms for starting export activity in districts where it is needed developing infrastructure for cheaper transportation services.

BIBLIOGRAPHY

Baltagi, B. H. and Q. Li, 1991, *A Transformation That Will Circumvent the Problem of Autocorrelation in an Error Component Model*, Journal of Econometrics 48: 385-393.

Edwards, L., and P. Alves, 2006, *South African Export Performance: Determinants of Export Supply*, South African Journal of Economics 74(3): 473-500.

Gries, T., Naudé, W. and M. Matthee, 2008, *The Optimal Distance to Port for Exporting Firms*, Research Paper No. 2008/32, United Nations University, World Institute for Development Economics Research (UNU-WIDER).

Helpman, E., Melitz M. J. and S. R. Yeaple, 2003, *Export versus FDI*, Discussion Paper No. 1998, Harvard Institute of Economic Research (HIER)

Holzmuller, H. H. and B. Stottinger, 1996, *Structural Modeling of Success Factors in Exporting: Cross-Validation and Further Development of an Export Performance Model*, Journal of International Marketing 2(4): 29-55.

Kumar, N., 1994, *Determinants of Export Orientation of Foreign Production by U.S. Multinationals: An Inter-Country Analysis*, Journal of International Business Studies 1(25): 141-156.

Melitz M. J., 2003, *The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity*, Econometrica 6(71): 1695-1725.

Mittelstaedt, J. D., Ward, W. A. and E. Nowlin, 2006, *Location, Industrial Concentration and The Propensity of Small US Firms to Export. Entrepreneurship in the international marketplace*, International Marketing Review 23(5): 486-503.

Naudé1, W. and M. Matthee, 2007, *The Geographical Location of Manufacturing Exporters in South Africa*, Research Paper No. 2007/09, United Nations University, World Institute for Development Economics Research (UNU-WIDER).

Sridhar, K. S. and G. Wan, 2007, *Firm Location Choice in Cities: Evidence from China, India and Brazil*, Research Paper No. 2007/56, United Nations University, World Institute for Development Economics Research (UNU-WIDER).

Wagner, J., 2002, *The Causal Effects of Exports on Firm Size and Labor Productivity: First Evidence From a Matching Approach*, Economics Letters 77: 287–292.

Wooldridge, J., 2002, *Introductory Econometrics: A Modern Approach*, 2nd edition.

Zhao, H. and S. Zou, 2002, *The Impact of Industry Concentration and Firm Location on Export Propensity and Intensity: An Empirical Analysis of Chinese Manufacturing Firms*, Journal of International Marketing 1(10): 52-71.

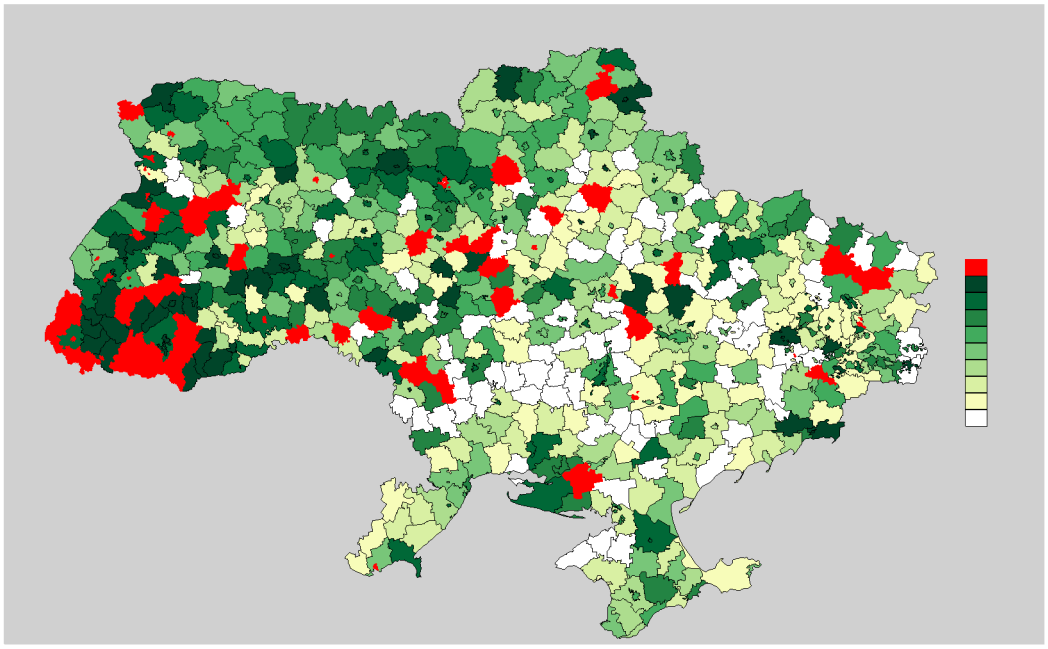
Oleksii Zagidullin

_____

(sign)

APPENDIX A

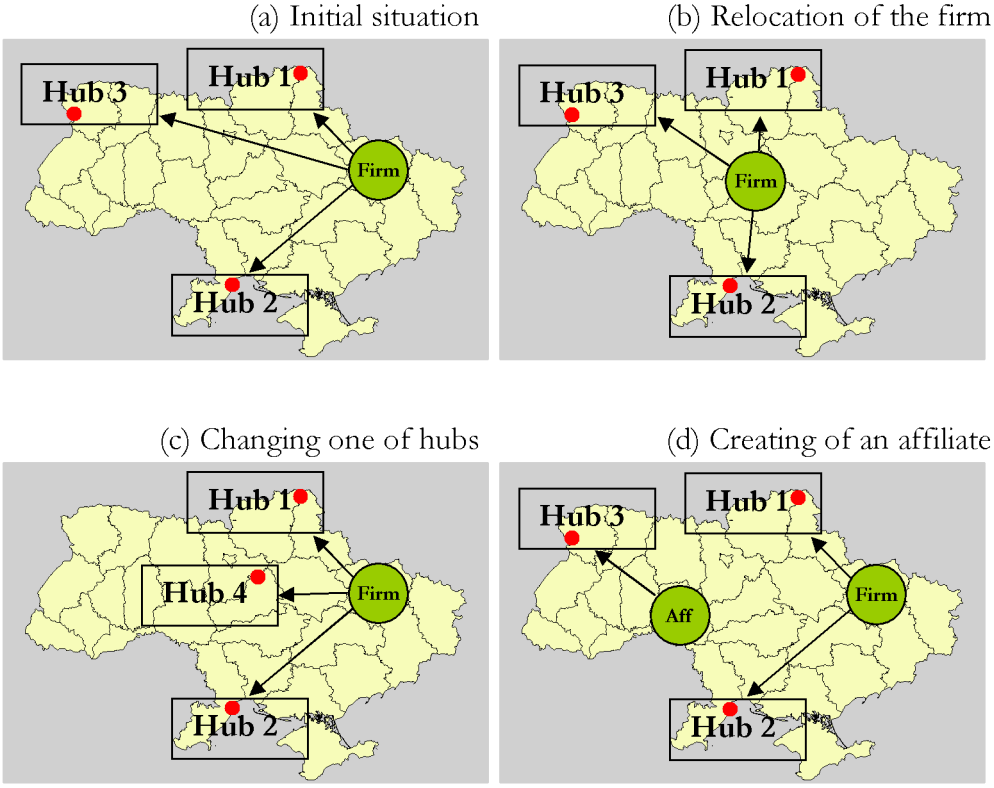
Figure 2. Distribution of overall average export intensity by districts



Note: Data on export intensity is averaged for each district (669 districts) across forms and across six years. In white districts with no exporting firms and in red districts with the most intensive firms (in terms of overall average export intensity) are mapped.

APPENDIX B

Figure 3. Possible ways of changing distance for firms



Note: The reader can think about following possible ways of changing distance to the border by particular firm (Figure 3). Various combinations of this ways also can be considered.