

DETERMINANTS OF THE
COMMODITY STRUCTURE OF THE
UKRAINIAN FOREIGN TRADE

by

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Abstract

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According to the Heckscher-Ohlin theorem, Ukraine, being in transition, should turn to exporting goods which production is labor intensive due to Ukraine's relative labor abundance. I conduct a regression analysis of the determinants of the trade commodity structure in order to estimate the importance of factor endowment differences in explaining the commodity structure of Ukrainian trade. This regression analysis incorporates human capital, technological differences, tax privileges and non-tariff barriers to imports. The results show that, in line with the Heckscher-Ohlin theorem predictions, Ukraine tends to export labor-intensive goods; however, its foreign trade structure is significantly influenced by relative endowments of human capital, differences in labor productivity, tax privileges granted to industries, and non-tariff trade barriers.

TABLE OF CONTENTS

List of tables	i
List of figures	ii
Acknowledgements.....	iii
Glossary.....	iv
<i>Chapter Page</i>	
1 Introduction	1
2 The Hecksher-Ohlin theorem	6
2.1 Development of the theorem	6
2.2 Empirical evidence and alternative theories development	11
3 Market and institutions	21
4 Methodology of empirical research.....	28
5 Test of the determinants of the structure of Ukrainian foreign trade	30
6 Conclusions	36
Bibliography.....	38
Appendix I.....	40
Appendix II.....	41

LIST OF TABLES

<i>Number</i>		<i>Page</i>
1	Dynamics of Ukraine's foreign trade in 1996-2001.....	23
2	OLS regression of NX on K_L.....	31
3	Pooled OLS regression (1) (using HIGH).....	33
4	Pooled OLS regression (2) (using PROF).....	33
5	GLS regression (1) (using HIGH).....	34
6	GLS regression (2) (using PROF).....	34
7	Capital-labor ratios for selected countries, 1999.....	38

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GLOSSARY

Absolute advantage. A country is said to have absolute advantage in producing a good if it can produce it with less resources than any other country.

Autarky (closed economy). An economic system which is closed to cross border goods, services and capital flows.

Comparative advantage. A country is said to have comparative advantage in producing of a good if it can produce this good at lower opportunity cost than any other country.

Dumping. A pricing practice when a firm charges a price for exported good which is lower than the comparable price, in the ordinary course of trade, for the like product when destined to consumption in the exporting country¹.

Economies of scale. Economies of scale in production are equivalent to increasing returns to scale: production is more efficient the larger the scale at which it takes place.

Export restraints. Limitations on the quantity of exports imposed by the exporting country at the importing country's request. Export restraints are sometimes referred to as voluntary export restraints to reflect the agreement of the exporting country to limit quantities.

Export subsidies. Any form of income or price support by the state, which operates directly or indirectly to increase exports of any product from its territory².

Factor abundance. Assuming 2 countries, Country 1 and Country2, and 2 factors, Factor X and Factor Y, country 1 is said to be abundant in factor X if the ratio of factor X endowment to factor Y endowment is higher in country 1 than in country 2.

¹ See the Agreement on Implementation of Article VI of the General Agreement on Tariffs and Trade 1994, available at http://www.wto.org/english/thewto_e/whatis_e/tif_e/agrm7_e.htm.

² See the General Agreement on Tariffs and Trade 1994, available at http://www.wto.org/english/docs_e/legal_e/final_e.htm#subsidies.

Factor intensity. Provided there are two factors of production, capital (K) and labor (L), good Y is relatively more capital-intensive and good X is relatively more labor-intensive if the capital-labor ratio used in production of Y (K_y/L_y) is higher than the capital-labor ratio used in production of X (K_x/L_x).

Free trade. Trade without any institutional restrictions on export/import including tariffs, quotas and other non-tariff barriers.

Import quotas. Limitations on the quantity of imports.

Import tariffs. Taxes levied on imports.

Red tape barriers to trade. Administrative import/export restraints in the form of documentation requirements and customs procedures that are usually designed to impede trade.

Technical barriers to trade. Trade restraints which are imposed for health, safety and consumer protection reasons. These may include standardization, certification, sanitary and phytosanitary measures, as well as technical requirements for packaging, marking and labeling.

Chapter 1

INTRODUCTION

One of the major theories of international trade is the Heckscher-Ohlin (H-O) theorem according to which “countries will tend to export those goods which use relatively intensively their relatively abundant factors of production” ((Deardoff, 1985, 478).

Factor abundance means that in case of two countries ratio of the abundant factor endowment to another factor endowment is higher in the factor abundant country comparing with the factor scarce country. This leads to an alternate definition of the factor abundance is in terms of prices (Markusen, Melvin, Kaempfer, and Maskus, (1995, 101)): the abundant factor is that which is a country’s relatively cheap in autarky.

Leontief achieved the most well known results of testing the H-O theorem in 1954. He tested the hypothesis that the US, being a capital-abundant country, would tend to export capital-intensive goods. Leontief calculated the capital-labor ratios of American merchandise exports and imports and found that the capital-labor ratio of US imports was 60% higher than the same ratio for exports. The hypothesis that the US is exporting capital-intensive product was therefore rejected as the empirical results showed that the US was instead exporting labor-intensive products.

These results known as the Leontief paradox promoted new tests of the H-O theorem by Baldwin (1971, 1979), Leamer (1980), Leamer and Bowen (1981), Bowen, Leamer, and Sveikauskus (1987), Harkness (1978) and others. In general, there have been used three types of studies of trade commodity structure (Bowen, Leamer, and Sveikauskas, 1987). The first is the classic test of the

Leontief paradox, and replicates the approach and empirical methods from the original Leontief study. The second and third types modify the Leontief frame with the former comprising of regressions of trade of many commodities on their factor input requirements, whilst the latter approach is to regress net exports for many countries. The body of work has provided explanations to dispel the notion of the Leontief paradox, and have resulted in an expanded understanding of the factors that determine the international trade pattern.

Possible explanations for the pattern of trade observed between the US and its trading partners include

- cross country technological difficulties differences;
- effects of economies of scale and product differentiation;
- complementarity of capital and natural resources;
- differentiating between the different types of labor to include, for example skilled and unskilled labor;
- factor intensity reversals;
- different demand patterns;
- effects of R&D activities;
- effects of trade distorting measures such as tariffs and non-tariff barriers to trade.

Yet despite the comprehensive nature of the above list, Helpman (1999) argues, that the existing explanations of the pattern of trade are still incomplete: “This is partly the result that the nature of world trade is changing rapidly. Technological change modified the patterns of specialization, reduced trading costs and encouraged larger trade volumes; new countries have joined the trading system...”³

³ See Helpman (1999, 142).

Until recently, the majority of the empirical studies on the H-O theorem focused on developed countries. The H-O theorem predicts that movement towards freer trade should cause significant reallocation of factors of production (Deardoff, 1985, 502), however this has not been the case in the process of liberalization of trade between developed countries after the World War II (Deardoff, 1985, 502). However, it is in transition economies where trade liberalization, which has been much more radical, that essential changes in the factor content of the foreign trade should be observed.

Until the beginning of the 1990's the structure of Ukrainian industry and foreign trade was determined not by price signals (i.e., on the basis of comparative advantage), but by decisions of USSR central planners. Open international trade was prohibited since it would have served to "partially negate the goals of the central plan and the highly distorted prices that resulted" (Hobbs, Kerr, and Gaisford, 1997, 4). This policy led to development of a huge capital-intensive heavy industry sector (ferrous metals and machine-building) while consumer goods production was considered to be of minor importance.

However, during the 10-year transition period, the country's industry has undergone some restructuring. My hypothesis is that, since it is labor that is a relatively abundant factor in Ukraine, it can be expected that the country now tends to export labor-intensive goods. Partially this tendency has been determined by the factor intensity reversal: with depletion of the capital stock, enterprises substitute it with labor; thus, technologies become more labor-intensive⁴. However, I think that relative factor abundance measured by capital-labor ratio only partially explains the commodity structure of Ukrainian foreign trade; one of the main reasons for this has been protectionist policy of the

⁴ For example, according to my calculations on the basis of the Derzhkomstat data, machinery and equipment in Ukraine are relatively labor-intensive goods: the capital-labor ratio of this commodity group is almost equal to this indicator for the textile industry.

Ukrainian government mainly in the form of subsidies⁵ and non-tariff barriers. This paper therefore tests whether the H-O theorem is valid in Ukraine.

First, I analyze the commodity structure of the foreign trade and foreign trade policy of Ukraine. The majority of Ukraine's exports have low degree of processing and low differentiation level (ferrous and non-ferrous metals, agricultural produce, mineral products and by large part chemicals constitute about 70% of export). Such goods compete primarily by price, which makes them highly sensitive to changes in world market conditions; moreover, they compete mainly in highly protected markets. The Ukrainian government, in its turn, also leans toward intensive protectionism to keep key exporting industries competitive or to protect local producers from foreign competitors. The structure of Ukrainian imports is rather one-dimensional: fuel constitutes about 50%, another important article is machinery and equipment with 14% share.

Then I estimate the importance of factor supply differences in explaining the commodity structure of Ukrainian trade, incorporating into the model human capital, technological differences and foreign trade policy. The results show that although Heckscher-Ohlin theorem predictions are correct in case of Ukraine and the country, being labor-abundant, tends to export labor-intensive goods, other factors such as relative human capital-intensity, productivity differences and protection of industries are also important in determining Ukraine's trade structure. Ukraine tends to export goods, production of which is characterized by relatively higher labor productivity and is subsidized through tax privileges; it tends to import human capital-intensive goods; non-tariff barriers to trade significantly deter imports.

⁵ For example, output of the ferrous metals sector contributed 18% to the total industrial output in Ukraine and 39% to the country's export of goods in 2001. In order to retain this position in face of worsening conditions in external markets and increasing input prices, industry receives substantial tax privileges, which represent the form of indirect subsidies, from the state.

The implication of the results is that due to protectionism of the Ukrainian government, foreign trade commodity structure of Ukraine is distorted from the optimal one determined by its comparative advantages.

The paper is organized as follows. The first part of the paper is focused on the history of economic thought in the area of determinants of foreign trade commodity structure. Alternative tests of the H-O theorem are surveyed and the differences in empirical findings are explained. The second chapter explores the H-O theory, empirical evidence on its explanatory power and alternative theories explaining determinants of the commodity structure of foreign trade. The third chapter reveals the institutional characteristics of the Ukrainian foreign trade market.

In the second part of the paper, I contribute to the evidence on the determinants of the commodity structure of foreign trade. The fourth chapter introduces the methodology for empirical research. The fifth chapter presents the empirical results and their implications. The sixth chapter summarizes and concludes the paper.

Chapter 2

THE HECKSHER-OHLIN THEOREM

2.1 Development of the theorem

The Heckscher-Ohlin theorem was developed to supersede the David Ricardo's theory of comparative advantage (Helpman, 1999, 122). In the Ricardo model there are two countries which produce two goods using only one resource – labor in the fixed proportion for each good. The theory predicts that a country will fully specialize in and export the product where its labor productivity is relatively higher.

However, this theory did not predict the direction of trade flows very well. Therefore, the question of the role of capital in explaining the trade structure aroused. Eli Heckscher and Bertil Ohlin modeled a situation of two countries, two goods, and two resources – capital and labor. Other essential assumptions include (Baldwin, (1971, 126); Markusen, Melvin, Kaempfer, and Maskus, (1995, 99)):

- homogeneity of degree one of production functions with diminishing marginal productivity of each factor;
- supplies of factors are fixed; factors are homogenous and perfectly mobile between industries within each country, but perfectly immobile between countries;
- countries have identical technologies but differ in their relative factor endowments;
- nonreversability of factor intensities;
- identity and homogeneity of consumption preferences;

- perfect markets, free trade, and no transportation costs.

Heckscher and Ohlin's conclusion is known as the Heckscher-Ohlin theorem and formulated in two versions: quantity and price ones. Originally the quantity version of the theorem was formulated in the commodity form: "countries will tend to export those goods which use relatively intensively their relatively abundant factors of production" ((Deardoff, 1985, 478). However, it has been difficult to prove the commodity form of the theorem; therefore, the alternative factor content form of the theorem has been widely used (Deardoff, 1985, 479). According to it, "countries will tend to export the services of their abundant factors employed as a factor content in the goods they trade (Deardoff, 1985, 479).

The price version of the H-O theorem says under autarky a country "has a lower (compared to the other country) relative autarkic price of the good making relatively intensive use of the factor which would be relatively cheap in that county in autarky. Also that good would be exported in free trade if autarkic equilibrium is unique in each country" (Ethier, 1985, 141).

Thus, the theorem links three separate phenomena: trade, resource supply and technological input coefficients. **Implicit conclusion is that movement towards freer trade should cause significant reallocation of factors of production.** The reason is that moving from autarky to free trade a country is increasing production of the good that relatively intensively uses the relatively abundant factor. Since country is assumed to produce at production possibilities frontier, it has to cut in production of the other good to transfer resources to the export good.

However, in a multi-good, multi-country, multifactor case, the three pairwise comparisons cannot be made unambiguously.

Many goods

If the number of goods is greater than two, "the problem comes from "intervening" goods, which necessarily present themselves whenever there are

more than two commodities” (Ethier, 1985, 136). To illustrate the problem, suppose there are three goods produced, denoted by indexes g, k, j , such that $\frac{K_g}{L_g} > \frac{K_k}{L_k} > \frac{K_j}{L_j}$, where $\frac{K_i}{L_i}$ is a capital (K) - labor(L) ratio for a good $i, i=g, k, j$. A pairwise comparison of goods g and k indicates that relatively labor-abundant country will export good k , whilst a pairwise comparison of goods k and j leads to a contrary conclusion that the country will export good j and import good k . The important aspect is that this difficulty arises “as a consequence solely of an increase in dimensionality beyond two goods: *no* restrictions on technology or preferences can set matters aright” (Ethier, 1985, 137).

If opening of countries to trade results in factor price equalization, costs of production and prices of all goods will be the same in the both countries (Dornbusch, Fischer, and Samuelson, 1980). Thus, the commodity pattern of trade between the countries will be indeterminate in terms of the H-O theorem. However, Bhagwati (1972) argues that “the Heckscher-Ohlin pattern of trade *can* arise even under factor prices equalization”⁶. If we represent transport costs on every commodity, commodity prices will no longer be equal across countries, and factor prices will be not equalized.

If factor prices are not equalized, the situation becomes more definite and the Heckscher-Ohlin pattern of trade must arise (Bhagwati, 1972, 1054). Let’s number the n goods in order of their relative factor intensities, good 1 being the most capital (K) intensive and the least labor (L) intensive: $\frac{K_1}{L_1} > \frac{K_2}{L_2} > \dots > \frac{K_n}{L_n}$.

The chain version of the H-O theorem states that free trade equilibrium will break the chain at good j (Ethier, 1985, 146). The capital-abundant country will export all the goods to the left of j and import all the goods to the right of j .

⁶ See Bhagwati (1972, 1054).

Indeterminacy remains with regard to the “borderline” good j that may be produced in both countries.

Many countries

If there are many countries, they can be similarly ordered on the basis of their capital-labor ratios. Each country will export goods from a certain segment of the commodity chain and import all the other goods (Ethier, 1985). Moreover, factor-price equalization between some subset of countries does not mean that members of the subset produce all the goods (Ethier, 1985). The chain version can be applied in this case if we treat countries in the subset as a single joint unit. The members of the subset will export to other countries goods which use relatively intensively their relatively abundant factor of production and import all the other goods. However, the commodity pattern of trade between the subset members is indeterminate.

Many factors

Suppose there are two goods, but the number of factors of production is $m > 2$. Equilibrium requires (a), (b) and (c) to hold for each country (Ethier, 1985, 142):

$$p \leq wA(w), \quad (a)$$

$$[p - wA(w)X = 0], \quad (b)$$

$$A(w)X = V, \quad (c)$$

where p is the vector of commodity prices, w is the vector of factor earnings, X is the vector of commodity outputs and V is the vector of factor endowments. The matrix $A(w)$ is the array of least-cost techniques at factor rewards w , so that $wA(w)$ is the vector of unit cost functions.

If there are two goods, this system becomes a set of two equations with n unknowns. Thus, factor prices in general cannot be determined by commodity prices and they differ between countries.

The $n \times n$ version of the H-O theorem

The $n \times n$ version of the H-O theorem is known as Heckscher-Ohlin-Vanek (H-O-V) model referring to Vanek's use of the assumption of homothetic tastes (Leamer and Levinsohn, 1995, 1363). A rationale for the interest in this model by many trade economists can be found "in the fact that a country need not produce more goods for the world market than it has factors" (Jones, 14). The model can be presented as follows (Leamer and Bowen, 1981, 1040):

Outputs, inputs and factor intensities satisfy by construction the identities

$$(1) A_i Q_i \equiv E_i, \text{ where}$$

$A_i = n \times n$ matrix of factor input requirements where the element a_{kj} indicates the amount of factor k used to produce one unit of commodity j in country i ;

$Q_i = n \times 1$ vector of commodities produced in country i ;

$E_i = n \times 1$ vector of factor endowments⁷ of country i .

Trade is related to outputs and consumption by the identities

$$(2) T_i \equiv Q_i - C_i, \text{ where}$$

$T_i = n \times 1$ vector of the net exports by country i ;

$C_i = n \times 1$ vector of commodities consumed in country i .

All individuals consume in the same proportion

$$(3) C_i = Q w_i = w_i A^T E, \text{ where}$$

w_i is the consumption share of country i in the world consumption ($C w_i = C_i$);

$Q = \sum_i Q_i$ - world output production vector;

$E = \sum_i E_i$ - world factor endowment.

Thus, (2), (1) and (3) imply that factor content of trade F_i is determined as follows:

$$(4) F_i = A T_i = A(Q_i - C_i) = E_i - A Q w_i = E_i - E w_i$$

From

⁷ For simplicity equal number of goods and factors is assumed.

$B_i = P' T_i = P' A^{-1} (E_i - E w_i) = Y_i - Y w_i$, where

$B_i = P' T_i$ - trade balance of country i ;

$Y_i = \text{GNP}$ of country i ;

$Y = \sum_i Y_i$ - world GNP,

it follows that

(5) $w_i = (Y_i - B_i) / Y$. The scalar w_i depends on the level of output and on the size of the trade balance.

“A correct way to infer in the relative abundance of factors from the factor content of trade refers to the factor content adjusted for trade imbalance” (Leamer and Levinsohn, 1995, 1364): $F^A_i = A T_i - E B_i / Y = E_i (Y_i / Y) E$. Dividing the k th element of each side by $E_k / (Y_i / Y)$ produces

$$(6) Z_{ik} = (F^A_{ik} / E_k) / (Y_i / Y) = (E_{ik} / E_k) / (Y_i / Y) - 1.$$

The ratio of the resource share (E_{ik} / E_k) to the GNP share (Y_i / Y) is a measure of the abundance of factor k . On the left-hand side, there is the exported share of the domestic factors of production adjusted for the trade imbalance. Thus, according to the theory, there are two ways to measure factor abundance: directly by measure of abundance of factor k $(E_{ik} / E_k) / (Y_i / Y) - 1$ or through the adjusted factor content of trade $(F^A_{ik} / E_k) / (Y_i / Y)$. A test of H-O theorem compares the adjusted factor content of trade Z_{ik} with direct measures of factor abundance. If $Z_K > Z_L$ where K and L are capital and labor, then trade reveals that a country is capital abundant compared to labor. It is also possible to perform the test by comparing the signs of the left hand side and the right hand side sign of the equation (6).

2.2 Empirical evidence and alternative theories development

Leontief achieved the most well known results of testing the H-O theorem in 1954. He tested the hypothesis that the US, being a capital-abundant country, should export capital-intensive goods. Leontief calculated the capital-labor ratios

of American merchandise exports and imports and found that the hypothesis should be rejected since the capital-labor ratio of the US imports was 60% higher than the same ratio of exports.

These results, known as the Leontief paradox, promoted development of a wide range of new trade theories using “extended” version of the H-O theorem. Among the proposed explanations, Helpman (1999) discusses effects of economies of scale and product differentiation. Other explanations (Baldwin, 1971) include differences in productivity across inputs and countries (i.e. different technologies), complementarity of capital and natural resources, inclusion of a human capital as a factor of production, factor intensity reversals, different demand patterns, effects of R&D activities and trade distorting measures such as tariffs and non-tariff barriers to trade.

Leamer (1980) proposes alternative explanation of the Leontief paradox. He argues that the paradox “rests on a simple conceptual misunderstanding. It makes use of the intuitively appealing but nonetheless false proposition that if the capital per man embodied in exports is less than the capital per man embodied in imports, the country is revealed to be poorly endowed in capital relative to labor”. The author derives from the H-O-V theorem the following conclusion: a country is considered relatively capital abundant if and only if one of the following conditions holds:

- 1) $K_x - K_m > 0, L_x - L_m < 0$, where $K_x, K_m, L_x, L_m, K_c, L_c$ are capital and labor embodied in exports, imports and consumption. The condition implies that capital embodied in exports is greater than capital embodied in imports and labor embodied in exports is less than labor embodied in imports;
- 2) $K_x - K_m > 0, L_x - L_m > 0, (K_x - K_m)/(L_x - L_m) > K_c/L_c$ — capital embodied in exports is greater than capital embodied in imports, labor embodied in exports is greater than labor embodied in imports, and capital per worker in net export is greater than capital per worker in consumption;

- 3) $K_x - K_m < 0$, $L_x - L_m < 0$, $(K_x - K_m)/(L_x - L_m) < K_c/L_c$ — capital embodied in exports is less than capital embodied in imports, labor embodied in exports is less than labor embodied in imports, and capital per worker in net export is less than capital per worker in consumption.

Leamer shows that, though Leontief found that $K_x - K_m > 0$, $L_x - L_m > 0$, data for the US in 1947 satisfy 2) (i.e., capital per worker in net export is greater than capital per worker in consumption), therefore the US is revealed to be capital abundant and the H-O theorem is not violated.

However, Leamer finds the same argument is not sufficient to reject the {Leontief} paradox confirmed by Baldwin (1971) on the basis of 1962 data⁸. Another evidence supporting the Leontief paradox is provided by Brecher and Choudry (1982). They show that net export of labor services in the US is positive even after adjusting for trade imbalance. The authors conclude that Leontief's results cannot be reconciled with H-O-V theorem and departures from the theorem assumptions (free trade, identical tastes, homogenous labor, etc.) are necessary to explain them.

In general, there have been used three types of studies of trade commodity structure (Bowen, Leamer, and Sveikauskas, 1987, 791). The first is the classic test of Leontief, which compares the capital per man embodied in a million dollar worth of exports with the capital per man embodied in a million dollar worth of imports. The second type is regression of trade of many commodities on their factor input requirements for a single country, and the third approach is to regress net exports for many countries on factor input requirements.

Leamer and Bowen (1981) criticize the cross-industry regressions for not being based on theoretical foundations. They usually are based on measurements of only two of the three concepts – factor input requirements (A), net commodity exports (T), and factor endowments (E). “In fact these studies take the theory as

⁸ According to 1962 data, the United States was a net exporter of both capital services and labor services ($K_x - K_m > 0$, $L_x - L_m > 0$), but the ratio $(K_x - K_m)/(L_x - L_m)$ fell below capital per man value.

given and use the relationship (4)⁹ to derive measures of the third concept given the other two” (Leamer and Bowen, 1981, 1041). It is implicitly assumed, that the signs of the coefficients reveal the relative abundance of factors. However, as Leamer and Bowen observe, it is not necessarily true. The regression vector is $\hat{\beta}=(AA')^{-1}AT_i=(AA')^{-1}(E_iEw_i)$. $\hat{\beta}$ and (E_iEw_i) have the same sign only when the transformation matrix $(AA')^{-1}$ preserves the orthant of E_iEw_i . A sufficient condition for this is that matrix $(AA')^{-1}$ be diagonal with strictly positive diagonal elements. In practice, industries employ several complementary factors; therefore, correspondence of the signs of the regression coefficients and measures of factor abundance cannot be assured (Bowen and Sveikauskas, 1992, 603). However, “if actual factor complementarities are small, then the above theoretical qualifications may be empirically unimportant, and coefficient signs might reliably indicate revealed factor abundances” (Bowen and Sveikauskas, 1992, 604),

Besides, an important question is how to scale the dependent variable so that make the cross-industry comparisons sensible. “If no attempt is made to control for scale, any explanatory variable that is correlated with the size of the commodity group will pick up the scale effect” (Leamer and Levinsohn, 1995, 1370). The scale effect has been usually controlled by dividing net export variable by some measure of market size, such as national or world output.

Though, Bowen and Sveikauskas (1992) show that while the cross-industry approach may not be theoretically correct, in practice the problem is not severe: regression approach works well provided trade is adjusted for trade imbalance¹⁰. They run several cross-industry regressions and show that the signs of the estimated coefficients usually are the same as the signs on the revealed factor abundance. Therefore, “many regression studies conducted over the past

⁹ $F_i=AT_i=A(Q_iC_i)=E_iAQ_iw_i=E_iEw_i$

¹⁰ Trade imbalance is insignificant in Ukraine, since the share of the country trade balance in the world GDP is approaching zero. Therefore, trade imbalance can be disregarded in the regression model for Ukraine.

30 years can be considered to have provided reliable evidence on countries' revealed factor abundance"¹¹.

Baldwin (1971) follows the second approach testing of the H-O theorem in the form of the regression of net exports of multiple commodities for one country. He tests the extent to which the level of US net exports by commodity¹² is explained by

- differences in the capital-labor ratios of the commodities exported and imported;
- abundance of educated labor;
- R&D expenditures;
- existence of economy of scale;
- relatively high degree of concentration and unionization in the US.

To account for human capital Baldwin (1971) chooses the average cost of education, average years of education, and percentage of labor force in various skill groups. Percentage of engineers and scientists in export and import competing industries is chosen as a measure of R&D activities; other exogenous variables are industry characteristics (scale, unionization and concentration indices).

Baldwin (1971) concludes that the Leontief paradox still holds and “a straightforward application of a two factor (capital and labor) factor-proportions model along Heckscher-Ohlin lines is inadequate for understanding the patterns of U.S. trade. Not only is the sign of the capital-labor ratio¹³ opposite from what would be expected from the model but it is statistically significant in this

¹¹ See Bowen and Sveikauskas (1992, 601).

¹² Baldwin tests the general US trade structure, as well as the structure of US trade with several groups of countries separately. Though the Heckscher-Ohlin theorem does not imply its results should hold on the bilateral basis, but the author finds a regional analysis to be useful in revealing additional information on the factors influencing the commodity pattern of U.S. trade.

¹³ Baldwin also calculated (capital + costs of educated labor)/labor ratios of exports and import competing products), but its sign also turns out to be significantly negative.

unexpected direction”¹⁴. This result can be partially explained by the abundance of skilled labor in the US exporting industries and by the fact that a large share of it is engaged in research and development activities, which is confirmed by the significant coefficients on percentage of engineers & scientists and other skill group variables. However, measures of education such as the average cost of education and average years of education appear to be insignificant. Baldwin explains this fact by fast educational adjustment through on-the-job training etc. allowed by fast technological progress that makes stock measures of human capital less significant. Such industry characteristics as scale, unionization and concentration indices also do not explain much of the US trade pattern, probably due to imperfect measures. Thus, it can be suggested that the US has comparative advantage based on technologies rather than on relative factor proportions.

Baldwin (1979) presents further evidence confirming the Leontief paradox in another study, where he looks at 30 countries instead of only the US. Baldwin performs the analysis similar to his previous work regressing net exports by industries on such variables as capital-labor ratio, percentage of labor in different skill groups, R&D proxy and others. He finds that other capital abundant countries (Japan, Germany, United Kingdom and Italy) also tend to export labor-intensive goods, though human capital variables turn out to be insignificant for countries other than the US. The author proposes the following explanations: the emergence of investment opportunities in capital-intensive raw materials production in developing countries, while labor-intensive industries remain unattractive for investors due to high costs of labor training and management; import-substitution policies of developing countries create incentives to capital-intensive home production while protecting labor-intensive industries from foreign competition in the form of imports.

¹⁴ See Baldwin (1971, 141).

In Baldwin's opinion, there is need for further, more elaborate empirical investigations of the factors determining the commodity structure of a country's foreign trade (Baldwin, 1971, 143). These should integrate explicitly technological differences, transportation costs and trade policies.

Other studies of the determinants of the US commodity trade structure using cross-industry regression approach, similar to the Baldwin one, were conducted by Stern and Maskus (1981) and Branson and Monoyios (1977).

Branson and Monoyios (1977) construct their own estimates of human capital as differences between an industry average wage and the total economy average unskilled wage. Besides, they scale the dependent net exports variable using gross trade as a scaling factor. According to their results, the US tends to import physical capital and non-skilled labor-intensive products, while exporting human capital-intensive products.

Stern and Maskus (1981) conduct a regression analysis for each year from 1958 through 1976 and reach the same conclusions as Branson and Monoyios (1977). Moreover, they find the negative coefficient on labor to grow both in absolute value and significance.

Harkness (1978) was first to introduce factor rewards shares in the final demand as the measure of factor intensity into cross-industry regression analysis for the US. He includes shares for 16 factors of production including pastureland, stone and clay, forests etc. His results differ from the above ones in that the US is found to export capital-intensive goods. Thus, the Leontief paradox seems to be reversed with inclusion of natural resources endowments.

McGilvray and Simpson (1973) provide an example of analysis of the commodity structure of foreign trade on a bilateral basis. Ireland, a labor-abundant country, is expected to export labor-intensive goods. This hypothesis is tested using input-output tables for Ireland, data on export and import flows and estimates of labor and capital stock coefficients. The authors make two sets of calculations: in one only the direct labor and capital requirements per unit of

output are used, in the second one total capital and labor requirements (direct + indirect, i.e., arising through intermediary inputs) are used. The resulting ratios (both for direct and total capital and labor requirements) indicate that Ireland tends to export labor-intensive commodities, which is consistent with the initial hypothesis. However, if natural resources are excluded from trade the results become reversed, which means that Irish exports are relatively more natural-resource intensive than import substitutes, and natural resources sector is a labor intensive one. The authors suggest that such trends in Irish foreign trade can be explained by the severe restrictions on exports of agricultural products, which give the domestic food industry a cost advantage.

Harrigan (1997) offers a different type of analysis of the determinants of a country's trade pattern. The author is the first to estimate the model with both technology and factor endowment differences as determinants of the international specialization. The dependent variable in his model is a share of a product in GDP; the model is estimated on a data set of ten industrial countries over 20 years for seven different manufacturing sectors. Technology differences are measured by comparing total factor productivity (TFP) in different sectors. Results show that both Ricardian and Heckscher-Ohlin effects matter: technology and factor supply differences are both significant. Though the paper does not explicitly address trade, the author states that its implications to trade are straightforward: if countries have similar tastes, the conclusions about the determinants of a country's commodity production pattern will lead to conclusions about the country's commodity trade pattern. Thus, Harrigan believes that technology differences should be included in any model of trade patterns.

All of the studies reviewed so far are focused on the developed economies. Maskus and Ramazani (1993) conduct test of the H-O theorem for Korea, which is a rapidly industrializing country. The authors take six factor inputs: agriculture, fishery and forestry, and mining as natural-resource inputs, production and non-

production labor as proxies for relatively unskilled and relatively skilled labor, and capital input. They compute direct factor-output ratios for each sector on the basis of the Korean input-output tables and then compute the total factor contents of net exports and production for comparison with actual endowment rankings in 1970 and 1980. Maskus and Ramazani find that the revealed factor abundance rankings differ significantly from the actual factor abundance rankings; therefore, they conclude that the H-O provides poor predictions in the Korean case. However, deviations of the revealed abundance rankings from the actual ones decreased significantly in 1980 relatively to 1970. Thus, Korean foreign trade may be moving towards the pattern predicted by the H-O.

Kaminski (forthcoming) confirms the conclusion about gradual adjustment of the foreign trade structure to the one predicted by the H-O during economic transition on the example of the Central and Eastern European countries (CEEC). The author breaks commodity groups into four groups reflecting their relative factor intensities (natural resources, capital, unskilled labor and skilled labor-intensive) and finds that the share of unskilled labor-intensive exports increased significantly in the CEEC over 1989-1997 reflecting their relative unskilled labor abundance.

I build a model similar to the Baldwin's one using the measure of human capital proposed by him (shares of educated and skilled workers in the total labor), since wage differences are a poor measure of human capital in case of Ukraine¹⁵. In the absence of total factor productivity data, I include a labor productivity variable in my model to measure technology differences. Besides, I include in the model variables for trade restrictions and would expect them to play an important role in determining structure of Ukrainian trade. Unfortunately, due to lack of data it is impossible to include natural resources endowments into the model.

¹⁵ For example, engineers and scientists receive much lower wages than miners.

Chapter 3

MARKETS AND INSTITUTIONS

MARKETS

Ukraine has largely outdated equipment, backward technologies and a large amount of unemployed, relatively qualified, labor.¹⁶ Endowments of inputs (capital, labor, human capital, technology), according to the Heckscher-Olin theorem, determine the comparative advantage of a country, and thus the commodity structure of its foreign trade.

Exports

Semi-finished goods, which are often highly energy consuming, prevail in Ukrainian exports (according to Derzhkomstat data, ferrous metals, non-ferrous metals, agricultural produce, mineral products and by large part chemicals constitute about 70% of export). Such goods compete primarily by price, which makes them highly sensitive to changes in world market conditions; prices remain the main factor determining Ukraine's dynamic.

It is noteworthy that the majority of processed export goods (machinery and equipment, and food) goes to the FSU (28.7%¹⁷ of merchandise export in 2001, according to NBU data, while the share of merchandise exports to Russia is 22.6%). Russia remains Ukraine's main trading partner, with nearly a one third share in its external trade turnover, though the share of trade volumes between

¹⁶ See "Quarterly Predictions" #12, July 2000, p.11.

¹⁷ Further the data of NBU are used if not otherwise stated. NBU data on the foreign trade flows differ from those of Derzhkomstat, in the amount of adjustments made by the bank. In particular, import is calculated in FOB prices in the trade balance, and in CIF prices in the balance of payment. Besides, a large portion of the adjustments is generated by unofficial trade.

the two countries has declined¹⁸. So big reciprocal trade has evolved partially due to close links between two countries established in the Soviet times. Ukraine and Russia have “highly integrated production and consumption chains, infrastructure for trade and business networks” (Djankov, Freund, 2000, 18).

Exports to the EU (18.2%) and US (3.5%) are comprised mainly of semi-finished goods. The main export items to the EU are scrap metals, semi-finished iron or steel products, and agricultural produce, in particular sunflower seeds (according to Derzhkomstat data, together these account for more than half of Ukraine’s exports to the region). Ferrous metals are also the biggest share of the Ukrainian export to the US (about 60%, according to the Derzhkomstat data). Ferrous metals and mineral products are the major export items to Central and Eastern European countries.

In 1999, Ukraine experienced a trade balance surplus for the first time, of 834 million USD. This was the result of a more rapid decline in imports than in exports: exports of goods fell by 9%, and imports fell by 20.5% in 1999. The fall in merchandise exports was most significant in Ukraine’s traditional export-oriented industries: ferrous metals, chemicals, and machine building. Although physical volumes of several groups of exports increased (primarily ferrous metals and chemicals), they declined in value terms, because of a decline in world prices. Exports suffered from the imposition of export tariffs on sunflower seeds and hides, frequent failures to reimburse VAT payments to exporters, and anti-dumping proceedings of EU countries and the US against Ukrainian producers of ferrous metals and chemicals.

¹⁸ Compared to 1996, Russia’s 2001 share of total Ukrainian merchandise exports fell from 38.0% to 22.6%.

Table 1. Dynamics of Ukraine's foreign trade in 1996-2001

Indicators	1996	1997	1998	1999	2000	2001
Export of goods, <i>millions USD</i>	15,547	15,418	13,699	12,463	15,722	17,091
Export of goods, % <i>change, y-o-y</i> ¹⁹	—	-0.8	-11.1	-9.0	26.1	10.6
Agricultural produce [9.6%] ²⁰	—	—	—	6.1	-25.5	52.4
Food [2.7%]	—	—	—	-7.2	30.9	11.8
Chemicals [9.4%]	—	—	—	-15.3	42.4	-4.1
Wood/pulp&paper [2.7%]	—	—	—	32.1	33.0	26.3
Textile/apparel [3.9%]	—	—	—	-9.5	18.5	14.2
Ferrous metals and ferroproducts [37.1%]	—	—	—	-11.5	32.4	-1.1
Electric and non-electric machinery [7.9%]	—	—	—	-17.1	48.2	26.2
Non-ferrous metals [5.0%]	—	—	—	19.3	35.0	29.2
Mineral products [10.1%]	—	—	—	0.5	19.8	25.0
Import of goods CIF, <i>millions USD</i>	-19,843	-19,623	-16,283	-12,945	-14,943	-16,893
Import of goods CIF, % <i>change, y-o-y</i>	—	-1.1	-17.0	-20.5	15.4	13.0
Agricultural produce [3.9%]	—	—	—	-8.3	2.3	19.6
Food [3.8%]	—	—	—	-19.6	-0.9	34.3
Chemicals [6.7%]	—	—	—	-20.8	13.9	25.5
Textile/apparel [4.0%]	—	—	—	-13.4	19.5	15.5
Electric and non-electric machinery [13.0%]	—	—	—	-32.5	25.9	22.5
Vehicles [4.5%]	—	—	—	-39.5	-6.1	48.1
Mineral products [47.3%]	—	—	—	-11.4	16.8	2.8

Data source: Derzhkomstat, NBU

In the year 2000, exports of goods experienced a reversal – they grew by 25.1%. Notwithstanding the fast growth of Ukrainian exports, the position of exporters in external markets has been unstable. This is confirmed by more than one hundred antidumping investigations initiated against Ukraine (the commodities that have been subject to antidumping investigations include sheet metal, metal rods, pipes, chemical fertilizers, and ammonium nitrate).

¹⁹ y-o-y = year-over-year.

²⁰ Figure in brackets indicates percentage of the total exports/imports in 2001.

Regardless of the worsening conditions in external markets, including the slow down of economic growth in the US and the EU and the decrease of world prices of ferrous metals, Ukrainian exports were growing rapidly in the first half of 2001. This dynamic can be explained by the fact that exporters anticipating the imposition of VAT on imports by Russia starting July 2001 and the resulting increase in Ukrainian export prices: local producers of machinery and equipment, agricultural and food products boosted their exports to Russia during the first 6 months of the year 2001²¹. However, in the second half of 2001, exports reacted to the worsening external situation and significantly slowed their growth to 10.6% comparing with 2000.

Imports

The structure of Ukrainian imports is rather homogeneous: according to Derzhkomstat data, fuel constitutes about 40%, coming mainly from Russia. Ukraine imports a great deal of gas because of the high-energy consumption of its industries (metallurgy and chemicals), therefore gas consumption has not changed much from year to year. A slow down of gas import in 2000 was due to two major factors (whose effects are only transitory)²²: (1) cutoff of non-paying customers²³, and (2) a warm winter, which allowed customers to consume less gas and cut gas transit volumes from Russia. Oil imports to Ukraine have grown rapidly over the last year due to the fulfillment of privatization obligations taken on by Russian investors - the new owners of Ukrainian oil refineries. One of these obligations is to provide refineries with crude oil.

Another important import article is machinery and equipment (its share was 13.9% in 2000, according to Derzhkomstat data). The share has been growing recently due to increases in investment in Ukrainian enterprises and

²¹ Export to Russia during first half of the year grew by 47.7% comparing with the same period last year, while in the third quarter it fell by 27.7%.

²² See "Quarterly Predictions" #16, July 2001, p.35.

²³ According to Naftogaz Ukrainy, this is the main determinant of the gas consumption decrease of 7 billion square meters in Q4 '00 – Q1 '01, contributing 80% to the rate of decrease.

growth of household incomes. There is also a good deal of intra-industry trade in machinery and equipment between Ukraine and Russia, due to the high integration of the countries' machine-building industries – a legacy from Soviet times²⁴.

INSTITUTIONS

Ukraine's exports have low degree of processing and low differentiation level, and compete mainly in highly regulated (i.e., protected) markets²⁵. For example, Ukraine regularly signs agreements with the EU on the size of quotas of ferrous metals and with Russia - on the size of quotas of pipes. Ukraine's agricultural producers find difficulties in finding markets for their produce abroad since countries often subsidize their home producers and protect their markets.

During recent years, metallurgical enterprises in Ukraine were granted the following privileges:

- the law “On the Conduction of Economic Experiment on Enterprises of Ukrainian Ferrous Metal Industry” (4.07.1999) set tax privileges for enterprises, i.e. 9% profit tax rate instead of 30%, exemption from taxes for construction, reconstruction and maintenance of highways, reduction of payments to the State Innovation Fund by 50%, the possibility of postponing tax and other mandatory payments up to 36 months, applying a zero rate of payment for tax credit use.
- setting export quotas and banning the export of metal scrap. The law “On Metal Scrap” (5.05.1999) gives the Cabinet of Ministers the right to impose quotas on or ban metal scrap exports. These restrictions were imposed in order to provide cheap supply of inputs to the metallurgical plants.

²⁴ See “Quarterly Predictions” #17, October 2001, p.38.

Tax privileges in the metallurgical industry and restrictions on scrap metal exports translate to government subsidization of enterprises in the mining sector. Such behavior encourages Ukrainian trade partners to apply compensatory sanctions. The restrictions on scrap metal export also create room for corruption, as the procedures for obtaining licenses for operations with scrap metal are opaque.

Increased indirect subsidies to the agricultural sector (through the restriction of exports of mineral fertilizers imposed by the telegram of Cabinet of Ministers at the beginning of 2001²⁶, for example), as well as privileges granted to fuel importers by the law “On stimulating the agriculture development during 2001-2004” (18.01.2001), obviously aim to speed up development of the agricultural sector. However, the benefits from these measures (cheaper inputs for agricultural enterprises) will not offset the loss to society, since:

- Restrictions on the export of mineral fertilizers distort their market price.
- Privileges granted to fuel importers contradict the principles of fair competition in the domestic fuels market and restrain the development of domestic oil refineries. In addition, consumers other than farmers enjoy lower prices for imported fuels. Thus, the privileges do not hit the target, and cause significant losses to the budget.
- Export restrictions on mineral fertilizers may prevent Ukraine from joining the WTO, because such policies contradict its requirements.

Protection of the domestic automobile industry from international competition exists through restricting imports and granting tax privileges (according to the law “On Stimulating Automotive Construction in Ukraine”

²⁵ See “Quarterly Predictions” #19, April 2002, p.41.

²⁶ See Quarterly Predictions #15, April 2001, p.43.

(19.09.1997)). Import duty isn't imposed on materials and spare parts used by an enterprise for productive purposes. VAT isn't imposed on materials and spare parts used by an enterprise for productive purposes. Excise relief is granted till 1.01.2007 to sales revenues from cars, vans, motorcycles produced by Ukrainian enterprises of any property type (if the production is not less than 1000 units per year)) has short- term positive effects, including the creation of extra jobs and production growth. The long- term effect of such protection is negative:

- (1) interests of consumers are hurt, as they have no possibility to select goods meeting their full range of tastes and incomes,
- (2) several companies obtain a virtual monopolistic position due to privileges allowing them to manufacture products of lower quality and higher price than in a competitive environment.

Besides, the Ukrainian government widely applies non-tariff barriers to trade including quotas, licenses, minimum custom value etc. to hinder imports, and the intensity of non-tariff protection has increased over the last six years (Movchan, 2002, 42).

About a third of Ukraine's exports go to members of CIS, where a free trade zone was created (the corresponding agreement was ratified on October 10, 1999). However, the functioning of this zone is hindered by disagreement among the member countries and presence of numerous exclusions from the free trade regime. Bilateral agreements on the creation of free trade zones with eleven CIS countries, signed in 1993 –1995, have not been implemented.

Chapter 4

METHODOLOGY OF EMPIRICAL RESEARCH

Ukraine is relatively labor-abundant country since its capital-labor ratio is lower than of the majority of its trading partners, including Russia (see Appendix 1). According to the Derzhkomstat data, the amount of capital stock in Ukraine has fell during the last 10 years. According to the Derzhkomstat survey carried out in the third quarter 2001, enterprises find the lack of capital as the most significant barrier to their activity, however they have been unable to finance necessary investment into new equipment. At the same time, supply of labor is vast²⁷. Therefore, according to the H-O theorem, the country should tend to export relatively labor-intensive goods.

However, until the beginning of the 1990's, capital-intensive goods dominated the commodity structure of Ukraine's foreign trade and industrial production structure due to decisions of the USSR central planners. The H-O predicts that, being in transition, the country should increase exports of the labor-intensive goods. My hypothesis is that relative factor abundance measured by capital-labor ratio only partially explains determinants of the commodity structure of Ukrainian international trade; the main reason for this has been protectionist policies of the Ukrainian government.

Testing this hypothesis requires a 2-step process. First, I conduct the Leontief-type analysis of the Ukrainian industry input-output tables. The question of whether the current Ukrainian foreign trade structure reflects its comparative advantage will be addressed by comparing capital-labor ratios of exporting and

²⁷ According to International Labor Organization data, unemployment in Ukraine was equal to 11.5% in 2001.

import competing industries. The second stage is a regression analysis of the determinants of the trade commodity structure on the basis of the Baldwin model. I estimate the importance of factor supply differences in explaining the commodity structure of Ukrainian trade, incorporating into the model human capital, labor productivity differences and policy, which restricts foreign trade.

Chapter 5

TEST OF THE DETERMINANTS OF THE STRUCTURE OF UKRAINIAN FOREIGN TRADE

Stage One: Leontief-type analysis

In this stage, the capital-labor ratio embedded in Ukraine's exports and imports is measured. This model is a two-factor one, and as such duplicates the two factor approach that is central to the Leontief's paradox. The two factors, capital (K) and labor (L), may be defined in a number of different ways. In this paper, the capital-labor ratio (K_L) capital is defined as capital stock measured in hryvnas divided by the total number of hours worked in the industry during the year; while labor is defined as amount of people being employed. Amount of hours worked is used instead of number of workers due to widespread practice of "virtual" employment. Virtual employment is prevalent in Ukraine and occurs when people are considered to be employed though they do not actually work being forced to have several month vacations or work only a few hours a week.

The net export variable (NX) is defined as a percentage share of net exports (measured in hryvnas) in industries' outputs. I use annual data on 16 industries for 2 years period 1999-2000. The source of the NX and K_L data is Derzhkomstat.

H-O "theory does imply that the simple correlation between net exports and the use of a factor across industries is positive if that factor is abundant within a country" (Bowen and Sveiskauskaus, 1992, 607). Correlation between NX and K_L calculated on the basis of 32 observations is equal to -0.4068 , which implies that Ukraine tends to export labor-intensive goods, while it imports goods production of which is relatively intensive in capital use, and is in line with H-O theorem predictions. Since testing $H_0: \rho = 1$ (where ρ is a coefficient of

correlation between NX and K_L) creates serious difficulties²⁸, I do not test this hypothesis here. Therefore, I use OLS regression of NX on K_L to estimate the power of K_L in explaining NX. The coefficient of K_L has negative sign and is significant at 1% level. This means that Ukraine tends to export labor-intensive goods. However, the low value of R² probably signals about omitted variables – this problem will be dealt in the next stage.

Table 2. OLS regression of NX on K_L

Dependent Variable: NX				
Method: Pooled Least Squares				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
K_L1?	-1.397159	0.433660	-3.221781	0.0030
R-squared	0.143309	Mean dependent var		-64.38437
Adjusted R-squared	0.143309	S.D. dependent var		172.6583
S.E. of regression	159.8084	Sum squared resid		791700.4

Stage Two:

I use two alternative regression models based on the model developed by Baldwin (1971). The first includes the percentage shares of labor with high education (that have graduated from a university) in total labor force (HIGH) as a regressor. The second includes the percentage shares of skilled labor (professionals) in total labor force (PROF) instead of HIGH. I refer to these alternative specifications as specification 1 and specification 2 respectively.

Correlation between these variables is equal to 0.646, which implies that a certain share of skilled labor does not have university degree. HIGH and PROF account for human capital employed, usage of which is suggested by Baldwin (1971, 1979).

Apart from HIGH/PROF, NX and K_L, models include the following variables:

PROD_R – rank of the industry productivity of labor, which is measured as hryvna value of output per employee-hour (rank is higher for higher industry

²⁸ See Кокс А., Хинкли Д. (1978), «Теоретическая статистика», p.158.

productivity). The rank is taken since labor productivity is highly correlated with capital-labor ratio by construction: both variables have employee-hours in the denominator.

TAX – rank of the industry according to tax privileges as a share of output that it receives (rank is higher for larger tax privileges).

INB – rank of the industry according to the value of the index of non-tariff barriers to imports²⁹. TAX and INB are included to account for protection of industries, which can distort their comparative advantages and thus, influence trade structure.

I use annual data on 16 industries for 2 years period 1999-2000. Source of all the data used is Derzhkomstat, except the data on tax privileges that are provided by State Tax Inspection.

The regression equations are the following:

$$NX_{it} = \beta_1 + \beta_2 * K_{L_{it}} + \beta_3 * HIGH_{R_{it}} + \beta_4 * PROD_{R_{it}} + \beta_5 * TAX_{it} + \beta_6 * INB_{it} + u_{it}, \quad (1)$$

$$NX_{it} = \gamma_1 + \gamma_2 * K_{L_{it}} + \gamma_3 * PROF_{R_{it}} + \gamma_4 * PROD_{R_{it}} + \gamma_5 * TAX_{it} + \gamma_6 * INB_{it} + v_{it}, \quad (2)$$

where i refers to the industry, t to the year.

I expect that β_2 , γ_2 , β_3 and γ_3 will have negative signs indicating that Ukraine tends to export labor-intensive goods which are produced with relatively high productivity and import physical and human capital-intensive goods³⁰. β_4 and γ_4 are expected to have positive sign indicating that Ukraine tends to export goods with higher productivity. β_5 , γ_5 , β_6 and γ_6 are expected to have positive sign since tax privileges are assumed to positively influence exports while non-tariff barriers are expected to hinder imports.

Running OLS regression yields the following results:

²⁹ Data on the index of non-tariff barriers (INB) were taken from Movchan (2002). On the methodology of the index calculation see Appendix II.

³⁰ Regardless the share of the population with high education in Ukraine is relatively high compared to many developed countries, rates of return to education are much lower in this country than in the developed ones (Zhylevskyy, 2002, 39). This accounts for the human capital mismatch: people with high education are often employed at low-skilled jobs.

Table 3. Pooled OLS regression (1) (using HIGH)

Dependent Variable: NX				
Method: Pooled Least Squares				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
K_L	-2.271284	1.111189	-2.044012	0.0508
PROD_R	9.553108	8.807511	1.084655	0.2877
HIGH	-3.187056	2.190564	-1.454902	0.1572
TAX	10.43844	4.315562	2.418791	0.0226
INB	5.041410	4.134420	1.219376	0.2332
R-squared	0.401426	Mean dependent var	-64.38437	
Adjusted R-squared	0.312749	S.D. dependent var	172.6583	
S.E. of regression	143.1348	Sum squared resid	553164.7	
F-statistic	4.526809	Prob(F-statistic)	0.006289	

Table 4. Pooled OLS regression (2) (using PROF)

Dependent Variable: NX				
Method: Pooled Least Squares				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
K_L	-2.708695	1.091959	-2.480584	0.0196
PROD_R	5.044095	8.687293	0.580629	0.5663
PROF	-2.121629	3.243810	-0.654055	0.5186
TAX	11.31472	4.742199	2.385965	0.0243
INB	4.118696	4.231031	0.973450	0.3390
R-squared	0.364567	Mean dependent var	-64.38437	
Adjusted R-squared	0.270429	S.D. dependent var	172.6583	
S.E. of regression	147.4760	Sum squared resid	587227.5	
F-statistic	3.872683	Prob(F-statistic)	0.012998	

The regressions results show that only two coefficients (at K_L and TAX) are significant at 5% level. Thus, Ukraine tends to export labor-intensive goods and tax benefits appear to be a significant factor promoting exports (the coefficients of K_L and TAX are significant at 5%. All the other variables appear to be insignificant.

However, Cook and Heisberg test of OLS regressions reveals existence of heteroskedasticity, which implies that estimated coefficients are inefficient and no

inference can be made on the basis of the calculated statistics. Applying GLS with adjusted to heteroskedasticity covariance matrix³¹ yields the following results:

Table 5. GLS regression (1) (using HIGH)

Dependent Variable: NX				
Method: GLS (Cross Section Weights)				
White Heteroskedasticity-Consistent Standard Errors & Covariance				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
K_L	-2.173067	0.291891	-7.444791	0.0000
PROD_R	9.491395	2.948057	3.219543	0.0033
HIGH	-1.380161	0.778203	-1.773525	0.0874
TAX	7.578399	0.728034	10.40940	0.0000
INB	2.254514	1.311260	1.719349	0.0970
Weighted Statistics				
R-squared	0.601946	Mean dependent var	-51.09320	
Adjusted R-squared	0.542975	S.D. dependent var	166.0057	
S.E. of regression	112.2259	Sum squared resid	340055.8	
F-statistic	10.20749	Prob(F-statistic)	0.000036	

Table 4. GLS regression (using PROF)

Dependent Variable: NX				
Method: GLS (Cross Section Weights)				
White Heteroskedasticity-Consistent Standard Errors & Covariance				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
K_L	-2.394978	0.192311	-12.45367	0.0000
PROD_R	6.732986	1.633494	4.121831	0.0003
PROF	-0.996334	0.631585	-1.577513	0.1263
TAX	8.624669	0.804812	10.71638	0.0000
INB	2.563382	0.602289	4.256063	0.0002
Weighted Statistics				
R-squared	0.714939	Mean dependent var	-57.68072	
Adjusted R-squared	0.672708	S.D. dependent var	193.6429	
S.E. of regression	110.7821	Sum squared resid	331362.2	
F-statistic	16.92913	Prob(F-statistic)	0.000000	

The new regression for model (1) has coefficients of HIGH and INB significant at the 10% level and all the other coefficients significant at the 1% level. The new regression for model (2) yields all the coefficients significant at the

³¹ This estimation technique assigns weights to each estimation (found as estimated variances in the degree - 1) and calculates White covariance matrix robust to heteroskedasticity.

1% level apart from the coefficient of PROF that is insignificant even at the 10% level. The new regressions results show that Ukraine tends to export labor-intensive goods and goods production of which requires technologies with higher labor productivity, while importing physical and human capital-intensive goods. Tax benefits significantly stimulate Ukrainian exports, while non-tariff barriers significantly hinder imports. The insignificant coefficient of PROF implies that educational attainments appear to be more important determinants of trade structure than professional characteristics of labor.

Chapter 6

CONCLUSIONS

The purposes of this paper were: i) to analyze the commodity structure of Ukrainian foreign trade and check whether the Heckscher-Ohlin theorem predictions based on comparative advantage estimation work in Ukraine, ii) to empirically estimate importance of other factors influencing the commodity structure of Ukrainian foreign trade, iii) to identify policy implications of the empirical findings.

The conclusion is that the Heckscher-Ohlin theorem predictions are correct in case of Ukraine and the country being labor-abundant tends to export labor-intensive goods like the Central and Eastern European countries. However, other factors such as relative human capital-intensity, productivity differences and protection of industries are found to be also important in determining trade structure. The empirical analysis shows that Ukraine tends to export labor-intensive goods, production of which is characterized by relatively higher labor productivity and is subsidized by means of tax privileges; it imports physical and human capital-intensive goods; non-tariff barriers to trade hinder imports.

The main implications of the results are the following:

- The fact that Ukraine tends to import human-capital intensive goods regardless relatively high proportion of people with high education in Ukraine indicates existence of human capital mismatch in the country - knowledge and skills become outdated

and people with high education often can find employment mainly at low-skilled jobs.

- Due to protectionism of the Ukrainian government, foreign trade commodity structure of Ukraine is distorted from the optimal one determined by its comparative advantages. Factors of production are allocated less efficiently than without protectionism, and production and consumption patterns are distorted in favor of protected goods. Moreover, tax privileges require redistribution of income from consumers and non-protected producers to the protected producers. As a result, such protectionist policy leads to the social welfare deadweight losses in the country.

However, the achieved results have essential limitations:

- (1) High level of aggregation may lead to biased estimates since it can hide factor intensity reversals in terms of one group. It is possible that the same commodities are relatively more labor-intensive in Ukraine than in its trading partners;
- (2) The capital stock data used can overstate the actual capital intensity of products since capital is often used not at full capacity³². Correction for this deficiency would probably result in higher labor-intensities of the exported goods;
- (3) Natural resources endowments are not included in the model due to lack of the data. Their inclusion may lead to different coefficients of the other factors variables;

³² According to the Ukrainian new agencies, it is often the case that machine-building or ferrous metallurgy enterprises work at less than 70% of their capacity.

- (4) There is no special treatment of links with the FSU (Russia), which may be an important factor in determining the Ukrainian foreign trade structure.

These limitations outline the possible directions of further work. When data that are more detailed become available, more sophisticated analysis of the determinants of the commodity pattern of Ukrainian foreign trade can be conducted. Still the achieved results offer the informative insight into the determinants of the commodity structure of Ukrainian foreign trade.

BIBLIOGRAPHY

- Baldwin, Robert E. (1971). *Determinants of the Commodity Structure of U.S. Trade*. American Economic Review, 61 (March): 126-146.
- Baldwin, Robert E. (1979). *Determinants of Trade and Foreign Investment: Further Evidence*. Review of Economics and Statistics, 61 (February): 40-48.
- Bhagwati, J.N. (1972). *The Heckscher-Ohlin Theorem in the Multi-Commodity Case*. The Journal of Political Economy, 80(5): 1052-1055.
- Bowen, H., Leamer, E., Sveikauskas, L. (1987). *Multicountry, Multifactor Tests of the Factor Abundance Theory*. American Economic Review, 77(5): 791-801.
- Bowen, H., Sveikauskas, L. (1992). *Judging Factor Abundance*. Quarterly Journal of Economics, 107(2): 599-620.
- Branson, W., Monoyios, N. (1977). Factor inputs in U.S. Trade. Journal of International Economics, 7 (May): 111-131.
- Brecher, R., Chaudhri, E. (1982). *The Leontief Paradox, Continued*. Journal of Political Economy, 90(4): 820-823.
- Deardorf, A.V. (1985). *Testing Trade Theories*. Handbook of International Economics. Volume I: 467-512.
- Dornbusch, R., Fischer, S., Samuelson, P.A. (1980). *Heckscher-Ohlin Trade Theory with a Continuum of Goods*. The Quarterly Journal of Economics, 95(2): 203-224.
- Djankov, S., Freund, C. (2000). *Disintegration and Trade Flows: Evidence from the Former Soviet Union*. Available at <http://wbln0018.worldbank.org/research/workpapers.nsf>.
- Ethier, W.J. (1985). *Higher Dimensional Issues in Trade Theory*. Handbook of International Economics. Volume I: 131-184.
- Harkness, Jon (1978). *Factor Abundance and Comparative Advantage*. American Economic Review, 68 (December): 784-800.
- Harrigan, J. (1997). *Technology, Factor Supplies and International Specialization: Estimating the Neoclassical Model*. American Economic Review, 87(4): 475-494.
- Helpman, E. (1999). *The Structure of Foreign Trade*. Journal of Economic Perspectives, 13(2):121-144.
- Hobbs, J., Kerr, W., Gaisford, J. (1997). *Trade Policy and the Transformation of the Agrifood System in Central and Eastern Europe and the New Independent States*. Canadian Economics Association Meeting 2001
- Jones, R.W. *Heckscher-Ohlin Trade Models for the New Century*. Available at <http://www.nd.edu/~tgresik/jones.pdf>.

- Kaminski, B. (forthcoming). *How Accession to the European Union Has Affected External Trade and Foreign Direct Investment in Central European Economies*. Available at http://econ.worldbank.org/files/1687_wps2578.pdf
- Leamer, E., Bowen, H. (1981). *Cross-Section Tests of the Heckscher-Ohlin Theorem*. American Economic Review, 71: 1040-1043.
- Leamer, E. (1980). *The Leontief Paradox Reconsidered*. Journal of Political Economy, 88: 495-503.
- Leamer, E., Levinsohn, J. (1995). *International Trade Theory: the Evidence*. Handbook of International Economics. Volume III: 1339-1390.
- Markusen, J., Melvin, J., Kaempfer, W., Maskus, K. (1995). *International Trade. Theory and Evidence*. McGraw-Hill, Inc.
- McGilvray, James, Simpson, David (1973). *The Commodity Structure of Anglo-Irish Trade*. Review of Economics and Statistics, 55 (November): 451-458.
- Movchan, V. (2002). *Non-Tariff Barriers in Ukraine's Foreign Trade: Did Liberalization Occur?* EERC conference, 15-16 May 2002.
- Ramazani, R., Maskus, K. (1993). *A Test of the Factor Endowments Model of Trade in a Rapidly Industrializing Country: The Case of Korea*. The Review of Economics and Statistics, 75(3): 768-572.
- Stern, R., Maskus, K. (1981). *Determinants of the Structure of U.S. Foreign Trade, 1958-1976*. Journal of International Economics, 11 (May): 207-224.
- Zhylevsky, A. (2002). *Human Capital Allocation in the Transitional Economies of Ukraine and Russia*. MA Research Report, EERC, National University of "Kiev-Mohyla Academy".

APPENDIX I

Table 6. Capital-labor ratios for selected countries, 1999

Country	Capital per worker, \$ ³³
Japan	29,723
France	24,798
Denmark	23,060
Germany	22,543
U.S.	17,835
Italy	14,398
Greece	7,242
Russia	3,513
Ukraine	2,056

Source: Compiled from International Monetary Fund, “International Financial Statistics Yearbook”; Nehru and Dhareshwar data set³⁴; Easterley and Fisher data set³⁵.

³³ Capital is calculated in constant 1990 US dollars.

³⁴ The data set compiled by Nehru, V. and Dhareshva, A. is available at <http://www.worldbank.org/research/growth/ddnehdha.htm>.

³⁵ The data set compiled by Easterly, W. and Fischer, S. is available at <http://www.worldbank.org/research/growth/ddeasfis.htm.htm>.

APPENDIX II

Index of non-tariff barriers to trade (INB) developed by Movchan (2002)³⁶ includes the following measures: quotas, licenses, excise charges, anti-dumping measures, and minimum custom value. The INB is constructed as follows:

$$INB_j = \frac{\sum_{i=1}^I NB_{ij} \times IM_j}{\sum_{j=1}^J IM_j}$$

where INB_j is an index of non-tariff barriers for commodity group j , NB_{ij} is an indicator of application of non-tariff barrier i to commodity group j , IM_j is the value of commodity group j , $i=1, \dots, I$, $j=1, \dots, J$, where I is a number of non-tariff barriers incorporated in the study, and J is the total number of groups of commodities.

The NB_{ij} is calculated as follows:

$$NB_{ij} = \begin{cases} 0 \\ 25 \\ 50 \\ 75 \\ 100 \end{cases}$$

where zero means absence of the non-tariff barrier i for commodity j , and 100 is a maximum value of severity of non-tariff barrier i for commodity j .

³⁶ It is called “core” non-tariff barriers index by Movchan (2002).

