

МІЖНАРОДНА ЕКОНОМІКА І ЗМІНИ ГЕОЕКОНОМІЧНОГО ПРОСТОРУ

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ANALYSIS OF THE GLOBAL VALUE CHAINS' LOCATION DETERMINANTS

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The growth of global value chains has dramatically changed the international trade and production. On average, more than half of the exports value is made up of intermediate products that are created and sold within production chains. Economies are not all equally engaged in global value chains, just as they are not equally engaged in international trade. Value chains have influenced not only the traditional form of international competition, but changed the classical locational determinants for foreign investments. In the paper we use multiple regression to ascertain the effect of location determinants upon a country engagement in global value chains. We use the sample, constructed from the database on trade in value added, datasets of the World Bank and United Nations Commission on Trade and Development. We found, that the public debt and the share of high-tech exports have the most perceptible effect upon the multinational companies' decision to locate value chain activity in any country.

Keywords: global economy, multinational enterprises, global value chains, international investment and trade, location determinants

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АНАЛІЗ ЧИННИКІВ РОЗТАШУВАННЯ ГЛОБАЛЬНИХ МЕРЕЖ ДОДАНОЇ ВАРТОСТІ

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Зростання глобальних ланцюгів створення вартості різко змінило характер (структуру) міжнародної торгівлі та виробництва. У середньому більше половини вартості експорту складається з проміжних продуктів, які створюються та продаються в межах виробничих ланцюгів. Не всі національні економіки однаково беруть участь у функціонуванні глобальних ланцюгів вартості, так само як вони не рівною мірою беруть участь в міжнародній торгівлі. Ланцюги вартості вплинули не лише на традиційну форму міжнародної конкуренції, але й змінили класичні детермінанти, що визначають локалізацію іноземних інвестицій. У роботі ми використовуємо багатофакторну регресію, щоб з'ясувати вплив визначальних чинників місцевості на залучення країни до глобальних ланцюжків

вартості. Ми використовуємо масив даних, побудований з бази даних про торгівлю доданою вартістю, наборами даних Світового банку та Комісії Організації Об'єднаних Націй з торгівлі та розвитку. Ми виявили, що державний борг і частка високотехнологічного експорту мають найбільш відчутний вплив на рішення міжнародних компаній щодо визначення місця діяльності в ланцюжку вартості в будь-якій країні.

Ключові слова: глобальна економіка, багатонаціональні підприємства, глобальні ланцюжки вартості, міжнародні інвестиції та торгівля, детермінанти місця розташування

Statement of the problem. During last decades, the considerable changes took place in the international trade and production. The acceleration of technical progress, liberalization of trade and investments, growing interconnectedness of economies, made possible the formation of global value chains (GVC), now playing the increasingly dominated role in international economy. In terms of gross exports, GVCs account for 80 per cent of global trade [12]. Backer and Miroudot [4] estimate that on average, more than half of the exports value is made up of products traded within GVCs.

Not all economies are equally engaged in GVCs. Countries became increasingly specialized in specific activities and stages of value chains rather than in industries. Trade in GVCs therefore involves extensive flows of intermediate goods and services [12].

According to UNCTAD [12], a MNE's choice of host country locations can be affected with various determinants, including economic characteristics (e.g. market size, the potential for growth, infrastructure, workforce availability and skills), the policy framework (e.g. public investment policy, trade agreements, and intellectual property modes) and business facilitation policies (e.g. costs of doing business and investment incentives).

The emergence and growth of GVCs have changed the influence of the "classical" location determinants for investments (so-called OLI-paradigm). The formation of new industries, types of players and GVC modes steadily actualize the GVC location determinants' analysis.

Analysis of recent researchers and publications. Most researches on the firm's location choices through the value chain focus on the elements of the external environment, specifically agglomeration economies [1; 2]. Other papers direct attention is to internal agglomerations: geographically bounded, intra-firm linkages [3]. Specifically, on GVC location, the most comprehensive

list of external location determinants we can find in World Investment Report 2013 [12]. In any case, all these papers have some shortcomings: used old date, for example 1990-s period; no analysis of strength and type of connection between variables; short list of analyzed countries, etc. Under the dynamic changes of MNE's activity, GVC recent development, it causes the necessity to validate the role of all possible location determinants.

The aim of this paper is to specify the modern key location determinants factors and, first of all, those, which cause the engagement of any economy in GVCs.

Main results of the research. To achieve the paper's aim, we use multiple regression. This tool helps us to ascertain the effect of different determinants (explanatory variables) upon a country involvement in GVC stages location.

The index of a country participation in GVC (*GVC_part*) is used as the dependent variable. Statistical data on it are taken from the joint OECD-WTO database on trade in value added – TiVA [8]. Since OECD and WTO calculate the index of country participation in GVC only for 1995, 2000, 2005, 2008 2009, 2010, and 2011 these years are taken as the basis during the initial sample construction.

The sample consist of OECD-members as well as other countries, for which the necessary data are available (Table 1). Unfortunately, the sample does not include the data on least developed countries.

Table 1

Countries in the sample

| OECD-members | Other countries |
|--|---|
| Australia, Austria, Belgium, Great Britain, Greece, Denmark, Estonia, Israel, Ireland, Iceland, Spain, Italy, Canada, Korea, Luxemburg, Mexico, Netherlands, Germany, New Zeland, Norway, Poland, Portugal, Slovakia, Slovenia, USA, Turkey, Hungary, Finland, France, Czech Republic, Chile, Switzerland, Sweden, Japan, Latvia | Argentina, Bulgaria, Brazil, Brunei, Vietnam, India, Indonesia, Cambodia, China, Cyprus, Lithuania, Malaysia, Malta, Republic of South Africa, Russia, Romania, Saudi Arabia, Singapore, Thailand, Philippines, Colombia, Costa Rica, Croatia, Hong Kong, Singapur, Tunisia |

Source: The table was developed by the author

Thus, we have 420 observations, describing the dependent variable.

The initial sample also contains 32 variables, representing the possible key location determinants of GVC fragments (Tabl. 2). We have divided them into two types: economic and policy-related. Economic variables include, besides macroeconomic date, workforce capabilities, quality of a transport and logistic infrastructure, possibilities of local companies.

Table 2

Variables in the sample

| № | Variable |
|---|--|
| Non-policy (economic determinants) | |
| 1. | <i>GDP_growth</i> – annual growth of GDP, %; |
| 2. | <i>GNI_per_cap.</i> – GNI per capita; |
| 3. | <i>FDI</i> – Direct foreign investments, net inflows, % of GDP; |
| 4. | <i>Centr_gov_debt</i> – National debt, % of GDP; |
| 5. | <i>Cur_acc_balance</i> – Current balance of payments, % of GDP; |
| 6. | <i>Inflation</i> – Inflation, GDP deflator, %; |
| 7. | <i>Unempl.</i> – Unemployment, % of labour force; |
| 8. | <i>Bank_cap./ass. ratio</i> – Bank capital and assets ratio, %; |
| 9. | <i>Real_int_rate</i> – Real credit rate, %; |
| 10. | <i>Dom_credit</i> – Domestic crediting to private sector, % of GDP; |
| 11. | <i>High-tech. Ex.</i> – Hi-tech export, % of the industrial export; |
| 12. | <i>Mark_cap.</i> – Market capitalization of local companies, which are quoted on a national exchange, % of GDP; |
| 13. | <i>R&D expend.</i> – Total expenditures on R&D (state and private), % of GDP; |
| 14. | <i>Researchers</i> – The amount of researchers, per million of population; |
| 15. | <i>Technicians</i> – The amount of technical specialists, per million of population; |
| 16. | <i>Health expend.</i> – Total expenditures on health protection (state and private), % of GDP; |
| 17. | <i>Publ. sp. on educ.</i> – Public spending on education, % of GDP; |
| 18. | <i>Wages in GDP</i> – Wages in GDP, %; |
| 19. | <i>Labor force part.</i> – Economically active population, % of all population; |
| 20. | <i>Urban popul.</i> – Urban population, % of all population; |
| 21. | <i>Railways, goods tr-ted</i> – Volume of commodities, transported by railroad, million tons per kilometre; |
| 22. | <i>Roads, goods tr-ted</i> – Volume of commodities, transported by road transport, million tons per kilometre; |
| 23. | <i>Cont. port traf.</i> – Turnover of goods in ports, in standard 20-foot; |
| 24. | <i>Qual. of port infr</i> – Index of ports infrastructure quality, takes on a value from 1 (extremely undeveloped) to 7 (well developed and effective in accordance with international standards); |
| 25. | <i>GDP per unit of energy</i> – GDP per unit of used energy, in USD (PPP) per a kg of oil or its equivalent; |
| 26. | <i>Electr pow cons.</i> – Consumption of electric power, kW/h per capita; |
| 27. | <i>Alt. & nucl. energy</i> – Use of alternative and atomic energy, % of the combined energy consumption. |
| Policy-related determinants | |
| 28. | <i>Tariff rate</i> – Custom duty, weighted average for all commodities and services, %; |
| 29. | <i>Tax rate</i> – Corporate tax rate, % of total incomes; |
| 30. | <i>Ease of doing bus.</i> – Index of doing business, takes on a value from 1 (most favourable terms) to 189 (the least favourable); |
| 31. | <i>Cred. depth of inf.</i> – Index of information depth on solvency (in state and private databases; estimates the availability and quality of such low information), takes on a value from 0 (low) to 6 (high); |
| 32. | <i>Str. of leg. rights</i> – Index of legal rights protection (represents legislative protection for creditors and borrowers rights), takes on a value from 0 () to 10 (high); |

Source: The table was developed by the author

Some of them are consistent with the determinants in [12]. There are also specific location determinants, influencing MNE activity [12]. For example, for the stage of knowledge creation, which includes innovations, R&D, trademark planning, design and promotion, the high level of intellectual property defense and well-educated, but relatively cheap workforce are the key factors.

Data on the explanatory variables are obtained from datasets of the World Bank and UNCTAD [10; 11]. GRETL soft is used to tabulate all data. Since the data are absent for some countries and variables, the pairwise exception of the skipped data is used in all cases of correlation or regression.

The UNCTAD researchers assert that «classic» determinants of investments location vary with time [12]. Therefore, the data of 1995 are withdrawn from the analysis, because it does not represent modern tendencies. Besides, data of 2009, when the global financial crisis touched the most countries of the international economy, will distort the real level of connection between the variables. That is why they are withdrawn from the analysis as well. In any case, two additional calculations are conducted for the greater authenticity of results – with data of 1995 and 2009 and without them. In the first case, the final equation has the correlation coefficient 0,83 and the determination coefficient 0,70, in the second – 0,92 and 0,85 respectively. Thus, the second case shows more close connection of dependent variable with the explanatory ones, as well as higher part of dependent variable variation. In addition, there is considerably less noise in second case. Thus, the decision to withdraw the data of 1995 and 2009 is correct.

The final calculations were obtained after 3 stages of determinants estimation and exclusion. At the beginning of the analysis, the correlation matrix for all variables is built to determine which of them should be included in the regression equation. Since the number of researchers and technicians in R&D are highly correlated with each other (0.65), it is decided to combine these two determinants into one (*Researchers & technicians*) by addition. The volume of goods transported by road and rail are strongly correlated (0.80) as well. They are combined into a single index (*Railways & roads, goods tr-ted*).

Such determinants as annual GDP growth, unemployment, ratio of capital and assets of banks, domestic lending to the private sector, public expenditures on education, GDP per unit of energy, market capitalization of local companies and the turnover in ports show low correlation level with the dependent

variable (GVC_part) – from 0.01 to 0.07 by modulus. So, they are excluded from the sample.

GNI per capita, urban population share, electricity consumption per capita, as well as port infrastructure quality index have high correlation coefficients with many other variables, but are only slightly correlated with the dependent variable or the correlation is not significant at $p < 0.05$. So, they are excluded from further regression analysis as well.

Total R&D costs are strongly correlated with the index of the number of researchers and technicians in R&D (correlation coefficient – 0.83). So the only one of these variables should be kept. Since the last variable has much lower correlation coefficient with the index of the country's participation in GVC, than the latter one (0.12 and 0.28 respectively), and this correlation is insignificant at $p < 0.05$, it is excluded from the database.

Thus, the new regression is calculated again for the left 17 independent variables. The results show high multiple correlation and determination coefficients (0.93 and 0.87 respectively). It means close correlation between the dependent variable and the location determinants, as well as high proportion of dependent variable variation (87%) due to the variation of independent variables. The determination coefficient is very significant at the significance level $p < 0.000001$. However, several regression coefficients are insignificant ($p > 0.05$), so the number of variables should be reduced. Due to high p -level of FDI, the current balance of payments, total expenditures on health and the legal rights protection index they are excluded from the sample. The number of researchers and technicians in R&D and the real interest rate are also a bit higher, than the required p -level, but only slightly, so far they are left in the model.

The adjusted regression model for 13 independent variables is built. Multiple correlation and determination coefficients have changed slightly – 0.92 and 0.85 respectively, but now coefficients of all variables, except for the real interest rate, are significant according to t-test ($p > 0.05$). Real interest rate index is excluded from the analysis.

Therefore, the final regression model is built. The regression coefficients of all variables are significant ($p > 0.05$) and show medium or strong connection between the determinants and the dependent variable. Multiple correlation coefficient (R) amounts 0.92, and the determination coefficient R^2 – 0.85. Therefore, the factors excluded from the analysis do not affect the

studied dependent variable significantly.

To verify the reliability of the model further, the function “Partial correlations” is used. The tolerance of all variables is high, indicating the absence of problems with multicollinearity. In addition, the Durbin-Watson statistic is used for verifying the regression. Its results show that serial correlation is low (0.04). The Durbin-Watson statistic – 1.89, indicates the insignificance of serial correlation. The distribution of residuals is as close to normal as possible as well, according the build plot.

The final regression equation for non-policy determinants is follow:

$$GVC_{part} = 64,2 - 0,64CGD - 0,21Infl + 0,6HTEx + 0,26R\&T + 0,15Wages - 0,28Labor - 0,42R\&R - 0,11A\&NE \quad (1)$$

The final regression equation for policy-related determinants is follow:

$$GVC_{part} = 43,8 - 0,41Tariff + 0,22Tax + 0,39EoDB - 0,33CDol \quad (2)$$

Thus, the macroeconomic determinants have stronger influence upon the MNEs’ decision to locate value chain activity in any country. Among them, the public debt and the share of high-tech exports have the most perceptible effect. As a result, the bigger is the country’s public debt, the less MNEs invest in its economy.

Positive correlation of the high-tech exports share with the county’s participation in GVC means, that multinationals are more likely to locate global production stages in the countries with well-developed technologies. The latter confirms the results of the previous researches on GVC and innovations [5; 6]. We do not take into account here the least developed countries due to the lack of statistics. Their inclusion in the analysis could slightly change the overall picture and the regression equation.

Large volumes of goods transported by rail and road are more the evidence of significant domestic, not international, trade flows. Because the overwhelming part of the world trade is done by the sea. Therefore, internal trade of intermediate goods in such countries is more active and producers rely less on imported components.

The country’s participation in GVC is also determined with the share of economically active population. The higher the percentage of it, the less the country uses imported components and more relies on its own production.

The number of researchers and technical specialists naturally constitutes

an important determinant for MNEs' decisions on the location of global production stages in different countries. The higher the index is, the more the country participates in GVC.

Other explanatory variables from the final regression equation have weaker effect on the dependent variable (*GVC_part*). The influence of the inflation (*Infl*) is well-predicted. The MNEs inclines less to locate their production in the country with high inflation rate due to economic instability.

The share of wages in GDP is slightly correlated with the participation in GVC index as well. It presents the fact, that more developed countries generally have higher wages, but they export more components to other countries. Therefore, they have high participation in GVC indexes.

And finally, the level of renewable and nuclear energy usage has the weakest correlation with the studied dependent variable in the equation, with the negative regression coefficient. Presumably, it means that countries, actively participating in GVC, rely more on traditional energy sources.

The weighted average customs tariff, index of doing business have significant impact on the country's participation in GVC among the policy-related determinants. Since the weighted average customs tariff has negative regression coefficient, the lower the tariff is, the more the country is attractive for GVC stages location. It presents the fact, that participation in GVC involves the import of raw materials, components, equipment or services, notwithstanding the production stage.

Doing business index has a positive regression coefficient, i.e. the higher the country index, meaning less favorable surrounding for business, the more it is involved in GVC. Such results can be explained with the fact, that it is probably better for the MNEs as well as the local business to use imported parts in the production of goods for exports instead of subcontract agreements with local manufactures.

Index of information depth on solvency, the share of economically active population and the number of researchers and technical specialists have slightly less effect on the MNEs' decisions where to locate GVC activity. The index of information depth on solvency has a negative regression coefficient. Thus, the more accessible and qualitative is the information on economic agents' solvency, the less active country's participation in the GVC. The high value of this indicator means a more stable banking system of the country. Therefore, domestic lending to local companies is more developed, and it enhances their

activities on the market and reduces the need to use foreign components in production.

Positive regression coefficient of the total tax rate for businesses (*Tax*) is slightly strange. But, taking into account a lower correlation with the dependent variable, it may be explained with the fact, that TNCs are primarily guided by other determinants, choosing location for production. And thus, they are willing to pay higher taxes in exchange for other benefits. Moreover, the sample does not include the least developed countries, what could have slightly changed the role of the tax rate.

Conclusions. Global value chains play the increasingly dominated role in international economy. Not all economies are equally engaged in GVCs. Countries became increasingly specialized in specific activities and stages of value chains rather than in industries. MNE's choice of host country locations is affected with various factors. The emergence and growth of GVCs have changed the influence of the "classical" locational determinants for investments (so-called OLI-paradigm).

We used multiple regression to ascertain the effect of location determinants upon a country engagement in global value chains. We use the sample, constructed from the database on trade in value added, datasets of the World Bank and United Nations Commission on Trade and Development. We found, that the macroeconomic determinants - public debt and the share of high-tech exports - have the most perceptible effect upon the multinational companies' decision to locate value chain activity in any country.

In order to sharpen our understanding of GVC, forthcoming research efforts ought to direct attention towards the role of developing countries, especially least developed ones, in GVC evolution.

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