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# ECONOMIC AND INSTITUTIONAL DETERMINANTS OF EXPORT SOPHISTICATION

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**Abstract**

This study examines how GDP per capita, education level, population size, territorial extent, and governance quality shape export sophistication (EXPY) in 149 countries, in the period between 2007 and 2022. Using regression analysis at two benchmark years (2007 and 2022), with EXPY constructed from detailed international trade data, we track the global trajectory of sophistication and the stability of the factors that determine it. We document a broad-based rise in EXPY, with the largest gains among high-income countries and more heterogeneous dynamics across middle- and low-income groups. In both years, GDP per capita is statistically significantly associated with higher EXPY; human capital exerts a positive effect that becomes more pronounced by 2022; population size shows a moderate yet consistent positive association; territorial extent remains negative but statistically insignificant; and the rule of law shifts from a weakly negative to a weakly positive association by 2022. The results are consistent across alternative model specifications and affirm the central role of economic development and human capital, supported by institutional quality, in upgrading export structures.

**Key words**: export sophistication, economic complexity, economic development, human capital, institutional quality.

# ЕКОНОМСКЕ И ИНСТИТУЦИОНАЛНЕ ДЕТЕРМИНАНТЕ СОФИСТИЦИРАНОСТИ ИЗВОЗА

**Апстракт**

Ово истраживање испитује како БДП по становнику, ниво образовања, величина становништва, територијални обим и квалитет управљања обликују софи-

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стицираност извоза (EXPY) у 149 земаља у периоду између 2007. и 2022. године. Користећи регресиону анализу у две референтне године (2007. и 2022.), при чему је EXPY конструисан на основу детаљних података о међународној трговини, пратимо глобални ток софистицираности и стабилност фактора који је одређују. Бележимо широко распрострањен раст EXPY, с највећим помацима међу земљама са високим дохотком, уз хетерогеније динамике у групама земаља са средњим и ниским дохотком. У обе године, БДП по становнику је статистички значајно повезан са вишим EXPY; људски капитал има позитиван ефекат који до 2022. године постаје израженији; величина становништва показује умерену, али конзистентну позитивну повезаност; територијални обим остаје негативан, али статистички безначајан; а владавина права прелази са слабо негативне на слабо позитивну повезаност до 2022. године. Резултати су конзистентни кроз различите моделске спецификације и потврђују кључну улогу економског развоја и људског капитала, уз подршку институционалног квалитета, у унапређењу извозних структура.

**Кључне речи**: софистицираност извоза, економска комплексност, економски развој, људски капитал, институционални квалитет.

## *INTRODUCTION*

The level of sophistication within a country's exports plays an important role in shaping its economic development and integration into the global economy. It goes beyond economic diversification, playing a key role in fostering technological innovation and attracting the attention of both economic theorists and practitioners. Understanding the dynamics and determinants of export sophistication is crucial for designing effective economic and trade policies to enhance sustainable development and global competitiveness. This paper analyses the impact of key economic and institutional factors on export sophistication, as measured by the Export Sophistication Index (EXPY).

Motivated by seminal research, such as the paper of Hausmann, Hwang, and Rodrik (2006), which underlined the key role of export structure, measured by EXPY, in driving economic growth, as well as other scholarly endeavours that have explored the factors underpinning export sophistication, this paper seeks to broaden insight into how export structures evolve and strengthen. This study aims to explore the influence of economic resources, human capital, and institutional frameworks on countries' capacity to sustain and develop export sophistication. Particular attention is given to identifying economic and institutional features that support the improvement of export composition and promote long-term economic growth.

Through quantitative analysis, the paper investigates changes in export sophistication from 2007 to 2022. The period captures global structural transformations, from the 2007 pre-crisis to the 2022 post-pandemic trade context. This comparison isolates long-term changes from short-term volatility. It aims to uncover key economic and institutional factors influ-

encing export sophistication, providing insights for policymakers, researchers, and practitioners interested in promoting economic sophistication and development. To better understand the structure and dynamics of global trade, the research uses the EXPY as a key indicator of economic development and competitiveness. EXPY is calculated for 149 countries using HS codes to assess each product's contribution to export sophistication. The findings are expected to offer valuable guidance for policymakers, emphasising the importance of improving institutional infrastructure and investing in human capital to achieve a high level of export sophistication.

The organisation of this study reflects the progression from theoretical background to empirical analysis. After the introductory section, the literature review synthesises key theoretical perspectives and empirical findings relevant to the research topic. The methodology section outlines the data sources, the construction of the export sophistication index, and the analytical approach employed. The subsequent section presents and discusses the empirical results, including both descriptive and regression analyses. Finally, the conclusion summarises the principal findings and offers suggestions for future research directions.

## *LITERATURE REVIEW*

How a nation's export composition affects its economic growth has attracted substantial attention in economic literature. This review examines several key studies that shed light on this relationship, highlighting the importance of export sophistication in driving economic development.

Hausmann et al. (2006) argue that not all exports are equal in their impact on economic growth. They introduce the concept of the EXPY, which captures the average productivity level implied by the types of goods a country exports. Their study shows that countries specialising in higher-income exports tend to experience faster economic growth, indicating the benefits of specialisation in high-productivity exports. Continuing from the discussion on export sophistication, Xu (2010) challenges the perception of China's exceptional export sophistication, suggesting that its success can be attributed to improvements in education, government policies, and integration into the global market. This perspective provides a clearer understanding of China's role in global economic dynamics. Anand, Mishra, and Spatafora (2012) emphasise the importance of education, market openness, and efficient information exchange in enhancing the quality of exports. Their argument underscores the necessity for countries aspiring to achieve rapid economic advancement to prioritise enhancing export sophistication through educational reforms and market liberalisation. Building on the notion that not all exports contribute equally to economic growth, Poghosyan and Kočenda (2016) delve deeper into the determinants

of export sophistication, shedding light on the role of GDP per capita, institutional quality, and market openness, and reinforcing the idea that diversified exports are crucial for sustainable economic development.

Expanding on the examination of export sophistication, Weldemicael (2012) highlights the positive impact of foreign direct investment (FDI) on export complexity, particularly in countries with weaker institutional environments. The author also highlights the importance of targeted policies to facilitate technology transfer and reduce trade costs, especially for countries with lower incomes. In contrast, Saadi (2012) examines how increasing export complexity may lead to the worsening of trading conditions in developing countries. His findings highlight the importance of adopting multidimensional strategies to improve export quality and technological advancement, emphasising the complexity and depth of the link between export sophistication and trade dynamics. Weldemicael's (2014) research further emphasises that countries with lower incomes face pronounced technological challenges in attempting to enhance the sophistication of their export products. The key finding of the study indicates that high costs of technology transfer and trade are significant barriers for these countries, limiting their ability to effectively integrate into global value chains with products of higher value added. The results highlight the importance for these countries to identify and address the barriers hindering the enhancement of their export sophistication. This entails the crucial role of targeted policies aimed at facilitating access to advanced technologies and reducing trade costs, which are essential for their economic development and progress.

Lin, Weldemicael, and Wang (2016) offer valuable insights as they explore how export sophistication correlates with income growth. This research addresses an important gap in the literature by evaluating whether rising export sophistication contributes to economic advancement in Sub-Saharan African countries. Analysing panel data from 1981 to 2000 and applying instrumental variables (IV) methods along with a heteroskedasticity-based identification strategy, the authors show that a 1% rise in the sophistication index corresponds to a 0.08% long-term gain in GDP per capita. This result is significant because it indicates that changes in export sophistication within a country can stimulate income growth, even in economies with historically low levels of export complexity. The robustness of these findings is further reinforced through multiple sensitivity checks and exclusion criteria, strengthening the credibility of the conclusions.

Atasoy (2020) contributes to the literature by examining the factors influencing export sophistication, particularly exploring how digital transformation affects export complexity. Drawing on data from a sample of 61 countries and employing three distinct indicators of export complexity, the study finds that increased digitalisation significantly enhances export sophistication. This work is among the first to establish a link between digital

development and export structure, showing that greater use of the internet and ICT leads to more advanced exports. In addition, the analysis identifies institutional strength, credit availability, and research and development as key enablers of export advancement. Nevertheless, the evidence regarding the impact of tertiary education enrollment and foreign direct investment is mixed. Interestingly, the study concludes that the degree of democratic governance plays a minimal role in shaping export complexity, suggesting that non-democratic nations, such as China, are also capable of upgrading their export structures.

In addition to these findings, Lectard and Rougier (2018) investigate an alternative development strategy that involves moving beyond traditional comparative advantage in order to stimulate greater export complexity and product diversification. Their research examines a panel of countries from 1992 to 2012, focusing on the impact of attracting vertical FDI and supporting new industries that deviate from a country's traditional factor endowments. They found that developing countries that defy their comparative advantage tend to export more sophisticated manufactured goods. Nonetheless, the influence on export diversification varies depending on a country's stage of development. Nations classified as middle-income or endowed with abundant natural resources benefit from diversification, while lower-income countries experience a concentration of exports. Lectard and Rougier (2018) also highlight the complex relationship between FDI and export sophistication, cautioning that while FDI can boost manufacturing exports, it may not increase manufacturing value-added, leading to partial and potentially unsustainable industrialisation.

Several studies further refine our understanding of how various structural, institutional, and sectoral dynamics influence export sophistication. Jarreau and Poncet (2012) validate the findings of Hausmann et al. (2006) at the subnational level by showing that Chinese provinces specialising in more sophisticated exports experience faster growth. However, their results also reveal that the benefits of export sophistication are concentrated in ordinary exports by domestic firms, while foreign-led processing trade contributes less to long-term development. This highlights the need to develop domestic productive capabilities rather than relying excessively on foreign-led export upgrading.

According to Schott (2008), China's export portfolio increasingly resembles that of OECD countries, yet the valuation of these exports in international markets remains lower. His study emphasises that structural similarity in export composition does not necessarily translate into equal product quality or price levels, underlining the importance of integrating qualitative dimensions into measures of sophistication.

In addition, Zhu et al. (2010) emphasise that capital intensity, human capital, and R&D investment play consistent and significant roles in promoting export sophistication. Their findings indicate that institutional qual-

ity can moderate the often negative effects of natural resource abundance, allowing countries with stronger governance to leverage resource wealth for export upgrading. The role of institutional quality is similarly underscored by Ullah et al. (2024), who show that both human capital and institutional strength significantly contribute to export sophistication in OECD countries, with energy consumption also emerging as a relevant factor.

Fan, Anwar, and Huang (2018) introduce cultural diversity as an additional dimension. Their panel analysis of 85 countries between 1995 and 2014 shows that cultural heterogeneity expands a country's technological frontier, thus enhancing the level of export sophistication. However, the effect on its growth rate is found to be less robust and model-dependent.

Moreover, Nguyen (2016) demonstrates that trade liberalisation, especially tariff reduction and deepened integration into free trade agreements, improves Vietnam's industrial export sophistication. This effect is more pronounced in non-manufacturing sectors, indicating sectoral variation in policy effectiveness.

Fortunato and Razo (2014) focus on the broader structural transformation process, arguing that many middle-income countries become stuck at intermediate levels of export sophistication due to weak industrial and educational policy frameworks. Their work underscores that productive capabilities are not passively acquired but must be actively cultivated through coordinated policy interventions.

Lall, Weiss, and Zhang (2006), in one of the earliest attempts to quantify export sophistication, find that medium-level sophistication products grew fastest in world trade, challenging assumptions that only high-tech exports drive growth. Their work laid the empirical groundwork for later developments, including the EXPY and PRODY measures.

Finally, Zhang and Yang (2016) examine the link between intellectual property rights (IPR) protection and export sophistication. They find that stronger IPR regimes improve sophistication in both developed and developing countries, operating through channels such as R&D, foreign direct investment, and imports, although the dominant mechanism differs by development level.

Taken together, the reviewed literature demonstrates that export sophistication is shaped by a wide range of economic, institutional and structural factors. While traditional determinants such as FDI, education and governance quality remain central, recent studies point to the growing importance of additional influences such as sectoral differences, cultural and technological capabilities, and energy use. These findings suggest that the process of upgrading export structures is more complex and context-dependent than previously assumed.

This body of research highlights the need for an integrated analytical approach that considers both the resource base of a country and its institutional and strategic capacity. Building on these insights, the present study

focuses on a core set of explanatory variables that are theoretically grounded and empirically supported, with the goal of assessing their combined effect on export sophistication across a broad cross-country sample. Accordingly, this study seeks to offer new empirical evidence on how key economic and institutional variables jointly shape export complexity, thereby informing strategies for long-term development.

## *METHODOLOGY*

Evaluating the technological advancement of a nation's export basket offers valuable perspective on its developmental trajectory. In their influential study What You Export Matters, Hausmann et al. (2006) introduced a quantitative framework for measuring export sophistication. They proposed the Product Technological Sophistication Index (PRODY), which serves to approximate the implicit technological intensity of goods. Products largely manufactured and exported by high-income nations are typically classified as advanced or high-value goods (World Bank, 2013, p. 39).

The initial step involves constructing the PRODY index. This is calculated as the GDP per capita of exporting countries, weighted by their respective shares in the global export of a given product, thereby reflecting the typical income level tied to that good. If countries are indexed with $j$ and goods with $l$, the total export of a country is defined as:

$$X_j = \sum_l X_{jl} \tag{1}$$

If the GDP per capita of country $j$ is denoted by $Y_j$, then the productivity level associated with product $k$, $PRODY_k$, is equal to:

$$PRODY_k = \sum_j \frac{(\frac{x_{jk}}{X_j})}{\sum_j (\frac{x_{jk}}{X_j})} Y_j \tag{2}$$

The numerator in the PRODY formula reflects the contribution of a given product to a country's total exports, while the denominator reflects that product's global export share. This ratio is used to weight each country's income level to compute the product's sophistication.

To further evaluate productivity within a nation's export mix, Hausmann et al. (2006, p. 9) introduced the EXPY index. EXPY calculates the weighted mean of PRODY scores for the full range of a country's exported products, where each product's share in total exports serves as the weight. The EXPY value approximates the expected GDP per capita based on a country's export composition. It is derived by summing the PRODY scores of all exported goods, each adjusted according to their export share. In this context, products exported more heavily by higher-income countries are

ranked above those mainly sold by economies with lower GDP per capita (World Trade Organization & UNCTAD, 2012, p. 27).

Our research examines a comprehensive sample of 149 countries, segmented according to the World Bank's country classification over the period from 2007 to 2022. The selection of the two endpoints, 2007 and 2022, allows for a focused comparison of pre-crisis and post-pandemic global economic environments. This comparative approach helps isolate long-term shifts in export sophistication from short-term volatility, providing a clearer understanding of the structural drivers of change over a 15-year horizon. The sample comprises 44 high-income countries, 43 upper-middle-income countries, 44 lower-middle-income countries, and 18 low-income countries. EXPY values were calculated by analysing export data for each year within this 16-year period. By examining this diverse set of countries over a substantial timeframe, we aim to uncover the distinct economic and institutional factors that drive export sophistication and their implications for economic development. The Harmonized Commodity Description and Coding System was used for export classification at the 6-digit level, which includes detailed categorisation of over 5,000 products, enabling precise measurement and analysis of export sophistication for each country included in the sample.

$$EXPY_i = \sum_l \left(\frac{x_{il}}{X_i}\right) PRODY_l \tag{3}$$

The EXPY values can range from 0 to +∞. Higher PRODY values indicate a more sophisticated product, while higher EXPY values indicate a more sophisticated export portfolio of a country.

The analysis uses updated data from 2007 and 2022 to capture the progression of export sophistication over time. The core explanatory variables include income per capita, educational attainment, population size, territorial extent, and governance quality as captured by the World Bank's Rule of Law indicator. The study relies on secondary data sources, particularly the BACI trade dataset provided by CEPII (2024). GDP per capita, adjusted for purchasing power parity (PPP) and expressed in constant 2017 prices, were retrieved from the World Bank repository. Education data is obtained from the UNDP (2024), while population and land area statistics were also sourced from the World Bank. The Rule of Law Index, commonly employed as a measure of institutional effectiveness, is included to capture governance effects on export performance.

The selection of the five explanatory variables (GDP per capita, educational attainment, population size, territorial extent, and governance quality) is grounded in empirical and theoretical research on export sophistication. GDP per capita is a commonly used proxy for a country's level of development and productive capacity, and it plays a central role in the EXPY index as introduced by Hausmann et al. (2006). Educational attain-

ment reflects the quality of human capital and the ability of the labour force to engage in knowledge-intensive production. This link is confirmed by Anand et al. (2012) and Zhu and Fu (2013). Population size is included to capture the potential scale of domestic markets and labour supply, which supports diversification and the upgrading of export structures, as suggested by Kočenda and Poghosyan (2018). Territorial extent serves as a proxy for access to natural resources and potential logistical challenges that could influence trade performance. Finally, governance quality, proxied by the Rule of Law index, captures institutional effectiveness. This factor is highlighted in both Levchenko (2007) and Zhu and Fu (2013) as significant for enabling export upgrading. Other studies have also explored the relevance of additional factors such as foreign direct investment, trade openness, or research and development intensity (Atasoy, 2020; Weldemicael, 2013). While these are certainly valuable, the present study focuses on a set of core variables that are widely used in the literature and available across a broad cross-country sample. This approach ensures consistency and comparability, while leaving room for future extensions that might include more specialised indicators.

The regression analysis uses the logarithm of most variables to facilitate the interpretation of coefficients and manage heteroscedasticity, enabling a more precise comparison of changes between the two observed years. This method provides deeper insights into how underlying economic and institutional factors influence countries' ability to participate in the global trade of high-value products.

## *RESULTS AND DISCUSSION*

Table 1 presents detailed results of the descriptive statistics of EXPY from 2007 to 2022. The analysis shows a gradual increase in the average EXPY values, ranging from $16,987.33 in 2007 to $20,349.06 in 2022. This trend indicates a consistent improvement in the export capacities of the observed countries. Significant fluctuations in the minimum and maximum EXPY values, as well as in the ranges between them, are particularly pronounced during 2013 and 2014. During these years, Macau had the highest maximum EXPY values. The data reflects variability in export performance among countries, while the overall upward trend suggests a general improvement in countries' ability to generate value through exports.

The analysis of EXPY value changes from 2007 to 2022, as shown in Table 2, and reveals differences among countries based on their income levels. Among high-income countries, 90.9% experienced an increase in EXPY values. Within this group, island nations and small countries recorded the most significant changes in EXPY values. Significant declines were primarily observed in countries geographically distant from their major trading partners. Middle-income countries constitute a highly heteroge-

neous group. Among upper-middle-income countries, 74.4% experienced growth, while 25.6% saw a decrease in EXPY values. Among lower-middle-income countries, 79.5% experienced growth, with a decline recorded in 20.5% of countries. Most countries experienced an increase in EXPY values, while the largest declines, similar to those in high-income countries were observed in geographically distant or sparsely populated countries. The percentage of low-income countries that experienced an increase in EXPY values from 2007 to 2022 is 72.2%. Within this group of countries, a decline in EXPY values was recorded in 27.8% of countries. Those experiencing the most significant declines face numerous political, economic, social, and other societal challenges.

*Table 1. Descriptive statistics for EXPY (USD)*

| Year | Obs. | Average | SD | Minimum | Maximum | Range |
|---|---|---|---|---|---|---|
| 2007 | 149 | 16987.33 | 7413.166 | 2934.777 | 35768.23 | 32833.45 |
| 2008 | 149 | 17232.27 | 6913.671 | 2973.506 | 35760.61 | 32787.1 |
| 2009 | 149 | 16577.83 | 6668.183 | 4218.215 | 34285.05 | 30066.84 |
| 2010 | 149 | 17230.45 | 7042.196 | 3997.254 | 37805.27 | 33808.02 |
| 2011 | 149 | 17741.95 | 7339.575 | 3916.254 | 44182.88 | 40266.63 |
| 2012 | 149 | 18038.56 | 7369.431 | 4693.014 | 45186.46 | 40493.45 |
| 2013 | 149 | 18277.04 | 7760.443 | 4761.773 | 55858.78 | 51097.01 |
| 2014 | 149 | 18474.86 | 7694.435 | 5546.497 | 61629.68 | 56083.18 |
| 2015 | 149 | 18556.54 | 7726.065 | 4935.073 | 51577.65 | 46642.58 |
| 2016 | 149 | 18792.03 | 7762.843 | 4951.782 | 51181.04 | 46229.26 |
| 2017 | 149 | 19295.22 | 8050.996 | 4741.378 | 51970.94 | 47229.56 |
| 2018 | 149 | 19725.81 | 8340.583 | 4175.437 | 54136.61 | 49961.17 |
| 2019 | 149 | 20036.7 | 8455.188 | 4755.751 | 50245.8 | 45490.05 |
| 2020 | 149 | 18545.38 | 7986.627 | 5548.604 | 45738.61 | 40190.01 |
| 2021 | 149 | 19727.28 | 8537.089 | 6043.203 | 49960.85 | 43917.65 |
| 2022 | 149 | 20349.06 | 8666.788 | 5376.983 | 53232.77 | 47855.79 |

*Source:* Authors' calculation

*Table 2. Number of Countries with Increase or Decrease in EXPY Values from 2007 to 2022*

| | Increase | | Decrease | |
|---|---|---|---|---|
| | | (%) | | (%) |
| High income | 40 | 90.9 | 4 | 9.1 |
| Upper-middle income | 32 | 74.4 | 11 | 25.6 |
| Lower-middle income | 35 | 79.5 | 9 | 20.5 |
| Low income | 13 | 72.2 | 5 | 27.8 |

*Source:* Authors' calculation

*Determinants of EXPY*

In the continued examination, the seminal study by Hausmann et al. (2006) was replicated, focusing on the analysis of factors influencing differences in export sophistication among countries, as measured by the EXPY indicator.

The following tables present the outcomes of our analysis concerning the factors influencing disparities in export sophistication across nations, as measured by the EXPY indicator. Table 3 encapsulates the results of regression analysis for the year 2007, while Table 4 delineates the findings for the year 2022. The variables under scrutiny encompass GDP per capita (ln_GDPpc), human capital (hum_cap), population size (ln_pop), land area (ln_area), and the rule of law, indicative of institutional quality.

*Table 3. Regression Analysis Results for 2007*

| | Dependent Variable: log EXPY in 2007 | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| ln_GDPpc | 0.379*** | 0.339*** | 0.331*** | 0.331*** | 0.363*** |
| | (0.0234) | (0.0315) | (0.0299) | (0.0304) | (0.038) |
| ln_hum_cap | | 0.134 | 0.170* | 0.170* | 0.168* |
| | | (0.0966) | (0.0946) | (0.0953) | (0.0928) |
| ln_pop | | | 0.0468*** | 0.0496** | 0.0501*** |
| | | | (0.0102) | (0.0194) | (0.0190) |
| ln_area | | | | -0.0026 | -0.0089 |
| | | | | (0.0153) | (0.0152) |
| ruleoflaw | | | | | -0.0591* |
| | | | | | (0.0304) |
| Constant | 6.158*** | 6.268*** | 5.533*** | 5.521*** | 5.287*** |
| | (0.230) | (0.204) | (0.251) | (0.259) | (0.316) |
| Observations | 149 | 147 | 147 | 147 | 147 |
| F-statiscis | 262.48 | 164.24 | 122.06 | 90.85 | 81.06 |
| R-squared | 0.727 | 0.739 | 0.769 | 0.769 | 0.774 |

Notes: Values in parentheses denote robust standard errors corrected for heteroskedasticity using the HC1 method. The VIF test was used to detect multicollinearity, and the results confirmed no significant multicollinearity (average VIF = 3.03). Significance levels are indicated as follows: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

*Source:* Authors' calculation

The regression coefficients on GDP per capita exhibit strong statistical significance in both 2007 and 2022, suggesting a persistent effect of economic development on export complexity. The minimal variation in coefficient magnitude between the two years indicates stability in this relationship, reinforcing the idea that higher-income countries are better positioned to export technologically advanced goods. This aligns with economic complexity theory. Each 1% rise in GDP per capita corresponds to a measurable gain in export sophistication, specifically 0.363% in 2007

and 0.297% in 2022. This implies that income growth enables nations to invest in education, infrastructure, and technology, factors that enhance their global competitiveness.

*Table 4. Regression Analysis Results for 2022*

| | Dependent Variable: log EXPY in 2022 | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| ln_GDPpc | 0.357*** | 0.324*** | 0.310*** | 0.310*** | 0.297*** |
| | (0.0182) | (0.0275) | (0.0265) | (0.0266) | (0.0335) |
| ln_hum_cap | | 0.106 | 0.163** | 0.164** | 0.166** |
| | | (0.0761) | (0.0824) | (0.0824) | (0.0827) |
| ln_pop | | | 0.0337*** | 0.0462*** | 0.0459*** |
| | | | (0.0104) | (0.0163) | (0.0164) |
| ln_area | | | | -0.0117 | -0.0094 |
| | | | | (0.0120) | (0.0415) |
| ruleoflaw | | | | | 0.0220 |
| | | | | | (0.0228) |
| Constant | 6.476*** | 6.554*** | 6.033*** | 5.970*** | 6.060*** |
| | (0.182) | (0.177) | (0.249) | (0.251) | (0.288) |
| Observations | 149 | 148 | 148 | 148 | 148 |
| F-statiscis | 382.45 | 196.66 | 136.17 | 102.44 | 84.43 |
| R-squared | 0.770 | 0.772 | 0.792 | 0.793 | 0.794 |

Notes: Values in parentheses denote robust standard errors corrected for heteroskedasticity using the HC1 method. The VIF test was used to detect multicollinearity, and the results confirmed no significant multicollinearity (average VIF = 3.22). Significance levels are indicated as follows: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.
*Source:* Authors' calculation

In addition to GDP per capita, human capital emerges as a key determinant of export complexity across countries. Its role underscores how a skilled workforce enables firms to engage in the production and international sale of technologically advanced goods. In 2007, human capital exhibited a favourable and statistically validated contribution to export upgrading, with a 1% increase in human capital linked to a 0.168% improvement in export sophistication. By 2022, the influence of human capital on export complexity reached statistical significance at the 5% threshold across multiple models. This growing significance highlights the increasing relevance of human capital in the shift toward knowledge-intensive industries. Accumulated skills contribute to labour productivity within firms and facilitate the absorption of advanced foreign technologies, ultimately raising the technological profile of national exports (Yang, 2019).

When analysing the effect of population size on the EXPY indicator across 2007 and 2022, a slight reduction in coefficient values is evident. In 2007, population size was positively associated and statistically meaningful. An increase of 1% in the population variable led to a 0.0501% increase in EXPY, compared to a 0.0459% rise in 2022. Despite the decrease, the

impact remains relatively stable, indicating the importance of labour supply and domestic market scale in export upgrading. Countries with larger populations can utilise this as a competitive edge when integrating into global value chains. Supporting findings from Kočenda and Poghosyan (2018), our results reinforce the idea that economic scale shapes the diversity of products a country is capable of manufacturing and trading, alongside the robust and persistent role of per capita income and demographic scale in shaping export complexity.

The impact of land area (ln_area) remains negative in both years, but statistically insignificant. While geographic size may reflect resource abundance, the findings suggest that logistics, market connectivity, and institutional strength are more critical. Larger nations may struggle with internal distribution, facing greater costs and complexity, especially in sectors requiring fast and reliable delivery.

Regarding institutional quality, as captured by the Rule of Law index, the analysis reveals a shift: a negative association in 2007 and a weakly positive one in 2022. This may signal improved institutional impact on trade dynamics over time (Zhu and Fu, 2013). However, contrary to expectations, a negative correlation between institutional performance and export advancement persists in some developing economies, particularly in lower-middle-income countries. As noted by Cabral and Vega (2010), elevated corruption levels serve as a major barrier to improving export quality. These findings suggest that a deeper investigation into the role of governance and institutional effectiveness is warranted.

The differences in coefficient values across the two observed years should be viewed in the context of profound global transformations that occurred between 2007 and 2022. The pre-crisis world in 2007 was shaped by a different trade logic, with stable global value chains, slower digital integration, and less concern over systemic risks. After the 2008 financial crisis, many emerging economies shifted towards industrial upgrading and export diversification strategies (Rodrik, 2009). The post-pandemic economy of 2022, however, reflects an accelerated shift toward digitalisation, reconfigured global production networks, and stronger emphasis on institutional resilience and technological capacity (Baldwin, 2017; UNCTAD, 2022). These global dynamics likely influenced why GDP per capita's impact slightly declined, while human capital gained importance. Moreover, the growing significance of population size and the trend reversal in the institutional variable (rule of law) may signal a broader shift from static economic indicators toward dynamic, knowledge-based, and governance-oriented drivers of export sophistication.

## *CONCLUSION*

The paper analyses key economic and institutional determinants of export sophistication. Over the period from 2007 to 2022, there has been a gradual increase in the average value of the index (EXPY), indicating a global trend of improving export capacities. However, the analysis shows significant differences in the dynamics of the export sophistication index among countries with different income levels. High-income countries have experienced the greatest growth in EXPY values, confirming that their economic development and technological superiority provide a strong foundation for producing and exporting highly sophisticated products. On the other hand, middle and low-income countries also show improvements in export sophistication, although they face specific challenges such as higher trade costs and limited access to advanced technologies.

The analysis conducted in this study provides a comprehensive insight into the dynamics and determinants of export sophistication. The research clearly demonstrates how economic development, education, demographic factors, and institutional quality collectively influence countries' ability to enhance their export profiles. Regression analysis indicates that an increase in GDP per capita directly affects the export of more sophisticated products. The results underscore the importance of human capital, measured by years of education, as a crucial factor in improving export sophistication. Statistically significant coefficients in the regression models for 2007 and 2022 confirm that investing in education enables countries to produce highly sophisticated products, directly impacting their competitiveness in the international market.

The analysis shows that population size has a positive impact on export sophistication. Countries with larger populations have the potential for larger internal market capacities and the ability to produce a more diverse range of sophisticated products. Geographic vastness shows a negative correlation with EXPY values, but it did not reach statistical significance. Although coefficients for the Rule of Law were not statistically significant in all models, a change in trend from negative to positive over time was observed. This change may indicate the importance of institutional infrastructure for the development of advanced industries and technologically sophisticated products. Stable and efficient institutions can create more favourable conditions for economic development and innovation.

These findings point to a complex interdependence between economic, educational, demographic, and institutional factors in shaping countries' export sophistication. Policies focused on enhancing economic development, investing in education, supporting demographic growth, and strengthening the institutional framework have the potential to significantly improve export performance. The results of this study highlight the importance of an integrated approach and synergy of different aspects of national policy, which has been key to ensuring countries' competitiveness

in the global market. This approach contributes to current economic success and lays the foundation for long-term sustainability and progress, promoting the development of more sophisticated exports that reflect comprehensive national efforts toward economic advancement.

In future research, it is necessary to further analyse the results for specific groups of countries to obtain a broader picture of the impact of these factors on countries' export performance. Segmentation can provide a deeper insight into the dynamics shaping export sophistication in different economic and social contexts. Understanding the specific challenges and opportunities faced by different groups of countries is essential for formulating effective strategies that promote progress in export sophistication.

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# ЕКОНОМСКЕ И ИНСТИТУЦИОНАЛНЕ ДЕТЕРМИНАНТЕ СОФИСТИЦИРАНОСТИ ИЗВОЗА

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**Резиме**

Рад анализира економске и институционалне факторе који утичу на софистицираност извоза, при чему се фокусира на упоредну анализу између 2007. и 2022. године. Користећи индекс EXPY као меру технолошке и вредносне структуре извозног портфолија земаља, истраживање обухвата узорак од 149 земаља различитог нивоа развоја. Период истраживања обухвата два значајна тренутка у светској економији: предкризни период 2007. године и постпандемијску глобалну економију 2022. године. Циљ рада је био да се утврди како се релативна важност економских и институционалних детерминанти мењала у условима дубоких глобалних трансформација.

Резултати показују континуирани раст просечне вредности EXPY индекса у посматраном периоду, што указује на глобално унапређење способности земаља да извезу софистицираније производе. Међутим, уочене су значајне разлике између група земаља. Земље са високим дохотком бележе највећи напредак, док земље са нижим дохотком показују умерене помаке, ограничене високим трошковима трговине, технолошким баријерама и недовољним институционалним капацитетима.

Регресионе анализе потврђују да је БДП по становнику најзначајнији покретач софистицираности извоза у оба посматрана тренутка. Људски капитал, мерен просечним годинама образовања, добија на значају у 2022. години, што одражава потребу за знањем и вештинама у производњи технолошки напредних производа. Величина становништва има стабилан позитиван ефекат на софистицираност извоза, док површина територије и даље показује негативну, али статистички незначајну везу. Индекс владавине права, као мера институционалног квалитета, бележи промену тренда од негативног ка позитивном, што може указивати на појачану улогу институционалне инфраструктуре у обликовању извозних капацитета.

Ови налази указују на потребу за интегрисаним политикама које обухватају улагање у образовање, јачање институција, и стратешко искоришћавање демографских и економских потенцијала. Посебан значај има увођење мера које смањују трошкове трансфера технологија и омогућавају интеграцију у глобалне ланце вредности. Истраживање даје препоруке креаторима политика да фокусирају напоре на стварање повољног окружења за развој и извоз софистицираних производа као основног услова за дугорочну економску одрживост и конкурентност.