



HOKKAIDO UNIVERSITY

Title	Essays on Trade, Environmental Challenges, and Poverty in Transition Economies
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Degree Grantor	北海道大学
Degree Name	博士(経済学)
Dissertation Number	甲第16392号
Issue Date	2025-03-25
DOI	https://doi.org/10.14943/doctoral.k16392
Doc URL	https://hdl.handle.net/2115/95123
Type	doctoral thesis
File Information	Shohruh_Khasanov.pdf



Essays on Trade, Environmental Challenges, and Poverty in Transition Economies

A Dissertation by

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Submitted in partial fulfillment of the requirements for
the degree of Doctor of Philosophy in Economics

The Graduate School of Economics and Business
Hokkaido University

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Sapporo, Hokkaido

February 2025

Abstract

In this dissertation, the author investigates the interrelations among international trade, energy and environmental issues, and socioeconomic well-being, with a particular focus on economic agents in the transition economies of Eastern and Central Europe, and Central Asia. As globalization deepens, economies are increasingly integrated into the global market. However, this integration is accompanied by significant environmental changes that pose threats to livelihoods worldwide. In response, recent economic discussions have emphasized the need for business and societal policies that balance economic growth and societal development with environmental sustainability. Moreover, post-communist economies face the unique challenge of transitioning to market economies while addressing these pressing issues. Hence, the overarching objective of this research is to provide new insights into how these economies can tackle persistent challenges and maximize their potential for growth and sustainable development.

In Chapter 2, the author examines the relationship of firm productivity on export propensity and intensity for manufacturing firms in 29 transition economies across Central and Eastern Europe and the Former Soviet Union. Due to their distinct institutions and trade geography, transition economies differ significantly from both developed and developing economies, necessitating a tailored approach to analyzing firm exports. By utilizing firm-level data, the author employs a two-stage estimation method to differentiate between the export entry and intensity stages while addressing sample selection issues using Heckman's two-step approaches. Importantly, the author examines the moderating effects of heterogeneous home institutions and destination markets on the productivity-export nexus. Findings indicate that productivity plays a distinct role in each export margin and underscores the varying firm behaviour under diverse institutional contexts. Notably, while productivity is positively associated with firm export start, this relationship is weak for those operating under deficient regulatory conditions than those enjoying high-quality institutional systems. Also, productivity's role diminishes concerning

export intensity, highlighting similar characteristics between foreign and domestic markets. The discussion on how these outcomes provide insights for academics, policymakers, and practitioners alike is also presented.

In Chapter 3, the author investigates the association of firm exports with energy efficiency and pro-environmental initiatives for manufacturing firms in transition economies. Given the peculiar institutional characteristics of transition countries and the firm business culture, green performance needs to be distinguished into tangible and intangible dimensions. The author utilizes firm-level data from the World Bank Enterprise Surveys and explores the relationships by attempting to mitigate endogeneity concerns. The findings show a dissimilar impact of exporting on the two dimensions: while it positively drives firm climate-friendly initiatives, exporting is not related to the energy efficiency for firms either upgrading their existing technologies or possessing a long history of export experience. The discussion on how these distinct results are related to the transition economy context and policy, as well as theoretical insights, are also presented.

In Chapter 4, the author examines poverty and other well-being issues of Yakutian Indigenous Peoples and discusses how they are related to environmental challenges for a single transition economy of Russia. The data comes from an e-Asia Joint Research Program project entitled “Climate Change Resilience of Indigenous SocioEcological Systems”. Utilizing data collected in 17 rural Indigenous settlements in Yakutia, findings reveal that one in two individuals lives in absolute poverty, while four out of five suffer from either malnutrition or anemia. These results highlight the severity of the issues, surpassing those reported in the existing literature and far exceeding the averages for the general population of Yakutia and Russia. The chapter also discusses how these findings are linked to climate issues, providing a comprehensive view of the socio-environmental challenges faced by these communities.

Acknowledgments

First and foremost, I would like to express my deepest gratitude to Prof. Masato Hiwatari for his guidance and supervision throughout my doctoral course. His expertise and encouragement have been instrumental in shaping this dissertation. Prof. Hiwatari also supported me by being a co-author of some of the works published in peer-reviewed journals. Thank you, Sensei.

I am profoundly thankful to the members of my dissertation committee, Prof. Toshiaki Aizawa and Prof. Hisamitsu Saito, for their critical feedback, thought-provoking discussions, and generous support. I would also like to thank Prof. Yukiko Abe for her insightful comments, which led to further improvements in this work.

I owe special thanks to Prof. Daichi Yamada for his significant contributions to all the works included in this thesis. Your suggestions and support have been incredible throughout my Ph.D. journey. I am also deeply grateful to Prof. Daiju Narita for his various forms of assistance. It has been a privilege to serve as a Research Assistant under your guidance and to contribute to a book chapter that helped shape the fourth chapter of this dissertation on poverty issues. Additionally, I extend my gratitude to Prof. Jorge Garcia Molinos and Prof. Tuyara Gavrilieva for their support, particularly regarding Chapter 4.

This work has also benefited greatly from feedback received at various conferences, especially the ones organized by the Japan Association for Comparative Economic Studies. I appreciate the comments from Prof. Shida on the third chapter. My thanks also go to the participants and my peers, especially Karamat Nurillaev, in the seminar at Hokkaido University, as well as to the researchers at the Slavic-Eurasian Research Center.

I am also thankful for financial support from the MEXT from the Ministry of Education, Culture, Sports, Science and Technology of Japan and Hokkaido University DX Doctoral Fellowship.

Last but not least, I appreciate the Graduate School of Economics and Business of Hokkaido University for their assistance with administrating throughout the doctoral course.

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Chapter 1. Introduction

Inclusive, sustainable, and equitable development is a fundamental goal that shapes the economic and social fabric of nations. In an era of globalization, the movement of goods and services across borders not only drives economic growth but also broadens access to global markets, creating opportunities for nations to engage inclusively in international trade and share in its benefits. However, alongside market expansion and economic shifts, there are environmental challenges—particularly those linked to climate change—that pose significant risks to sustainable development. These challenges compel nations to find a balance between fostering economic progress and ensuring environmental protection, as both are essential for long-term prosperity and resilience. More importantly, inclusive and sustainable development must ensure that the well-being of even marginalized and isolated communities is fully addressed, as they are often the most vulnerable to the unavoidable consequences of climate change. Ensuring equitable participation and support for these groups is essential for fostering resilience and shared prosperity in the face of environmental challenges.

The importance of visiting the above issues is more accelerated by the context of the transition. The integration of Central and Eastern Europe and the former Soviet Union into the global economy has brought significant challenges, especially in fostering the growth of manufacturing exports. While some transition economies (TEs) have experienced notable export growth and diversification, others have struggled with sluggish performance despite nearly three decades of reforms (Rahmanov 2019). Moreover, these economies deserve special attention in environmental analysis as they witnessed significant declines in energy and electricity intensities (Carvalho 2018). Specifically, though historical estimates indicate that energy consumption per unit of Gross Domestic Product (GDP) in the TEs was four to eight times higher compared to the Organisation for Economic Cooperation and Development (OECD) countries (Gray 1995), they have achieved energy efficiency improvements mainly

due to reforms aimed at market liberalization, financial sector and most infrastructure industries (Nepal et al. 2014).

In this dissertation, we explore issues related to foreign trade expansion, environmental sustainability, and well-being, using data from transition economies. Chapter 2 investigates the impact of firm productivity on exports, with a particular focus on the moderating effects of heterogeneous domestic institutions and destination markets. Chapter 3 examines the environmental behavior of firms, specifically their energy efficiency and pro-environmental initiatives, and analyzes whether exporting influences these behaviors. Chapter 4 addresses well-being concerns within a single transition economy, focusing on rural Indigenous households.

Chapter 2 specifically estimates the relationship between productivity and export decision-making, as well as export intensity in TEs, taking into account institutional factors and the similarities between export partners' markets. We test two hypotheses based on an extension of Melitz's theoretical framework by Crinò and Epifani (2012). First, while higher productivity is generally associated with increased export likelihood for firms in TEs, this relationship is stronger for firms from countries with higher-quality institutional environments and weaker for those from countries with lower-quality institutions. Second, productivity significantly influences export intensity for TE exporters targeting developed markets but has no significant effect for those exporting to markets with similar characteristics. The first hypothesis addresses export propensity, and the second focuses on export intensity, underscoring the need to differentiate between these aspects. We empirically test these hypotheses using Heckman's two-stage estimation with exclusion restrictions, utilizing firm-level data from the Business Environment and Enterprise Performance Survey (BEEPS) covering 29 TE countries. Our main findings indicate that in TEs, productivity positively correlates with firms' initiation of exports, although the effect is diminished in countries with weaker institutional frameworks. However,

we find no significant association between productivity and export intensity, regardless of the trading partners. This outcome, though partially contradicting our hypothesis, suggests that the similar market preferences and development levels among TE trading partners might account for this result.

In Chapter 3 we investigate the association between firm exports and environmental performance, focusing on both tangible and intangible dimensions, such as energy efficiency and pro-environmental initiatives, in TEs. By revisiting the environmental consequences of international trade and discussing the role of institutional contexts, we aim to provide insights for policies promoting climate-friendly and cleaner production in the manufacturing industry. Specifically, we analyze the relationship between foreign sales and environmental performance using data from the World Bank Enterprise Survey (WBES) across 29 TEs. Specifically, we examine whether firms enhance energy efficiency through technological upgrades following their entry into foreign markets, as suggested by the learning-by-exporting hypothesis, and whether they adopt climate-friendly initiatives due to pressures from foreign stakeholders concerning the environmental aspects of their products. We argue that these two dimensions—energy efficiency and pro-environmental initiatives—are distinct in TEs, with the latter not always translating into actual performance improvements. To address potential endogeneity, we employ instrumental variable (IV) two-stage least squares (2SLS) and bivariate probit methods in our empirical analysis. Our findings reveal contrasting outcomes. We observe no significant relationship between exporting and energy efficiency, regardless of whether firms have upgraded their technologies or have long exporting experience. Conversely, exporting positively influences pro-environmental initiatives, evidenced by the adoption of strategic environmental objectives and the appointment of environmental managers. These differing results, which do not fully align with existing theories, highlight the unique nature of transition economies. Institutional deficiencies and trade dynamics may hinder the conversion of export-

driven technological investments into energy efficiency gains. Moreover, while firms may adopt climate-friendly practices to signal positive environmental behavior, these initiatives may struggle to translate into concrete green actions within firm operations. This interpretation is further supported by our findings of a disconnect between pro-environmental initiatives and actual energy efficiency improvements.

Chapter 4 examines the livelihoods, health, and well-being of Arctic Indigenous communities in the context of climate change and challenging environmental conditions, comparing these aspects with the general population of Russia to highlight similarities and differences. Using primary data from face-to-face surveys conducted in 17 rural Indigenous villages in Yakutia under the Climate Change Resilience of Indigenous Socio-Ecological Systems (RISE) project, we assess absolute poverty through self-reported income, nutritional status via anthropometric measurements and blood samples, and subjective well-being based on life and health evaluations. The chapter contributes by addressing a gap in the literature on the life and health conditions of Northern Indigenous Peoples (IPs), emphasizing the compounded environmental and social challenges they face. By using quantitative data from diverse locations, the research offers a robust depiction of their conditions. Findings indicate extreme poverty and severe nutritional challenges among Yakutian IPs, with poverty rates nearly five times higher and nutritional issues over three times more prevalent than in the general Russian population. Despite these hardships, the communities report high levels of subjective health and life satisfaction, presenting a contrast to their material conditions.

This dissertation is structured as outlined above, concluding with Chapter 5 where the author presents the final insights. Appendices with supplementary information follow each chapter, and the complete list of references is included at the end of the dissertation.

Chapter 2. Firm Productivity and Manufacturing Exports in Transition Economies: an institutional and trade geography perspective¹

¹ An earlier version of this chapter was published with Masato Hiwatari (University of Tokyo; Hokkaido University) as a co-author.

2.1 Introduction

Since the 1990s, the integration of Central and Eastern Europe and the former Soviet Union into the global economy has posed significant challenges, particularly in expanding manufacturing exports (Aristei et al. 2013; Fertő 2008; Krammer et al. 2018). Exports play a crucial role in mitigating the issues of unstable and narrow domestic markets, fostering technological advancements, increasing employment and wages, and improving the current account balance. These factors are essential for market-oriented reforms and the growth transition. Nearly 30 years later, there is notable diversity in the export performance of TEs, with some experiencing remarkable growth and trade diversification, while others face sluggish export growth (Rahmanov 2019). The exploration of firm exporting activities has long been a focus in international trade theory, with prevailing views linking firm export success to productivity performance (Bernard et al. 2012; Melitz 2003). This scholarly discourse suggests that exporters tend to be larger, more productive, more skill- and capital-intensive, and pay higher wages compared to their domestically-focused counterparts (Bernard et al. 2018; Ding 2021; Mayer and Ottaviano 2008; Melitz 2003). However, in TEs, increasing firm productivity may not directly translate to increased exports due to institutional barriers and the specific characteristics of their trading partners.

Existing studies do not adequately capture the unique characteristics of TEs in two key respects, nor do they fully clarify the role of productivity in exports. First, they often overlook the institutional costs and risks associated with initiating exports. In market transition countries, obtaining licenses, building connections, and securing formal and informal permits are critical for starting exports. High institutional costs may deter even highly productive firms from exporting, suggesting that the role of productivity might differ from that in developed countries. Second, trade between former Soviet Union countries often involves markets with a common legacy and similar preferences and development levels. In such cases, more productive firms

might not have a distinct advantage in exporting, and productivity might not significantly increase export intensity. Existing studies have not thoroughly examined these aspects, leaving the role of productivity in countries undergoing market transitions insufficiently understood.

This study aims to estimate the association of productivity on export decision-making and export intensity in TEs, considering institutional issues and the similarities in export partners' markets. By doing so, we seek to revise the conventional understanding that merely increasing productivity will boost exports and provide policy insights into the additional conditions needed for TEs.

To achieve this objective, we test two hypotheses based on an extension of Melitz's theoretical framework by Crinò and Epifani (2012). First, while productivity is positively associated with export decisions for firms in TEs, this relationship is more significant for firms from countries with higher-quality institutional environments and lower for those from countries with lower-quality institutions. Second, productivity significantly relates to export intensity for TE exporters to developed markets but is insignificant for TE exporters to markets with similar characteristics. The former hypothesis concerns export propensity and the latter export intensity, highlighting the importance of distinguishing between the two. We empirically examine these issues using Heckman's two-stage estimation with exclusion restriction, drawing on firm-level data from the BEEPS on 29 TE countries.

Our study contributes to existing literature in two main ways. First, by examining TEs within their unique market and policy environments, we contribute to the general framework of heterogeneous firm exports derived from Melitz (2003). Our analysis offers a more explicit empirical investigation of issues theoretically expected but often neglected in empirical studies of developed and developing countries, such as heterogeneity across home institutions and trading partners. By demonstrating how these factors influence productivity effects, we aim to

enhance the understanding of productivity's role in exports. Second, it clarifies the role and limitations of productivity in expanding exports in TEs. Previous studies often blur the distinction between export propensity and export intensity, lacking consideration of the different conditions that productivity requires at each stage. Our analysis provides a clearer picture of these conditions in TEs.

Our key findings are as follows: In TEs, productivity is positively associated with firms' export initiation, but the magnitude is weaker in countries with poorer institutional environments. We find no significant relation of productivity on export intensity regardless of trading partners. This result, while not fully supporting our hypothesis, suggests that similar market preferences and development levels among trading partners in TEs might explain this outcome. Overall, our study indicates that for productivity to drive export growth in TEs, the quality of the institutional environment must be improved, and firms should extensively target more developed markets. Without these conditions, productivity increases may not translate into export growth.

The remainder of the chapter is structured as follows: Section 2.2 reviews the previous literature on the relationship between firm productivity and export, highlighting the hypotheses; Section 2.3 presents the methodology and data used for analysis; Section 2.4 discusses the findings and robustness checks, including an analysis of divided samples; finally, Section 2.5 provides the discussion and concluding remarks.

2.2 Literature review

2.2.1 Theoretical Framework and Hypotheses

The relationship between firm productivity and export behavior is modeled in the seminal theoretical heterogeneous-firm framework by Melitz (2003). This model formalizes empirical patterns highlighting that exporting firms perform better across several dimensions—they are

larger, more capital-intensive, and more productive (see, for example, Bernard and Jensen (1995, 1999) for the U.S.; Roberts and Tybout (1997) for Colombia; Aw et al. (2000) for Taiwan). Unlike traditional models, where all firms are assumed identical, Melitz introduces variation in productivity among firms within an industry by extending Krugman's trade model and incorporating firm heterogeneity within a framework of monopolistic competition. In addition to per-unit iceberg costs, the model accounts for substantial, upfront fixed costs that do not vary with export volume and are sunk in nature. These fixed costs mainly include expenses for foreign market research, product adaptation to foreign standards, establishing distribution networks, and navigating bureaucratic and administrative procedures (Alessandria and Choi 2007; Das et al. 2007). Importantly, these fixed export entry costs define the productivity threshold needed for exporting profitability, thus enabling only sufficiently productive firms to export, while less productive firms serve only the domestic market. This embodies the self-selection hypothesis. Since the firm heterogeneity framework was established, numerous studies have documented that firms self-select into exporting based on their productivity. This evidence prevails in both developed and developing countries (e.g., Haidar 2012; Kimura and Kiyota 2006; Temouri et al. 2013; Cieřlik and Michařek 2018; Putniņš 2013; Cieřlik et al. 2015; Wilhelmsson and Kozlov 2007).

For our empirical specifications, we refer to the extension of the Melitz framework by Crinò and Epifani (2012) to capture firm behavior regarding both export entry and intensity. This model considers firms producing differentiated goods under monopolistic competition, characterized by heterogeneity in both productivity and quality. Additionally, two further assumptions are made: first, unlike Melitz (2003), it incorporates non-homothetic preferences, meaning that the representative consumer's preference for goods varies with per capita income. This implies higher relative demand for high-quality products in high-income destinations. Second, it assumes varying fixed costs across products based on their quality, which differ

across markets. Consequently, a firm's entry into any market is contingent upon positive profits, determined by productivity-driven revenue, sunk entry costs, and fixed costs related to product improvement given consumer preferences.

While this extension explicitly addresses the differing productivity-export intensity nexus across various destinations, it can also be implied that firm productivity will have varying effects on export initiation given heterogeneous home institutions. Specifically, since firm productivity enters the model through marginal cost, which decreases with increasing efficiency, it sets the revenue cutoff for breaking into foreign sales. Under high-quality institutional conditions, higher productivity ensures higher revenue, driving firms toward internationalization due to pro-market reforms (Vendrell-Herrero et al. 2022). However, we propose that firms operating in environments with institutional voids are less likely to self-select into exporting despite achieving above-threshold revenue. This may be due to uncertainties stemming from unstable policies in such institutions (Li et al. 2013). These institutional deficiencies deter firms from making export decisions to avoid future risks of revenue fluctuations and potential loss of initial investments needed to cover entry costs.

Considering asymmetric export destinations in Crinò and Epifani (2012) framework, the productivity-export intensity nexus is positive when the foreign market is more sophisticated or wealthier than the domestic one, negative if vice-versa, and insignificant when both markets share similarities. This conclusion is derived by observing increasing elasticities of revenues with respect to productivity given destination market characteristics, which shape consumer preferences towards differentiated products. Specifically, high-productivity firms can produce higher quality goods, for which relative demand is higher (lower) in high- (low-) income destinations, thereby increasing (decreasing) their export intensity to these markets (see, also, Curzi and Olper 2012). When domestic and foreign markets have similarities, the relative

advantage of exporting to the foreign market diminishes because consumer preferences are comparable in both markets, resulting in an insignificant impact of productivity on export intensity. Given this and the above channel for the relationship of productivity on export propensity, we posit our propositions as follows:

Hypothesis 1.1: Productivity is positively associated with the exporting decision for firms in TEs. Additionally, productivity's role in the exporting decision is stronger for firms operating under high-quality institutional environments than for those in low-quality institutions.

Hypothesis 1.2: Productivity is significantly associated with export intensity for TE firms serving advanced markets, while this relationship is insignificant for those directing their sales to markets with similar characteristics.

2.2.2 Related Literature and Empirical Evidence

Our study is closely related to various extensions of the firm heterogeneity framework in trade theory, which have shown that diverse institutional conditions in the home market and asymmetries in the destination market are critical in shaping exporting activities. These extensions explain, for example, different productivity cutoffs for successful export entry by assuming varying entry costs stemming from heterogeneous home business environments (Lai et al. 2020). Governments may manipulate some of these costs by erecting non-tariff barriers abroad (Melitz 2003) or reducing domestic fees when entering foreign markets (Alessandria and Choi 2007). Regarding asymmetric export destinations, studies consider the number of destination markets (single or multiple) (Melitz and Redding 2014) and the heterogeneity of income levels and consumer preferences in export destinations (Crinò and Epifani 2012; Curzi and Olper 2012; Brambilla et al. 2012).

Empirical studies based on the above views have been limited to specific or developed countries. Supporting their models, Crinò and Epifani (2012) and Curzi and Olper (2012) find a negative association between productivity and export intensity for Italian exporters targeting low-income destinations. Similarly, using Argentinian and cross-country data, Brambilla, Lederman and Porto (2012), and Brambilla and Porto (2016) show that exporters serving high-income destinations hire more skilled labor and pay higher wages. Both papers link the mechanism to the demand for quality products in these countries, which drives exporters to upgrade their labor force.

Also, there are several empirical studies employing firm-level data from TEs examine the relationship between productivity and exports (Cieřlik et al. 2014; Cieřlik et al. 2024; Vendrell-Herrerro et al. 2022). These studies have often emphasized differences in productivity effects due to institutional and geographic differences. However, while the issue of data censoring by exporters is often addressed, the differences in mechanisms between the export

initiation and export intensification stages are mostly overlooked, and there is a lack of consideration of the different conditions that productivity requires at each stage.

Overall, our study contributes to the existing literature by extending the analysis of the productivity-export relationship to transition economies, considering both institutional and export destination conditions. This allows for a deeper understanding of how productivity influences export decisions and intensity under varying institutional and market conditions. Our hypotheses build on the established theoretical frameworks while addressing gaps in the empirical literature, particularly concerning transition economies. By incorporating institutional quality and market similarities into the analysis, we aim to provide a comprehensive view of the determinants of export behavior in transition economies, highlighting the critical role of productivity and the conditions under which it translates into export success.

2.3 Method

2.3.1 Data source and sample

We use data from BEEPS for 29 TEs to conduct the empirical analysis. This is an establishment-level survey jointly performed by the European Bank for Reconstruction and Development and the World Bank. For the main analyses, we pooled the last three rounds of the survey conducted in 2008/2009, 2012/2013, and 2018/2019/2020 for 29 TEs using only the manufacturing industry. The sample contains 18,942 observations for 29 countries and 15 industries.

In addition to firm-level data, we combine two more open datasets to account for institutions and trade geographies: the World Governance Indicators (WGI) and the United Nations (UN) Comtrade database. The former, which was developed by the World Bank researchers, provides six aggregate indicators for over 200 countries and they combine the views of a large number of enterprise, citizen, and expert survey respondents in industrial and

developing countries.² For our analyses, we obtained the regulatory quality index for all years across the 29 TEs. Regarding the UN Comtrade dataset, we extract the industry-level total export volume of TEs, as well as their volume directed to advanced markets and to those with similar characteristics.³ However, for certain countries, such as Uzbekistan, Tajikistan, and Kosovo, the data is not available across some or all years.⁴

2.3.2 Variable description

Table 2.1 shows the description of variables that we employ throughout analyses and Table 2.2 provides their summary statistics. The two dependent variables we use are *export propensity* and *export intensity*. The former is a binary variable and represents a firm's exporting decision in every period, the latter is a ratio that can indicate the relative importance of exporting (Defever and Riaño 2022). We follow Curzi and Olper (2012) to measure export intensity as exports over domestic sales.

As for the main independent variable, we utilize three measures to ensure the robustness of our results across various proxies: *total factor productivity (TFP)*, *labor productivity*, and *value-added per worker*. *TFP*, a more straightforward measure, is calculated using Levinsohn and Petrin (2003) method. This approach addresses the simultaneity issue because firms' input choices are often correlated with unobserved productivity shocks, leading to biased estimates in traditional regression methods like Ordinary Least Squares (OLS). It uses intermediate inputs, such as materials, as a proxy for unobserved productivity shocks, assuming firms adjust these inputs in response to productivity changes. Levinsohn-Petrin assumes that intermediate inputs increase monotonically with productivity, allowing for an inversion approach where productivity is expressed as a function of inputs. This enables a two-step estimation: first, labor

² For full description about the data, refer to <https://info.worldbank.org/governance/wgi/>

³ We mostly follow Crinò and Epifani (2012) and refer to the following economies as advanced for all TEs: European Union (EU) 15 countries, North America (United States and Canada), Norway, Switzerland, Australia, New Zealand, Japan, and South Korea. However, we additionally assume EU TEs and Russia as advanced for the rest of TEs given higher income disparities.

⁴ However, in later sections we show the robustness of our findings including all these data using a different method.

and intermediate input coefficients are estimated, and then the capital coefficient is recovered using moment conditions. For the second stage, Levinsohn-Petrin assume that productivity is governed by a first-order Markov process by utilizing lagged productivity in the moment conditions to estimate the capital coefficient. Thereby, we refer to the panel structure of data to calculate TFP.

We also include the following firm characteristics as control variables: *firm size*, *age*, *foreign and state ownership*, *managerial experience*, *foreign-origin input*, *foreign licensed technology*, and *quality certification*. These firm features, studied within the firm heterogeneity framework, are associated with mostly both export propensity and intensity through various channels. Starting from firm size, larger firms can enjoy economies of scale which helps to absorb the fixed and variable costs associated with export entry and expansion, and they possess higher efficiency (Melitz 2003), as well as are capable of undertaking larger investment and higher risks (Ha et al. 2020). As for firm age, on the one hand, it can be indicative of experience-based capabilities, ability to adapt and reliability (Shinkle and Kriauciunas 2010), thereby facilitating export entry. On the other hand, it has been observed that some small firms begin exporting soon after their inception, a phenomenon referred to as ‘born global’ (Gkypali et al. 2015). Foreign ownership can positively influence foreign sales through international investment experience that lowers transaction costs, or information spillovers that facilitate networking during internationalization (Ye et al. 2021). Regarding state ownership, its relationship with exporting can be mixed: while it may lead to inefficiencies and a lack of competitiveness (Liljeblom et al. 2020), state-owned enterprises might also better generate exports through innovation as they possess complementary resources and networks (Dong et al. 2022). Furthermore, managerial experience as a form of human capital can also drive firm export decisions by lowering sunk costs (Masso et al. 2015), however, such an effect on export penetration is not previously supported (Mulliqli et al. 2019). Foreign origin inputs, indicating

also a firm's participation in global value chains, can positively affect export entry and intensity through efficiency gains by lower factor costs, more varieties and higher quality goods (Bas 2012). Likewise, firms using technology licensed by foreign-owned companies are exposed to better quality, knowledge transfer and enhanced efficiency, which can facilitate exporting activities (Sharma 2018). Finally, we control for owning the internationally recognized quality certification in export start stage as it can reduce entry costs by overcoming information asymmetry in international markets and thereby easily gaining trust among foreign buyers (Goedhuys and Sleuwaegen 2016).

For the main analyses across different institutions and destinations, we additionally utilize country- and industry-level variables, namely institutional quality and share of exports to different destinations. Institutional quality is proxied by the regulatory quality index from the WGI, as its construction sources primarily reflect the economic aspects of countries. The prior usage of this index as a part of institutional quality can be found, for example, in Golovko and Sahin (2021). Next, we employ an industry's share of exports to high-income or advanced countries, and to countries with similar development levels or characteristics. These variables are acquired from UN Comtrade by classifying Harmonized Systems two-digit industries according to a general correspondence table given in Mallick and Marques (2017).

Table 2.1 Names and descriptions of variables used throughout analyses.

Variable name	Description
<i>Dependent variables</i>	
Export propensity	A dummy variable equals to 1 if a firm engages in any modes of exporting, whether direct or indirect, over the last fiscal year, and 0 otherwise
Export intensity	Exports over domestic sales
<i>Main independent variables</i>	
Total factor productivity	Firm technical efficiency obtained by estimating translog production function through Levinsohn and Petrin (2003) approach, with material inputs serving as a proxy variable
Labor productivity	A firm's total sales are converted to USD and divided by the total number of full-time workers. This variable is in logarithm
Value added per worker	A firm's sales minus material costs are converted to USD and divided by the total number of full-time workers. This variable is in logarithm
<i>Control variables</i>	
Firm size	Total number of full-time employees. This variable is in logarithm
Firm age	Survey year minus the year when the firm started operations
Foreign ownership	A dummy variable equals 1 if more than 10% of the firm's capital is owned by foreign individuals, and 0 otherwise
State ownership	A dummy variable equals 1 if at least 1% of the firm's capital is owned by the government, and 0 otherwise
Managerial experience	A firm top manager's years of experience in the sector
Foreign-origin input	The percentage of material inputs of foreign origin
Foreign licensed technology	A dummy variable equals 1 if a firm uses technology licensed from a foreign-owned company
Quality certificate	A dummy variable equals to 1 if a firm is holding or has applied for any internationally recognized quality certification, and 0 otherwise
<i>Country- and industry- level variables</i>	
Institutional quality	A state's regulatory quality scores, ranging from -2.5 to +2.5
Export share to high-income markets	An industry's exports to advanced markets divided by the industry's total exports in a given country and year
Export share to similar markets	An industry's exports to similar markets divided by the industry's total exports in a given country and year
Industry total exports	An industry's total exports in USD. This variable is in logarithm

Table 2.2 Summary statistics

VARIABLES	N	Mean	Std	Min	Max
Export propensity	18769	.3849433	.4865949	0	1
Export intensity	6467	4.524228	14.18594	.010101	99
Total factor productivity	7809	5.134089	.7967022	3.345503	12.96711
Labor productivity	15971	10.12368	1.70839	.9477971	22.17813
Value added per worker	10460	9.466448	1.716082	.9747172	21.26849
Firm size	18783	105.6914	339.6221	1	20000
Firm age	18714	17.89997	16.31729	0	202
Foreign ownership	18720	0.105609	0.307345	0	1
State ownership	18723	.0254233	.1574111	0	1
Manager experience	18357	17.29722	10.47646	1	66
Foreign-origin input	17687	32.83253	36.42823	0	100
Foreign licensed technology	18358	.1914152	.3934258	0	1
Quality Certificate	18593	.314527	.4643397	0	1
Institutional Quality	18942	.0706124	.6890764	-1.603983	1.589629
Export share to high-income markets	17698	.5080032	.2136114	.0030681	.985266
Export share to similar markets	17707	.2686594	.1749132	.0110622	.9601849
Industry total exports	17707	19.31426	2.30447	9.842277	25.50402

Notes: (1) Figures given in this table for “Firm size” are in original units; (2) Figures for “Export intensity” are calculated for only exporters.

2.3.3 Model specification and empirical approach

Our main empirical specification concerns how firm productivity and other firm factors are associated with export propensity and intensity across heterogeneous institutions and destinations. The baseline equation for export propensity takes the following form:

$$EP_{icsy} = \begin{cases} 1 & \text{if } EP_{icsy}^* > 0 \\ 0 & \text{if otherwise} \end{cases}, \quad (2.1)$$

$$EP_{icsy}^* = \beta_1 + \beta_2 productivity_{icsy} + \mathbf{X}_{icsy}\beta_3 + \beta_4 Z_{icsy} + \beta_5 W_{csy} + C_c + S_s + Y_y + u_{icsy},$$

where EP is observed export propensity and is equal to 1 if firm i in a country c , in an industry s and for year y , exports, and 0 otherwise. As for EP^* , it is a latent variable that indicates the profitability of firm i , and *productivity* is proxied by *TFP*, *labor productivity* and *value-added per worker*. As for X , it includes other firm characteristics such as *size*, *age*, *foreign and state ownership*, *managerial experience*, *foreign-origin input*, and *foreign-licensed technology*. Additionally, C , S , and Y denote country, industry, and time-fixed effects, respectively, and u is the error term. We expect that adding time-fixed effects might partially capture nominal fluctuations in monetary variables. In addition to serving as control variables in the above equation, the quality certificate and industry total exports are included under Z and W , respectively, to act as exclusion restrictions. The rationale for their use as exclusion restrictions will be detailed later.

The following is the baseline equation for export intensity:

$$EI_{icsy} = \beta_1 + \beta_2 productivity_{icsy} + \mathbf{X}_{icsy}\beta_3 + \beta_4 IMR_{icsy} + C_c + S_s + Y_y + v_{icsy}, \quad (2.2)$$

where EI_{icsy} is the export intensity of firm i in a country c , in an industry s and for year y . Productivity and all other control variables included in X are the same as those in equation (2.1).

The equation also includes the inverse Mill's ratio (IMR) or non-selection hazard obtained from equation (2.1), which is detailed further below.

While dealing with the export intensity specification, we may face a potential issue of sample selection bias. Specifically, as we have both exporters and non-exporters, we observe positive export values only for firms that engage in foreign trade, whereas we observe only zero values for non-exporters. As there are too many zeros, we assumed the data to be censored, and this may cause our model to suffer from selectivity bias because these zero export values are assumingly not random. To overcome the selection bias, the previous studies applied both the Heckman method (Estrin et al. 2008; Faria et al. 2020) and the Tobit approach (Gashi et al. 2014; Mulliqi et al. 2019). While the Tobit model offers the advantage of estimating a single equation that simultaneously accounts for selection, we prefer the Heckman method to separately address firm selection into exporting and subsequent export expansion. This preference is primarily due to the distinct determinants of these two stages, where sunk entry costs pose significant barriers during the entry phase but become less critical for expansion (Das et al. 2007). Moreover, the nature of our cross-section pooled data requires Heckman usage to address such sample selection issues unlike panel data analysis, where most forms of unobserved heterogeneity will be eliminated by fixed effects estimation (Vella 1998).

The estimation begins by using a probit model to estimate equation (2.1) and then obtaining IMR, which is added to equation (2). If the coefficient of IMR is significant, it indicates that there is a correlation between the error terms of the two equations and, therefore, confirms the presence of the bias and validates our approach in estimation. Importantly, the Heckman approach requires exclusion restriction, which appears only in the selection stage affecting export decision, and not in the export intensity equation. Accordingly, we use two variables as exclusion restrictions: an industry's total exports and a firm's possession of the

internationally recognized quality certification. Regarding the former, the literature suggests that firm export experience, often proxied by lagged export status, can significantly reduce entry costs (Das et al. 2007; Roberts and Tybout 1997). However, due to data unavailability, we cannot observe firm-level exporting in the previous period, thereby we use industry-level exports as a proxy. In addition, we assume that firms holding internationally recognized quality certificates tend to enter foreign markets since certification reduces trade costs that are required to begin export activities (Goedhuys and Sleuwaegen 2016). On the other hand, this certificate is not expected to have a direct effect on export intensity, since the effect of such certificates on a company's credibility is not limited to international markets but is equally effective domestically in transition countries where domestic certification systems are less trusted (Goedhuys and Sleuwaegen 2013). A comparison of the export intensity of exporting firms in the transition countries with and without certificates shows no significant difference between them.⁵

Finally, while the above equations serve as baseline specifications, our main findings stem from interactions between home institutions and export destinations in the productivity-export relationship. Specifically, we interact the *productivity* with the *institutional quality* to investigate the productivity-export entry nexus under different institutions. Additionally, we interact the *productivity* with *export share to high-income markets* and *export share to similar markets* to explore how the productivity-export intensity nexus is moderated with heterogeneous destinations.

⁵ The mean of export intensity for exporters with certificates is around 47.48%, while for those without certificates is around 45.73%.

2.4 Results and robustness checks

2.4.1 Descriptive analyses

Table 2.7 in the appendix shows summary statistics of the sample by country. Higher variations are observed for the ratio of exporters across countries, with Slovenia and Estonia having the highest share of exporters (86% and 79%, respectively), while Kazakhstan and Azerbaijan have the lowest percentages (11% and 16%, respectively). Moreover, Figures 2.1 and 2.2 provide overall insights into the relationship between productivity and exporting. Specifically, Figure 2.1 illustrates that exporters tend to exhibit higher productivity than non-exporters across the entire sample. This finding generally aligns with the new international theory on heterogeneous firms for TEs. However, Figure 2.2 manifests no noteworthy correlation between productivity and export intensity.

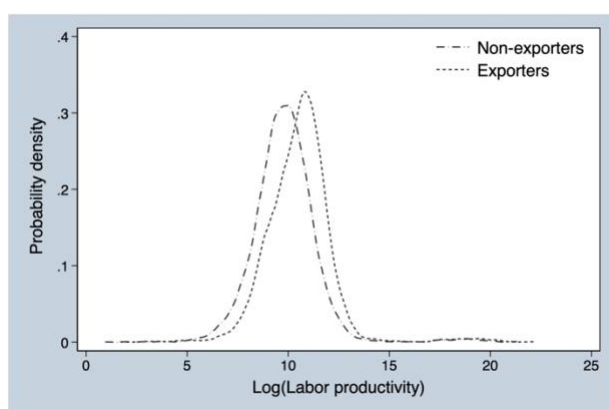


Fig. 2.1 Productivity distribution of exporters and non-exporters for the whole sample of TEs

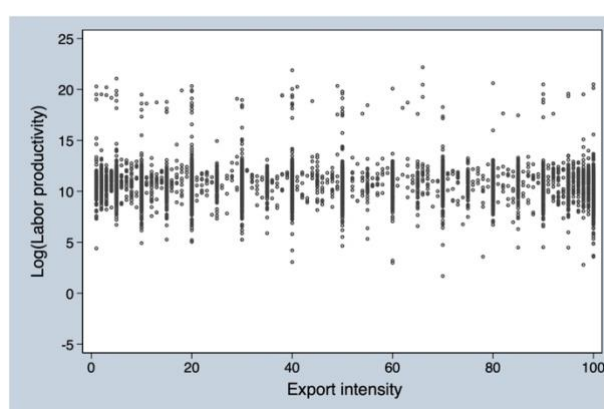


Fig. 2.2 Labor Productivity and Export Intensity Scatterplot for the whole sample of TEs

2.4.2 Main findings

Tables 2.3 and 2.4 present the results for export propensity and intensity, respectively, using Probit and Heckman's two-stage methods. The models across both tables might show minor variations from the baseline specifications owing to the inclusion of interactions and their main effects. Moreover, in Table 2.3 we opt not to include country-fixed effects in the export propensity models to avoid redundancy, assuming that the main institutional effects capture most of the cross-country variations.⁶ Table 2.4 reports coefficients for IMR, which is consistently significant across all models, affirming the presence of sample selection and lending support to our adopted approach. Across both tables, models with labor productivity have the highest number of observations followed by those with value-added per worker. The main reason for the loss of observations in TFP is related to the missing information of firm cost information, such as material inputs.

The findings in Table 2.3 highlight the significant positive relationships between all productivity measures and export decisions, confirming the standard firm heterogeneity view that exporters are more productive than non-exporters. Importantly, institutional quality positively moderates this relationship as shown in the positive and significant coefficient of the interactions across models, though that of labor productivity has stronger significance compared to the other two models. This finding underscores that higher-quality institutions enable more productive firms to engage more effectively in foreign sales, thereby implying that firm heterogeneity towards exporting is more pronounced in better institutional environments. That is, firms benefiting from institutional advancements are more likely to export compared to those operating in environments with institutional voids. This outcome may relate to the uncertainty in institutionally deficient markets (Li et al. 2013), where firms face greater risks in securing future profits from exporting, thus potentially avoiding not losing the initial

⁶ However, we show the robustness of results by including country-fixed effects in robustness checks.

investments of covering entry costs. Moreover, this might also imply that firms located under poor institutions are selected to export not because of their efficiency, but due to the distorted systems where corruption or political ties have higher roles (Vendrell-Herrerro et al. 2022).

Table 2.4 provides partial support for hypothesis 2.2, showing an insignificant relationship between productivity and export intensity, a pattern that remains unchanged for firms oriented towards both markets with similar characteristics and more sophisticated markets. This insignificance can be attributed to several factors. For firms exchanging goods among markets that were once part of a single economic unit, similar demand structures and revenue elasticities might neutralize the impact of productivity on export intensity because similar revenue elasticities might stem from similar preferences on product quality among markets with similar characteristics. However, the lack of significance for those targeting more sophisticated markets may be due to the integration of certain TEs, like those in Central and Eastern Europe (CEE), into the Western world. This integration has led to institutional alignments with developed countries despite income disparities. Additionally, these Eastern markets have undergone rapid transformations to market economies, reducing market concentration (Friesenbichler 2020) and quickly adopting Western consumer preferences and buying habits (Kunc and Križan 2018). These factors collectively diminish the direct relationship of productivity on export intensity for even those exporting to advanced markets, explaining the insignificant findings in Table 2.4.

As for control variables, we observe both similarities and differences across their relationships with the two export dimensions. Specifically, it is revealed that larger firms tend to be present in foreign markets and penetrate more into those markets. This can be attributed to larger firms' ability to leverage economies of scale, resource availability, market power, experience, and risk diversification (Ha et al. 2020; Shinkle and Kriauciunas 2010). In contrast, firm age is found to be positively associated with export entry, while its effect on export

intensity is negative. The former might indicate the importance of experience and trust accumulated over years (Shinkle and Kriauciunas 2010), while the latter can be indicative of the presence of the “born-global” concept (Kim et al. 2011). Furthermore, firms with foreign investments tend to engage in exporting activities and to export at a higher degree, which can be explained by having spillovers required both to break into foreign markets and for expansion (Ye et al. 2021). State ownership is found not to be associated with both export dimensions, which can be possibly due to the nature of the transition context neutralizing the performance of state-involved enterprises. Regarding managerial experience, its effect is positive in export entry, indicating the role of human capital in reducing entry costs (Masso et al. 2015), while it is insignificant with export intensity potentially signaling market diversification behaviors regardless of experience. As for foreign-origin input, its effect is equally positive for both export dimensions pointing out efficiency gains, as well as higher quality goods (Bas 2012). Regarding technology licensed by foreign-owned companies, its association is positive with export propensity, while insignificant with intensity.

Table 2.3 Main Probit results for export propensity

Dependent variable	Export propensity		
	(1)	(2)	(3)
Total factor productivity	0.0855*** (0.0125)		
Total factor productivity * Institutional quality	0.0241* (0.0130)		
Labor productivity		0.0466*** (0.00366)	
Labor productivity * Institutional quality		0.0185*** (0.00412)	
Value added per worker			0.0424*** (0.00445)
Value added per worker * Institutional quality			
Firm size			0.00899* (0.00514)
Firm age	0.0917*** (0.00755)	0.120*** (0.00431)	0.121*** (0.00529)
Foreign ownership	0.00161*** (0.000482)	0.00173*** (0.000344)	0.00176*** (0.000409)
State ownership	0.241*** (0.0248)	0.200*** (0.0176)	0.220*** (0.0214)
Manager experience	0.0471 (0.0457)	-0.0119 (0.0331)	0.00365 (0.0384)
Foreign-origin input	0.00153*** (0.000209)	0.00193*** (0.000146)	0.00187*** (0.000180)
Foreign technology use	0.0738*** (0.0182)	0.0749*** (0.0129)	0.0736*** (0.0157)
Quality certificate	0.205*** (0.0153)	0.177*** (0.0111)	0.176*** (0.0134)
Regulatory quality	0.0477 (0.0705)	-0.0353 (0.0449)	0.0816 (0.0529)
Industry total export	0.0187*** (0.00428)	0.0117*** (0.00301)	0.0161*** (0.00377)
Country fixed effects	No	No	No
Time fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
Observations	6939	13382	9163
Pseudo R2	0.272	0.279	0.279
Log likelihood	-3473.5	-6515.7	-4508.7

Note(s): (1) Standard errors in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; (2) Marginal effects at means are given.

Table 2.4 Main results for export intensity using Heckman two-step approach

Dependent variable	Export intensity					
	(1)	(2)	(3)	(4)	(5)	(6)
Total factor productivity	-0.100 (1.337)	0.0336 (0.799)				
TFP * Export share to high-income markets	0.709 (1.983)					
TFP * Export share to similar markets		1.299 (2.469)				
Labor productivity			0.861 (0.485)	-0.013 (0.274)		
Labor productivity * Export share to high-income markets			-1.040 (0.701)			
Labor productivity * Export share to similar markets				0.993 (0.947)		
Value added per worker					-0.175 (0.582)	0.090 (0.324)
Value added per worker * Export share to high-income markets					0.255 (0.838)	
Value added per worker * Export share to similar markets						-0.381 (1.086)
Firm size	3.051*** (0.437)	3.017*** (0.437)	2.859*** (0.314)	2.838*** (0.312)	2.783*** (0.372)	2.803*** (0.371)
Firm age	-0.0458*** (0.0153)	-0.0460*** (0.0153)	-0.0366*** (0.0117)	-0.0366*** (0.0117)	-0.0395*** (0.0134)	-0.0394*** (0.0134)
Foreign ownership	7.529*** (0.830)	7.527*** (0.830)	7.284*** (0.632)	7.265*** (0.631)	7.505*** (0.740)	7.506*** (0.742)
State ownership	-1.823 (1.675)	-1.733 (1.679)	-1.456 (1.296)	-1.422 (1.294)	-1.589 (1.486)	-1.602 (1.485)
Manager experience	-0.0151 (0.0267)	-0.0154 (0.0267)	0.00705 (0.0201)	0.00618 (0.0201)	-0.0125 (0.0240)	-0.0125 (0.0240)
Foreign-origin input	0.0465*** (0.00922)	0.0461*** (0.00921)	0.0453*** (0.00713)	0.0447*** (0.00710)	0.0431*** (0.00838)	0.0430*** (0.00837)
Foreign technology use	-0.00595 (0.715)	0.00633 (0.716)	0.353 (0.534)	0.346 (0.533)	0.226 (0.635)	0.247 (0.636)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6577	6580	12423	12430	8605	8610
Selected observations	2799	2799	4610	4612	3419	3419
Mills Ratio	8.131***	8.217***	7.584***	7.463***	6.801***	6.930***

Note(s): (1) Standard errors in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; (2) The main effects of export share to high-income/similar markets, which are all insignificant across all models, have been suppressed but available upon request; (3) Refer to Table 2.9 in the appendix for the first stage result.

2.4.3 Robustness checks

We have conducted additional analyses to validate the above main results related to export propensity and intensity. Regarding the former, firstly, we categorized countries into two groups proxying their institutional environments: European Union (EU) TEs and non-EU TEs. Specifically, we categorize non-EU TEs as possessing institutional environments characterized by low quality, while EU TEs offer environments of high quality. The institutional performance of the latter group surpasses that of the former in various dimensions, including but not limited to aspects such as reduced corruption, banking policies, financial reforms, and environmental outcomes (Biscione et al. 2022; Cojocaru et al. 2016).

Moreover, we consider also a potential endogenous relationship between firm productivity and export decision in this stage. The source of endogeneity can be related to the learning-by-exporting hypothesis that exporting firms may acquire and apply foreign knowledge from international buyers and competitors to increase their post-entry performance (Wagner 2007). To partly mitigate the endogeneity, we employed IV approach to estimate the export propensity models. For the instrument, we used information on whether a firm has provided training for its employees or not. These firm-provided trainings can update the schooling qualifications of workers, help with technology adoption in a firm, and therefore, be crucial for human capital accumulation (Almeida and Aterido 2015; Martins 2021). However, there can be concerns with the instrument regarding exclusion criteria such as reverse causality or the direct relationship of training with export. The former means that firms may decide on skill upgrading of the existing workforce through training after their sales in foreign markets (Bastos et al. 2016). Nevertheless, we anticipate that training is intentionally adopted to reduce average production costs or catch up to the technological frontier, especially in emerging countries where skilled workers are scarce (Almeida and Aterido 2015; Boikos et al. 2023). This implication can also be inferred in our sample that more than 60 percent of firms are concerned with an inadequately educated workforce. Another concern is that training programs

may directly drive firms to export as exporting requires expertise in communication or foreign languages (Bastos et al. 2016). However, the latest round of the survey reveals that ‘foreign language skills’ programs, which may directly affect export activities, account for around 7 percent of other formal training programs. This small share of the foreign language program may imply that firms may be more inclined towards efficiency enhancement than direct export training. In this sense, we use firm-provided training as an instrument to address the endogeneity issue, recognizing that it may not entirely resolve the matter.

Table 2.5 illustrates the robustness of our main findings. Notably, the productivity coefficients are higher for the EU sample compared to the non-EU sample, persisting across all productivity measures and the IV methods. To validate the IV models, we conducted several tests and additional checks. First, an endogeneity test confirmed that productivity is endogenous in three out of four models, as indicated by the p-values, which reject the null hypothesis of exogeneity. Second, the Anderson canonical correlation test shows that the excluded instrument is indeed relevant, with p-values strongly rejecting that models are underidentified. To address concerns about weak instruments, we report F-scores exceeding 10 in nearly all models. Finally, Table 2.10 in the appendix presents an additional check for potential violations of the exclusion restriction, or when the instrument is “plausibly exogenous”, following Conley et al. (2012). Specifically, Conley et al. (2012) propose relaxing the exclusion restriction by allowing the coefficient on the instrument in the structural equation to fall within a specified range, rather than assuming it is exactly zero. Here, we also allow the coefficient of worker training to influence the export decision directly, within an interval of 0 to 0.15. The results show that none of the 95% confidence intervals include zero, suggesting that productivity affects export decisions even when allowing for some direct effect of training.

In the export intensity models, we group the Western Balkans (WB) to represent trade directions toward more advanced markets, while Central Asian (CA) and Eastern Europe and

Caucasus (EEC) countries are combined to represent trade patterns toward similar markets.⁷ The latter group has maintained or intensified trade ties with traditional partners through regional integrations, such as the Commonwealth of Independent States (CIS) and the Eurasian Economic Union (EAEU) (Libman and Vinokurov 2018). For instance, between 2009 and 2019, nearly half of the exports from some CA Republics were directed to their post-colonial partners within the CIS (Cieřlik and Gurshev 2023). In contrast, the WB's geographical proximity to EU countries and the Stabilization and Association Agreements can partially explain their trade orientation toward advanced markets. The results, presented in Table 2.6, utilize OLS due to the insignificance of IMR when applying the Heckman method, despite the relevance of exclusion restrictions. Across all models, productivity remains insignificant for both country groups and different productivity proxies, reinforcing our main conclusions.

⁷ Western Balkans include Albania, Bosnia and Herzegovina, Kosovo, Montenegro, and Serbia. Central Asia includes Kazakhstan, Kyrgyz Republic, Mongolia, Tajikistan, and Uzbekistan, while Eastern Europe and Caucasus include Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine.

Table 2.5. Robustness checks for export propensity models across different institutions

	Low-quality institutional environment (non-EU TEs)				High-quality institutional environment (EU TEs)			
	Probit		IV-Probit		Probit		IV-Probit	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Labor productivity	0.0233*** (0.00371)		0.425*** (0.0909)		0.0442*** (0.00871)		0.676*** (0.232)	
Value added per worker		0.0224*** (0.00458)		0.391*** (0.140)		0.0254** (0.0102)		0.574 (0.383)
Firm size	0.112*** (0.00478)	0.116*** (0.00606)	0.285*** (0.0319)	0.289*** (0.0470)	0.136*** (0.00773)	0.134*** (0.00884)	0.265*** (0.0782)	0.289*** (0.110)
Firm age	0.000208 (0.000365)	0.000203 (0.000438)	0.00176 (0.00107)	0.00144 (0.00125)	0.00133* (0.000703)	0.00125 (0.000801)	0.00309* (0.00177)	0.00322 (0.00216)
Foreign ownership	0.126*** (0.0192)	0.141*** (0.0240)	0.199** (0.0859)	0.266** (0.119)	0.268*** (0.0330)	0.299*** (0.0378)	0.402* (0.217)	0.552* (0.328)
State ownership	-0.0638** (0.0319)	-0.0839** (0.0374)	-0.0301 (0.106)	-0.113 (0.129)	-0.0835 (0.0942)	0.00838 (0.131)	-0.208 (0.232)	0.144 (0.348)
Manager experience	0.000567 (0.000537)	0.000419 (0.000681)	0.00190 (0.00154)	0.00202 (0.00193)	0.00431*** (0.000867)	0.00372*** (0.000999)	0.00978*** (0.00283)	0.00914*** (0.00340)
Foreign-origin input	0.000741*** (0.000164)	0.000634*** (0.000207)	0.000973 (0.000639)	0.000978 (0.000755)	0.00323*** (0.000270)	0.00316*** (0.000312)	0.00630*** (0.00189)	0.00681** (0.00267)
Foreign technology use	0.0706*** (0.0138)	0.0825*** (0.0172)	0.144*** (0.0479)	0.155** (0.0716)	0.0730*** (0.0242)	0.0465* (0.0278)	0.110 (0.0831)	0.0596 (0.100)
Quality certificate	0.135*** (0.0129)	0.134*** (0.0160)	0.244*** (0.0717)	0.278*** (0.0878)	0.132*** (0.0188)	0.118*** (0.0215)	0.157 (0.126)	0.198 (0.148)
Industry total export	0.0471*** (0.00517)	0.0495*** (0.00645)	0.124*** (0.0186)	0.129*** (0.0245)	0.0345* (0.0188)	0.0288 (0.0213)	0.0883* (0.0471)	0.0674 (0.0585)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8783	5883	8742	5861	4599	3280	4585	3279
Log likelihood	-3885.6	-2609.7	-19015.1	-12889.2	-2048.8	-1438.2	-8320.7	-5856.9
Wald test of exogeneity: P-value			0.0018	0.0554			0.0711	0.2777
Anderson canonical correlation test: P-value			0.0000	0.0000			0.0001	0.0031
F-test of excluded instruments: F-score			59.01	27.13			15.92	8.69

Note(s): (1) Standard errors are given in parentheses; significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; (2) The F and Anderson canonical correlation tests for IV models are obtained using the *ivreg2* command of STATA, though the models are estimated using *ivprobit* Maximum Likelihood approach; (3) Marginal effects at means are given for all models.

Table 2.6 Robustness checks for export intensity models

	WB			CA and EEC		
	OLS					
	(1)	(2)	(3)	(4)	(5)	(6)
Total factor productivity	0.201 (1.623)			-0.0952 (0.533)		
Labor productivity		-0.435 (0.505)			-0.178 (0.145)	
Value added per worker			-0.969* (0.546)			-0.155 (0.162)
Firm size	2.621*** (0.821)	1.729*** (0.465)	2.228*** (0.535)	0.352 (0.314)	0.350 (0.216)	0.558** (0.254)
Firm age	-0.0386 (0.0333)	-0.0357 (0.0269)	-0.0451 (0.0315)	-0.00848 (0.0180)	-0.0151 (0.0138)	-0.0242 (0.0156)
Foreign ownership	0.402 (1.933)	6.870*** (1.573)	4.417** (1.763)	1.690* (0.891)	3.518*** (0.705)	3.752*** (0.824)
State ownership	-2.190 (3.102)	-2.360 (2.757)	-1.743 (3.035)	0.237 (1.331)	0.187 (1.102)	0.386 (1.231)
Manager experience	-0.0847 (0.0626)	-0.00705 (0.0491)	-0.0364 (0.0568)	0.0405 (0.0329)	0.0655*** (0.0252)	0.0530* (0.0294)
Foreign-origin input	0.0238 (0.0186)	0.00457 (0.0147)	0.0144 (0.0168)	0.0208** (0.0104)	0.0184** (0.00815)	0.0229** (0.00947)
Foreign technology use	2.748** (1.330)	1.392 (1.066)	2.716** (1.223)	-0.173 (0.735)	0.114 (0.587)	-0.424 (0.671)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	424	681	525	835	1546	1134

Notes: (1) Standard errors are given in parentheses; significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

2.5 Discussions and conclusions

Extensive scholarly literature underscores the overarching significance of exporting, emphasizing productivity as a key driver, although empirical evidence remains relatively scant in the context of transition economies. The distinctiveness of these nations, characterized by unique institutional frameworks and trade dynamics, is shaped by multifaceted factors such as political, economic, and geographic considerations. This interplay has resulted in a divergence in both domestic institutional quality and trade orientation among transition countries. Consequently, it is crucial to advance our understanding of how firm behavior within these environments influences decisions related to exporting activities.

In line with this, we attempted to examine how firm productivity is associated with export propensity and intensity of exports using BEEPS data for 29 transition countries. Also, we explored whether and how institutional environments and trade geography impact this relationship. The results reveal a robust positive influence of firm productivity on the decision to enter export markets. While this result is consistent with the main theoretical view (Melitz 2003), our findings additionally demonstrate heterogeneity in the magnitudes of productivity's association with export decision given institutional conditions. Specifically, exporting decisions are weakly driven by productivity for firms operating under imperfect institutional environments rather than those enjoying high-quality regulatory conditions.

On the other hand, our findings demonstrate an insignificant relationship of productivity with the exports over domestic sales, regardless of trade destinations. One of the main possible explanations is tied to the specific characteristics of the trade geography of TEs and the similarities between domestic and foreign markets that firms cater to. Since these economies were once a single economy, they might still share similar characteristics and as a result, firms directing goods

to those markets are not inclined to prioritize exports over domestic sales. Moreover, such a view can not only be related to firms located in CA or EEC but also those in the EU as their integration to the advanced markets can go beyond institutional alignments and also cover shared preferences in markets. On top of this, this result might be due to homogenous consumer preferences over vertically differentiated goods

Our analysis yields several theoretical implications. Firstly, while studies suggest and find that the same factors influence both export measures, we argue that a firm's export concept must be distinguished in the discussion on the relationship between productivity among other firm characteristics and export, particularly in TEs. Secondly, our findings confirm the significance of incorporating institutions and export geography in the specification, highlighting how it shapes the association of productivity on export entry and expansion, respectively. Thirdly, though productivity has a dissimilar association with the two export dimensions, our study supports discussions on the new international theory that exporters perform better along firm characteristics, being larger, more experienced, and more productive than their non-exporter counterparts.

In the pursuit of economic growth, policymakers aim to enhance the productivity-related business environment, addressing factors such as infrastructure and innovation. Our analysis has supported an additional insight of high productivity, which is the promotion of non-exporting firms to enter foreign markets. Although such policies lead to extensive export growth, they may not sufficiently encourage current exporters in TEs to further internationalize their activities. However, this does not eliminate the importance of productivity for current exporters as they may still serve domestic and foreign markets simultaneously and benefit from economies of scale. Interestingly, though our institutional analysis confirms that these discussions and policy suggestions are

relevant for transition countries pursuing export-oriented policies regardless of their regulatory environment, the impact scale should be considered given the home business conditions.

While this study sheds light on the complex relationship between firm productivity and exports, the available data has caused two limitations. The first limitation concerns the chosen instrument—worker training—to address the endogeneity of productivity in the export decision. Despite conducting various tests, including the exclusion restriction test, concerns persist, particularly regarding the potential reverse causality of exporting on on-the-job training. Finding an instrument that is both relevant and fully satisfies the exclusion restriction is a challenge commonly faced in studies utilizing survey data. This limitation could introduce bias into the estimates, potentially compromising the validity of the causal inferences. Therefore, some caution should be taken when interpreting IV results. The second limitation is the absence of a panel analysis, which limits our ability to account for unobserved heterogeneity and to observe changes over time. Conducting panel analyses could unveil the dynamic effects of productivity on export activities, offering a more nuanced understanding of the relationship over time. While the latter limitation can be partly mitigated with further rounds, future research could address both constraints by employing more comprehensive datasets with a more thorough examination of both cross-sectional and longitudinal effects.

Appendix for Chapter 2

Table 2.7 General statistics across countries

Country	Number of firms	Percent	Percentage of exporters	Firm average export intensity	Firm average labor productivity
Albania	321	1.700122	51.41956	72.61349	9.494457
Belarus	551	2.918278	53.55191	44.73129	13.20424
Georgia	437	2.314496	27.35632	62.36975	9.357616
Tajikistan	397	2.102643	18.20513	59.85915	8.301138
Ukraine	2247	11.90085	31.56475	39.28347	9.181496
Uzbekistan	1092	5.783592	23.96694	47.02299	8.965464
Russian Federation	2956	15.65595	21.43342	23.75436	10.34342
Serbia	380	2.012605	65.25199	32.49593	10.46278
Kazakhstan	1307	6.922303	11.70543	32.03311	9.576282
Moldova	356	1.885493	43.78531	62.32903	9.52429
Bosnia and Herzegovina	376	1.99142	63.82979	51.81667	10.55088
Azerbaijan	294	1.557121	15.86207	37.45652	9.278084
North Macedonia	381	2.017902	60.62992	65.01732	9.890562
Armenia	498	2.637572	38.10484	39.46032	9.435759
Kyrgyz Republic	343	1.816641	30.70175	47.6381	9.021733
Mongolia	368	1.949049	20.38043	50.82667	9.26287
Kosovo	321	1.700122	37.62376	28.11403	10.10503
Montenegro	153	.8103384	30.26316	47.36956	10.67963
Czech Republic	505	2.674646	75.2495	53.22812	11.25722
Hungary	691	3.659764	59.67977	47.22439	11.02205
Latvia	340	1.800752	65.97633	61.16143	10.56442
Lithuania	336	1.779567	67.17325	59.29864	10.55291
Slovak Republic	377	1.996716	55.43767	48.73684	11.1382
Slovenia	365	1.93316	86.30137	55.11428	11.66172
Bulgaria	634	3.357873	48.26498	56.18954	10.1433
Croatia	337	1.784863	66.17211	47.49776	11.09857
Romania	876	4.639585	37.58621	54.89602	10.27126
Poland	1332	7.054711	38.1323	38.73265	10.61623
Estonia	310	1.641862	79.54545	65.45715	11.02328
Total	18881	100	38.40603	49.36	10.2

Source: Authors' calculations using BEEPS data.

Table 2.8 OLS results to test the direct relationship of the exclusion restrictions

Dependent variable	(1)	(2)	(3)
	Export intensity		
Total factor productivity	0.0238 (0.499)		
Labor productivity		-0.208 (0.156)	
Value added per worker			-0.340* (0.186)
Firm size	1.382*** (0.304)	1.240*** (0.180)	1.304*** (0.220)
Firm age	-0.0498*** (0.0150)	-0.0380*** (0.0113)	-0.0447*** (0.0132)
Foreign ownership	6.255*** (0.747)	6.264*** (0.577)	6.582*** (0.688)
State ownership	-0.999 (1.601)	-0.912 (1.247)	-1.067 (1.447)
Manager experience	-0.0160 (0.0269)	0.00138 (0.0202)	-0.0176 (0.0243)
Foreign input use	0.0407*** (0.00902)	0.0356*** (0.00675)	0.0367*** (0.00815)
Foreign technology use	-1.170* (0.664)	-0.804 (0.490)	-0.903 (0.595)
Quality Certificate	0.396 (0.622)	-0.0468 (0.468)	0.422 (0.564)
Industry lagged export	0.216 (0.338)	0.122 (0.249)	0.181 (0.302)
Country fixed effects	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
Observations	2864	4829	3519

Note(s): Standard errors in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.9 The first stage results for the Heckman models

	(1)	(2)	(3)	(4)	(5)	(6)
Total factor productivity	0.0808 (0.0799)	0.0884** (0.0369)				
Total factor productivity * Exporting to high income countries	-0.00526 (0.125)					
Total factor productivity * Exporting to post-communist countries		-0.0452 (0.0388)				
Labor productivity * Exporting to high income countries			-0.153*** (0.0420)			
Labor productivity * Exporting to post-communist countries				0.165*** (0.0583)		
Value added per worker * Exporting to high income countries					-0.125** (0.0501)	
Value added per worker * Exporting to post-communist countries						0.0706 (0.0661)
Firm size	0.343*** (0.0210)	0.343*** (0.0208)	0.356*** (0.0122)	0.357*** (0.0122)	0.367*** (0.0147)	0.368*** (0.0146)
Foreign ownership	0.544*** (0.0683)	0.545*** (0.0682)	0.414*** (0.0506)	0.419*** (0.0506)	0.466*** (0.0599)	0.470*** (0.0599)
State ownership	-0.174 (0.123)	-0.173 (0.123)	-0.141 (0.0922)	-0.137 (0.0921)	-0.219** (0.104)	-0.209** (0.104)
Quality certificate	0.411*** (0.0428)	0.411*** (0.0428)	0.413*** (0.0321)	0.413*** (0.0321)	0.380*** (0.0378)	0.381*** (0.0379)
Foreign input use	0.00314*** (0.000584)	0.00311*** (0.000584)	0.00395*** (0.000428)	0.00392*** (0.000428)	0.00368*** (0.000515)	0.00364*** (0.000515)
Foreign technology use	0.201*** (0.0497)	0.202*** (0.0497)	0.189*** (0.0366)	0.188*** (0.0366)	0.205*** (0.0437)	0.205*** (0.0437)
Industry total exports	0.102*** (0.0202)	0.101*** (0.0200)	0.108*** (0.0149)	0.109*** (0.0147)	0.111*** (0.0175)	0.111*** (0.0174)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6577	6580	12423	12430	8605	8610

Note(s): Standard errors in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.10 Additional checks relaxing the exclusion restriction assumption of the IV approach.

The exclusion restriction support interval	Non-EU TEs: Labor productivity		Non-EU TEs: Value-added		EU TEs: Labor productivity		EU TEs: Value-added	
	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper
[0,0.15]	0.0214	0.3629	0.0038	0.4155	0.0761	0.5557	0.0348	0.6584

Notes: (1) Lower and upper bounds are reported for the productivity coefficients of IV results on Table 2.5; (2) The bounds are obtained based on the approach by Conley et al. (2012) through the union of confidence intervals method and estimations are conducted using *plausexog* command described in Clarke and Matta (2018); (3) All control variables are the same as those on Table 2.5.

Chapter 3. Firm export, energy efficiency and pro-environmental initiatives in Transition Economies⁸

⁸ An earlier version of this chapter was released as a discussion paper by the author.

3.1 Introduction

With the sharp development of the global economy together with energy shortage problems and climate issues, the question of how to expand into international markets by keeping environmental sustainability in production has drawn much attention. The scholarly discourse in this thread mainly refers to trade's environmental impact (Roy and Yasar 2015) and discusses how to offset increased energy use following sales expansion into foreign markets by adopting cleaner technologies (Batrakova and Davies 2012). Moreover, the literature discusses channels for exporting firms to meet the environmental needs of different stakeholders (Wu and Ma 2016).

However, the extant literature mostly fails to cover two important features in investigating this relationship. Firstly, while most empirical studies focusing on this relationship present results for the industrialized world (Imbruno and Ketterer 2018), there is a lack of investigation related to the TEs of the former Soviet Union and Eastern Europe. These countries that underwent a shift from a centrally planned economy to a market-based economy following the collapse of the Soviet Union deserve special attention in this analysis as they witnessed significant declines in energy and electricity intensities (Carvalho 2018). Specifically, though historical estimates indicate that energy consumption per unit of GDP in the TEs was four to eight times higher compared to OECD countries (Gray 1995), they have achieved energy efficiency improvements mainly due to reforms aimed at market liberalization, financial sector and most infrastructure industries (Nepal et al. 2014). Such a unique aspect of TEs requires special approaches to the analysis of energy efficiency and export. Secondly, institutional conditions in TEs and corporate business culture among firms might differently shape the effects of exporting on tangible environmental performance, such as energy efficiency, and on intangible performance, such as environmentally friendly initiatives. In this case, it is essential to distinguish measures of environmental performance and thereby, to provide separate policy insights for both dimensions.

This chapter aims to investigate how firm export is associated with tangible and intangible environmental performance dimensions, energy efficiency and pro-environmental initiatives, for firms operating in TEs. Thereby by revisiting the environmental consequences of international trade on one side and discussing institutional contexts in this relationship on another, we attempt to bring insights for policies targeting climate-friendly and cleaner production in the manufacturing industry.

To achieve the above objectives, we quantify prevailing views on the relationship of firm foreign sales on both energy efficiency and climate-friendly initiatives using the WBES data on 29 TEs. Specifically, regarding the former, we investigate two views prevailing in the related literature: whether firms become more energy-efficient through technological upgrades following the entry into foreign sales and through spillovers coming from foreign markets as put forward in the learning-by-exporting hypothesis. As for the pro-environmental initiatives, we point to the stakeholder perspective that firms face pressures from economic agents abroad concerning their products' environmental aspects and consequently making them adopt a climate-friendly culture in the system. However, we additionally argue that the above two dimensions are distinct, particularly in the case of TEs, with the latter not always leading to the actual performance. We empirically explore these views by attempting to mitigate endogeneity issues using IV 2SLS and bivariate probit methods.

We find contrasting outcomes in the relationships between exports and the two environmental performance dimensions. Firstly, we find no significant association of firm exporting on energy efficiency. This finding is unchanged for both firms upgrading their existing technologies and for those having long experience in exporting. On the contrary, firm exporting positively impacts pro-environmental initiatives measured as the presence of firm strategic

environmental objectives and the presence of environmental managers. These distinct outcomes, which may not fully support the existing theories, reveal the particular nature of transition states. While institutional deficiencies and trade trajectories must be responsible for the insufficient conversion of export-driven spillover and technological investment to energy efficiency, we also interpret that firm climate-friendly schemes, communicating positive firm behavior towards the environment, might also have difficulties in moving forward to solid green actions in firm operation. Such an expounding can be inferred also by our additional results of dissociation between pro-environmental initiatives and energy efficiency.

The remainder of this chapter is as follows: Section 3.2 presents existing studies and views on the relationship between exports and energy efficiency, together with pro-environmental initiatives; Section 3.3 describes methodology including data, variable construction, and estimation approaches; Section 3.4 reports the main and robustness results; and lastly Section 3.5 concludes the chapter overall and presents a discussion of findings.

3.2 Literature review

3.2.1 Energy efficiency and pro-environmental initiatives

Environmental performance can be reflected in two forms: energy efficiency and pro-environmental initiatives. On the one hand, these two concepts are interrelated: the latter can be a cornerstone for the former to be improved. Specifically, firms that own management commitment, energy knowledge or awareness are more energy efficient through increased performance, better human capital and support from the public organizations (Fernando and Hor 2017). Moreover, organizational capabilities can reinforce adoption of energy-saving technologies that is shaped by state institutions and regulations (Zhu and Chertow 2017). Relatedly, Mungai et al. (2023) find that energy audits, management compensation, employee training on energy and written energy

policies bring valuable outcomes to improve energy efficiency for Kenyan manufacturing firms. Overall, pro-environmental initiatives mostly serve as stimuli to improve energy efficiency.

On the other hand, the two concepts of energy efficiency and pro-environmental initiatives can be distinct: the former reflects tangible and more direct environmental outcomes (Fernando and Hor 2017), while the latter implies motives towards addressing environmental issues. More specifically, energy efficiency, measured as the inverse of energy over output (Moltalbano and Nenci 2019) or as the adoption of energy saving technologies (Pons et al. 2013), implies a cleaner production: using less energy to achieve the same output and thereby leading to reduction of pollution emissions per output (Shapiro and Walker 2018; Zhang et al. 2015). Regarding pro-environmental initiatives, such as presence of firm strategic environmental objectives (Boring 2019; Mondejar et al. 2013), environmental manager (Martin et al. 2012; Otrashchenko et al. 2023), or awareness (Rustam et al. 2020), they can mostly be referred as intangible efforts. Such environmental efforts are mostly associated with actual performance, such as the reduction of product environmental impact (Xie et al. 2024), or improvement of environmental sustainability in the form of water/energy saving and waste reduction (Qu et al. 2015). Nevertheless, the prior literature has also argued that pro-environmental initiatives might imply “greenwashing” behavior (Delmas and Burbano 2011; Li et al. 2023; Zhang 2022). This term refers to “wordy” strategies with “nonfeasance” actions (Li et al. 2023) or poor environmental performance despite positive environmental communication (Delmas and Burbano 2011).

3.2.2 Theoretical viewpoints on the relationships

The literature presents two main channels related to the export-energy efficiency nexus. The first is related to the learning-by-exporting view that firms benefit from spillovers and technology diffusion following foreign sales. These externalities appear in the extant literature as the

consequence of transnational linkages (Perkins and Neumayer 2009) or trade partnerships at the national or sub-national level, while export-led learning at the firm level. Push factors for such export-led spillovers/positive externalities can include severe global competition in foreign markets (Debbarma et al. 2022). These spillovers help firms improve the existing structures and production techniques through climate-friendly management practices or technological innovation (Debbarma et al. 2022; Roy and Yasar 2015). Specifically, if a firm uses fewer inputs, such as machines, to produce the same outputs, then energy per output would fall. Such an effect can be particularly sounder for firms located in the developing markets engaging in trade with developed countries. Most studies find support for such learning effects on energy efficiency improvement, though studies such as Perkins and Neumayer (2009) show no significant influence. The second channel is associated with firm abatement investments in innovation and technologies. These investments can be mainly driven by production scale, and stringent environmental regulations (He and Huang 2021; Batrakova and Davies 2012; Forslid et al. 2018). Specifically, the increased volume of sales because of market expansion allows firms to cover costs, thereby stimulating innovation investment (He and Huang 2021; Forslid et al. 2018). Moreover, exporters might be forced to adopt such energy-efficient technologies after facing implicit pollution taxes imposed to reduce emissions (Forslid et al. 2018; Shapiro and Walker 2018).

As for mechanisms on how export drives firms to employ corporate environmental initiatives, the stakeholder perspective stands out in the prior literature. It states that firms face pressures from overseas customers, as an important group of stakeholders, which consequently drives firms to be environmentally friendly or self-regulated (Christmann and Taylor 2001; Carballo-Penela and Castroman-Diz 2015). Evidence has been found for developing economies such as Chile (Blyde and Ramirez 2022) and China (Wu and Ma 2016). Particularly, Blyde and

Ramirez (2022) state that such a channel might be sounder for firms exporting to high-income markets than those exporting to developing markets as the former has buyers who value a clean environment. Another mechanism is also proposed and related to competition in overseas markets. The role of competition towards positive climate action, such as clean energy development, is proposed in macro-level studies for USA-China relationship (see, for example, Moore 2023). Also, since exporting firms experience competitive advantage and hence, may survive in highly competitive markets, it might benefit foreign firms in the presence of environmental regulations (Tai and Yan 2022). In most cases, competition between exporters and domestic firms pushes the latter to be in favor of stringent environmental regulations, which leads the former to be more environmentally friendly (Kennard 2020).

Although the above channels theoretically explain the relationships among exports and both energy efficiency and pro-environmental initiatives, transition markets need more consideration given peculiar institutional conditions, corporate business culture, and trade patterns. Specifically, learning effects might be weak for firms operating in certain TEs given their trade relations among post-soviet countries that used to be a single economy. That is, exporters trading with former colonial states might not gain technological spillovers given similar market characteristics and similarities. Regarding institutional conditions, they might shape firm abatement investment incentives. Specifically, because corruption hinders laws and regulations from being effective, firms might not have enough stimuli to invest in energy-saving technologies because they can circumvent environmental policies due to institutional voids.

On the other hand, we argue that a positive effect between exports and pro-environmental initiatives is far sounder for TE firms since they attempt to meet external stakeholder pressures by employing “wordy” environmental initiatives or strategies. This can be related to both corporate

business culture, as well as weak institutional environment in TEs. The former includes low transparency in TE firms' business operations (Arsov and Busevsca 2017; Braguinsky and Mityakov 2015), which makes it difficult to know actual environmental outcomes. The latter incorporates inadequate regulations governing environmental claims, or lack of enforcement mechanisms of existing laws stemming from corruption and insufficient monitoring (Casady and Peci 2021). All and all, we posit that such organizational and market deficiencies embed with the mechanisms mentioned, and drive TE exporters to further adopt environmental initiatives.

3.3 Method

3.3.1 Data

We utilize data from Enterprise Surveys (ES) which are a joint initiative of the European Bank for Reconstruction and Development (EBRD), the European Investment Bank (EIB), and the World Bank Group. These surveys are a successor to the BEEPS, which were conducted in five rounds between 1999 and 2016. They are firm-level surveys based on face-to-face interviews with managers and examine the quality of the business environment. We refer to surveys conducted in 2018-2020, which provide a green economy module. Our sample consists of 9,417 manufacturing firms in 29 economies of transition within 23 two-digit sectors.

3.3.2 Variable description

Table 3.1 refers to the set of variables used throughout the analyses. The dependent variable for energy efficiency is measured uniquely and shows the output produced per kilowatt of energy. For this purpose, we have converted all energy units reported by a firm, such as petroleum, natural gas and coal, into kilowatt form. In addition to this measure, we also utilize the cost of fuel and electricity, as well as carbon dioxide emission from firm energy sources, for robustness purposes. Regarding pro-environmental initiatives, we use information on whether a firm has strategic

objectives that mention climate change issues, and whether a firm has a manager responsible for environmental issues.

As for the main independent variable, we employ both firm export status and experience. For the export-energy efficiency nexus, the former measure allows us to investigate the relationship through the channel of investment when interacting with firm asset purchase information. The firm export experience can be related to both energy efficiency and pro-environmental initiatives for the learning mechanism (Vendrell-Herrero et al. 2022).

Control variables for both analyses include firm size, age, and foreign ownership. The previous literature presents reasonings for how these factors are related to firm energy behavior. Starting from the size, larger firms can be expected to be more energy efficient given better management in energy use, technological superiority, and robust financial backing (Haider et al. 2019). As for firm age, it can be indicative of the age of assets, which has negative performance in the case of aged ones (Prasad and Mishra 2017). Regarding ownership in general, Aung et al. (2021) found heterogeneous strategies for addressing environmental issues by Japanese- and Chinese-owned foreign multinationals in Myanmar.

In addition to the above common control variables, we employ the share of skilled production workers, the share of university graduates and total assets for energy efficiency models. We expect technical skills among production workers to lead to less energy-intensive production given the efficient use of equipment thanks to accumulated knowledge. The share of university graduates implies human capital and is anticipated to bring positive impacts because of cleaner energy use and better compliance with environmental regulations in the presence of educated workforce (Chen et. al. 2021). Regarding firm assets, it increases the total energy use of a firm, thereby negatively affecting energy efficiency. Moreover, we include information on requirements

of both environmental certificates and energy performance as control variables for exclusively pro-environmental initiative models. We expect both variables to pressure firms to adopt more environmentally-friendly strategies in firm decisions.

Table 3.1. Variable names and description

Variable name	Description
<i>Dependent variables</i>	
Sales over total energy in kilowatt	A ratio of total sales over kilowatt form of all energy sources. This variable is in logarithm. To convert energy sources other than electricity into kilowatt, first, a reported physical unit of each energy source is converted to British thermal units (Btu) using conversion rates by United States Energy Information Administration. Then corresponding kilowatt equivalent is calculated for all energy sources.
Sales over fuel and electricity costs	A ratio of total sales over the sum of costs on fuel and electricity usage reported by firms. This variable is in logarithm.
Carbon dioxide per output	Sum of carbon dioxide emissions from all energy sources of a firm. This variable is in logarithm. A kilogram emission of carbon dioxide per unit of each energy source, except electricity, is obtained from United States Energy Information Administration. For electricity, the average carbon intensity of electricity generation is obtained.
Environmental objectives	Dummy variable equals to 1 if a firm has strategic objectives that mention environmental or climate change issues, and 0 otherwise
Environmental manager	Dummy variable equals to 1 if a firm has a manager responsible for environmental or climate change issues, and 0 otherwise
<i>Independent variables</i>	
Exported	Dummy variable equals to 1 if a firm engages in either direct or indirect, or both exporting activities over the last fiscal year, and 0 otherwise
Export experience	Survey year minus the year the firm first exported directly or indirectly
<i>Control variables</i>	
Firm size	Total number of full-time employees. This variable is in logarithm
Firm age	Survey year minus the year the firm started operations
Foreign ownership	Dummy variable equals to 1 if at least 1% of the firm's capital is owned by foreign individuals, and 0 otherwise.
University graduates	The percentage of workers that have a university degree
Skilled production workers	The percentage of production workers in highly and semi-skilled jobs.
Machinery assets	Total amortized value of firm machinery, equipment and vehicles. This variable is in logarithm.
Environmental certificate required	Dummy variable equals to 1 if a firm's customers require environmental certifications or adherence to certain environmental standards as a condition to do business with this firm
Energy performance required	Dummy variable equals to 1 if a firm is subject to an energy performance standard in its operations
<i>Other variables</i>	
Asset purchase	Dummy variable equals to 1 if a firm purchased any new or used fixed assets including expansion and renovations of existing structures
Membership	Dummy variable equals to 1 if a firm is part of a business membership organization, trade association, guild, chamber of commerce, or other business support group.

3.3.3 Empirical specification

The objective of our empirical analysis is to explore whether firm exports along with other firm characteristics affect energy efficiency and pro-environmental initiatives. To this end, the baseline model for energy efficiency is constructed as follows:

$$EE_{isc} = \beta_1 + \beta_2 export_{isc} + \mathbf{X}_{isc}\beta_3 + S_s + C_c + u_{isc}, \quad (3.1)$$

where EE_{isc} is the energy efficiency of firm i of sector s , and in country c , and as discussed earlier, it is calculated as the output per kilowatt of energy. Regarding $export$, it is either a binary variable equal to one if a firm exported last fiscal year or a continuous variable representing the number of firm exporting years (export experience). As for X , it includes firm characteristics as controls such as *size*, *age*, *foreign ownership*, *the share of university graduates*, *the share of skilled production workers*, and *total assets*. Additionally, S and C denote industry- and country-fixed effects, respectively, and u is the error term.

We propose that Equation (3.1) alone might help us to explore whether the association holds through the channel of learning-by-exporting when we use the export experience as the main independent variable. However, we build an extended version of the main specification to investigate the mechanism through technological investment and, hence, interact export status with asset purchase information.

The baseline model for pro-environmental initiatives is constructed as follows:

$$Env_{isc} = \gamma_1 + \gamma_2 export_{isc} + \mathbf{W}_{isc}\gamma_3 + S_s + C_c + v_{isc}, \quad (3.2)$$

where Env is a dummy variable equals 1 if there are environmental objectives or environmental managers of firm i of sector s , and in country c . Regarding export, as discussed earlier, it is either a binary variable showing whether firm exported or a continuous variable of export experience. W includes control variables consisting of *size*, *age*, *foreign ownership*, *the requirement of*

environmental certificates, and *environmental performance requirements*. Additionally, S and C denote industry- and country-fixed effects, respectively, and v is the error term.

However, both equations above may suffer from endogeneity issues when export is proxied by firm export status. One of the reasons for such an effect can be reverse causalities that strict environmental regulations by governments might push firms not to even deal with foreign sales (Hering and Poncet 2014). Additionally, there might be unobservable factors affecting both export and energy efficiency or pro-environmental initiatives (Roy and Yasar 2015).

3.3.4 Estimation

We employ methods addressing endogeneity issues for estimation when export is proxied by the dummy variable indicating export status. We apply the standard IV 2SLS approach to estimate equation (3.1) though the endogenous covariate of exporting status is binary and the dependent variable, energy efficiency, is continuous following Wooldridge (2010). Regarding equation (3.2), where both dependent and endogenous variables are binary, it can be treated as a bivariate probit (biprobit) model, which is a natural extension of the probit model by allowing more than one equation with correlated disturbances (Greene, 2017). The biprobit model is used to estimate the joint determination of two binary outcomes while accounting for potential correlation in their unobserved factors. It consists of two probit equations, each modeling a binary dependent variable, and assumes that the error terms follow a bivariate normal distribution with a correlation coefficient (ρ). If ρ is significantly different from zero, it suggests that the two binary outcomes are interdependent. Thereby, we utilize the method that fits maximum likelihood bivariate probit models to estimate equation (3.2). Nevertheless, for equation (3.2) we additionally employ 2SLS by applying linearity to the models, since this approach and biprobit methods rely on entirely

different assumptions. Wooldridge (2010) also mentions that IV 2SLS method may also provide good approximations to the average partial effects.

As an instrument, for both equations, we use the information on whether a firm is part of a business membership organization, trade association, guild, chamber of commerce, or other business support group, or not. We expect this variable to be a relevant instrument for export push because they often facilitate to overcome entry barriers through networking opportunities with international buyers and partners, and providing knowledge on foreign market regulations, standards, and practices, or inter-firm information flows (Brache and Felzensztein 2019; Kneller and Pisu 2011; Pyle 2006). Additionally, we anticipate that this variable is exogenous, particularly in post-communist transition countries, where membership in legitimate associations may be compulsory in some cases (Ivanova et al. 2019). Firms in these contexts also face bureaucratic corruption regardless of their trade patterns, which often drives them to join various associations or support groups, even if they are informal (Duvanova 2007). Moreover, while such organizations may provide general business knowledge, their role does not typically extend to promoting specific energy-saving technologies or environmental practices, which are more directly influenced by industry-specific regulations, firm-level strategies, or external environmental pressures. However, we do not strongly argue that the IV approach with the given instrumental variable to entirely solve the issue of endogeneity, we attempt to mitigate the issue and also refer to tests to partly validate the approach.

3.4 Results

3.4.1 Main results

Table 3.2 presents results on energy efficiency and Table 3.3 demonstrates those on pro-environmental initiatives. Notably, we focus on only IV results for the models with export status

information, given that they are consistent even when the explanatory variable is exogenous, while OLS estimators are valid only under the exogeneity assumption.

Columns 1-2 of Table 3.2 show the models estimated using IV 2SLS, while column 3 reports results obtained through the OLS approach. In the model featured in column 2, the main effect of the asset purchase variable is incorporated, given its interaction with the export status variable. Moreover, we treated both export and its interaction with asset purchase information as endogenous variables. For the latter, we used the interaction of membership with asset purchase as an instrument. The first-stage F-statistics exceed the conventional threshold of 10 for most models, indicating strong instrument relevance. However, the model in column 2 exhibits a weaker instrument for the export status variable, possibly due to the interaction-based instrument's limited effect on export status (refer to column 2 of Table 3.6 in the Appendix). Nevertheless, the first-stage results in columns 1-3 of Table 3.6 demonstrate robust instrument effects on their respective endogenous variables.

Findings in Table 3.2 demonstrate that firm export, whether it is propensity or gained experience, does not drive energy efficiency. Specifically, while column 1 shows the insignificant association of exporting in general, column 2 reports similar results even after interacting the export with the asset purchase variable, indicating a technology upgrade. This and the model with export experience reveal that such insignificance is consistent across the two channels. The reasoning can be related to the weak learning effects or institutional deficiencies that exporters might not gain enough technical knowledge to improve existing structures, or they might lack stimuli to invest in technologies, both of which result in stagnated levels of energy efficiency performance.

Regarding Table 3.3, the dependent variable of the first three columns is the information on whether a firm has environmental objectives and that of the last three columns is the presence of an environmental manager. For both models of this table, we present IV 2SLS and bivariate probit results when export is proxied by the exporting status and OLS results when exporting represents export experience. In this table also we provide F-scores of the first stages for IV 2SLS and they are higher than the conventional threshold of 10. Moreover, the first-stage results in columns 4-5 of Table 3.6 in the Appendix show strong effects of the instrument on the endogenous variable of export status.

In contrast to the energy efficiency models, Table 3.3 reports mostly significant positive relationships between exports and firm pro-environmental initiatives. More precisely, while export decision shows consistent significant positive associations across all models, export experience serves as a push factor for the presence of environmental managers. Particularly, these results imply that firms involved in exporting are more likely to integrate environmental goals into their business practices and are more likely to employ an environmental manager. This could be because they may adopt sustainable practices to meet the demands of environmentally conscious customers abroad or exporting may expose firms to best practices in sustainability, driving the adoption of environmental objectives as part of their competitive strategy.

Table 3.2. Main results for energy efficiency measured as sales over total energy in kW

	(1)	(2)	(3)
Dependent variable	Sales over total energy in kW		
	IV 2SLS		OLS
Exported	-1.088 (1.606)	-0.834 (1.781)	
Exported*Purchased asset		0.162 (0.638)	
Export experience			-0.00174 (0.00938)
Firm size	0.253 (0.204)	0.237 (0.211)	0.0877 (0.0861)
Firm age	-0.00963*** (0.00284)	-0.00958*** (0.00305)	
Foreign ownership	0.431 (0.278)	0.385 (0.301)	0.400*** (0.132)
Skilled production workers	0.00444 (0.00285)	0.00403 (0.00294)	0.00265 (0.00309)
University graduates	0.00663** (0.00286)	0.00638** (0.00301)	0.000677 (0.00441)
Ln(Capital)	0.0393 (0.0564)	0.0366 (0.0575)	-0.105** (0.0429)
Purchased asset		-0.361 (0.281)	
F-test (F-score)	14.23	6.55/15.01	
Endogeneity test (P-value)	0.4494	0.8510	
Industry fixed effects	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes
Observations	2321	2307	897

Notes: (1) Standard errors are clustered at the country level to correct for intra-country correlation and heteroskedasticity. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; (2) In column 2, both *exported* and *exported*purchased* asset variables are treated as endogenous. For the latter, we interacted the variables of membership with asset purchase variables and used it as an instrument.; (3) Columns 1-3 of Table 3.6 in the Appendix refer to the first stage results for models in columns 1 and 2, respectively.

Table 3.3. Main results for pro-environmental initiatives

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Environmental objective			Environmental manager		
	IV 2SLS	BiProbit	Probit	IV 2SLS	BiProbit	Probit
Exported	0.636** (0.261)	0.210*** (0.0442)		0.726*** (0.241)	0.101*** (0.0262)	
Export experience			0.000551 (0.000962)			0.00158** (0.000731)
Firm size	-0.0161 (0.0282)	0.0248*** (0.00738)	0.0552*** (0.00599)	-0.0109 (0.0261)	0.0478*** (0.00479)	0.0706*** (0.00807)
Firm age	-0.000344 (0.000513)	-0.000232 (0.000301)		0.000281 (0.000557)	0.000199 (0.000230)	
Foreign ownership	-0.0450 (0.0451)	0.0105 (0.0160)	0.0293 (0.0214)	-0.0642 (0.0472)	0.0144 (0.0115)	0.0295** (0.0149)
Environmental certificate required	0.247*** (0.0286)	0.193*** (0.0152)	0.229*** (0.0192)	0.227*** (0.0381)	0.172*** (0.0153)	0.234*** (0.0180)
Energy performance required	0.123*** (0.0215)	0.106*** (0.0128)	0.149*** (0.0228)	0.0513** (0.0247)	0.0451*** (0.0137)	0.0809*** (0.0171)
F-test (F-score)	24.35			23.21		
Endogeneity test (P-value)	0.0076			0.0003		
Correlation (ρ)		-0.425***			-0.263***	
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8389	8389	3036	8399	8399	3053

Notes: (1) Standard errors are clustered at the country level to correct for intra-country correlation and heteroskedasticity. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; (2) For Probit and BiProbit models, average marginal effects are given; (3) Columns 4 and 5 of Table 3.6 in the Appendix refer to the first stage results for IV models in columns 1-2 and columns 4-5, respectively.

3.4.2 Robustness results

To ensure the robustness of the findings in our energy efficiency models, we provide additional analyses in Tables 3.4 and 3.7 in the appendix. Regarding the former, columns 1-3 present results where we substitute the dependent variable of sales over energy in kilowatt form with the ratio of sales over fuel and electricity costs. As for models in columns 4 to 6, the dependent variable is proxied by carbon dioxide emission per monetary unit of total sales, or in other words, emission intensity. Like the main models, we estimate the models with exporting status as independent variables using IV approaches while those with export experience using OLS. The results largely confirm the robustness of the earlier findings, particularly the lack of a significant association between exporting and energy efficiency or emission intensity. However, the effect of export experience turns negative and is statistically significant at the 1% level in column 3.

Regarding Table 3.7 in the appendix, we additionally investigated whether such insignificant results are due to an exceeding number of control variables, some of which might be redundant. Columns 2-3 show that such insignificance persists even if we overlook the effects of age, ownership, assets and the share of skilled workers. However, the effect of exporting status becomes positive and significant once we drop the effect of firm size (column 4). Although it might indicate that the exporting effect on energy efficiency is absorbed in the size effect, we argue that controlling firm size is important as larger firms are inclined towards clean technologies or practices. Moreover, the models with export experience show consistent insignificant outcomes regardless of adding or dropping effects of control variables.

In addition to ensuring the main results, we presented a conceptually different analysis to check whether firm pro-environmental schemes are related to the actual performance given the contrary impacts of export on the tangible and intangible environmental performance. Table 3.5

illustrates that the two environmental performance dimensions are not associated with energy efficiency when climate-friendly schemes are proxied by either environmental objectives or environmental manager.

Table 3.4. Robustness results

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Sales over fuel and electricity costs			Carbon dioxide per USD of sales		
	IV 2SLS		OLS	IV 2SLS		OLS
Exported	-0.627 (0.841)	-0.545 (0.801)		0.816 (1.529)	0.591 (1.658)	
Exported*Purchased asset		-0.427 (0.468)			-0.129 (0.580)	
Export experience			-0.0108*** (0.00365)			0.00258 (0.00889)
Firm size	0.335** (0.136)	0.340** (0.135)	0.246*** (0.0477)	-0.246 (0.201)	-0.232 (0.207)	-0.0904 (0.0896)
Firm age	-0.00611*** (0.00177)	-0.00560*** (0.00176)		0.00970*** (0.00292)	0.00962*** (0.00313)	
Foreign ownership	0.368** (0.174)	0.383** (0.181)	0.331*** (0.0584)	-0.385 (0.275)	-0.347 (0.292)	-0.391*** (0.132)
Skilled production workers	0.000637 (0.00129)	0.000618 (0.00126)	0.000417 (0.00126)	-0.00456* (0.00271)	-0.00423 (0.00280)	-0.00310 (0.00304)
University graduates	0.00385** (0.00164)	0.00378** (0.00165)	0.00381 (0.00268)	-0.00630** (0.00270)	-0.00605** (0.00289)	-0.00110 (0.00419)
Ln(Capital)	-0.0466** (0.0187)	-0.0441** (0.0208)	-0.0897*** (0.0205)	-0.0303 (0.0461)	-0.0277 (0.0475)	0.0985** (0.0416)
Purchased asset		0.266 (0.302)			0.306 (0.270)	
F-test (F-score)	10.22	4.47/11.52		14.23	6.55/15.01	
Endogeneity test (P-value)	0.3304	0.5992		0.5134	0.8668	
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4369	4339	1972	2321	2307	897

Notes: (1) Standard errors are clustered at the country level to correct for intra-country correlation and heteroskedasticity. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; (2) Columns 6-8 and columns 1-3 of Table 3.6 in the Appendix refer to the first stage results for IV models in columns 1-3 and columns 4-6, respectively.

Table 3.5. Robustness results showing the relationship between pro-environmental initiatives and energy efficiency.

	(1)	(2)	(3)	(4)
Dependent variable	Sales over total energy in kW		Sales over fuel and electricity costs	
	OLS			
Environmental objectives	-0.120 (0.184)		0.000478 (0.0802)	
Environmental manager		-0.290 (0.176)		-0.120 (0.0921)
Exported	0.183 (0.189)	0.194 (0.188)	0.0712 (0.0600)	0.0749 (0.0618)
Firm size	0.141* (0.0791)	0.155* (0.0816)	0.268*** (0.0750)	0.278*** (0.0746)
Firm age	-0.00915*** (0.00300)	-0.00872*** (0.00305)	-0.00596*** (0.00171)	-0.00575*** (0.00168)
Foreign ownership	0.210 (0.167)	0.215 (0.163)	0.260*** (0.0632)	0.265*** (0.0645)
Skilled production workers	0.00388 (0.00297)	0.00410 (0.00284)	0.000473 (0.00117)	0.000441 (0.00114)
University graduates	0.00490** (0.00195)	0.00518** (0.00196)	0.00262 (0.00177)	0.00271 (0.00177)
Ln(Capital)	0.0107 (0.0476)	0.0138 (0.0483)	-0.0614*** (0.0219)	-0.0604*** (0.0216)
Industry fixed effects	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes
Observations	2326	2327	4323	4326

Notes: (1) Standard errors are clustered at the country level to correct for intra-country correlation and heteroskedasticity. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

3.5 Conclusions and Discussions

With the rapid development of the global economy and growing concerns about climate change, the relationship between international trade and environmental sustainability has drawn significant attention. However, while firm environmental performance is often measured by pollution emissions, the role of energy efficiency has been comparatively underexplored in the existing literature. Additionally, the experiences of transition economies, despite their progress in reducing energy intensities, have received limited focus. This paper aims to address these gaps by examining not only how manufacturing firm exports influence energy efficiency, but also how pro-environmental initiatives—considered as intangible environmental performance—are driven by foreign sales, using data from 29 transition countries.

Our findings offer two key insights. First, exporting does not enhance energy efficiency among firms in TEs. This outcome holds true for firms that invest in technological upgrades, which could indicate abatement investments, as well as for firms with extensive export experience, which may signal learning-by-exporting effects. The second, and somewhat contrasting, result indicates that firms engaged in foreign sales are more inclined to adopt environmentally friendly practices and to hire managers responsible for environmental strategies. These contrasting outcomes, which diverge from studies conducted in developed and developing countries, suggest a unique context within transition economies, shaped by institutional conditions, corporate culture, and trade patterns. Specifically, weak institutional frameworks may limit firms' motivation to fully utilize management practices in translating firm technological investment into efficiency, while learning-by-exporting effects may be muted in certain TEs due to their trade ties with other post-Soviet economies, which once functioned as a single economic entity. As for pro-environmental initiatives, pressures from external stakeholders and stiff competition may drive exporters to adopt

such climate-friendly strategies. However, in some cases, these initiatives may also be “non-feasant,” reflecting the low levels of transparency prevalent in these economies.

At the same time, this result may seem counterintuitive: while productivity influences export decisions, as observed in our previous analysis, export activity itself does not seem to drive improvements in energy efficiency. One possible explanation is that many transition economies are rich in natural energy resources, which may reduce the incentive for firms to invest in energy-efficient technologies or efforts to reduce emission intensity. As such, in oil-rich countries, for instance, the extraction of natural resources can sometimes hinder environmental sustainability (Nwani et al. 2024). Furthermore, corporate responsibility regarding environmental concerns may be weak, as environmental regulations can be circumvented due to low transparency or corruption. This can result in firms improving asset efficiency in output without necessarily improving energy efficiency.

Altogether, this paper, which explores firm internationalization and environmental issues in transition economies, offers several theoretical and policy implications. First, the differing effects of firms' international activities on tangible and intangible environmental performance highlight the need for future research to treat these dimensions separately in theoretical models. This is also crucial for empirical studies that apply findings from specific contexts to broader cases. Second, transition economies should carefully consider institutional barriers when implementing policies aimed at improving energy performance alongside export promotion, as economic growth driven by foreign market expansion may come with environmental costs. Lastly, while firm-level pro-environmental initiatives reflect a commitment to cleaner production, policymakers should not rely solely on these strategies to meet long-term environmental goals. Instead, governments should implement supportive programs to ensure firms

have the technical capabilities necessary for achieving tangible improvements in environmental performance.

Appendix for Chapter 3

Table 3.6. First-stage results for IV models

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Corresponding second stage results	Column 1 Table 3.2	Column 2 Table 3.2	Column 2 Table 3.2	Column 1/2 Table 3.3	Column 3/4 Table 3.3	Column 1 Table 3.4	Column 2 Table 3.4	Column 2 Table 3.4
Dependent variable	Exported	Exported * Purchased asset		Exported		Exported * Purchased asset		
Membership	0.0831*** (0.0220)	0.0790** (0.0360)	-0.0712*** (0.0198)	0.0806*** (0.0163)	0.0806*** (0.0167)	0.0692*** (0.0216)	0.0828*** (0.0277)	-0.0626*** (0.0167)
Membership * Purchased asset		-0.00494 (0.0439)	0.240*** (0.0439)				-0.0512* (0.0251)	0.185*** (0.0386)
Firm size	0.0869*** (0.00904)	0.0849*** (0.00857)	0.0361*** (0.00709)	0.0982*** (0.00445)	0.0980*** (0.00431)	0.0911*** (0.00742)	0.0883*** (0.00747)	0.0312*** (0.00817)
Firm age	-0.000359 (0.000503)	-0.000329 (0.000503)	0.000432 (0.000366)	0.000337 (0.000393)	0.000401 (0.000414)	-0.000139 (0.000444)	- (0.000410)	0.000436 (0.000345)
Foreign ownership	0.178*** (0.0260)	0.177*** (0.0264)	0.0682*** (0.0200)	0.165*** (0.0192)	0.166*** (0.0193)	0.161*** (0.0254)	0.157*** (0.0253)	0.0703*** (0.0134)
Skilled production workers	0.000235 (0.000446)	0.000298 (0.000448)	-0.0000645 (0.000220)			0.000324 (0.000295)	0.000355 (0.000297)	0.000115 (0.000168)
University graduates	0.00135* (0.000712)	0.00137* (0.000720)	0.000341 (0.000354)			0.00161** (0.000623)	0.00155** (0.000615)	0.000388 (0.000346)
Ln(Capital)	0.0220*** (0.00470)	0.0210*** (0.00461)	0.0133*** (0.00354)			0.0204*** (0.00549)	0.0187*** (0.00531)	0.0147*** (0.00385)
Environmental certificate required				0.0687*** (0.0162)	0.0695*** (0.0161)			
Energy performance required				0.0113 (0.0183)	0.0114 (0.0183)			
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2321	2307	2307	8389	8399	4369	4339	4339

Note(s): (1) Standard errors are clustered at the country level to correct for intra-country correlation and heteroskedasticity. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3.7 Additional robustness checks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable	Sales over total energy in kWh							
	OLS							
Exported	0.267** (0.124)	0.180 (0.141)	0.153 (0.141)	0.272 (0.177)				
Export experience					-0.00190 (0.00868)	-0.00155 (0.00920)	0.0126 (0.0115)	0.0105 (0.0106)
Firm size		0.0747 (0.0844)	0.108 (0.0864)			-0.00917 (0.0578)	0.00934 (0.0600)	
Firm age			-0.0125*** (0.00290)	-0.00842*** (0.00228)			-0.0162** (0.00609)	-0.0104*** (0.00344)
Foreign ownership			0.233* (0.135)	0.292* (0.149)			0.284** (0.125)	0.436*** (0.125)
Ln(Capital)				0.0448 (0.0605)				-0.0712* (0.0392)
Skilled production workers				0.00377 (0.00300)				0.00268 (0.00293)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2951	2950	2941	2376	1108	1108	1107	917

Note(s): Standard errors are clustered at the country level to correct for intra-country correlation and heteroskedasticity. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Chapter 4. Poverty, well-being and environmental issues among Indigenous communities: the case of Yakutia⁹

⁹ Contributors to this chapter include Daichi Yamada (Hiroshima University), Daiju Narita (University of Tokyo), Tuyara Gavrilova (North-Eastern Federal University), Varvara Parilova (Tohoku University), and Jorge García Molinos (Arctic Research Center, Hokkaido University), among others.

4.1 Introduction

The two phenomena of poverty and climate issues have been threatening the planet equally for rich and poor states given that 44 percent of the planet's inhabitants lives in poverty (when measured at \$6.85 per person per day) (World Bank, 2024) and the past nine years 2015-2023 were the nine warmest years on record (World Meteorological Organization, 2024). Of the planet's different nations and states, IPs are particularly more exposed to the above two challenges, given IPs being the poorest among the poor, as they account for about 19 percent of the extreme poor, and their livelihood dependencies on and historical relationships with nature. According to World Bank, IPs are distinct social and cultural groups that share collective ancestral ties to the lands and natural resources where they live, occupy or from which they have been displaced. They own, occupy, or use a quarter of the world's surface area and it is estimated that there are more than 476.6 million indigenous people spread across 58 countries worldwide (International Labour Organization, 2019).

Indigenous societies living in diverse environments face unique challenges, as described above, but Arctic IPs deserve special attention due to the region experiencing global warming at rates 2 to 2.5 times higher than the global average (Gorokhov and Fedorov 2018). These accelerated environmental changes intensify existing vulnerabilities, resulting in heightened economic hardships and health disparities. Traditional livelihoods such as fishing, hunting, and herding, which are central to the cultural and economic well-being of Arctic IPs, are particularly affected (Garcia et al. 2024).

This paper aims to examine the livelihoods, health, and experienced well-being of Arctic Indigenous communities amidst growing concerns related to climate change and their environmentally challenged living conditions. Additionally, it seeks to compare these well-being

measures with the general population of Russia, highlighting both similarities and differences. To achieve this objective, we employ primary household data collected through face-to-face surveys conducted under RISE project, which encompassed 17 rural Indigenous villages in Yakutia, Russian Far East. Our methodology includes analyzing absolute poverty using self-reported income, assessing nutritional status through anthropometric measurements and blood samples, and evaluating subjective well-being based on evaluative life and health assessments.

This study contributes to the existing literature primarily in two ways. First, it addresses a significant gap by examining the life and health conditions of Northern IPs from different angles. Specifically, it highlights the severity of their circumstances due to the mixture of environmental and social challenges, thereby drawing the attention of policymakers and academics to these issues. Next, the conclusions are primarily derived from human-involved samples and quantitative data collected across various locations in a harsh climatic region involving IPs of diverse ethnicities and lifestyles. This approach enables a more precise depiction of their conditions compared to the qualitative data and, additionally, it allows for the incorporation of unit heterogeneity, enhancing the robustness of the evidence.

The findings reveal that rural IPs in Yakutia face extreme poverty and significant nutritional challenges. Evidence shows that half of the IP population lives in deprivation, and four out of five adults are affected by malnutrition or anemia. When compared to national and regional statistics, these disparities become more pronounced. The poverty rate among Yakutian IPs is nearly five times that of the general Russian population, and nutritional problems are more than three times as prevalent. Interestingly, these harsh realities contrast sharply with their reported high levels of subjective health and life satisfaction.

4.2 Literature review

4.2.1 Well-being and environmental issues among Indigenous Peoples

Irrespective of the region or whether they reside in rural or urban areas, IPs consistently represent a disproportionately large share of those living in poverty (International Labour Organization, 2019). The existing literature underscores that Indigenous groups experience greater deprivation compared to their non-Indigenous counterparts within the same geographical areas (Canedo 2018). This disparity is further exacerbated in rural communities, where IPs are often closely associated with extreme and chronic poverty (Castellanos and Rahut 2012). The factors contributing to this persistent poverty include not only economic challenges but also significant social and political exclusions. IPs frequently face barriers to accessing quality education, healthcare, and employment opportunities, which further entrench their marginalized status (Islam and Carlsen 2015).

The existing literature highlights significant nutritional challenges among IPs, emphasizing that these issues are more pronounced compared to non-Indigenous populations. Indigenous communities frequently face higher rates of malnutrition, a condition exacerbated by socioeconomic marginalization and geographic isolation (Kolahdooz et al. 2015). A study by Morris et al. (2018), using clinical patient data, found that approximately 46% of Indigenous Australians are malnourished, compared to 37% of their non-Indigenous counterparts. This nutrition transition has resulted in a dual burden of malnutrition, with undernutrition occurring alongside rising obesity rates, particularly affecting Indigenous children and adults (Damman et al. 2008).

IPs around the world are also facing a multitude of environmental issues that threaten their traditional ways of life and well-being. Climate change is a significant factor, with rising temperatures, shifting weather patterns, and extreme weather events disproportionately impacting

Indigenous communities, especially those in the Arctic and coastal regions (Ford et al. 2016). Deforestation, land degradation, and biodiversity loss further exacerbate these challenges, as IPs often rely on their natural surroundings for sustenance and cultural practices (Raygorodetsky 2011). Additionally, industrial activities such as mining and oil extraction have led to pollution and land displacement, disrupting ecosystems and reducing the availability of clean water and arable land (Gilio-Whitaker 2019). These environmental changes not only threaten the physical health and livelihoods of IPs but also pose a risk to their cultural heritage and identity, which are deeply rooted in their connection to the land.

4.2.2 Yakutia: background, Indigenous populations, and environmental issues

Located in the Russian Far East, along the Arctic Ocean, Yakutia, or, officially, the Republic of Sakha, is the largest region of Russia and the largest administrative division in the world. Despite its vastness, Yakutia is a sparsely populated and less dense territory, covering more than three million square kilometers, or Russia's 18 % territory, with less than a million people. Urban and rural populations correspond to around 66 % and 40 %, respectively, with 129 different nationalities (Danilova et al. 2022).

Yakutia's main source of economic activities and growth in recent years is the mining industry, particularly the oil and diamond sectors (Tabata 2021). Also, it is noted that its traditional economy is characterized by the complexity of traditional economic activities, with reindeer herding being the leading direction (Sannikova 2018). Moreover, although Yakutia has higher disposable income than Russia on average, which is a legacy from the Soviet era, the cost of living is also high and the purchasing power of the income is low. Therefore, the poverty rate in Yakutia is traditionally higher than Russia (1.5 times higher), with the percentage of the population living below the subsistence minimum level reaching 18-20 percent between 2003 and 2019 (Gavrileva

et al. 2022). Notably, the fertility rate in Yakutia is historically higher than in Russia on average, ranging from 50 % in the 2000s to nearly 30 % in early the 2010s (Gavrileva et al. 2022).

As most parts of the globe facing climate change issues, the Russian Arctic of Yakutia has experienced a mean annual air temperature rise that is 2 to 2.5 times higher than the global average. This significant warming trend is already affecting local ecosystems and the livelihoods of residents, particularly minorities who depend on subsistence practices for their survival. There is a different trend of climate change across the Yakutian regions and also mountain-taiga and tundra regions have faced contrasting, positive and negative, respectively, trends in annual precipitation (Gorokhov and Fedorov 2018).

Often referred to as "Indigenous small-numbered peoples of the North" or "Indigenous peoples of the North" (Revich 2008; Stammeler-Gossmann 2010; Evengard et al. 2011), Yakutia has a significant population share of Indigenous Peoples, including Chukchi, Dolgan, Even, Evenk, and Yukagir who are cataloged as Indigenous small-numbered peoples of the North, Siberia, and the Far East. These Indigenous groups, each with unique cultures and traditional practices, have historically adapted to the harsh climatic conditions of the Arctic and sub-Arctic regions. Their livelihoods predominantly revolve around subsistence activities such as reindeer herding, hunting, fishing, and gathering, which are not only crucial for their survival but also central to their cultural identity.

Indigenous communities of Yakutia are disproportionately impacted by climate change despite their minimal contribution to global emissions, unlike industrialized regions (Turner and Clifton 2009; Norton-Smith 2016). Although, their proactive involvement in developing and applying nature-based solutions for adaptation has been increasingly recognized and supported (Etchart 2017; Townsend et al. 2020), these communities are increasingly vulnerable to the

impacts of climate change and socio-economic transformations, which threaten their traditional ways of life and overall well-being.

4.3 Materials and methods

4.3.1 Data

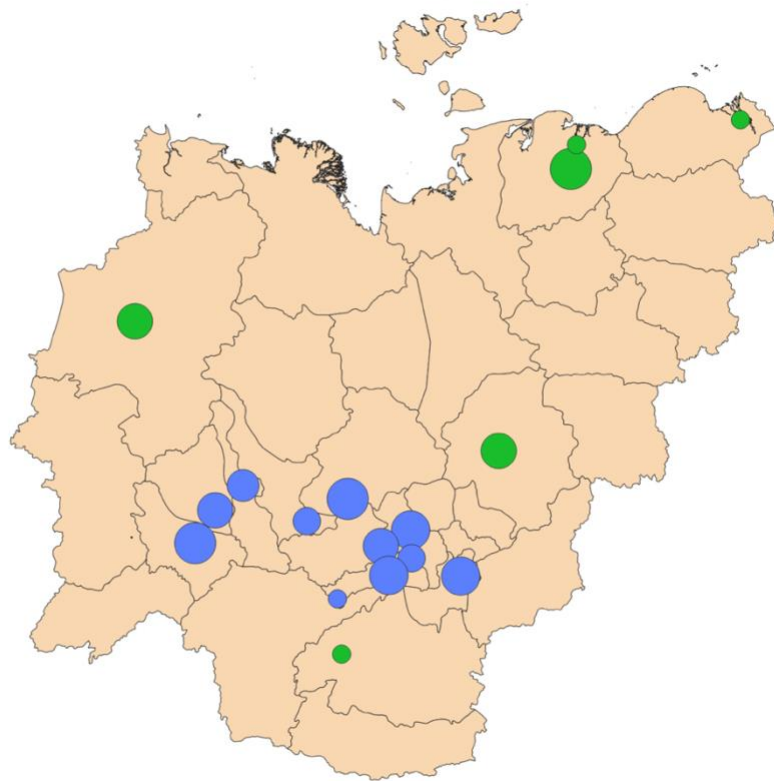


Fig 4.1. Locations of settlements surveyed.

Notes: (1) The size of the circles refers to sample size, with the smallest corresponds to 10 households, while the largest represents 35 households; (2) The color changes with ethnicity: blue represents Sakha households, while green shows non-Sakha households.

Data used for this study comes from a fieldwork survey conducted under the RISE project in 18 remote settlements of Yakutia, Russia. The survey was conducted in two stages. In the first stage, 18 settlements with 400 households are surveyed using somewhat general questions on household information, salary, diets, farming, climate issues and subjective life assessments. The first stage covered 400 households from 18 settlements during June– December 2021 (three settlements were visited in the beginning of 2022 due to accessibility problems). The sample sizes for the settlements

were determined by distributing the total sample size ($n = 400$ respondents) across the five economic zones of Yakutia (Arctic, Southern, Central, Eastern, and Western Yakutia) based on population class sizes for working-age and older residents in each rural settlement. Settlements with populations of ≤ 500 , 501–1,000, 1,001–2,000, and $\geq 2,001$ people correspond to 10–15, 20–25, 30, and 35 respondents, respectively. The total sample size was initially calculated using the Slavin formula for a precision level of 0.05, based on the total population of working-age and older residents. The population column in Table 4.1 presents the total population of each settlement, with the number of working-age and older residents shown in brackets. For this Chapter, we refer to data from 17 settlements and accordingly, do not use responses from Bykov Mys as the original responses recorded at the above data became inaccessible due to technical reasons under harsh weather conditions. In the second stage, two settlements of Rassoloda and Kharyallakh, Sakha- and non-Sakha-ethnic settlements, were selected to conduct in-depth or detailed surveys. In this stage, anthropometric measurements and blood samples were also recorded.

Table 4.1. General information on the surveyed settlements

Settlement	District	Main ethnic group(s)	Population	Traditional activities
Pokhodsk	Nizhnekolymsky	Russian old-timers, Chukchi, Ukagirs	266 (201)	Tundra reindeer husbandry, fishing
Kharyallakh	Oleneksky	Evenks	855 (646)	Forest-tundra reindeer husbandry, hunting, gathering
Chokurdakh	Allaikhovsky	Russian old-timers, Ukagirs	2077 (1568)	Fishing, Tundra reindeer husbandry
Russkoe Ystye		Russian old-timers, Ukagirs	127 (96)	Fishing, Tundra reindeer husbandry
Betuntsy	Amginsky	Sakha	1209 (913)	Cattle breeding, gathering
Isit	Khangalassky	Sakha	272 (205)	Cattle and horse breeding, hunting, gathering
Ulakhan-An	Khangalassky	Sakha	1133 (855)	Cattle and horse breeding, hunting, gathering
Kobyay	Kobyaysky	Sakha	2289 (1728)	Fishing, hunting
Magaras	Gorny	Sakha	1044 (788)	Cattle and horse breeding, hunting, gathering
Edeytsy	Namsky	Sakha	1202 (908)	Cattle and horse breeding, hunting, gathering
Rassoloda	Megino-Kangalassy	Sakha	431 (325)	Cattle and horse breeding, hunting, gathering
Kharbala	Verkhnevilyuysky	Sakha	593 (448)	Cattle and horse breeding, hunting, gathering
Lekechen	Viluiysky	Sakha	441 (333)	Cattle and horse breeding, hunting, gathering
Chappanda	Nurbinsky	Sakha	797 (602)	Cattle and horse breeding, hunting, gathering
Elgey	Suntarsky	Sakha	1660 (1253)	Cattle and horse breeding, hunting, gathering
Topolinoe	Tomponsky	Evens	915 (691)	Mountain taiga reindeer husbandry, hunting
Ugoyan	Aldansky	Evenks	375 (283)	Taiga reindeer husbandry, hunting
Bykov Mys	Bulunsky	Russian old-timers, Evenks, Evens, Ukagirs	514 (388)	Fishing, Tundra reindeer husbandry, hunting

Table 4.1 shows information on settlements that we surveyed. As can be seen, majority of settlements are Sakha-majority people and there are ethnic groups other than Sakha, such as Evenks and Evens. Their activities are accordingly different for these two groups: Sakha people

are mainly involved in farming, while non-Sakha people's main activities include taiga reindeer husbandry and hunting, fishing.

4.3.2 Statistical measures

To analyze poverty and well-being conditions among IPs of Yakutia, we calculate three statistics, each of which portrays a distinct aspect of the socioeconomic condition of IP households. Specifically, we report the poverty rate derived using monetary and non-monetary earnings, nutritional conditions, and subjective well-being using self-reported life and health assessments utilizing blood sample collections. Specific calculations for each statistic are given below.

To calculate the *absolute poverty* rate, we utilize self-reported household income, which encompasses both monetary incomes (such as salaries and social benefits) and non-monetary incomes derived from the self-consumption of products obtained through farming, hunting, fishing, and gathering. Per capita household income is then determined by dividing the total household income by the household size. A household is classified as poor if its per capita income falls below the subsistence minimum established by the Russian Statistical Office.

In addressing nutritional issues, we focus on undernutrition, overweight and anemia among adults aged 18 and above, employing definitions provided by the World Health Organization. Specifically, an adult is categorized as undernourished if their Body Mass Index (BMI) is less than 18, and overweight or obese if BMI is greater than 25. Anemia in adults is defined as a hemoglobin concentration below 13 grams per deciliter (g/dL) for men and below 12 g/dL for women.

For the assessment of subjective well-being, we rely on self-reported levels of life and health satisfaction from the respondents. Health satisfaction is evaluated using the question, "How do you evaluate your own health?" with responses recorded on a five-point scale, where 1 indicates "very bad" and 5 indicates "excellent." Responses of "I do not know" were excluded for clarity.

Life satisfaction is measured through the question, “Please imagine a ladder, with steps numbered from 0 at the bottom to 10 at the top. The top of the ladder represents the best possible life for you, and the bottom of the ladder represents the worst possible life for you. On which step of the ladder would you say you personally feel you stand at this time?”.

4.4 Results

Absolute poverty

Figure 4.2 illustrates that the poverty rate among individuals in the surveyed villages surpasses 50%. This indicates that, on average, one out of every two individuals, regardless of age, experiences deprivation in their daily life. Figures 4.6a and 4.6b in the Appendix further reveal that Sakha majority households experience significantly higher levels of deprivation compared to their non-Sakha counterparts. However, no statistically significant difference is observed between male- and female-headed households in terms of deprivation.

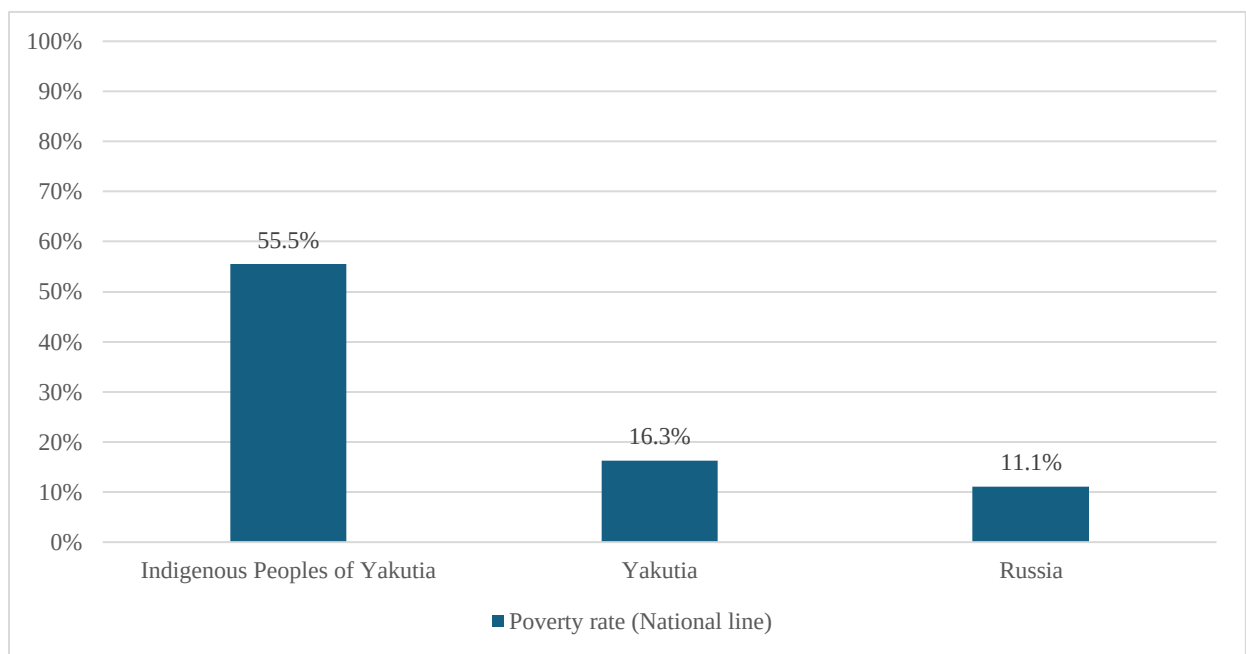


Fig 4.2. Comparison of percentages of poor individuals: Yakutian Indigenous Peoples, Yakutia, and Russia.

Source: Authors calculations using RISE data for IPs and Russian statistics data for Yakutia and Russia

Note(s): The 95 % confidence interval of the share of the poor for IPs is [52.85,58.15].

The figure also underscores that the poverty rate among Yakutian IPs is significantly higher and more severe than that of the general population in both Yakutia and Russia, with poverty rates at approximately 15% and 10%, respectively. While the disparity between Yakutia and Russia is largely due to higher living costs, a substantial rural population primarily engaged in agriculture, and a higher dependency ratio in Yakutia (Gavrileva et al. 2022), we contend that Yakutian IPs

face additional challenges. These include environmentally driven limitations on economic and employment opportunities, contributing to their nearly threefold higher poverty rate. The harsh climate exacerbates already underdeveloped infrastructure, resulting in restricted access to social services and larger population centers (Neustroeva and Samsonova 2022). Furthermore, the poor living conditions may be influenced by a changing climate, which leads to food insecurity and disrupts traditional livelihoods, as these remote and isolated communities heavily depend on animal and plant-based resources derived mainly from traditional practices (Panikkar and Lemmond 2020; Molinos et al. 2024).

Nutritional issues

Figure 4.3 presents the nutritional conditions of IPs living in the two settlements, Kharyallakh and Rassoloda, based on anthropometric measurements. The figure highlights a significant issue: 77 % of adults are affected by overweight or obesity and 20 % suffer from anemia. Although the difference is not statistically significant, the remote, Arctic-located settlement of Kharyallakh shows a higher prevalence of nutritional issues compared to Rassoloda, which is situated near Yakutsk, the region's center (Figure 4.7a in the Appendix). Additionally, these nutritional challenges are markedly more prevalent among females (89%) than males (76%), as detailed in Figure 4.7b in the Appendix.

These nutritional issues are substantially more severe than those observed in the general Russian population. According to Food and Agriculture Organization (2023) report on food security and nutrition, less than 2.5% of the Russian population experiences undernourishment, and over 23% of adults suffer from obesity, figures that are nearly three times lower than those for Yakutian IPs. However, the prevalence of anemia among Russian women of reproductive age, at around 21%, closely aligns with our findings, which show approximately 20% among adult women in the Yakutian IP population.

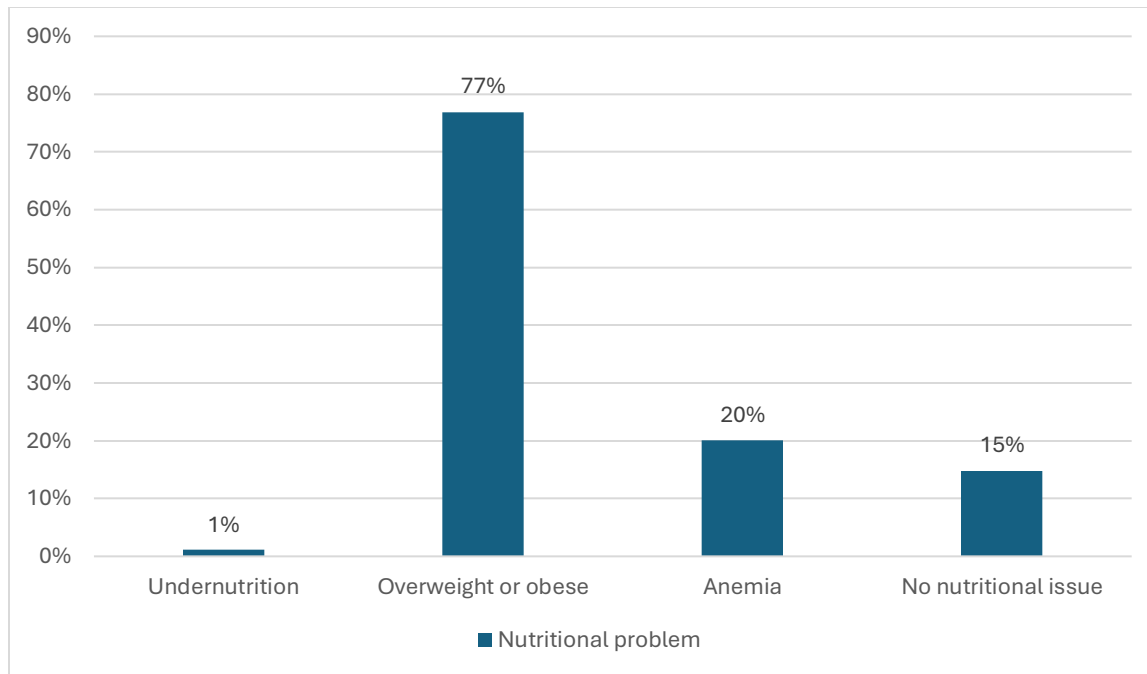


Fig 4.3 Nutritional problems among adults of Yakutian IPs.
Source: Authors calculations using RISE data.

Factors such as dietary changes and nutritious food insecurity may contribute to the alarming levels of malnutrition among IPs. The dietary shift involves the loss or decline of traditional diets and the adoption of Westernized food habits, which increases the prevalence of chronic diseases and leads to a nutritional transition among IPs (Damman et al. 2008; Kuhnlein et al. 2006). Regarding the inaccessibility of vitamin-rich foods, it is noteworthy that most Yakutian rural households are deprived of fruit consumption due to its unavailability and unaffordability (Gavrileva et al. 2020).

Both issues of dietary changes and food insecurity are prevalent among the IPs in Kharyallakh and Rassoloda, as highlighted by Gavrileva and Parilova (2024), who analyzed food consumption patterns using the same dataset. They argue that dietary changes and differences can be observed between the two villages. Rassoloda's dietary patterns are getting more aligned with urban residents, given higher access to a wider range of affordable products, while Kharyallakh, isolated in the Arctic, faces limited availability and higher costs for nutritious food.

Subjective well-being

Although Yakutian IPs experience relatively higher levels of deprivation, at least 95% report average levels of health satisfaction, indicating that most of them do not perceive this aspect to be poor or fair (Figure 4.4). Moreover, Figure 4.5 shows that more than 90% of respondents rate their life satisfaction more than average. This figure also indicates that approximately 61% of responses are equal to or greater than 6, a rate higher than the 54% reported for the general population of Russia, according to the Russia Longitudinal Monitoring Survey (RLMS) (Andreenkova 2019). Furthermore, the surveyed Yakutian IPs' average health satisfaction score, which is 3.46, is also slightly higher than the general Russian average of 3.30, as reported in the RLMS (Isaeva and Salahodjaev 2021).

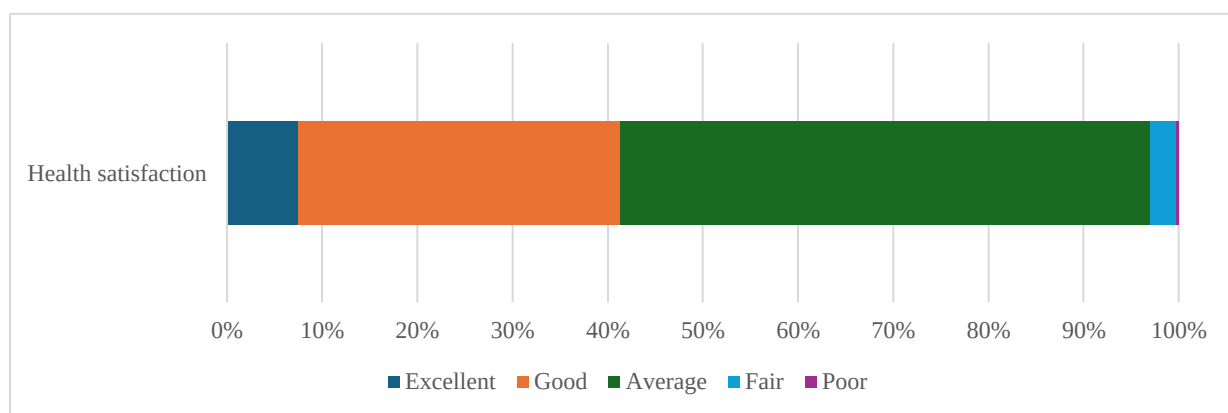


Fig 4.4. Health satisfaction among Yakutian IPs.
Source: Authors calculations using RISE data.

The higher levels of subjective well-being among IPs, despite their poor living conditions and health issues, may be attributed to non-materialistic and spiritual factors. Wu (2021) found that IPs in Arctic Alaska experience greater happiness when engaging in traditional hunting and gathering activities in nature, even though they have fewer job opportunities and lower wage incomes. Moreover, Kirmayer et al. (2011) argue that Indigenous cultural values prioritize

relational well-being over individual material success, which contributes to life satisfaction even in the face of economic adversity.

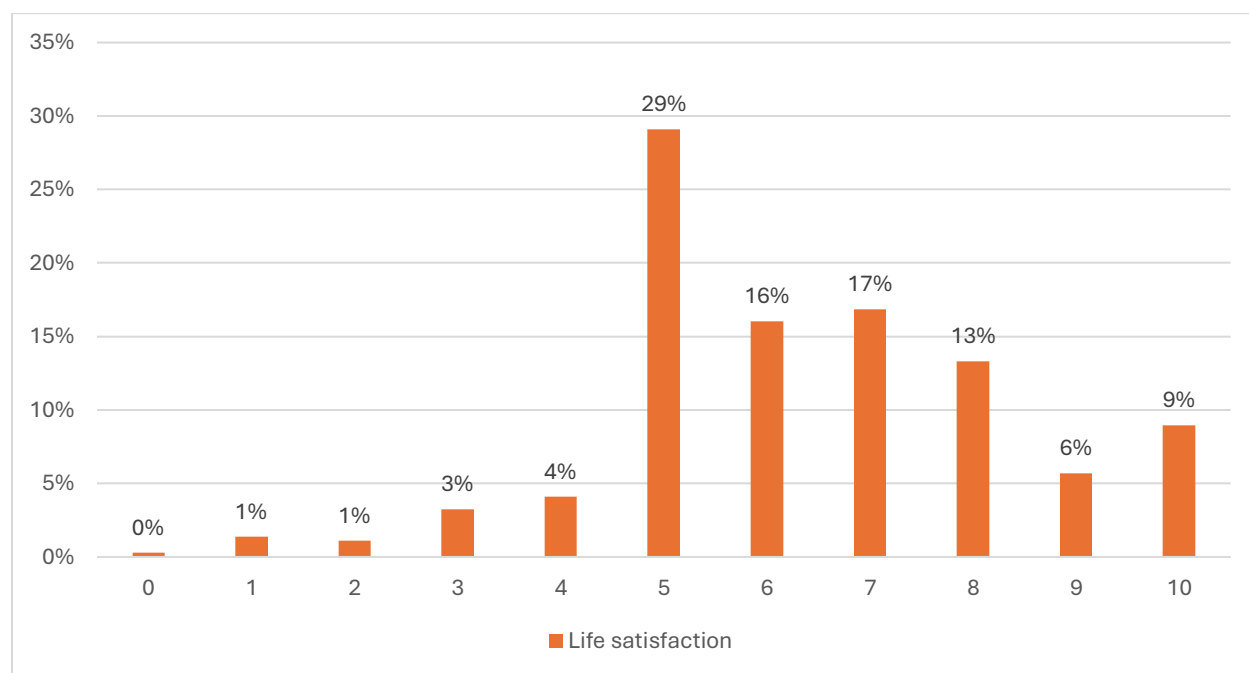


Fig 4.5. Life satisfaction among Yakutian IPs.
Source: Authors calculations using RISE data.

4.5 Conclusions and discussions

Amidst concerns of poverty and growing climate change issues, it is particularly of interest how Indigenous Peoples cope with these challenges, given they are among the poorest of the poor and their livelihood subsistence is primarily dependent on nature. On top of this, the Arctic region necessitates special consideration because the rapid pace of environmental changes directly threatens the sustainability of traditional practices, while geographic isolation further limits access to resources, infrastructure, and support systems, exacerbating the impacts of climate change and socio-economic marginalization.

In this paper, we attempted to illustrate how Yakutian IPs are experiencing challenges across various dimensions of well-being. Our findings indicate that Yakutian rural Indigenous Peoples endure severe poverty and nutritional well-being issues. This is evidenced by the fact that

every second individual experiences deprivation, and four out of five adults suffer from either malnutrition or anemia. Moreover, comparisons with national and regional data highlight substantial disparities. Specifically, the poverty rate among Yakutian IPs is approximately five times higher, and the prevalence of nutritional issues is more than three times greater than that observed in the general Russian population. However, these severe conditions are not reflected in their contrastingly highly reported subjective assessments of their health and life satisfaction.

The main factors contributing to the poor living and health conditions of these minority communities in isolated rural areas may include limited economic opportunities, high living costs, expensive nutritious food, and largely inaccessible healthcare services due to poor connectivity with larger population centers (Gavrileva et al. 2020; Gavrileva et al. 2022; Neustroeva and Samsonova 2022). These issues might be predominantly linked to the Arctic's harsh climate and environmental changes (Zamyatina and Kulchitsky 2024). Despite these hardships, subjective emotional well-being of such IPs may be shaped by non-material wealth and activities (Kirmayer 2011; Wu 2021).

Our findings reveal policy implications for addressing the severe poverty and nutritional well-being issues faced by Yakutian rural Indigenous Peoples. Given the stark disparities in poverty rates and nutritional health compared to the general Russian population, targeted interventions are essential. Policies should prioritize enhancing economic opportunities in these remote areas through infrastructure development and connectivity improvements, which would facilitate access to markets, healthcare, and nutritious food. Additionally, subsidizing the costs of living essentials, particularly nutritious food, could alleviate some of the economic burdens these communities face. Recognizing the environmental challenges exacerbated by climate change,

policies should also focus on sustainable development practices that preserve traditional food sources and support adaptation to changing climatic conditions.

Despite the approaches employed in this study, several limitations and unresolved issues persist. Notably, although detailed anthropometric measurements and blood samples were collected from respondents in two distinct Indigenous communities, the inability to integrate this data with socio-economic responses—owing to the use of different respondent units—restricts the comprehensiveness of the analysis. Additionally, further investigation is warranted to provide more precise insights into the well-being of IPs, particularly by examining poverty among farming and non-farming households to clarify the impact of varied livelihood strategies. Furthermore, it remains uncertain whether climate change will intensify poverty in extremely cold regions, as the long-term socio-economic effects of environmental changes on these communities require deeper exploration. Addressing these limitations in future research would strengthen the robustness and applicability of the findings, facilitating a more nuanced understanding of the challenges confronting Arctic Indigenous communities.

Appendix for Chapter 4

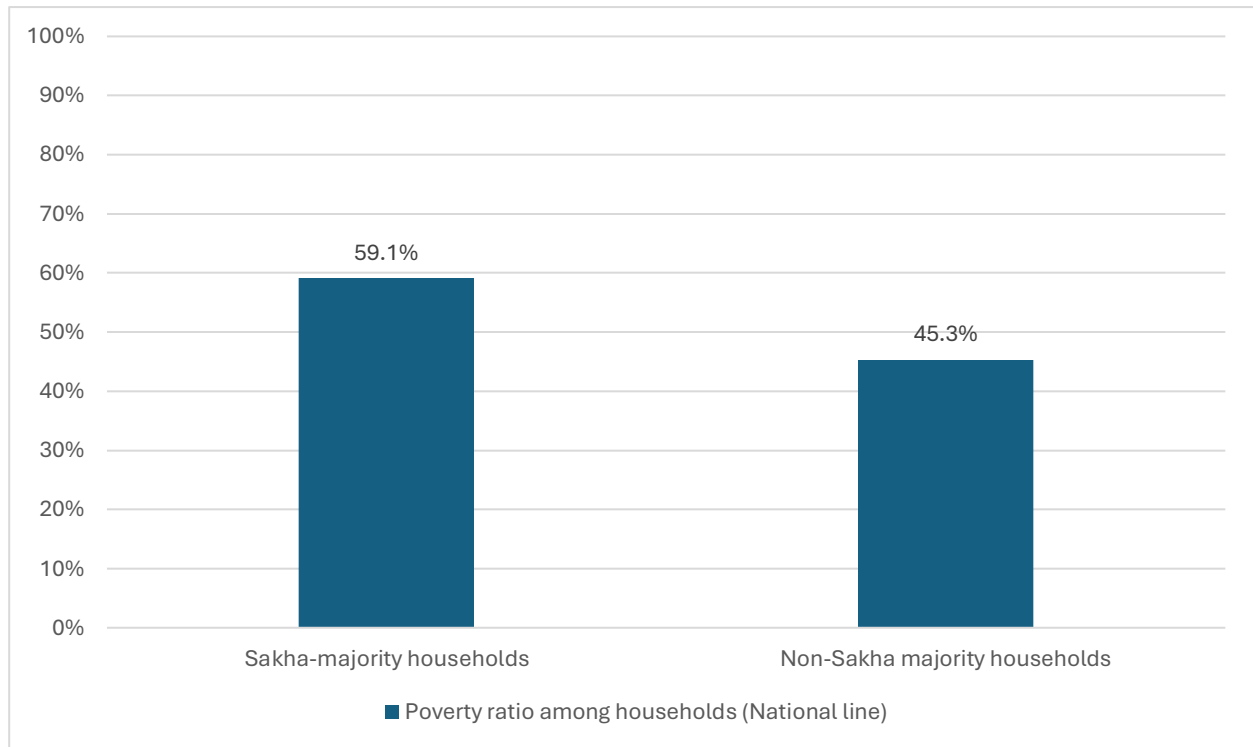


Fig 4.6a. Comparing the ratio of poor households according to the main ethnicity.

Note(s): (1) The 95 % confidence intervals of the ratios for Sakha and non-Sakha majority households are [56.04,62.16] and [40.09,50.51], respectively. T-score for the difference is 4.48.

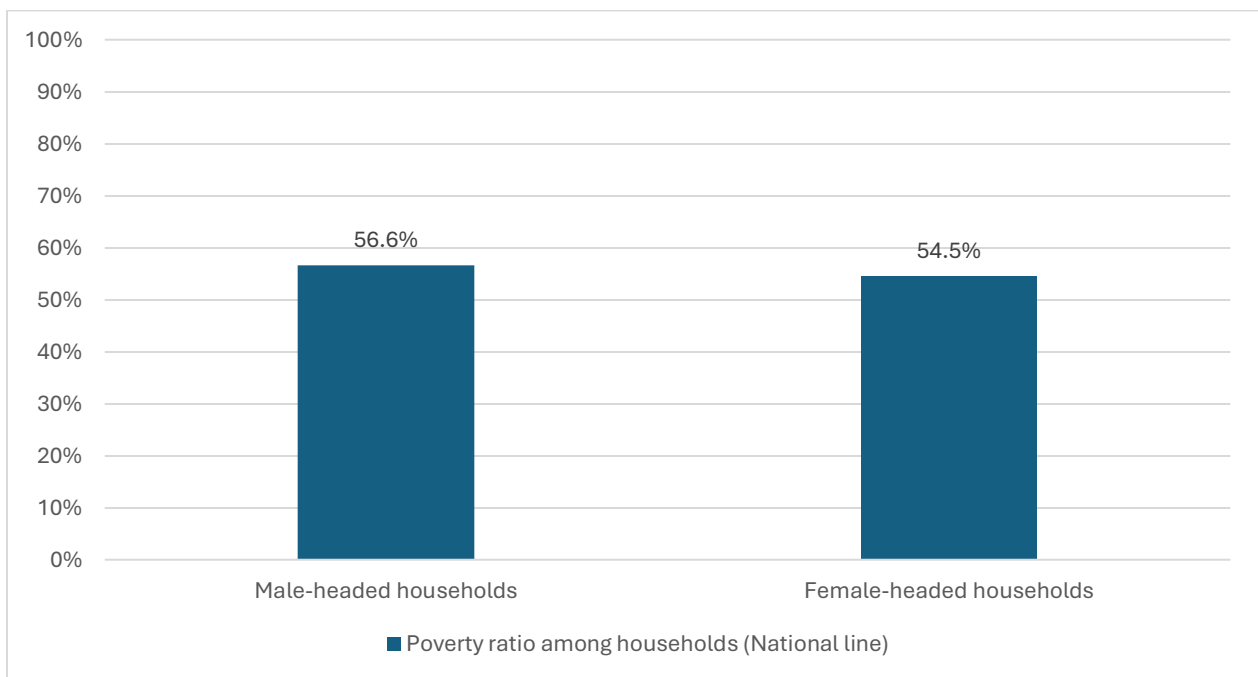


Fig 4.6b. Comparing the ratio of poor households according to the head's gender.

Note(s): (1) The 95 % confidence intervals of the ratios for male- and female-headed households are [53.01,60.19] and [50.38,58.62], respectively. T-score for the difference is 0.75.

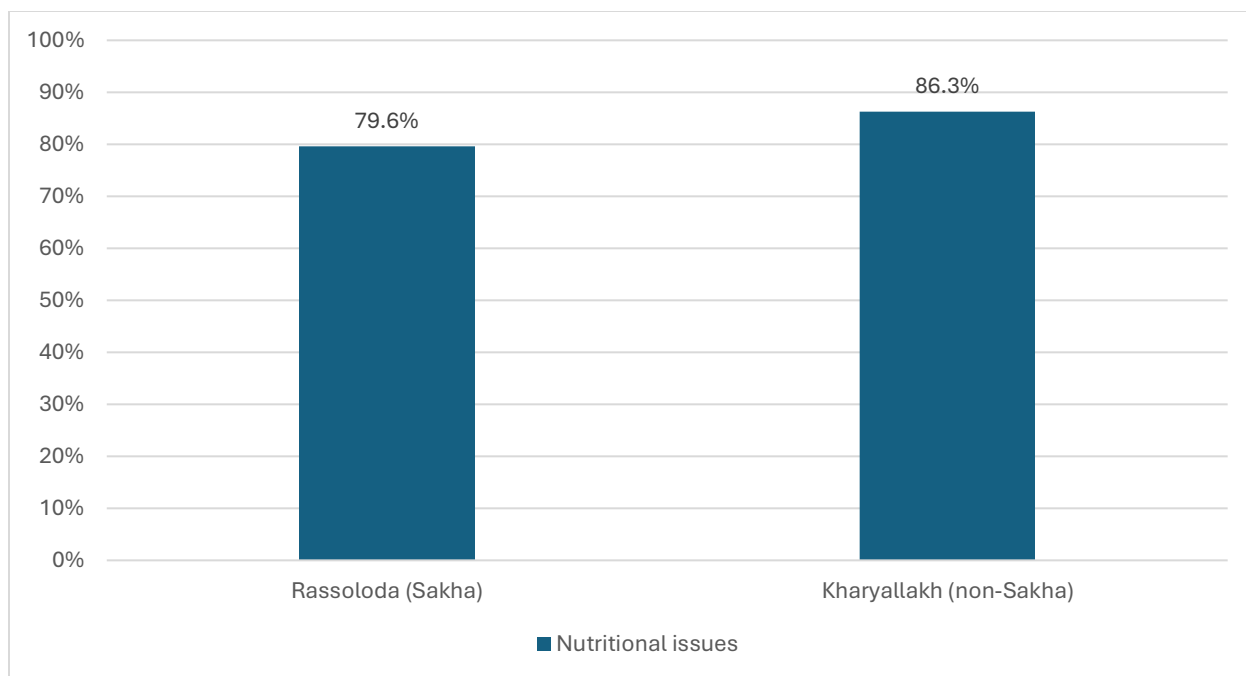


Fig 4.7a Nutritional issues in both forms among Sakha majority of Rassoloda and Evenk majority of Kharyallakh settlements.

Note(s): (1) The 95 % confidence intervals of the ratios for Rassoloda and Kharyallakh are [67.89,91.29] and [80.15,92.43], respectively. T-score for the difference is -1.09.

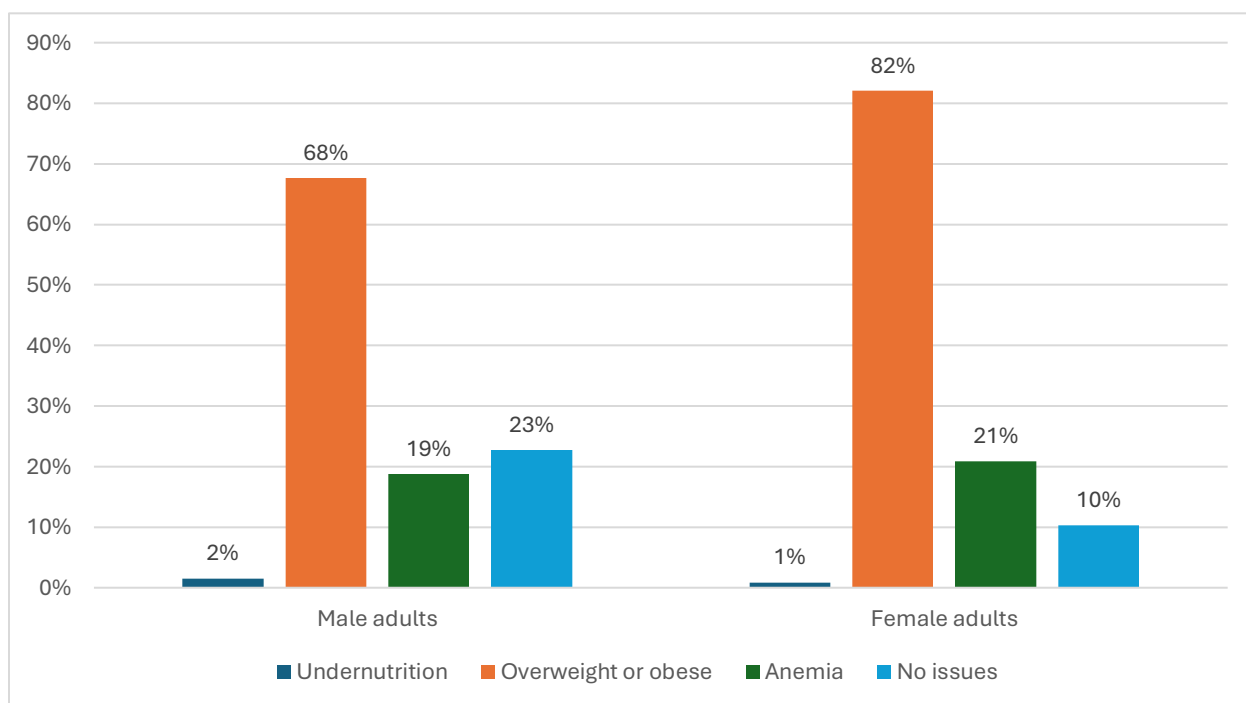


Fig 4.7b Nutritional issues among male and female adults of Yakutian IPs

Note(s): The 95% confidence interval for the difference between males and females in means of having a nutritional issue is [-24.12, -1.68]. T-score for this difference is -2.27.

Chapter 5. Conclusions

In this dissertation, we attempted to shed light on international trade, environmental issues, and the well-being of different agents of society. These aspects are particularly essential to achieving inclusive, sustainable, and equitable development in various sectors of an economy. TEs face unique challenges in this balance, with some experiencing export growth and others lagging despite extensive reforms. These economies also play a crucial role in environmental discussions, having significantly reduced energy intensities, highlighting the importance of targeted reforms in achieving both economic and environmental goals.

In Chapter 2, we examined how firm productivity relates to export propensity and intensity using BEEPS data from 29 transition economies, considering the impact of institutional environments and trade geography. Our results confirm a strong positive effect of productivity on export entry, consistent with Melitz's theory, but highlight significant variation based on institutional conditions, with weaker export propensities in firms operating under imperfect institutions. Conversely, productivity showed no significant link to export intensity, likely due to the similar characteristics of domestic and foreign markets in these economies, which were once part of a unified system. This pattern suggests that firms may prioritize domestic sales over exports due to shared consumer preferences in neighboring markets. Our findings also imply that export concepts should be differentiated when analyzing the relationship between firm characteristics and exports, particularly in transition economies. The study underscores the importance of incorporating institutional factors and export geography in explaining productivity's role in export decisions. While policymakers focus on boosting productivity to foster export growth, our results suggest that such measures may not always encourage further internationalization among current exporters, though they remain crucial for firms operating in both domestic and international

markets. Additionally, the institutional context plays a critical role in shaping the effectiveness of export-oriented policies, with varying impacts depending on the regulatory environment.

Chapter 3 examined how manufacturing firm exports influence energy efficiency and how foreign sales drive pro-environmental initiatives, using data from 29 transition economies. Our findings reveal two key insights. First, exporting does not enhance energy efficiency, even for firms investing in technological upgrades or with extensive export experience, suggesting that abatement investments and learning-by-exporting effects are muted in these contexts. Second, exporters are more likely to adopt environmentally friendly practices and appoint managers for environmental strategies, driven by external pressures and competition. However, these initiatives may sometimes be superficial, reflecting the low transparency and weak institutional frameworks in transition economies. These outcomes underscore the unique challenges in these regions, where weak institutions hinder the effective translation of technological investments into efficiency, and trade ties with post-Soviet economies dilute learning-by-exporting benefits. The findings have theoretical and policy implications, highlighting the need to treat tangible and intangible environmental performance separately in research and urging policymakers to address institutional barriers when promoting energy performance alongside exports. Furthermore, while firm-level initiatives reflect progress, governments must support technical capabilities to achieve substantial environmental improvements and ensure sustainable growth.

In Chapter 4, we explored the challenges faced by Yakutian rural Indigenous Peoples across various dimensions of well-being, revealing severe poverty and nutritional deficiencies. Every second individual experiences deprivation, and four out of five adults suffer from malnutrition or anemia. These issues are magnified when compared to national and regional data, with poverty rates approximately five times higher and nutritional challenges over three times

more prevalent among Yakutian Indigenous Peoples than in the general Russian population. Surprisingly, despite these hardships, their subjective health and life satisfaction remain high, likely influenced by strong community bonds and non-material wealth. The root causes of these issues include limited economic opportunities, high living costs, scarce nutritious food, and inaccessible healthcare, exacerbated by harsh northern climates and environmental changes. Climate change further impacts traditional diets and economic resilience in these remote regions. To address these disparities, targeted policies must enhance economic opportunities through improved infrastructure and connectivity, enabling better access to markets, healthcare, and affordable nutritious food. Subsidies for living essentials and sustainable practices to preserve traditional food sources are vital. Additionally, climate adaptation strategies are essential to support these communities in mitigating environmental challenges and achieving better overall well-being.

The limitations discussed in this dissertation must also be acknowledged and addressed. Chapter 2 faces two limitations. First, using worker training as an instrument for productivity raises concerns about potential reverse causality and challenges in fully satisfying exclusion restrictions, which may bias the IV estimates and affect causal inferences. Second, the lack of panel data restricts the ability to account for unobserved heterogeneity and observe temporal changes, limiting insights into the dynamic relationship between productivity and exports. Future research could address these issues with richer datasets and a more thorough exploration of both cross-sectional and longitudinal effects. Regarding Chapter 4, the inability to integrate anthropometric and blood sample data with socio-economic responses due to differing respondent units limits the analysis's scope. Further research is needed to examine poverty among farming and non-farming households, shedding light on the role of livelihood strategies. Additionally, the long-term socio-

economic effects of climate change on Arctic Indigenous communities remain unclear, particularly its potential to exacerbate poverty in extremely cold regions. Addressing these gaps would enhance the findings' robustness and provide a deeper understanding of the challenges faced by these communities.

References

- Alessandria, G., & Choi, H. (2007). Do sunk costs of exporting matter for net export dynamics? *The Quarterly Journal of Economics*, 122(1), 289–336. <https://doi.org/10.1162/qjec.122.1.289>
- Almeida, R. K., & Aterido, R. (2015). Investing in formal on-the-job training: Are SMEs lagging much behind? *IZA Journal of Labor & Development*, 4(1), 1–23. <https://doi.org/10.1186/s40175-015-0029-3>
- Andreenkova, A. V., & Andreenkova, N. V. (2019). Comparative analysis of life satisfaction determinants in Russia and in Europe. *Discourse*, 5(1), 67–81.
- Aristei, D., Castellani, D., & Franco, C. (2013). Firms' exporting and importing activities: Is there a two-way relationship? *Review of World Economics*, 149(1), 55–84. <https://doi.org/10.1007/s10290-012-0137-y>
- Arsov, S., & Bucevska, V. (2017). Determinants of transparency and disclosure: Evidence from post-transition economies. *Economic Research-Ekonomska Istraživanja*, 30(1), 745–760.
- Aw, B. Y., Chung, S., & Roberts, M. J. (2000). Productivity and turnover in the export market: Micro-level evidence from the Republic of Korea and Taiwan (China). *The World Bank Economic Review*, 14(1), 65–90. <https://doi.org/10.1093/wber/14.1.65>
- Aung, T. S., Overland, I., & Vakulchuk, R. (2021). Environmental performance of foreign firms: Chinese and Japanese firms in Myanmar. *Journal of Cleaner Production*, 312, 127701. <https://doi.org/10.1016/j.jclepro.2021.127701>
- Batrakova, S., & Davies, R. B. (2012). Is there an environmental benefit to being an exporter? Evidence from firm-level data. *Review of World Economics*, 148, 449–474. <https://doi.org/10.1007/s10290-012-0120-7>

- Bas, M. (2012). Input-trade liberalization and firm export decisions: Evidence from Argentina. *Journal of Development Economics*, 97(2), 481–493. <https://doi.org/10.1016/j.jdevco.2011.05.010>
- Bastos, P., Silva, J., & Proença, R. (2016). Exports and job training. *Review of International Economics*, 24(4), 737–756. <https://doi.org/10.1111/roie.12236>
- Bennett, R. J. (1998). Business associations and their potential to contribute to economic development: Reexploring an interface between the state and market. *Environment and Planning A*, 30(8), 1367–1387. <https://doi.org/10.1068/a301367>
- Bernard, A. B., & Jensen, J. B. (1999). Exceptional exporter performance: Cause, effect, or both? *Journal of International Economics*, 47(1), 1–25. [https://doi.org/10.1016/S0022-1996\(98\)00027-0](https://doi.org/10.1016/S0022-1996(98)00027-0)
- Bernard, A. B., Jensen, J. B., Redding, S. J., & Schott, P. K. (2018). Global firms. *Journal of Economic Literature*, 56(2), 565–619. <https://doi.org/10.1257/jel.20160792>
- Bernard, A. B., & Jensen, J. B. (1995). Exporters, jobs, and wages in U.S. manufacturing: 1976–1987. *Brookings Papers on Economic Activity: Microeconomics*, 1995, 67–119. <https://doi.org/10.2307/2534772>
- Bernard, A. B., Jensen, J. B., Redding, S. J., & Schott, P. K. (2012). The empirics of firm heterogeneity and international trade. *Annual Review of Economics*, 4(1), 283–313. <https://doi.org/10.1146/annurev-economics-080511-110928>
- Biscione, A., Boccanfuso, D., de Felice, A., & Porcelli, F. (2022). Barriers to firms' energy efficiency in transition countries. *Applied Economics*, 54(1), 1–15. <https://doi.org/10.1080/00036846.2022.2128180>
- Blyde, J. S., & Ramirez, M. A. (2022). Exporting and environmental performance: Where you export matters. *The Journal of International Trade & Economic Development*, 31(5), 672–691. <https://doi.org/10.1080/09638199.2022.2048686>

- Boikos, S., Pinar, M., & Stengos, T. (2023). Bribery, on-the-job training, and firm performance. *Small Business Economics*, 60(1), 37–58. <https://doi.org/10.1007/s11187-022-00633-6>
- Børing, P. (2019). The relationship between firm productivity, firm size, and CSR objectives for innovations. *Eurasian Business Review*, 9(3), 269–297. <https://doi.org/10.1007/s40821-019-00130-z>
- Brache, J., & Felzensztein, C. (2019). Exporting firms' engagement with trade associations: Insights from Chile. *International Business Review*, 28(1), 25–35. <https://doi.org/10.1016/j.ibusrev.2018.07.004>
- Braguinsky, S., & Mityakov, S. (2015). Foreign corporations and the culture of transparency: Evidence from Russian administrative data. *Journal of Financial Economics*, 117(1), 139–164. <https://doi.org/10.1016/j.jfineco.2015.03.005>
- Brambilla, I., Lederman, D., & Porto, G. (2012). Exports, export destinations, and skills. *American Economic Review*, 102(7), 3406–3438. <https://doi.org/10.1257/aer.102.7.3406>
- Brambilla, I., & Porto, G. G. (2016). High-income export destinations, quality, and wages. *Journal of International Economics*, 98, 21–35. <https://doi.org/10.1016/j.jinteco.2015.09.004>
- Canedo, A. P. (2018). Analyzing multidimensional poverty estimates in Mexico from an ethnic perspective: A policy tool for bridging the indigenous gap. *Poverty & Public Policy*, 10(4), 543–563. <https://doi.org/10.1002/pop4.228>
- Carballo-Penela, A., & Castromán-Diz, J. L. (2015). Environmental policies for sustainable development: An analysis of the drivers of proactive environmental strategies in the service sector. *Business Strategy and the Environment*, 24(8), 802–818. <https://doi.org/10.1002/bse.1847>
- Casady, C. B., & Peci, F. (2021). The institutional challenges of public-private partnerships (PPPs) in transition economies: Lessons from Kosovo. *Economic Research-Ekonomska Istraživanja*, 34(1), 1949–1965. <https://doi.org/10.1080/1331677X.2020.1863829>

- Castellanos, I. V., & Rahut, D. B. (2012). Household welfare, extreme and chronic poverty between indigenous groups of Bolivia. *Poverty & Public Policy*, 4(2), 1–28. <https://doi.org/10.1002/pop4.9>
- Carvalho, A. (2018). Energy efficiency in transition economies: A stochastic frontier approach. *Economics of Transition*, 26(3), 553–578. <https://doi.org/10.1111/ecot.12153>
- Chen, S., Song, H., & Wu, C. (2021). Human capital investment and firms' industrial emissions: Evidence and mechanism. *Journal of Economic Behavior & Organization*, 182, 162–184. <https://doi.org/10.1016/j.jebo.2021.01.003>
- Christmann, P., & Taylor, G. (2001). Globalization and the environment: Determinants of firm self-regulation in China. *Journal of International Business Studies*, 32(3), 439–458. <https://doi.org/10.1057/palgrave.jibs.8490964>
- Cieřlik, A., & Gurshev, O. (2023). Trade policies in Central Asia after EAEU enlargement and after Russian WTO accession: Regionalism and integration into the world economy revisited. *Eurasian Geography and Economics*, 64(1), 1–23. <https://doi.org/10.1080/15387216.2022.2162098>
- Cieřlik, A., & Michałek, J. J. (2018). Firm-level determinants of direct and indirect exports: Empirical evidence for CEE and MENA countries. *Economic Research-Ekonomska Istraživanja*, 31(1), 982–996. <https://doi.org/10.1080/1331677X.2018.1436452>
- Cieřlik, A., Michałek, J. J., & Michałek, A. (2014). The influence of firm characteristics and export performance in Central and Eastern Europe: Comparisons of Visegrad, Baltic, and Caucasus States. *Entrepreneurial Business and Economics Review*, 2(1), 7–18. <https://doi.org/10.15678/EBER.2014.020102>
- Cieřlik, A., Michałek, J. J., & Nasadiuk, I. (2015). Determinants of export performance of Ukrainian firms. *Equilibrium. Quarterly Journal of Economics and Economic Policy*, 10(1), 91–103. <https://doi.org/10.12775/EQUIL.2015.026>

- Cieřlik, A., Michalek, J. J., & Szczygielski, K. (2024). Direct versus indirect exports in post-communist Europe and Central Asia: The role of innovation activities and internationalization. *Eastern European Economics*, 62(1), 1–17. <https://doi.org/10.1080/00128775.2022.2164510>
- Clarke, D., & Matta, B. (2018). Practical considerations for questionable IVs. *The Stata Journal*, 18(3), 663–691. <https://doi.org/10.1177/1536867X1801800308>
- Cojocaru, L., Falaris, E. M., Hoffman, S. D., & Miller, J. B. (2016). Financial system development and economic growth in transition economies: New empirical evidence from the CEE and CIS countries. *Emerging Markets Finance and Trade*, 52(1), 223–236. <https://doi.org/10.1080/1540496X.2015.1013828>
- Conley, T. G., Hansen, C. B., & Rossi, P. E. (2012). Plausibly exogenous. *Review of Economics and Statistics*, 94(1), 260–272. https://doi.org/10.1162/REST_a_00139
- Crinò, R., & Epifani, P. (2012). Productivity, quality, and export behaviour. *The Economic Journal*, 122(563), 1206–1243. <https://doi.org/10.1111/j.1468-0297.2012.02529.x>
- Curzi, D., & Olper, A. (2012). Export behavior of Italian food firms: Does product quality matter? *Food Policy*, 37(5), 493–503. <https://doi.org/10.1016/j.foodpol.2012.05.004>
- Damman, S., Eide, W. B., & Kuhnlein, H. V. (2008). Indigenous peoples' nutrition transition in a right to food perspective. *Food Policy*, 33(2), 135–155. <https://doi.org/10.1016/j.foodpol.2007.10.003>
- Danilova, N. K., Khokholova, I. S., Pestereva, K. A., Tomaska, A. G., & Vasileva, A. P. (2022). Urban population identities and symbolic value: Cities in the Sakha Republic (Yakutia). *Sibirica*, 21(3), 97–127. <https://doi.org/10.3167/sib.2022.210306>
- Das, S., Roberts, M. J., & Tybout, J. R. (2007). Market entry costs, producer heterogeneity, and export dynamics. *Econometrica*, 75(3), 837–873. <https://doi.org/10.1111/j.1468-0262.2007.00769.x>

- Debbarma, J., Choi, Y., Yang, F., & Lee, H. (2022). Exports as a new paradigm to connect business and information technology for sustainable development. *Journal of Innovation & Knowledge*, 7(4), 100233. <https://doi.org/10.1016/j.jik.2022.100233>
- Defever, F., & Riaño, A. (2022). The twin peaks of the export intensity distribution. *Journal of the European Economic Association*, 20(3), 1347–1394. <https://doi.org/10.1093/jeea/jvac006>
- Delmas, M. A., & Burbano, V. C. (2011). The drivers of greenwashing. *California Management Review*, 54(1), 64–87. <https://doi.org/10.1525/cmr.2011.54.1.64>
- Ding, Z. (2021). Firm heterogeneity, variable markups, and multinational production: A review from trade policy perspective. *Journal of Economic Surveys*, 35(5), 1365–1396. <https://doi.org/10.1111/joes.12486>
- Dong, G., Kokko, A., & Zhou, H. (2022). Innovation and export performance of emerging market enterprises: The roles of state and foreign ownership in China. *International Business Review*, 31(6), 102025. <https://doi.org/10.1016/j.ibusrev.2022.102025>
- Duvanova, D. (2007). Bureaucratic corruption and collective action: Business associations in the postcommunist transition. *Comparative Politics*, 39(4), 441–461. <https://doi.org/10.5129/001041507X12911361134297>
- Estrin, S., Meyer, K. E., Wright, M., & Foliano, F. (2008). Export propensity and intensity of subsidiaries in emerging economies. *International Business Review*, 17(5), 574–586. <https://doi.org/10.1016/j.ibusrev.2008.04.002>
- Etchart, L. (2017). The role of indigenous peoples in combating climate change. *Palgrave Communications*, 3(1), 1–4. <https://doi.org/10.1057/palcomms.2017.85>
- Evengård, B., Berner, J., Brubaker, M., Mulvad, G., & Revich, B. (2011). Climate change and water security with a focus on the Arctic. *Global Health Action*, 4(1), 8449. <https://doi.org/10.3402/gha.v4i0.8449>

FAO, IFAD, UNICEF, WFP, & WHO. (2023). *The state of food security and nutrition in the world 2023: Urbanization, agrifood systems transformation and healthy diets across the rural–urban continuum*. FAO.

Faria, S., Rebelo, J., & Gouveia, S. (2020). Firms' export performance: A fractional econometric approach. *Journal of Business Economics and Management*, 21(2), 521–542. <https://doi.org/10.3846/jbem.2020.11934>

Fernando, Y., & Hor, W. L. (2017). Impacts of energy management practices on energy efficiency and carbon emissions reduction: A survey of Malaysian manufacturing firms. *Resources, Conservation and Recycling*, 126, 62–73. <https://doi.org/10.1016/j.resconrec.2017.07.023>

Fertő, I. (2008). The evolution of agri-food trade patterns in Central European countries. *Post-Communist Economies*, 20(1), 1–10. <https://doi.org/10.1080/14631370701865680>

Ford, J. D., Stephenson, E., Cunsolo Willox, A., Edge, V., Farahbakhsh, K., Furgal, C., ... & Sherman, M. (2016). Community-based adaptation research in the Canadian Arctic. *Wiley Interdisciplinary Reviews: Climate Change*, 7(2), 175–191. <https://doi.org/10.1002/wcc.376>

Forslid, R., Okubo, T., & Ulltveit-Moe, K. H. (2018). Why are firms that export cleaner? International trade, abatement, and environmental emissions. *Journal of Environmental Economics and Management*, 91, 166–183. <https://doi.org/10.1016/j.jeem.2018.07.003>

Friesenbichler, K. S. (2020). Does EU accession affect domestic market structures and firm-level productivity? *Empirica*, 47(2), 343–364. <https://doi.org/10.1007/s10663-018-9423-9>

García Molinos, J., Yamada, D., Parilova, V., Khasanov, S., Gabyshev, V., Makarov, A., ... & Gavrilova, T. (2024). Future climate and land use changes challenge current dependencies on wild food harvesting by rural indigenous communities. *PNAS Nexus*, 3(12), pgae523. <https://doi.org/10.1093/pnasnexus/pgae523>

Gashi, P., Hashi, I., & Pugh, G. (2014). Export behaviour of SMEs in transition countries. *Small Business Economics*, 42(2), 407–435. <https://doi.org/10.1007/s11187-013-9487-7>

- Gavrileva, T. N., Naberezhnaya, A., & Nikiforov, F. (2022). Poverty in the Russian Arctic: The case of the Republic of Sakha (Yakutia). *Forum for Social Economics*, 51(4), 377–393. <https://doi.org/10.1080/07360932.2022.2036827>
- Gavrileva, T. N., Tomaska, A. G., Naberezhnaya, A. T., & Bochoeva, R. I. (2020). Multidimensional poverty on the basis of sociological survey of the population in the Republic of Sakha (Yakutia). *Region: Economics and Sociology*, 107(3), 135–164. <https://doi.org/10.15372/REG20200307>
- Gkypali, A., Rafailidis, A., & Tsekouras, K. (2015). Innovation and export performance: Do young and mature innovative firms differ? *Eurasian Business Review*, 5(4), 397–415. <https://doi.org/10.1007/s40821-015-0030-4>
- Gilio-Whitaker, D. (2019). As long as grass grows: The Indigenous fight for environmental justice, from colonization to Standing Rock. *Beacon Press*.
- Goedhuys, M., & Sleuwaegen, L. (2013). The impact of international standards certification on the performance of firms in less developed countries. *World Development*, 47, 87–101. <https://doi.org/10.1016/j.worlddev.2013.02.014>
- Goedhuys, M., & Sleuwaegen, L. (2016). International standards certification, institutional voids and exports from developing country firms. *International Business Review*, 25(6), 1344–1355. <https://doi.org/10.1016/j.ibusrev.2016.04.006>
- Golovko, A., & Sahin, H. (2021). Analysis of international trade integration of Eurasian countries: Gravity model approach. *European Economic Review*, 11(3), 519–548. <https://doi.org/10.1007/s40822-021-00168-3>
- Gorokhov, A. N., & Fedorov, A. N. (2018). Current trends in climate change in Yakutia. *Geography and Natural Resources*, 39(2), 153–161. <https://doi.org/10.1134/S187537281802010X>
- Gray, D. (1995). *Reforming the energy sector in transition economies: Selected experience and lessons* (Vol. 296). World Bank Publications.

Greene, W. H. (2017). *Econometric analysis* (8th ed.). Pearson.

Ha, V. T. C., Holmes, M. J., & Le, T. M. (2020). Firms and export performance: Does size matter? *Journal of Economic Studies*, 47(5), 985-999. <https://doi.org/10.1108/JES-12-2018-0451>

Haidar, J. I. (2012). Trade and productivity: Self-selection or learning-by-exporting in India. *Economic Modelling*, 29(5), 1766-1773. <https://doi.org/10.1016/j.econmod.2012.05.005>

Haider, S., Danish, M. S., & Sharma, R. (2019). Assessing energy efficiency of Indian paper industry and influencing factors: A slack-based firm-level analysis. *Energy Economics*, 81, 454-464.

He, L. Y., & Huang, G. (2021). How can export improve firms' energy efficiency? The role of innovation investment. *Structural Change and Economic Dynamics*, 59, 90-97.

Heckman, J. J. (1979). Sample selection bias as a specification error. *Econometrica*, 47(1), 153-161.

Hering, L., & Poncet, S. (2014). Environmental policy and exports: Evidence from Chinese cities. *Journal of Environmental Economics and Management*, 68(2), 296-318.

Imbruno, M., & Ketterer, T. D. (2018). Energy efficiency gains from importing intermediate inputs: Firm-level evidence from Indonesia. *Journal of Development Economics*, 135, 117-141.

International Labour Organization. (2019). *Implementing the ILO Indigenous and Tribal Peoples Convention No. 169: Towards an inclusive, sustainable and just future*. ILO.

Isaeva, A., & Salahodjaev, R. (2021). Correlates of life satisfaction inequality in Russia. *Applied Research in Quality of Life*, 16, 2251-2269.

Islam, F., & Carlsen, J. (2016). Indigenous communities, tourism development and extreme poverty alleviation in rural Bangladesh. *Tourism Economics*, 22(3), 645-654.

Ivanova, E., Maier, M., & Meyer, M. (2019). Associations in transition: The business of Russian civil society. *European Journal of International Management*, 13(5), 709-732.

- Kennard, A. (2020). The enemy of my enemy: When firms support climate change regulation. *International Organization*, 74(2), 187-221.
- Kim, D., Basu, C., Naidu, G. M., & Cavusgil, E. (2011). The innovativeness of born-globals and customer orientation: Learning from Indian born-globals. *Journal of Business Research*, 64(8), 879-886. <https://doi.org/10.1016/j.jbusres.2010.09.008>
- Kimura, F., & Kiyota, K. (2006). Exports, FDI, and productivity: Dynamic evidence from Japanese firms. *Review of World Economics*, 142, 695–719. <https://doi.org/10.1007/s10290-006-0089-1>
- Kirmayer, L. J., Dandeneau, S., Marshall, E., Phillips, M. K., & Williamson, K. J. (2011). Rethinking resilience from indigenous perspectives. *The Canadian Journal of Psychiatry*, 56(2), 84-91.
- Kneller, R., & Pisu, M. (2011). Barriers to exporting: What are they and who do they matter to? *The World Economy*, 34(6), 893-930.
- Kolahdooz, F., et al. (2015). Understanding the social determinants of health among Indigenous Canadians: Priorities for health promotion policies and actions. *Global Health Action*, 8(1), 27968.
- Krammer, S. M. S., Strange, R., & Lashitew, A. (2018). The export performance of emerging economy firms: The influence of firm capabilities and institutional environments. *International Business Review*, 27, 218–230. <https://doi.org/10.1016/j.ibusrev.2017.07.003>
- Kuhnlein, H., Erasmus, B., Creed-Kanashiro, H., Englberger, L., Okeke, C., Turner, N., ... & Bhattacharjee, L. (2006). Indigenous peoples' food systems for health: Finding interventions that work. *Public Health Nutrition*, 9(8), 1013-1019.
- Kunc, J., & Križan, F. (2018). Changing European retail landscapes: New trends and challenges. *Moravian Geographical Reports*, 26(3), 150-159. <https://doi.org/10.2478/mgr-2018-0012>
- Lai, H., Maskus, K. E., & Lei, Y. (2020). Intellectual property enforcement, exports, and productivity of heterogeneous firms in developing countries: Evidence from China. *European Economic Review*, 123, 103373. <https://doi.org/10.1016/j.euroecorev.2020.103373>

- Levinsohn, J., & Petrin, A. (2003). Estimating production functions using inputs to control for unobservables. *Review of Economic Studies*, 70(2), 317-341. <https://doi.org/10.1111/1467-937X.00246>
- Li, J., Vertinsky, I., & Zhang, H. (2013). The quality of domestic legal institutions and export performance. *Management International Review*, 53, 361–390. <https://doi.org/10.1007/s11575-012-0146-z>
- Li, Z., Ling, Z., & Xu, S. (2023). When firms talk, do they act? The impact of environmental strategies and actions on executive promotion in China. *China Economic Review*, 82, 102061.
- Libman, A., & Vinokurov, E. (2018). Autocracies and regional integration: The Eurasian case. *Post-Communist Economies*, 30(3), 334-364. <https://doi.org/10.1080/14631377.2018.1442057>
- Liljeblom, E., Maury, B., & Hörhammer, A. (2020). Complex state ownership, competition, and firm performance—Russian evidence. *International Journal of Emerging Markets*, 15(2), 189-221. <https://doi.org/10.1108/IJOEM-08-2017-0287>
- Mallick, S., & Marques, H. (2017). Export prices, selection into exporting and market size: Evidence from China and India. *International Business Review*, 26(6), 1034-1050. <https://doi.org/10.1016/j.ibusrev.2017.03.009>
- Masso, J., Rõigas, K., & Vahter, P. (2015). Foreign market experience, learning by hiring, and firm export performance. *Review of World Economics*, 151, 659-686. <https://doi.org/10.1007/s10290-015-0224-y>
- Nepal, R., Jamasb, T., & Tisdell, C. A. (2014). Market-related reforms and increased energy efficiency in transition countries: Empirical evidence. *Applied Economics*, 46(33), 4125–4136. <https://doi.org/10.1080/00036846.2014.931916>
- Neustroeva, A. B., & Samsonova, I. V. (2022). Problems of Indigenous Peoples of the North (Based on the Materials of the Republic of Sakha (Yakutia)). *Sotsiologicheskie issledovaniya*, 7, 88–96.

Norton-Smith, K. (2016). *Climate change and indigenous peoples: A synthesis of current impacts and experiences* (Vol. 944). United States Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Nwani, C., Effiong, E. L., Okere, K. I., & Iorember, P. T. (2024). Beyond the barrels: The impact of resource wealth on the energy-economy-climate targets in oil-rich economies. *Heliyon*, 10(3), e25345. <https://doi.org/10.1016/j.heliyon.2024.e25345>

Otrashchenko, V., Hartwell, C. A., & Popova, O. (2023). Energy efficiency, market competition, and quality certification: Lessons from Central Asia. *Energy Policy*, 177, 113539. <https://doi.org/10.1016/j.enpol.2023.113539>

Panikkar, B., & Lemmond, B. (2020). Being on land and sea in troubled times: Climate change and food sovereignty in Nunavut. *Land*, 9(12), 508. <https://doi.org/10.3390/land9120508>

Perkins, R., & Neumayer, E. (2009). Transnational linkages and the spillover of environment-efficiency into developing countries. *Global Environmental Change*, 19(3), 375–383. <https://doi.org/10.1016/j.gloenvcha.2009.03.002>

Pons, M., Bikfalvi, A., Llach, J., & Palcic, I. (2013). Exploring the impact of energy efficiency technologies on manufacturing firm performance. *Journal of Cleaner Production*, 52, 134–144. <https://doi.org/10.1016/j.jclepro.2013.02.025>

Prasad, M., & Mishra, T. (2017). Low-carbon growth for Indian iron and steel sector: Exploring the role of voluntary environmental compliance. *Energy Policy*, 100, 41–50. <https://doi.org/10.1016/j.enpol.2016.10.011>

Putniņš, T. J. (2013). Exporting by Latvian companies: Vitality, drivers of success, and challenges. *Baltic Journal of Economics*, 13(2), 5–35. <https://doi.org/10.1080/1406099X.2013.10840531>

Pyle, W. (2006). Resolutions, recoveries and relationships: The evolution of payment disputes in Central and Eastern Europe. *Journal of Comparative Economics*, 34(2), 317–337. <https://doi.org/10.1016/j.jce.2006.03.002>

- Qu, Y., Liu, Y., Nayak, R. R., & Li, M. (2015). Sustainable development of eco-industrial parks in China: Effects of managers' environmental awareness on the relationships between practice and performance. *Journal of Cleaner Production*, 87, 328–338. <https://doi.org/10.1016/j.jclepro.2014.10.015>
- Rahmanov, R. (2019). Financial constraints and export participation of SMEs in post-communist countries. *Acta Oeconomica*, 69(2), 289–319. <https://doi.org/10.1556/032.2019.69.2.7>
- Raygorodetsky, G. (2011). Why traditional knowledge holds the key to climate change: Climate change, culture & religions. *United Nations University*.
- Revich, B. A. (2008). Climate change alters human health in Russia. *Studies on Russian Economic Development*, 19(3), 311–317. <https://doi.org/10.1134/S1075700708030105>
- Roberts, M. J., & Tybout, J. R. (1997). The decision to export in Colombia: An empirical model of entry with sunk costs. *American Economic Review*, 87(4), 545–564.
- Roy, J., & Yasar, M. (2015). Energy efficiency and exporting: Evidence from firm-level data. *Energy Economics*, 52, 127–135. <https://doi.org/10.1016/j.eneco.2015.09.010>
- Rustam, A., Wang, Y., & Zameer, H. (2020). Environmental awareness, firm sustainability exposure and green consumption behaviors. *Journal of Cleaner Production*, 268, 122016. <https://doi.org/10.1016/j.jclepro.2020.122016>
- Sannikova, Y. M. (2018). Structural changes in management of traditional economy of North of Yakutia in 1992–1993. *Nauchnyi Dialog*, 9, 295–306.
- Stammler-Gossmann, A. (2024). Knowledge exchange in the Arctic environmental studies: Bridging science and the local community in dialogue. *Polar Science*, 41, 101103. <https://doi.org/10.1016/j.polar.2024.101103>
- Tabata, S. (2021). The contribution of natural resource producing sectors to the economic development of the Sakha Republic. *Sustainability*, 13(18), 10142. <https://doi.org/10.3390/su131810142>

Tai, L., & Yan, L. (2022). The impact of environmental regulation on foreign firms' exit: From the perspective of competition. *Environmental Science and Pollution Research*, 29(11), 15539–15550. <https://doi.org/10.1007/s11356-021-16848-1>

Townsend, J., Moola, F., & Craig, M. K. (2020). Indigenous Peoples are critical to the success of nature-based solutions to climate change. *Facets*, 5(1), 551–556. <https://doi.org/10.1139/facets-2020-0005>

Turner, N. J., & Clifton, H. (2009). “It's so different today”: Climate change and indigenous lifeways in British Columbia, Canada. *Global Environmental Change*, 19(2), 180–190. <https://doi.org/10.1016/j.gloenvcha.2008.11.004>

Shapiro, J. S., & Walker, R. (2018). Why is pollution from US manufacturing declining? The roles of environmental regulation, productivity, and trade. *American Economic Review*, 108(12), 3814–3854. <https://doi.org/10.1257/aer.20151272>

Sharma, C. (2018). Exporting, access of foreign technology, and firms' performance: Searching the link in Indian manufacturing. *Quarterly Review of Economics and Finance*, 68, 46–62. <https://doi.org/10.1016/j.qref.2017.11.015>

Shinkle, G. A., & Kriauciunas, A. P. (2010). Institutions, size and age in transition economies: Implications for export growth. *Journal of International Business Studies*, 41(2), 267–286. <https://doi.org/10.1057/jibs.2009.9>

Temouri, Y., Vogel, A., & Wagner, J. (2013). Self-selection into export markets by business services firms: Evidence from France, Germany and the United Kingdom. *Structural Change and Economic Dynamics*, 25, 146–158. <https://doi.org/10.1016/j.strueco.2012.02.004>

Vella, F. (1998). Estimating models with sample selection bias: A survey. *Journal of Human Resources*, 33(1), 127–169. <https://doi.org/10.2307/146317>

Vendrell-Herrero, F., Darko, C. K., Gomes, E., & Lehman, D. W. (2022). Home-market economic development as a moderator of the self-selection and learning-by-exporting effects. *Journal of International Business Studies*, 53(7), 1519–1535. <https://doi.org/10.1057/s41267-021-00481-8>

- Wagner, J. (2007). Exports and productivity: A survey of the evidence from firm-level data. *World Economy*, 30(1), 60–82. <https://doi.org/10.1111/j.1467-9701.2007.00872.x>
- Wilhelmsson, F., & Kozlov, K. (2007). Exports and productivity of Russian firms: In search of causality. *Economic Change and Restructuring*, 40(4), 361–385. <https://doi.org/10.1007/s10644-008-9038-4>
- Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data* (2nd ed.). MIT Press.
- World Bank. (2024). *Poverty, prosperity, and planet: 2024 report*. World Bank.
- World Meteorological Organization. (2024). *State of the global climate 2024*. WMO.
- Wu, F. (2021). Modern economic growth, culture, and subjective well-being: Evidence from Arctic Alaska. *Journal of Happiness Studies*, 22(6), 2621–2651. <https://doi.org/10.1007/s10902-020-00327-4>
- Wu, J., & Ma, Z. (2016). Export intensity and MNE customers' environmental requirements: Effects on local Chinese suppliers' environment strategies. *Journal of Business Ethics*, 135(2), 327–339. <https://doi.org/10.1007/s10551-014-2467-2>
- Xie, J., Abbass, K., & Li, D. (2024). Advancing eco-excellence: Integrating stakeholders' pressures, environmental awareness, and ethics for green innovation and performance. *Journal of Environmental Management*, 352, 120027. <https://doi.org/10.1016/j.jenvman.2024.120027>
- Xue, B., Zhang, Z., & Li, P. (2020). Corporate environmental performance, environmental management and firm risk. *Business Strategy and the Environment*, 29(3), 1074–1096. <https://doi.org/10.1002/bse.2418>
- Zamyatina, N. Y., & Kulchitsky, Y. V. (2024). Beyond normality: Features of the structure of economic activity in Arctic cities and settlements. *Economy of Region*, 20(2), 446–461. <https://doi.org/10.17059/ekon.reg.2024-2-1>

Zhang, D. (2022). Environmental regulation, green innovation, and export product quality: What is the role of greenwashing? *International Review of Financial Analysis*, 83, 102311. <https://doi.org/10.1016/j.irfa.2022.102311>

Zhang, S., Worrell, E., & Crijns-Graus, W. (2015). Evaluating co-benefits of energy efficiency and air pollution abatement in China's cement industry. *Applied Energy*, 147, 192–213. <https://doi.org/10.1016/j.apenergy.2015.02.081>

Zhu, J., & Chertow, M. R. (2017). Business strategy under institutional constraints: Evidence from China's energy efficiency regulations. *Ecological Economics*, 135, 10–21. <https://doi.org/10.1016/j.ecolecon.2016.12.017>

Ye, Z., Zhang, F., & Zhang, S. (2021). Export effect and influence mechanism of foreign ownership. *International Review of Economics and Finance*, 76, 258–276. <https://doi.org/10.1016/j.iref.2021.06.006>