AGRO-FOOD COMMON TRADE FRAMEWORK, REVIEW: INSIGHTS FROM MOUNTAIN FARMING CHAINS

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RESEARCH ARTICLE

Abstract
The research paper advocates for the utilization of the Tukey-Hanning window econometric model in the context of simulating agricultural and food exports, with a specific emphasis on models applied to mountainous regions in New Zealand, Romania, and South Korea. Analyzing data spanning the years 2002 to 2040, the models unveil the integration of these nations into the global agricultural value chain. The proposed economic model posits a unified export framework for three diverse world economies, characterized by distinct structures yet marked similarities in exports and mountainous topography.

Empirical evidence presented in the paper affirms that both tariff barriers and the presence of agricultural mountain areas exert a positive influence on export activities. The study further illustrates that the export policies governing the agricultural and food sectors, particularly those pertaining to mountainous regions, are macroeconomically shaped by factors such as most-favored-nation clauses, the multiplicity and specifications of agreements, the nature of tariff and non-tariff barriers, domestic export promotion initiatives, adherence to mountain development objectives, and the promotion of mountain products.

On a microeconomic scale, the determinants of exports encompass considerations such as farm management practices, support mechanisms for farmers, agricultural and food education with a specific focus on the consumption of mountain products, incentives conferred for mountain-related activities through compensatory measures, and other integrative factors impacting farmers. The ultimate objective and proposed solutions presented in the paper center around ensuring the sustainability of mountainous areas, with a view to providing healthier alternatives for future food production.

INTRODUCTION

The research reviews the paper *A Common Trade Framework – Support for Agricultural and Food Products. Models of New Zealand, South Korea, and Romania Mountains*, published by the same researchers, investigating the agricultural and food exports of Romania, South Korea, and New Zealand, with a specific emphasis on the vegetable sector. Noteworthy is the acknowledgment of the United Nations' designation of 2022 as the "International Year of Sustainable Mountain Development." The primary objective of this article is to propose solutions for enhancing the sustainability of the agricultural economy

through the promotion of mountain agriculture and food products. The selection of countries aligns with the author's research, considering the proportional alignment of economic dimensions and geographical features of mountainous regions.

The paper discloses that these three nations, integrated into the global value chain of agricultural and food exports, share similar trade and mountain policies (Zhang et al., 2022). The agricultural and food sectors in these countries evolve within the framework of their tariff barriers and agreements (World Bank – WITS, 2022a). South Korea's substantial economic progress, particularly in its agricultural sector, is attributed to the European Free Trade Agreement with European countries,

including Iceland, Liechtenstein, Norway, and Switzerland, since 2005. The presence of a most-favored-nation tariff clause for 67 agricultural group products further contributes to South Korea's positive impact on the global economy (WTO, 2022; Lee et al., 2021).

Despite its geographically isolated position, New Zealand has experienced significant economic growth since 1983, primarily through its agricultural agreement with Australia ANZCERTA and the application of a most-favored-nation tariff for three agricultural group products. New Zealand's consistent expansion has elevated it to the top position among tradable countries, solidifying its standing as a leading global exporter (WTO, 2022). Romania, transitioning from a centralized to a market-oriented society over the past three decades, benefited from a most-favored-nation clause in the final years of communism, facilitating a smooth transition to globalization. Various agricultural agreements with entities such as the European Commission, Central European Free Trade Agreement, European Free Trade Agreement, Turkey, and Israel have facilitated the export of diverse Romanian products. The sustained development of the mountain area in Romania, constituting approximately 37.9% of the total surface area, is instrumental in the region's distinctive approach (Rey, 2020).

These countries have recently developed their mountain areas, transforming land users into agricultural entrepreneurs, specifically mountain farmers. Regulatory frameworks in Romania, South Korea, and New Zealand have facilitated the organized development of mountain activities, even as these economies have shifted toward the second, tertiary, and quaternary sectors. Despite this shift, the agricultural and food exports continue to underpin the sustainability of these countries. Each nation exhibits strengths in key areas of agricultural and food exports, contributing to their competitive positions in the global market.

The paper elucidates that the mountain economies of New Zealand, South Korea, and Romania, particularly in the vegetable sector, could serve as models for similarly structured economies with developed mountain areas. These economies, reliant on upstream industries, demonstrate significant backward linkages connecting market demand with agricultural and food sectors. While the countries engage in agriculture and tourism as distinct sectors, the paper posits that the vegetal sector, particularly in mountain areas, is more suitable for these nations.

New Zealand's predominantly pastoral agriculture, emphasizing grazing wild flora, has positioned it as a leader in various agricultural products. The country's mountain economy has undergone substantial transformation over the past three decades, transitioning from marginalization to technological and global integration with government support. In South Korea, agriculture and food industries are closely tied to the export of agricultural enterprises, and the country's mountain policy exhibits a significant degree of sustainability through the "Development Project of Mountain Settlements." Romania's mountain economy, predominantly based on family farms and ruminant animal production, benefits from legal and applied support through numerous regulations, policies, and public-private funds.

The world's mountain areas have experienced significant transformations in socio-economic, technical, technological, and environmental aspects due to globalization, with the presented countries serving as illustrative examples. These mountain economies have evolved from rural to complex agro-silvo-pastoral structures, integrating elements from secondary, tertiary, and quaternary sectors. The global value-chain approach is theoretically considered, indicating a common export conjuncture of mountain products as a unifying point despite the diverse economic structures of the presented countries.

In conclusion, the hypothesis of the paper posits that the export conjuncture of agricultural and food products significantly develops within the context of the global value chain. The trade context of these products exhibits flexibility in alignment with macroeconomic development, and microeconomic sustainability emerges as a pivotal factor influencing global trade patterns.

MATERIAL AND METHOD

The research employs the Tukey-Hanning window methodology to replicate the conceptual framework articulated in the manuscript. In these instances, spectral simulation via econometric analysis has been employed to ascertain the frequency of prospective occurrences. The scholarly contribution encapsulates pertinent information concerning the export of agricultural and alimentary products, sourced

from the United Nations Conference on Trade and Development and the International Trade Center - Trade Map. Additionally, data pertaining to mountainous vegetable sectors have been sourced from Eurostat, alongside other references delineated within the manuscript, subsequently processed utilizing SPSS and Excel.

The core analytical underpinning of the study revolves around descriptive and predictive methodologies applied to the identified nations, with statistical analyses being extended to the entirety of Harmonized System (HS) codes for agricultural and alimentary products (HS 01-24). For the formulation of econometric models, UNCTAD data, derived from the Trade Map portal, has been simulated in SPSS through the expert modeler and spectral plots procedures. The resultant forecast models (see appendices: charts 1) have been calibrated through the Brown model for Korea (designated as model 1), the Holt model for New Zealand (designated as model 2), and the ARIMA model for Romania (designated as model 3). These forecast models are of the linear trend variety and do not exhibit seasonality, being tailored to the unique data characteristics of each country. The Brown model (Korea) presupposes the insignificance of inter-data differentials, while the Holt model (New Zealand) accommodates non-binding inter-value data. The ARIMA model, a comprehensive SPSS model, serves as the progenitor to the others and is characterized by autoregressive (AR), integration (I), and moving average (MA) components. Statistical fitting is accomplished based on stationary R-squared, dynamic R-squared, root mean squared error, mean absolute percentage error, maximum absolute percentage error, mean absolute error, maximum absolute error, and normalized Bayesian information criterion. These continuous models offer a holistic representation, rather than point-to-point evaluations. Autocorrelation function modeling is conducted at 5, 10, 15, and 50 percentiles.

The manuscript adopts a spectral analysis approach for select mountainous vegetable sectors (HS 06, 07, 08), proffering strategies to enhance export competitiveness for the nations under consideration. The chosen vegetable sector product groups are of particular interest due to the high export volumes exhibited by the studied countries, coupled with their perceived health benefits in the prevailing pandemic context. In instances necessitating a cohesive commercial framework for economically diverse nations, conjoined by the commonality of agricultural mountainous areas, the Tukey-Hanning window method is deployed for spectral simulation to establish a frequency periodogram for future event amplitudes (refer to appendices: charts 2) (Hearn and Metcalfe, 1995). The Tukey-Hanning window is derived from Tukey window analysis and represents a specific instance of a cosine-tapered ratio equal to or greater than 1. The Tukey-Hanning window equation model utilizes Tukeywin analysis, as expounded upon in the ensuing expression:

$$w(x) = \frac{1}{2}(1 + cos(\pi x/N)), |x| = 0,1, \ldots, N$$

where w(x) is the Tukey-Hanning window equation, x is a coordinate from the L - point linearly spaced vector ($cos(\pi x/N)$, which in Matlab is generated using linspace); N is the maximum of the chosen interval (Hearn and Metcalfe, 1995; MathWorks, 2022; Siemens, 2019). In the case of the paper, x represents the HS and N the years.

Due to the inherent imprecision of the dataset, an analytical approach involving the amalgamation of Hanning window analysis with the Tukey window has been adopted. This integration enhances the precision of data randomization, thereby facilitating more accurate measurements of both frequency and amplitude. The graphical representations within the manuscript illustrate the outcomes derived from the Tukey-Hanning window simulation applied to Harmonized System codes HS01-HS24 across South Korea, New Zealand, and Romania.

RESULTS AND DISCUSSIONS

The examination of export dynamics within the scrutinized nations delineates recent performances in the trade of agricultural and food sectors for New Zealand, South Korea, and Romania. The findings of this study pertain to the added value of exports in the agricultural and food domains, specifically targeting the mountainous economies of the aforementioned countries. Noteworthy outcomes emanate from the application of the Tukey-Hanning window analysis, providing both descriptive and predictive insights into the agricultural and food sectors, complemented by a periodogram detailing the pertinent mountain vegetable resources.

Review of the export conjecture

The export conjuncture analysis illuminates the evolving trade landscape of the selected countries, with a specific emphasis on the vegetable sector. Notably, New Zealand, South Korea, and Romania have demonstrated ascendant trajectories in recent years, with some trade conjunctures exhibiting improvement during the pandemic, thereby enhancing the global export standings of these nations. According to World Bank – WITS (2022b), export indicators have been notably favorable for New Zealand, South Korea, and Romania. The analyzed countries exhibit a propensity to impose fewer taxes on exports, fostering a trade environment where exports supersede imports (Kook and Choi, 2022; Shin and Hur, 2022). Table 1 underscores the growth patterns in the economic sectors of the mentioned countries, with the vegetable sector aligning itself with the overarching sectoral trends.

Comparative research discerns nuanced performances across diverse economic indicators. South Korea, for instance, exhibits a high index of export market penetration and a Herfindahl–Hirschman market concentration index. Romania, in the context of the vegetable sector, boasts the highest number of exports (US$ 1000), yet South Korea and New Zealand outshine in terms of effective value-added to the trade balance. Amidst the pandemic, South Korea solidifies its position in country growth (%) and export product share (%), while New Zealand and Romania primarily excel in the latter indicator. The revealed comparative advantage, a pivotal competitiveness metric, suggests elevated sustainability for vegetable exports from New Zealand, followed by Romania and South Korea.

Analyzing OECD data variations for the 2005-2015 period (see table 2), discernible increases in exports are noted for the examined countries. The conjuncture for agricultural and food exports unveils specific indicators reflecting the value-added contributions of each country's agricultural and food sectors. Notably, Romania exhibits substantial growth in the value-added of agricultural foreign exports, with a focus on the share of gross exports. South Korea excels in the value-added of exports of final products, while New Zealand exhibits prowess in the value-added share of gross exports and exports of intermediate products as a proportion of total gross exports. These developments suggest a shift towards foreign exports, accentuating the value-added aspect for foreign direct investments and investors in the analyzed nations.

Review of the econometric model

The outcomes concerning Harmonized System (HS) sectors 01-24, as depicted in appendices (charts 1), affirm the statistical validity of the Tukey-Hanning window equation model. The examination of agricultural and food exports within the HS 01-24 category, spanning the econometric model period (2002-2021) and the forecasting horizon (2022-2040), reveals a consistent linear increase in exports across the analyzed countries. Specifically, sectors HS 01-04, 07-08, 12, 16, 19, 21-23 exhibit linear growth, while HS 06 and HS 14 maintain their prevailing linear trajectories. Remarkably, notable instances of increased exports are observed, with New Zealand experiencing growth in HS 05, HS 09, HS 11, HS 17; South Korea in HS 13, HS 15, HS 18, HS 20, HS 24; and Romania in HS 10, HS 11, HS 13, HS 15, HS 18, HS 20, and HS 24. The competitive dynamics of subsectors such as animals, meat, aquatic products, dairy, honey, edible fruits and vegetables, oil seeds, oleaginous fruits, and beverages underscore the significance of evolving consumer preferences over the past two decades, with a discernible upward trend anticipated across the presented countries.

The findings corroborate a period marked by challenges in food security and safety over the last two decades, indicating persistent repercussions even in the next two decades albeit in a more subtle and diminished manner. The decline in agricultural and food exports intertwined with artisanal and entertainment pursuits underscores society's unwavering prioritization of the fundamental human necessity – sustenance. A singular instance of export reduction for New Zealand in HS 24 is attributed primarily to the burgeoning development of electronic cigarettes, whereas other cases exhibit a sustained linear progression.

The examination of sectors HS 06-08 echoes a statistically validated Tukey-Hanning window equation model. Periodogram analysis for the period 2002-2021 (appendices: charts 2), focusing on HS 06 (live trees and other plants) and HS 08 (edible fruit and nuts), elucidates substantial overperformance by South Korea and New Zealand in global exports, contrasting with Romania's comparatively modest performance. In the context of HS 07 (edible vegetables and certain roots and

tubers), the periodogram indicates that all analyzed countries actively participated in global exports. Factors contributing to this scenario include the Most Favored Nation (MFN) clause, Romania's loss of which in the 90s, consumer preferences favoring other European Union products (especially post-2007 integration), and the substantial emigration of the Romanian population to foreign countries. South Korea and New Zealand face fewer impediments in this regard, rendering their agricultural and food exports more competitive.

In the context of the Mountain European Union model, exemplified by Romania, special attention is accorded to business reporting in the mountainous regions, emphasizing production and services. Eurostat highlights key sectors crucial for the sustainability of agricultural and food trade, encompassing Agriculture - Meadows and Livestock (primary sector), Industry and Services (secondary and tertiary sectors), specifically Accommodation and food service activities, Arts, entertainment and recreation, and other service activities. Business demographics play a pivotal role in understanding entrepreneurship trends, employment levels, and overall economic development, as indicated by data encompassing active enterprises, establishment, survival rates, termination rates, start-up rates, and employment-occupancy.

Review of the mountain European Union model: Romania case

Within the primary economic sector, sustainable value chains pertaining to meadows, bovines, ovines, goats, pigs, and meat are critical. The numerical evolution of meadows in Romania, specifically in terms of the area cultivated/harvested/produced per 1000 ha, exhibited a negative trend from 2000 to 2020. The production values also experienced negative changes across all regions/macroregions, indicating the unsustainability of grasslands in certain territories. Projections for the period 2021-2028 anticipate a further negative trajectory due to the transformation of meadows into buildable areas. Similarly, the numerical evolution of bovine heads in Romania registered a negative trend from 1995 to 2021, with pronounced negative dynamics across all regions/macroregions. Forecasts for 2022-2028 predict a continued strong negative trend, indicative of the diminishing sustainability of the bovine sector in Romania. The extant data pertaining to goat herds in Romania indicates a

robust positive numerical evolution in head count from 1995 to 2021. In contrast to the cattle segment, production values witnessed positive changes across all regions/macroregions during this period. Romania exhibited a noteworthy increase of +10.69%, with prominent positive dynamics observed in North-West (+59.60%), Center (+114.09%), North-East (+289.41%), South-East (+198.35%), South - Muntenia (+85.47%), Bucharest - Ilfov (-25.86%), South-West Oltenia (+56.38%), and West (+35.29%). Statistical analyses underscore the sustainability of goat herds in Romania, especially in the North-West, Central, North-East, and South-East regions, which are conducive to the development of agribusiness in these territories. Forecasts for 2022-2028 anticipate a moderate positive trend, indicating sustained efficiency.

Conversely, the numerical evolution of ovine flocks in Romania exhibited negative dynamics from 1995 to 2021. Negative changes in production values were observed for most regions/macroregions, with Romania experiencing a decline of -3.19%. Notable exceptions include positive dynamics in North-West (+37.68%), Center (+22.67%), and West (+33.58%). While ovine herds in Romania demonstrate a moderately sustainable situation in specific regions, the overall forecast for 2022-2028 indicates a moderate negative trend, attributing this to the depreciation of livestock assets.

The numerical evolution of pig herds in Romania from 1995 to 2021 portrayed negative dynamics, with declines across all regions/macroregions. Romania witnessed a substantial reduction of -54.52%, along with notable contractions in North-West (-48.26%), Center (-59.49%), North-East (-54.23%), South-East (-56.27%), South - Muntenia (-72.24%), South-West Oltenia (-42.08%), and West (-31.00%). Statistical analyses affirm the pronounced negative dynamics of pig herds in Romania, rendering the situation unsustainable for agribusiness development in these territories. The forecast for 2022-2028 indicates a strongly negative trend, emphasizing the diminished efficiency of this sector.

Analysis of meat production in Romania spanning 1999-2021/2020 reveals negative dynamics for cattle, pigs, sheep, and goats, and positive dynamics for poultry. Production values exhibit substantial negative changes for bovine (-76.34%), pigs (-47.80%), and ovine/goats (-87.53%). Poultry meat

production, conversely, experienced a robust positive evolution of +77.60%. Statistical values highlight the overall negative dynamics of the meat sector in Romania, with sustainability concerns across various livestock categories. The forecast for 2021-2025 anticipates a strongly negative trend, underlining the sector's declining efficiency.

During the analyzed period, the mountain business environment in Romania's secondary, tertiary, and quaternary sectors demonstrated consistent growth, occasionally at the expense of the primary sector. Addressing the paramount issue of food provision, public and private governance should strategically align the development of the primary sector with the broader economic landscape. The dynamic analysis encompasses Romania and its macroregions, highlighting the evolving nature of the business environment.

Statistical assessments for the Accommodation and food service activities sectors reveal increasing values for mean and median, accompanied by fluctuating trends in other indicators. Despite sporadic negative values, the overall depiction signifies a positive business situation for these sectors in the mountainous areas of Romania. Harmonization statistics for the forecast period 2030 present relevant values, emphasizing the sector's development and potential.

The comprehensive analyses contribute to our understanding of the evolving agricultural and livestock sectors in Romania's mountainous regions, fostering insights into sustainability, efficiency, and potential future trends. The statistical data pertaining to the sectors encompassing Art, entertainment, and recreation, along with other activities dedicated to services, exhibits ascending values for mean and median, with occasional antagonistic fluctuations in other statistical indicators. The presented values, including mean, standard error, median, standard deviation, skewness, kurtosis, variance, minimum, maximum, and percentiles, underscore the positive development of these sectors in the mountainous regions of Romania concerning the population of active enterprises. Despite occasional negative values, the overall entrepreneurial landscape in the mountainous areas is favorable. Forecast harmonization statistics indicate relevant values, pointing towards sustained growth until 2030.

The central trends of the sectors, presented as a sustainable production development model for the export of mountain and agricultural food products, reveal considerable growth in the population of active enterprises in mountainous Romania from 2008 to 2019. Symmetric distributions and low kurtosis standard error suggest a stabilizing business environment during the analyzed period. Forecasts for these sectors in Romania's mountainous regions indicate continuous growth until 2030, showcasing sustainability at national, macro-regional, regional, and county levels.

The substantial weight of active mountain enterprises in Romania within the total European population of active mountain enterprises prompts the consideration of viable strategies for added value and sustainable development. Solutions involve identifying profitable businesses and products for both domestic and international markets, with an emphasis on processed exports. Romania's reindustrialization, particularly in sectors like agri-food, wood industry, textiles, biotechnology, medicine, religious tourism, and ICT, is crucial for successful development. Sustainable development in the mountain area hinges on the high quality of food and agricultural exports, aligning with common frameworks among mountainous and European countries.

Review of the mountain products trade common framework: New Zealand, South Korea and Romania

The export common framework proposed in the paper for agricultural and food exports entails sharing best practices among the analyzed countries, namely New Zealand, South Korea, and Romania. Drawing on Shakya et al.'s (2019) perspective, this common framework involves the co-integration of the entire value chain, encompassing local development, national regions evolution, national progress, regional improvement, and global expansion. It aims to develop added-value chains sustainably from local to global levels.

Implications for theory, readers, business, and economic practice are addressed in the paper. The trade theory posits that exports of agricultural and food products share a common framework, especially for mountainous countries, with the export conjuncture theory offering improvements through the validated model. Readers gain insights into the value chain of agricultural and food exports from mountainous countries, aiding informed consumption and business decisions. The

business environment stands to benefit from investing in the most developed and profitable agricultural and food areas, replicating successful trade patterns observed in New Zealand, South Korea, and Romania. In terms of economic practice, mountain farming administration emerges as a sustainable core for the agricultural and food sectors, with effective integration into local, regional, and global value-chain patterns presented in the paper.

CONCLUSIONS

The study establishes the viability of employing the Tukey-Hanning window econometric model for the analysis of agricultural and food sectors, specifically in the context of mountain area development. Econometric modeling of descriptive statistics and forecasting analyses for agricultural and food products, particularly those originating from mountainous regions, can be effectively executed through the utilization of Brown, Holt, and ARIMA models. The empirical analyses conducted serve to validate the assumptions posited in the paper.

A comprehensive qualitative examination of both the existing literature and the paper underscores that achieving sustainable development and ensuring the sustainability of the three examined mountain economies necessitate the implementation of a research-innovation system tailored to the specific realities of the regions. This involves the adoption of distinctive modes of association and cooperatives. Proposals for value concentration solutions in the mountain area advocate for the establishment of bio-eco-clusters, fostering the development of niche mountain products and local brands. These endeavors are strategically directed at consumers who prioritize quality over quantity.

Concerning mountain agricultural policies, it is imperative for the governments of New Zealand, South Korea, and Romania to direct their focus towards eco-systemic considerations. These include climate change, water supply management, land conversion for mountain agriculture, soil health, and pollution eradication, with a particular emphasis on nutrients and pesticides. The strategic implementation of agricultural science plans, emphasizing the triad of research, development, and innovation, along with the formulation of mountain development technological plans, is recommended.

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