

Export competitiveness of Egyptian potatoes under global market dynamics: An econometric assessment

Sally I. A. Elawady

Department of Economics, College of Business and Economics
Qassim University, Saudi Arabia

Keywords

agricultural competitiveness; determinants of trade; Egypt export growth; gravity model; Potato exports

Abstract

Agricultural exports serve as critical drivers of economic growth by generating foreign currency earnings, stimulating employment creation, facilitating the adoption of advanced production technologies, and enhancing the overall competitiveness of the agricultural sector. Egypt's potato exports recorded a robust average annual growth rate of 11.9% during the period 2000–2024, representing approximately 5% of the total value of the country's agricultural exports. This remarkable performance raises an important research question regarding the principal determinants underpinning the growth trajectory of Egyptian potato exports.

The present study seeks to examine the standing of Egyptian potato exports within key destination markets, to identify the principal countries competing with Egypt in global potato trade, and to empirically investigate the determinants of such export flows. Employing an augmented gravity model, the empirical results reveal that three variables exert the most statistically significant influence on Egyptian potato export performance: the bilateral exchange rate, the population of the importing country, and the physical distance between Cairo and the importers' capitals. While the GDP of Egypt and its trading partners, together with economic development differentials, also demonstrate significance, their explanatory weight is comparatively lower. The aggregate size of Egypt's specific export market for potatoes is likewise found to be of secondary importance in explaining bilateral trade flows.

Introduction

Agricultural exports occupy a central position in Egypt's economic development agenda. Beyond their contribution to foreign exchange earnings, they generate sustainable employment, foster the diffusion of advanced agronomic technologies, and reinforce the competitive standing of the agricultural sector in international markets. Given that agricultural exports constitute approximately 14.6% of Egypt's total exports during the period 2000–2024, their promotion represents a strategic imperative – particularly in addressing the persistent trade balance deficit and advancing broader economic development objectives. In this context, Egypt's Agricultural Sustainable Development Strategy 2030 (ASDS) devotes considerable attention to bolstering the international competitiveness of agricultural commodities (MALR, 2009).

Egypt's agricultural exports have exhibited strong and sustained growth over the study period, expanding from USD 0.47 billion in 2000 to approximately USD 8.8 billion in 2024, equivalent to an average annual increase exceeding 12.5%. Among the key export commodities driving this growth are potatoes, oranges, onions, cotton lint, rice, grapes, green beans, and strawberries (FAOSTAT, 2026). Egypt's global reputation as a producer and exporter of potatoes is well established; the surplus output

has found lucrative and well-entrenched markets internationally, yielding substantial foreign exchange inflows and contributing positively to economic development.

Despite this strong export performance, Egyptian potato exports are confronting intensifying international competition, rendering it imperative to understand and strengthen competitive positioning in world markets. The determinants of export growth encompass both supply-side factors, including production costs, agronomic practices, and climatic conditions—and demand-side marketing variables that shape export flows. Among the latter, key factors influencing export volumes are hypothesized to include gross domestic product (GDP), per capita gross national income (GNI), economic development differentials, bilateral geographic distance, importer-side market size, bilateral exchange rates, and the importing country's population.

These considerations give rise to the central research question of this study: What are the most significant determinants of the growth of Egypt's potato exports? Accordingly, the study pursues three primary objectives: (i) to analyze the evolution and distribution of Egyptian potato exports across key destination markets; (ii) to identify the principal countries competing with Egypt in global potato trade; and (iii) to empirically investigate the determinants of such exports through application of the augmented gravity model, thereby generating evidence-based insights to inform export promotion strategies.

The remainder of this paper is structured as follows. Section 2 presents a review of the relevant theoretical and empirical literature. Section 3 describes the methodological framework, including data sources and the specification of the gravity model. Section 4 presents and discusses the empirical findings. Section 5 concludes with policy implications and recommendations.

Literature Review

Review of Previous Studies

National (Egyptian) Studies

Egyptian potato exports have attracted considerable attention in the agricultural economics literature due to their importance as one of Egypt's leading agricultural export commodities. Previous studies have focused on export competitiveness, market performance, determinants of export growth, and opportunities for expanding Egypt's presence in international potato markets.

Most recently, Aliou et al. (2024) concluded that increasing production capacity and improving marketing efficiency are among the most important factors for strengthening the international competitiveness of Egyptian potato exports and sustaining their long-term growth.

Tameem et al. (2024) analyzed the competitiveness of Egyptian potato exports using competitiveness indicators and the Policy Analysis Matrix (PAM). The study confirmed Egypt's strong comparative advantage in potato exports and highlighted the importance of improving marketing efficiency, export quality, packaging, grading systems, and market diversification to strengthen Egypt's position in international potato markets.

Similarly, Kassem, Hassan, and Tantawy (2024) assessed the potential for enhancing the competitiveness of Egyptian potato exports using indicators such as Revealed Comparative Advantage (RCA), market share, market penetration, and export strength. Their findings showed that the Russian Federation, Greece, and Lebanon account for a substantial share of Egyptian potato exports, while Egyptian potatoes enjoy a strong comparative and competitive advantage in global markets. The study also identified export prices, competitors' prices, and global potato import demand as key determinants of export performance, recommending stronger export-oriented production policies, compliance with international quality standards, market diversification, and enhanced international marketing efforts.

Several studies published in 2023 further examined different dimensions of Egyptian potato export performance. Fakhry and Soliman (2023) analyzed the future prospects of the Egyptian potato sector

through an econometric assessment of domestic and international markets during 2008–2021. Their findings emphasized the importance of improving production efficiency, strengthening export-oriented policies, and expanding market access to sustain export growth.

El-Banna et al. (2023) investigated the factors affecting Egyptian potato exports in major foreign markets and found that export performance is significantly influenced by market demand, export prices, exchange rate fluctuations, and Egypt's competitive position in destination markets. The study highlighted the need to improve export efficiency, diversify export destinations, and strengthen international marketing strategies.

Emam (2023) examined the geographical distribution and competitiveness of Egyptian potato exports, revealing that the Russian Federation, Greece, Lebanon, the United Arab Emirates, Italy, and Germany absorb the largest share of exports. The study confirmed the existence of a strong revealed comparative advantage and emphasized the importance of market diversification, quality improvement, and targeting higher-value markets.

Dabbous (2023) highlighted the substantial contribution of potato exports to Egypt's agricultural export revenues and identified significant opportunities for increasing export volumes through improvements in supply chain management and greater cost efficiency.

Gad et al. (2023) reported that Egypt accounts for approximately 4–5% of global potato exports, identifying major European exporters as Egypt's principal competitors while emphasizing the promising growth potential of Gulf Cooperation Council (GCC) markets as future export destinations.

El-Zenaty (2023) documented a continuous increase in Egyptian potato export volumes accompanied by price volatility and export concentration in a limited number of markets. The study recommended implementing price stabilization measures and expanding market diversification strategies to reduce export risks.

Earlier, El-Damrawy (2022) evaluated the competitive position of Egyptian potato exports in both traditional and non-traditional markets. The results indicated that Egypt is among the leading global potato exporters and possesses substantial export potential due to its comparative and price advantages. The study recommended expanding into new markets while maintaining competitiveness in established export destinations.

Sherif et al. (2021) assessed the competitiveness of Egyptian potato exports using Revealed Comparative Advantage (RCA) indices and market share analysis. Their findings confirmed Egypt's position among the leading global potato exporters despite fluctuations resulting from increasing international competitive pressures, highlighting the resilience of the sector in global markets.

Overall, the literature indicates that the performance of Egyptian potato exports is shaped by a combination of competitiveness indicators, market demand conditions, price dynamics, exchange rate movements, production capacity, marketing efficiency, and market access factors. While previous studies have provided valuable insights into export competitiveness and market performance, relatively limited attention has been given to examining these determinants within an integrated augmented gravity-model framework. Therefore, the present study contributes to the literature by employing an augmented gravity model to identify the key economic drivers of Egyptian potato export flows and provide policy implications for enhancing Egypt's competitiveness in international agricultural markets.

International Studies

At the international level, several studies have examined the competitiveness of agricultural exports and the dynamics of global potato trade. The Organization for Economic Co-operation and Development (2022) highlighted the role of sustainable agricultural practices in mitigating the adverse effects of climate variability on agricultural exports and improving long-term competitiveness.

Similarly, the World Bank (2021) documented that disruptions caused by the COVID-19 pandemic negatively affected agricultural export supply chains, while greater market diversification enhanced export resilience and reduced vulnerability to external shocks.

Reardon et al. (2020) emphasized the importance of supply chain efficiency and integration into global value chains as key factors in improving export performance and strengthening international competitiveness.

Using panel data methods, Bojnec and Fertő (2019) identified productivity growth, trade openness, and institutional quality as significant determinants of agricultural export competitiveness, while highlighting the constraining effects of non-tariff barriers on market access.

Earlier, the Food and Agriculture Organization and International Trade Centre (2018) reported that European countries dominate global potato exports, whereas emerging exporters such as Egypt have gradually strengthened their position in international markets. The study further emphasized that logistical efficiency and compliance with phytosanitary standards are among the most important determinants of export competitiveness.

Critical Assessment of the Literature and Research Gap

The reviewed body of literature confirms the strategic importance of Egyptian potato exports and their growing competitiveness in global markets. Domestic studies have predominantly relied on traditional analytical tools, including RCA indices, market share analysis, and gravity models—while primarily emphasizing price competitiveness, production dynamics, and market distribution. International studies, by contrast, incorporate broader frameworks encompassing supply chain resilience, institutional quality, and climate change impacts, dimensions that remain insufficiently explored in the Egyptian context.

Notwithstanding the breadth of existing scholarships, several research gaps persist limited engagement with post-2020 global trade dynamics; insufficient integration of competitiveness and sustainability dimensions; absence of rigorous comparative international benchmarking; limited application of advanced econometric techniques and global value chain models; and inadequate attention to logistics and supply chain resilience. The present study addresses several of these gaps through application of the augmented gravity model over an extended time horizon encompassing 2000–2024.

Methodological Framework

Data Sources

The empirical analysis draws on annual data spanning the period 2000–2024, compiled from a range of official and international statistical sources, including: the Central Agency for Public Mobilization and Statistics (CAPMAS); the Egyptian Central Department of Agricultural Economics and Statistics; the United Nations Commodity Trade Statistics Database (UN COMTRADE); the Food and Agriculture Organization Statistical Database (FAOSTAT); the World Bank World Development Indicators; and the World Economic Outlook databases of the International Monetary Fund (IMF).

Research Methodology

This study employs an augmented gravity model to examine the determinants of Egyptian potato exports using balanced panel data covering the period 2000–2024. The analysis focuses on Egypt's potato exports to the principal destination markets, namely Italy, Greece, and United Kingdom. All variables were transformed into logarithmic form to facilitate elasticity interpretation and minimize heteroscedasticity problems.

To ensure the validity of the econometric specification, panel unit root tests were conducted using the Levin–Lin–Chu (LLC) and PP–Fisher Chi-square tests to examine the stationarity properties of the variables, with optimal lag lengths selected according to the Akaike Information Criterion (AIC).

Furthermore, panel data estimation techniques were evaluated through the Breusch–Pagan Lagrange Multiplier (LM) test and the Hausman specification test in order to determine the most appropriate estimation approach between the Fixed Effects (FE) and Random Effects (RE) models. The results supported the use of the Random Effects estimator; therefore, the augmented gravity model was estimated using the Random Effects panel data technique.

The model’s explanatory power and overall statistical significance were assessed using the adjusted coefficient of determination (Adjusted R²) and the F-statistic test.

Analytical Method: The Augmented Gravity Model

To identify the determinants of Egyptian potato export flows, this study applies an augmented gravity model. The gravity model of international trade has a well-established theoretical foundation and has been demonstrated to yield robust empirical results across a wide array of bilateral trade settings. Originally formulated by Tinbergen (1962) and Poyhonen (1963), the traditional gravity model posits that bilateral trade flows are positively related to the economic mass of the trading partners and inversely related to the physical distance between them – mirroring the structure of Newton's law of gravitation.

Helpman and Krugman (1985), as recognized by Frankel (1997), provided a formal theoretical rationale for this relationship by linking trade flows to country size under conditions of increasing returns to scale and imperfect competition. The role of distance in the model is interpreted through multiple economic channels: as a proxy for transportation costs, transaction costs, synchronization costs (particularly relevant for perishable commodities such as potatoes), and cultural distance, all of which impede bilateral trade. Bergstrand (1985) incorporated a formal role for shipping costs within an imperfect substitution framework.

The baseline gravity model is augmented in the present study to incorporate additional variables that capture demand-side and institutional dimensions of trade. The first specification is as follows:

$$\text{Log}(\text{VExp}_{t\text{ni}}) = \alpha + \beta_1 \text{log}(\text{GDP}_{t\text{n}}) + \beta_2 \text{log}(\text{GDP}_{t\text{i}}) + \beta_3 \text{log}(\text{GNIC}_{t\text{n}}) + \beta_4 \text{log}(\text{GNIC}_{t\text{i}}) + \beta_5 \text{log}(\text{D}_{t\text{n}})$$

where t denotes a specific year, n represents Egypt (the exporter), and i identifies the importing country partner (Italy, Greece, or the United Kingdom). The dependent variable VExp_{t_ni} represents the value of Egyptian potato exports to importer i in year t (USD).

The augmented specification, which serves as the primary estimation equation, extends this framework as follows:

$$\text{Log}(\text{Exp}_{t\text{ni}}) = \alpha + \beta_1 \text{log}(\text{GDP}_{t\text{n}}) + \beta_2 \text{log}(\text{GDP}_{t\text{i}}) + \beta_3 \text{EconDif}_{t\text{ni}} + \beta_4 \text{log}(\text{IMP}_{t\text{in}}) + \beta_5 \text{log}(\text{ER}_{t\text{ni}}) + \beta_6 \text{log}(\text{Pop}_{t\text{i}}) + \beta_7 \text{log}(\text{Dist}_{t\text{ni}})$$

Table 1 below provides precise variable definitions and their respective economic interpretations.

Variable Definitions and Expected Signs in the Augmented Gravity Model Table 1

| Variable | Definition & Economic Interpretatio | Expected Sign |
|----------|--|---------------|
| VExptni | Value of Egyptian potato exports to importer i in year t (USD) | Dependent |
| GDPtn | GDP of Egypt (proxy for supply/export capacity) | + (positive) |
| GDPti | GDP of trading partner i (proxy for economic market size) | + (positive) |
| GNICTn | Per capita GNI of Egypt (proxy for Egypt's development stage) | ± (ambiguous) |

| Variable | Definition & Economic Interpretatio | Expected Sign |
|------------|--|---------------|
| GNIcti | Per capita GNI of partner i (proxy for importer's income level) | + (positive) |
| EconDiftni | Absolute difference in per capita GNI between Egypt and importer i | + (positive) |
| IMPtin | Total potato imports by partner i from Egypt in year t (proxy for market size) | + (positive) |
| ERtni | Exchange rate: The value of the importing country's currency relative to the Egyptian pound. | - (negative) |
| Popti | Total population of importer i (proxy for physical market size) | + (positive) |
| Distni | Physical distance (km) from Cairo to capital of importer i | - (negative) |

Results and Discussion

Development of Egypt's Agricultural and Potato Exports (2000–2024)

The data presented in Table 2 reveal that agricultural exports constitute a significant and expanding component of Egypt's total export structure. Their share fluctuated between approximately 6% and 21% of total exports over the study period, while the absolute value increased markedly from USD 519 million in 2000 to approximately USD 8.8 billion in 2024, a trajectory reflecting substantial improvements in both production capacity and export competitiveness. Egypt's total exports grew at an average annual rate of approximately 9.8%, while agricultural exports outpaced this benchmark with a growth rate of 12.5% per annum, underscoring their growing structural importance.

Potato exports recorded consistent and notable growth, increasing from USD 27.4 million in 2000 to over USD 410 million in 2024, at an average annual growth rate of 11.9%. Their share within agricultural exports ranged from approximately 3% to 9%, with an overall average of around 5%–6%. Several periods, especially post-2010, witnessed sharp accelerations in export value, reflecting the combined effects of improved trade performance, favorable demand conditions in key destination markets, and export-oriented agricultural policy interventions.

Table 2. Growth of Egypt's Total Agricultural and Potato Exports (2000–2024)

| Year | Total Exports (M USD) | Agric. Exports (M USD) | Agric./Total (%) | Potatoes Exports (M USD) | Potatoes/Agric. (%) |
|------|-----------------------|------------------------|------------------|--------------------------|---------------------|
| 2000 | 4,710 | 519 | 11.0% | 27.4 | 5.28% |
| 2001 | 4,160 | 530 | 12.7% | 29.8 | 5.61% |
| 2002 | 4,683 | 671 | 14.3% | 42.6 | 6.35% |
| 2003 | 6,349 | 777 | 12.2% | 44.0 | 5.66% |
| 2004 | 7,694 | 1,104 | 14.3% | 67.2 | 6.09% |
| 2005 | 10,662 | 918 | 8.6% | 77.4 | 8.44% |
| 2006 | 13,755 | 855 | 6.2% | 65.4 | 7.64% |
| 2007 | 16,195 | 1,203 | 7.4% | 108.1 | 8.99% |
| 2008 | 26,335 | 2,091 | 7.9% | 176.1 | 8.42% |
| 2009 | 24,213 | 2,966 | 12.2% | 145.4 | 4.90% |

| Year | Total Exports (M USD) | Agric. Exports (M USD) | Agric./Total (%) | Potatoes Exports (M USD) | Potatoes/Agric. (%) |
|-------------|-----------------------|------------------------|------------------|--------------------------|---------------------|
| 2010 | 26,332 | 3,799 | 14.4% | 129.6 | 3.41% |
| 2011 | 31,582 | 4,249 | 13.5% | 250.7 | 5.90% |
| 2012 | 29,417 | 4,175 | 14.2% | 127.4 | 3.05% |
| 2013 | 28,779 | 3,919 | 13.6% | 205.9 | 5.25% |
| 2014 | 26,812 | 4,522 | 16.9% | 326.8 | 7.23% |
| 2015 | 21,859 | 4,641 | 21.2% | 232.9 | 5.02% |
| 2016 | 22,973 | 4,306 | 18.7% | 162.0 | 3.76% |
| 2017 | 26,434 | 5,204 | 19.7% | 272.7 | 5.24% |
| 2018 | 29,304 | 4,993 | 17.0% | 206.9 | 4.14% |
| 2019 | 30,505 | 5,073 | 16.6% | 266.2 | 5.25% |
| 2020 | 29,323 | 5,450.9 | 18.6% | 221.9 | 4.07% |
| 2021 | 43,637 | 5,120 | 11.7% | 200.1 | 3.91% |
| 2022 | 52,116 | 5,538.5 | 10.6% | 316.0 | 5.71% |
| 2023 | 42,553 | 7,000 | 16.4% | 396.5 | 5.66% |
| 2024 | 44,847 | 8,800 | 19.6% | 410.2 | 4.66% |
| Annual Avg. | 24,209 | 3,536.9 | — | 180.4 | — |
| Growth Rate | 9.8% | 12.5% | — | 11.9% | — |

Source: Compiled and calculated from CAPMAS (2024) and UN COMTRADE (2024).

Figure 1 – Growth of Egypt's Total Agricultural and Potato Exports (2000-2024)



Development of Potato Cultivated Area, Production, and Yield

Table 2 documents the evolution of the key supply-side indicators for Egypt's potato sector across the study period. The harvested area expanded from 178.6 thousand feddans in 2000 to 639.5 thousand feddans in 2024, yielding an average of 379.1 thousand feddans and an annual growth rate of 5.46%. This horizontal expansion reflects the increasing strategic importance of potatoes as an export-oriented crop within Egypt's agricultural production structure.

Production volumes grew correspondingly, rising from 1,769.9 thousand tons in 2000 to 8,082.3 thousand tons in 2024, with an average of 4,332.9 thousand tons and a compound annual growth rate of 6.53%. This growth is attributable to both the expansion in cultivated area and improvements in agronomic practices. By contrast, yield improvements – from 9.91 ton/feddan in 2000 to 12.64 ton/feddan in 2024 – were more modest, registering an average annual growth rate of only 1.02%, suggesting that productivity gains at the plot level have been relatively limited compared to area expansion.

The quantity of potato exports increased from 156.6 thousand tons in 2000 to 898.7 thousand tons in 2024, at an annual growth rate of 7.55%, reflecting strong integration into global markets. However, potato exports as a proportion of total production averaged approximately 11.12% across the study period, indicating that while Egypt's export orientation in potatoes is appreciable, the large majority of production continues to serve domestic consumption needs.

Table 3. Development of Egypt's Potato Production, Harvested Area, Yield, and Export Quantity (2000–2024)

| Year | Harvested Area ('000 feddan) | Production ('000 ton) | Yield (ton/feddan) | Export Qty ('000 ton) | Exports/Production (%) |
|------|------------------------------|-----------------------|--------------------|-----------------------|------------------------|
| 2000 | 178.6 | 1,769.9 | 9.91 | 156.6 | 8.85% |
| 2001 | 189.8 | 1,903.1 | 10.03 | 185.5 | 9.75% |
| 2002 | 196.6 | 1,985.3 | 10.10 | 229.4 | 11.55% |
| 2003 | 197.3 | 2,039.4 | 10.34 | 296.3 | 14.53% |
| 2004 | 248.1 | 2,546.6 | 10.27 | 381.5 | 14.98% |
| 2005 | 300.7 | 3,167.4 | 10.53 | 392.2 | 12.38% |
| 2006 | 220.2 | 2,312.8 | 10.50 | 367.1 | 15.87% |
| 2007 | 257.0 | 2,760.5 | 10.74 | 389.7 | 14.12% |
| 2008 | 327.4 | 3,567.1 | 10.89 | 397.9 | 11.16% |
| 2009 | 329.7 | 3,659.3 | 11.10 | 215.1 | 5.88% |
| 2010 | 334.6 | 3,643.2 | 10.89 | 298.6 | 8.19% |
| 2011 | 390.8 | 4,338.4 | 11.10 | 637.4 | 14.69% |
| 2012 | 421.9 | 4,758.0 | 11.28 | 263.0 | 5.53% |
| 2013 | 381.4 | 4,265.2 | 11.18 | 427.9 | 10.03% |
| 2014 | 409.5 | 4,611.1 | 11.26 | 684.7 | 14.85% |
| 2015 | 437.6 | 4,955.4 | 11.32 | 601.0 | 12.13% |
| 2016 | 376.8 | 4,113.4 | 10.92 | 473.0 | 11.50% |

| Year | Harvested Area ('000 feddan) | Production ('000 ton) | Yield (ton/feddan) | Export Qty ('000 ton) | Exports/Production (%) |
|-------------|------------------------------|-----------------------|--------------------|-----------------------|------------------------|
| 2017 | 415.0 | 4,841.0 | 11.66 | 671.3 | 13.87% |
| 2018 | 408.2 | 4,960.1 | 12.15 | 495.1 | 9.98% |
| 2019 | 422.8 | 5,200.6 | 12.30 | 684.7 | 13.17% |
| 2020 | 656.3 | 6,786.3 | 10.34 | 633.1 | 9.33% |
| 2021 | 502.8 | 6,273.9 | 12.48 | 581.3 | 9.27% |
| 2022 | 585.1 | 7,210.5 | 12.32 | 847.2 | 11.75% |
| 2023 | 649.3 | 8,572.5 | 13.20 | 836.0 | 9.75% |
| 2024 | 639.5 | 8,082.3 | 12.64 | 898.7 | 11.12% |
| Annual Avg. | 379.1 | 4,332.9 | 11.18 | 481.8 | 11.12% |
| Growth Rate | 5.46% | 6.53% | 1.02% | 7.55% | 1.01% |

Source: Compiled and calculated from UN COMTRADE (2025), MALR (2025), and FAOSTAT2025.

Principal Destination Markets for Egyptian Potato Exports

As evidenced in Table 4, Italy, Greece, and the United Kingdom collectively represent the three principal destination markets for Egyptian potato exports during the period 2000–2024. Italy ranks as the leading importer in terms of both volume and value, recording an average annual import quantity of approximately 25.2 thousand tons and an average value of approximately USD 67.5 million, with annual growth rates of 22.4% in quantity and 18.7% in value. These figures signal a strongly expanding and high-value market for Egyptian potatoes.

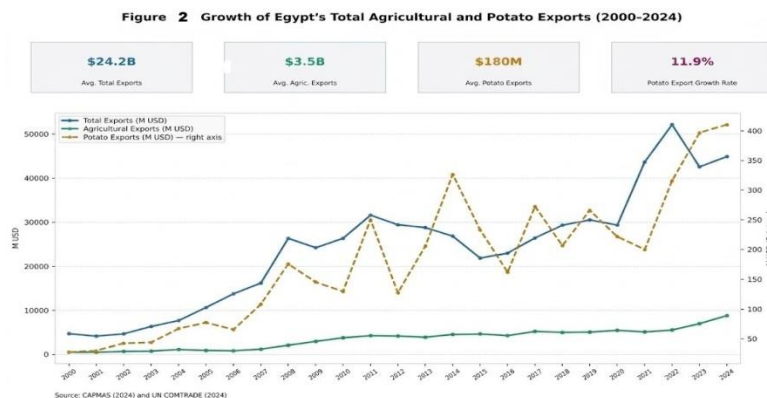
The United Kingdom occupies second position, with average annual imports of 22.4 thousand tons valued at approximately USD 62.8 million, registering moderate yet stable growth rates of 12.6% in quantity and 7.3% in value. Greece ranks third, with an average of 6.2 thousand tons at approximately USD 15.9 million per annum and growth rates of 16.2% and 13.0% in quantity and value, respectively. These findings collectively highlight the pivotal role of European markets, and Italy in particular, as the primary engines of Egypt's potato export performance.

Table 4. Egyptian Potato Exports to Principal Destination Markets (2000–2024)

| Year | Quantity (Tons) | | | Value (USD '000) | | |
|------|-----------------|--------|----------------|------------------|---------|----------------|
| | Italy | Greece | United Kingdom | Italy | Greece | United Kingdom |
| 2000 | 344 | 334 | 2,478 | 1,559 | 1,942 | 16,654 |
| 2001 | 1,891 | 7,534 | 49,511 | 29,899 | 12,191 | 47,157 |
| 2002 | 10,365 | 8,541 | 47,157 | 17,534 | 51,402 | 47,157 |
| 2003 | 8,581 | 11,697 | 70,453 | 7,367 | 54,624 | 70,453 |
| 2004 | 21,142 | 10,669 | 61,163 | 16,901 | 112,893 | 61,163 |
| 2005 | 19,830 | 15,541 | 76,295 | 23,006 | 83,249 | 76,295 |

| Year | Quantity (Tons) | | | Value (USD '000) | | |
|----------|-----------------|--------|----------------|------------------|---------|----------------|
| | Italy | Greece | United Kingdom | Italy | Greece | United Kingdom |
| 2006 | 15,705 | 17,362 | 97,337 | 19,595 | 88,423 | 97,337 |
| 2007 | 17,133 | 23,316 | 77,980 | 21,317 | 59,515 | 77,980 |
| 2008 | 17,556 | 18,740 | 83,871 | 21,306 | 77,062 | 83,871 |
| 2009 | 30,280 | 20,400 | 30,277 | 13,876 | 45,040 | 30,277 |
| 2010 | 21,656 | 20,819 | 64,043 | 18,833 | 60,539 | 64,043 |
| 2011 | 27,081 | 34,506 | 66,081 | 24,185 | 57,416 | 66,081 |
| 2012 | 26,339 | 25,242 | 53,467 | 18,965 | 54,332 | 53,467 |
| 2013 | 22,391 | 37,555 | 79,050 | 30,637 | 47,361 | 79,050 |
| 2014 | 23,612 | 34,075 | 76,449 | 26,339 | 55,327 | 76,449 |
| 2015 | 24,834 | 30,595 | 73,848 | 22,041 | 63,292 | 73,848 |
| 2016 | 26,055 | 27,115 | 71,248 | 17,743 | 71,258 | 71,248 |
| 2017 | 27,276 | 23,635 | 68,647 | 13,445 | 79,223 | 68,647 |
| 2018 | 17,980 | 10,273 | 24,590 | 4,910 | 43,037 | 24,590 |
| 2019 | 45,490 | 24,353 | 64,395 | 5,890 | 120,948 | 64,395 |
| 2020 | 27,509 | 15,062 | 42,962 | 5,271 | 78,462 | 42,962 |
| 2021 | 14,008 | 10,111 | 29,369 | 2,203 | 40,686 | 29,369 |
| 2022 | 32,804 | 17,685 | 47,413 | 1,061 | 87,946 | 47,413 |
| 2023 | 48,799 | 35,434 | 74,706 | 3,067 | 102,883 | 74,706 |
| 2024 | 59,000 | 42,575 | 93,278 | 12,726 | 129,264 | 93,278 |
| Avg. | 25,200 | 22,400 | 62,800 | 6,200 | 67,500 | 62,800 |
| Growth % | 22.4% | 12.6% | 7.3% | 16.2% | 18.7% | 13.0% |

Source: Compiled and calculated from UN COMTRADE (2025).



Principal Competing Countries in Global Potato Trade

Egyptian potato exports face heightened competitive pressure in international markets, particularly from France, the Netherlands, and Germany—the three dominant competing exporters identified in Table-5.

France occupies the leading position among competing exporters in terms of export quantity, with an average of approximately 2,047.8 thousand tons per annum and a robust annual growth rate of 6.34%. In terms of value, French potato exports averaged approximately USD 600 million, growing at 8.85% annually—a performance reflecting both scale and dynamism in market penetration.

The Netherlands ranks second in export quantity, with an average of 1,883.9 thousand tons, though at a more modest growth rate of 2.67%. However, the Netherlands commands the highest average export value among competitors, at approximately USD 759 million per annum, growing at 7.25%, suggesting a strong competitive advantage in premium and high-value market segments.

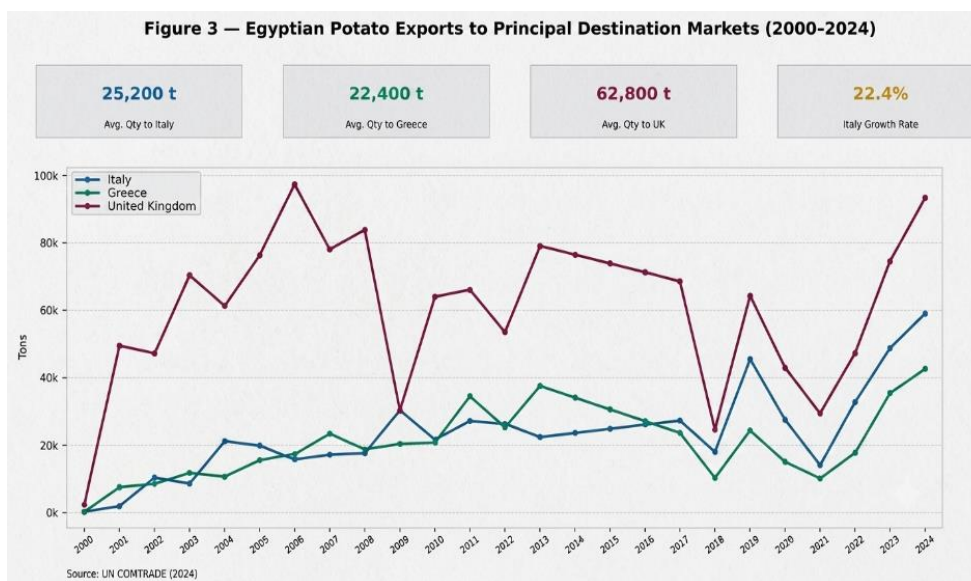
Germany ranks third, with average annual exports of 1,731.9 thousand tons and a growth rate of 2.85%, while its export value averaged USD 336.2 million with a growth rate of 8.33%. Overall, these data underscore the considerable competitive challenge posed to Egypt by major European exporters in both volume and value dimensions, requiring strategic attention to product quality, value addition, and market positioning.

Table 5. Potato Exports of Principal Competing Countries in Global Markets (2000–2024)

| Year | Quantity (Tons) | | | Value (USD '000) | | |
|------|-----------------|-------------|-----------|------------------|-------------|---------|
| | France | Netherlands | Germany | France | Netherlands | Germany |
| 2000 | 1,109,320 | 1,347,739 | 1,354,049 | 183,975 | 251,990 | 110,514 |
| 2001 | 1,113,815 | 1,551,547 | 1,485,974 | 207,998 | 595,853 | 112,985 |
| 2002 | 1,023,504 | 1,741,565 | 1,290,243 | 238,591 | 399,530 | 124,168 |
| 2003 | 1,438,611 | 1,814,207 | 1,337,116 | 343,719 | 418,570 | 143,921 |
| 2004 | 1,434,335 | 1,696,616 | 1,320,537 | 428,990 | 497,983 | 177,613 |
| 2005 | 1,488,230 | 1,504,176 | 1,281,175 | 314,319 | 358,059 | 147,311 |
| 2006 | 1,848,230 | 1,634,892 | 1,466,216 | 493,211 | 575,809 | 215,434 |
| 2007 | 1,962,429 | 1,552,730 | 1,542,572 | 682,552 | 718,850 | 294,970 |
| 2008 | 1,889,809 | 1,488,171 | 1,396,583 | 545,724 | 676,915 | 266,273 |
| 2009 | 1,964,404 | 1,698,245 | 1,675,535 | 478,477 | 670,235 | 265,869 |
| 2010 | 2,318,680 | 1,883,601 | 1,592,520 | 613,074 | 789,735 | 306,905 |
| 2011 | 1,987,500 | 1,942,352 | 1,596,295 | 684,868 | 789,735 | 402,628 |
| 2012 | 2,090,195 | 1,841,399 | 1,621,450 | 592,140 | 1,007,472 | 325,134 |
| 2013 | 1,921,591 | 2,064,376 | 2,234,876 | 762,342 | 1,051,207 | 551,086 |
| 2014 | 1,901,724 | 2,090,394 | 1,653,808 | 519,419 | 901,244 | 345,489 |
| 2015 | 1,979,032 | 1,865,718 | 1,714,590 | 464,361 | 708,528 | 283,233 |
| 2016 | 1,850,858 | 1,940,995 | 1,839,216 | 603,406 | 780,270 | 356,776 |

| Year | Quantity (Tons) | | | Value (USD '000) | | |
|-------------|-----------------|-------------|-----------|------------------|-------------|---------|
| | France | Netherlands | Germany | France | Netherlands | Germany |
| 2017 | 2,039,946 | 1,808,530 | 1,871,140 | 596,901 | 789,801 | 393,966 |
| 2018 | 1,501,581 | 1,785,907 | 1,903,064 | 645,645 | 790,103 | 385,058 |
| 2019 | 2,338,976 | 2,249,872 | 1,884,646 | 820,574 | 982,708 | 444,318 |
| 2020 | 2,381,795 | 2,012,512 | 1,987,505 | 749,058 | 798,160 | 380,061 |
| 2021 | 2,049,631 | 2,249,825 | 2,002,126 | 644,595 | 827,593 | 386,867 |
| 2022 | 2,958,030 | 2,229,742 | 2,173,986 | 866,392 | 955,253 | 478,521 |
| 2023 | 3,787,093 | 2,582,986 | 2,403,305 | 1,109,221 | 1,244,723 | 704,117 |
| 2024 | 4,815,458 | 2,520,442 | 2,669,724 | 1,410,424 | 1,395,405 | 801,727 |
| Annual Avg. | 2,047,791 | 1,883,942 | 1,731,930 | 599,999 | 759,029 | 336,198 |
| Growth Rate | 6.34% | 2.67% | 2.85% | 8.85% | 7.25% | 8.33% |

Source: Compiled and calculated from UN COMTRADE (2025).



Empirical Results of the Augmented Gravity Model

Table 6 presents the estimation results of the augmented gravity model for Egyptian potato exports to Italy, Greece, and the United Kingdom over the period 2000–2024. All continuous variables are log-transformed to facilitate linear estimation and enable elasticity interpretation. The model exhibits a high overall explanatory power, with the adjusted coefficient of determination (Adj. R²) indicating that the included variables collectively account for approximately 92% of the observed variation in bilateral Egyptian potato export flows. The overall F-statistic (60.64) is statistically significant, confirming the joint explanatory relevance of the model. Only variables significant at the 90% confidence level or above are reported.

Table 6. Empirical Results of the Augmented Gravity Model for Egyptian Potato Exports

| Variable | Coefficient | t-Statistic | p-Value | Economic Interpretation |
|---|-------------|-------------|---------|--|
| Constant (α) | 6.45 | 2.00*** | 0.055 | — |
| GDP of Egypt (GDP _{tn}) | 0.47 | 1.93*** | 0.071 | Proxy for export supply capacity |
| GDP of trading partner (GDP _{ti}) | 1.51 | 2.50** | 0.019 | Reflects the economic size of the importing market |
| Economic differential (EconDif _{tni}) | 0.23 | 1.73*** | 0.085 | Measures the development gap between exporter and importer |
| Market import size (IMP _{ti-n}) | 0.75 | 2.07** | 0.031 | Indicates Egypt's share in the partner country's import market |
| Exchange rate (ER _{tni}) | -0.63 | -1.97* | 2E-04 | Reflects financial risk and currency devaluation effects |
| Population of importer (Pop _{ti}) | 1.92 | 3.27* | 2E-02 | Proxy for the physical size of the importing market |
| Geographic distance (Dist _{tni}) | -3.15 | -7.13* | 1E-05 | Proxy for transportation and transaction costs |
| F-value | 60.64* | | | Indicates overall model significance and goodness of fit |
| Adjusted R ² | 0.92 | | | Explains approximately 92% of the variation in trade flows |
| Observations | 36 | | | Balanced panel dataset |

Note: (*) Significant at the 1% level; (**) Significant at the 5% level; (***) Significant at the 10% level.

Source: Author's calculations based on CAPMAS, UN COMTRADE, FAOSTAT, World Bank, and IMF data

The empirical results yield several noteworthy findings. First, the GDP of Egypt ($\beta = 0.47$) is positively significant at the 10% level, indicating that stronger domestic supply capacity—as reflected by aggregate economic output—contributes to enhanced potato export performance. A 1% increase in Egypt's GDP is associated with a 0.47% increase in potato export value, confirming the supply-side linkage between economic growth and export capacity.

Second, the GDP of the importing country ($\beta = 1.51$) is positively significant at the 5% level, implying that the economic scale of the destination market exerts a substantial positive influence on bilateral trade flows. A 1% rise in the importer's GDP increases Egyptian potato exports by approximately 1.51%—an elasticity greater than unity, suggesting that market size is a dominant pull factor.

Third, the economic development differential between Egypt and the importer ($\beta = 0.23$) is positively significant at the 10% level. This finding indicates that Egyptian potatoes tend to be directed toward markets that differ substantially from Egypt in terms of per capita income—consistent with the Linder hypothesis variant whereby complementarity in economic structure underpins trade.

Fourth, the total volume of potato imports by the trading partner from Egypt ($\beta = 0.75$) is positively significant at the 5% level, reflecting the importance of established bilateral trade relationships and market embeddedness. A 1% increase in the importer's total potato purchases from Egypt generates a 0.75% increase in export value.

Fifth, the bilateral exchange rate ($\beta = -0.63$) is negatively significant at the 1% level, confirming that currency depreciation of the importing country relative to the Egyptian pound reduces Egypt's competitiveness by raising the effective price of Egyptian potatoes in those markets. A 1% appreciation in the exchange rate (i.e., weakening of the importer's currency) is associated with a 0.63% decline in export value – underscoring the importance of exchange rate stability in sustaining export performance.

Sixth, the population of the importing country ($\beta = 1.92$) is positively significant at the 1% level, representing the most elastic demand-side variable in the model. A 1% increase in the importer's population is associated with a 1.92% increase in Egyptian potato exports, confirming that physical market size – as measured by demographic scale – is the strongest driver of bilateral export flows.

Seventh, geographic distance ($\beta = -3.15$) is negatively significant at the 1% level and carries the largest absolute elasticity in the model. A 1% increase in bilateral distance reduces Egyptian potato exports by approximately 3.15%, reflecting the combined costs of transportation, transaction management, and logistical coordination. Given that potatoes are a perishable commodity, distance represents an especially critical constraint on export competitiveness.

Notably, neither the per capita GNI of Egypt nor the per capita GNI of the importing partners attained statistical significance, suggesting that the stage of development of either party is not independently instrumental in driving Egyptian potato trade flows when controlling for other gravity and market size variables.

Concluding Remarks and Policy Implications

The study analyzed the distribution and evolution of Egyptian potato exports, identified the major competing exporters, and examined the determinants of export growth using an augmented gravity model. The results confirmed the strong explanatory power of the model, with an adjusted R^2 of 0.92, indicating that bilateral exchange rates, importing country population, and geographic distance are the most influential determinants of Egyptian potato trade flows.

The findings revealed that market size and population significantly stimulate Egyptian potato exports, while distance-related transportation and transaction costs constitute the primary constraint on export expansion. In addition, Egyptian potato exports respond positively to both domestic and partner-country economic growth, whereas the economic development level of importing countries was found to be statistically insignificant, suggesting that export promotion strategies should target developed, emerging, and developing markets alike.

Based on these findings, several policy implications emerge. Egypt should strengthen trade relations with large and highly populated markets, particularly in the Middle East, Africa, and emerging Asian economies. Improving transportation infrastructure, cold-chain logistics, port efficiency, and trade facilitation measures is essential to reducing export costs for perishable products. Exchange rate stabilization policies and export financing mechanisms should also be enhanced to maintain international competitiveness.

Furthermore, Egypt needs to reinforce compliance with international phytosanitary and quality standards, while promoting value-added agricultural exports through agro-processing industries, especially processed and frozen potato products. In light of growing competition, exporters should focus on quality differentiation, branding, packaging development, market diversification, and the adoption of modern agricultural and post-harvest technologies to improve productivity and export quality.

Finally, strengthening cooperation between research institutions, producers, and exporters, alongside integrating sustainability, climate adaptation, and global value chain considerations into future trade policies, will be essential for enhancing the long-term competitiveness and resilience of Egypt's agricultural exports.

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