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Title thesis: Effects of Turkish Lira (TRY) depreciation on trade patterns between Republic of Türkiye and Republic of Azerbaijan

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Abstract

The research study explores Türkiye-Azerbaijan trade patterns, concentrating on macroeconomic variables like inflation, central bank reserves, GDP growth, and exchange rate variations and geopolitical factors like political stability, Russian-Ukrainian war and international events and how these factors affect exports from both nations using multivariate regression analysis on a sample of 120 data observed through the period of 10 years. Azerbaijan's inflation rate has statistically significant effect on both its exports and imports, at 95% and 90% CL, respectively. Both models reveal that exchange rate fluctuations[1] significantly affect trade flows, with change in both AZN/TRY affecting Azerbaijani exports at 99% and TRY/AZN affecting Turkish exports at 99% CL. The models explained 61.21% variation for Azerbaijani exports and 99.75% for Turkish exports. GDP growth rate variable was only significant in Azerbaijani economy for Azerbaijani exports. These findings demonstrate the intricate interaction of economic and geopolitical variables on bilateral commerce, indicating that specialized measures are needed to improve economic cooperation. The study also proposes using border regulations and international events in future research to better understand this dynamic link.

[1] Model assumes that only AZN/TRY affects Azerbaijani exports to Türkiye while TRY/AZN only affects Turkish exports to Azerbaijan, with the inverse currencies excluded from the respective models for the purpose of solving multicollinearity problem

List of abbreviations and terms

ARDL	Auto-regressive Distributed Lag
ASEAN	Association of Southeast Asian Nations
ATEC	Agreement on Trade and Economic Cooperation
Avg-I-REER	Average Industry-Specific Real Effective Exchange Rate
AZN	Azerbaijani Manat
BIS	Bank for International Settlements
BPCG	Balance-of-payments-constrained growth
BRCA	Bilateral Revealed Comparative Advantage
BS	Balassa-Samuelson
BTA	Bilateral Trade Agreement
CBAR	Central Bank of Azerbaijan Republic
CBR	Central Bank Reserves
CIS	Commonwealth of Independent States
CL	Confidence Level
CNY	Chinese Yuan
EEC	European Economic Community
EFTA	European Free Trade Agreement
EU	European Union
F1	Formula One
GDP	Gross Domestic Product
GMT	Gravity Model of Trade
GN	Global North
GS	Global South

GVC	Global Value Chain
HLSCC	High Level Strategic Cooperation Council
HO	Heckscher-Ohlin
IMF	International Monetary Fund
ML	Marshall-Lerner
NAFTA	North American Free Trade Agreement
OLS	Ordinary Least Squares
PPP	Purchasing Power Parity
PTA	Preferential Trade Agreement
REER	Real Effective Exchange Rate
RER	Real Exchange Rate
RTA	Regional Trade Agreement
SSC	State Statistical Committee
TRY	Turkish Lira
TURKSTAT	Turkish Statistical Institute
UEFA	Union of European Football Associations
UNCTAD	United Nations Conference on Trade and Development
USD	United States Dollar
WB	World Bank
YoY	Year-over-Year

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Introduction

Trade has been a major subject of focus economically and strategically between Türkiye and Azerbaijan because of the historical cultural-geographical bond between the two countries. Central to this is the relation that Azerbaijan has had with Türkiye since it obtained independence in 1991, economically cooperating through treaties. However, the bilateral trade partnership has enhanced and broadened over time for both countries mainly through focusing on energy, machinery and agriculture trade tracts (Akay, 2023). Exchange rates, inflation and GDP growth rates have macroeconomic effect that forms the basis for the flow of trade between two countries. Foreign exchange rate changes for example, can impact the relative trade costs of exporting and importing goods and services where a change in the price level makes it difficult for one country's goods to compete with those of another countries' (Beckmann, et al., 2017). Similarly, a country's inflation rates affect the purchasing power within a country and the demand for imported and exported goods (Sugiharti, et al., 2020). Additionally, the GDP growth captures the general state of an economy through its impact on the capacity and need for exportation (Ali, et al., 2022). These aspects do not only affect the level of competitiveness of exports but also the trade balance and stability of each country's economy.

Starting of mid-2021, a negative real interest rate policy introduced by Türkiye's authorities to boost investments, exports and reduce the current account deficit led to TRY-USD depreciation by roughly 60% and skyrocketing of local inflation rates from 19.3% in August 2021 to 85.5% in October 2022, due to the willingness by the government to achieve nominal exports growth for the nation of Türkiye which relied significantly on the industrial output coming via imported intermediate goods and energy (Iyigun, 2024). While this policy has increased the trade imbalance from $46 billion to $106 billion, its current account deficit grew from 0.9% to 4.1% of GDP coupled with the compound effects contributed by rising global energy costs in the framework of the Ukraine conflict.

Research Question

Despite the Turkish economy's crisis, its imports from neighboring Azerbaijan have steadily increased, and the depreciation of the Turkish lira against the Azerbaijani manat has boosted retail trade between the two countries (Akhundov, 2024). That being said, an empirical study

was needed for exploring the reasons and factors bringing about such a controversial outcome and to address the following research question with valid response:

How does the rate of change in TRY affect its trade with Azerbaijan?

In order to respond to the foregoing research question, the following sub questions are being devised:

How does the rate of change in TRY affect Türkiye's exports to Azerbaijan?
How does the rate of change in TRY affect Türkiye's imports from Azerbaijan?

Hypothesis

To address the research questions, the two sets of hypotheses are proposed:

$H0_1$: *The depreciation of TRY does not significantly affect Türkiye's exports to Azerbaijan.*
Ha_1: *The depreciation of TRY significantly affects Türkiye's exports to Azerbaijan.*

$H0_2$: *The depreciation of TRY does not significantly affect Türkiye's imports from Azerbaijan.*
Ha_2: *The depreciation of TRY significantly affects Türkiye's imports from Azerbaijan.*

Objectives of the study

This paper aims to investigate the economic factors influencing the level of trade between Türkiye and Azerbaijan, emphasizing export drivers while attempting to establish the magnitude of effects under which the changes in exchange and inflation rates, as well as GDP impact the export volumes of Türkiye and Azerbaijan using secondary and tertiary data sources, foundational data visualization techniques and regression analysis.

Significance of the study

This paper is important for policymakers and businesses in Türkiye and Azerbaijan since it explains the fluctuation of the trade relationship caused by external and internal economic factors. The findings of this study, therefore, demonstrate the effectiveness of using a

quantitative method to examine the correlation between these macroeconomic factors to the overall relations of trade between the two countries (Tahir & Majeed, 2021). The results of this study will be useful in understanding the interaction between Türkiye and Azerbaijan in terms of macroeconomic factors affecting trade. Furthermore, the results will complement the literature on international trade by presenting the specifics of the dynamics that occur in this significant partnership. They are needed for making policies related to economy as well as for making strategies for businesses in the conditions of growing internationalization of economy.

Outline of the Study

The structure of the study is as follows: after this introduction, the paper will give the reader a literature review that defines the current state of research on the topic. Data collection and analysis procedures that are used in the study will also be described in Methodology which precedes the findings from the regression models in the empirical analysis and a related discussion, described in respective Results and Discussion sections. Last, the conclusion will restate the main findings and indicate their implications for further studies and public policy.

Literature Review

Bilateral Trade

International trade is one of the key components for understanding any country's balance of trade due to its direct relevance to the concept of net exports and thus, all the factors that affect international trade is relevant to its export/imports. Such variables include phenomena such as factor endowments, productivity, trade policy, exchange rates, foreign currency reserves, inflation, demand, etc. International factor flows have been described through an extensive gravity equation literature dating back to 19th century (Carey, 1858; Ravenstein, 1876; Ravenstein, 1885). GMT (Gravity Model of Trade) theory is commonly used to analyze and forecast trading patterns (Nasrullah, et al., 2020). Factor endowments (labor, land and capital) also affect this equation by determining who produces what. The gravity model refers to bilateral trade as a function of macroeconomic factors such as aggregate supply of the exporting country and the aggregate demand of the importing country; trade costs including the close geographic proximity, historical ties, lower tariffs, trade agreements; and sectoral composition of supply and demand meaning the specialization and international division of labor (Anderson & Wincoop, 2003). Initial econometric model for examining bilateral trade flows have been introduced by Tinbergen (1962) who predicted that the size of the given countries' economies, geospatial proximity between their borders as well as shared borders will predict such flows. Using OLS in log levels, he derived a gravity equation used in international trade which links bilateral trade to distances as well as economic masses. Since then, the "gravity equation" has approximated bilateral trade flows between any two nations, making it one of the greatest triumphs of contemporary economics (Carrère, et al., 2020). The equation have been later extended and the first econometric analyses were conducted to reveal the equilibrium trade effects of securing the membership in any given economic union, particularly for EEC and/or the EFTA, on bilateral trade dynamics (Linnemann, 1966; Aitken, 1973; Sapir, 1981). Theoretical basis for GMT theory uses Armington model with goods differentiated by location of production, assuming the national income equal to sum of home and foreign demand for the given good which will differ from country to country due to the existence of transaction costs (Anderson, 1979; Bergstrand, 1985). Thus, early theoretical models of gravity have been subsequentially modified over the next three decades by the modern economists trying to rationalize its relevance for the time being (Helpman & Krugman, 1985; Bergstrand, 1989;

Bergstrand, 1990; Baier & Bergstrand, 2001). Modern empirical works rely on ‘‘structural gravity’’ framework which serves as the combination of the classical GMT with Anderson’s market-clearing condition (Anderson & Wincoop, 2003; Anderson, 2024). Other attempts at interpreting the abstraction of the gravity model focused on its links to the theory of monopolistic competition with identical countries specialized in manufacturing of different products trading differentiated goods (Bergstrand, 1985; Bergstrand, 1989; Helpman & Krugman, 1985). Thus, numerous more models have been used in combination with gravity model studies to analyze the bilateral trade. Those included the traditional factor-proportions explanation of trade like Heckscher–Ohlin (HO) framework, that relies on differences in factor endowments among countries as the basis for trade; Ricardian-based comparative advantage model, which relies on differences in technology across countries to explain trade patterns; the Bayesian model averaging; extreme bound analysis and robustness tests; and theoretical models of global trade in differentiated products with firm (company) heterogeneity and export fixed costs (Deardorff, 1998; Eaton & Kortum, 2002; Melitz, 2003; Debaere, 2003; Gosh & Yamarik, 2004; Yamarik & Ghosh, 2005; Helpman, et al., 2008; Chaney, 2008; Arkolakis, et al., 2012; Costinot & Rodriguez-Clare, 2014; Head & Mayer, 2014; Beck, 2017; Carrère & Masood, 2018; Beck, 2020). Even though used extensively, GMT theory features series of limitations due to the lack of consistent measures across countries, compounded with the fact that changes in tariffs does not just affect bilateral trade but also influence the international division of labor and macroeconomic factors separately, providing partial-equilibrium effects than complete refection of trade interactions (IMF Research Department, 2018). Additionally, the gravity model has been used to test hypotheses rooted in purer economic theories of trade despite consisting of factors linked with geography and spatiality. It was claimed, mostly by Wassily Leontief, that gravity model with its foundation in HO model was inconsistent with the real-world trading patterns as its predictions did not depict the full extent and dynamics of global trade, a problem that became known as Leontief paradox (Leontief, 1953; WTO & UNCTAD, 2012).

Relatively more recent research focused on drawing proper inferences from estimations using the gravity equation, particularly to show the importance of controlling for relative trade costs since relative trade costs were demonstrated to be as important to bilateral trade as the absolute trade costs (Anderson & Wincoop, 2003). The gravity model has also been used to study bilateral trade in many countries using factors like population size, culture, GDP, geography, cost of transportation and trading blocs, currency exchange rates, as well as political constraints

on trade (Li, et al., 2020; Davis & Weinstein, 2001; Frankel & Rose, 2002; Rose & Van Wincoop, 2001; Klein & Shambaugh, 2006; Zhou, 2011).

Currency Exchange Rate Effects on Exports

RER's significant implications for export and economic output metrics have long been a subject of debates among international economists. With one side claiming the RER is not tightly related to the growth in the long term, and another holding it as a key variable for achieving long-term economic growth, recent empirical evidence agrees with neither, pointing out to the substantial impact of RER on exports. Majority of economic perspectives investigating this phenomenon, including the old/new neoclassical, classical-Marxian and post-Keynesian models, combined with those of trade-focused growth models ignore the role played by RER compared to many other variables. Taking an example, the growth models developed by Grossman and Helpman (1991), many post-Keynesian economists, including Thirlwall's (1979) BPCG model omit RER as a factor affecting international trade (Blecker, 2022). However, some models like Kaldorian approach do employ RERs as key determinants of economic growth and international trade, a pattern which is observed more as one explores the newly industrialized economies of Latin America (Dixon & Thirlwall, 1975; Setterfield & Cornwall, 2002; Boggio & Barbieri, 2017; Bresser-Pereira, et al., 2015). Brazil especially has recently popularized a new developmentalist school among the local economists who emphasize RER's crucial role in keeping up with 'industrial equilibrium', main predictor of sustainable long-run growth, especially in manufacturing sector which comes to demonstrate that currency value is an important equilibrating variable for the economies of GS as opposed to the economies of GN (Oreiro, et al., 2020; Marconi, et al., 2021; Dutt, 2002). With more recent econometric evidence coming up to favor the role played by the competitive RERs for export potential buildup, the popularity of the concept in promoting sustainability for local manufacturing growth among the policymakers of South rises (Caglayan & Demir, 2019; Rapetti, 2020; Demir & Razmi, 2022). Çağlayan/Demir (2019) found that RER affects total exports in statistically significant manner and low and medium skill, resource intensive manufactures, strongest and most significant for higher and lower medium hybrid (involving both technology and skill) intensity goods, and mostly statistically not significant for low and high hybrid intensity goods as well as primary commodities. Proponents of this new school of thought claim that RER is one of the most important drivers of growth in the long term by criticizing Thirlwall's law for treating income elasticities of exports and imports as

fundamental parameters in determining the long-run equilibrium growth of output (Bresser-Pereira, et al., 2015).

Exchange rate shifts have historically affected trade volumes, balances, and market shares. Changes in relative pricing of products and services among nations affect exchange rates and trade volumes (Beckmann, et al., 2020). A country's exports become cheaper for overseas customers when its currency depreciates, potentially increasing export volume. Imports increase in price, which may limit volume. If export volume rises more than import volume, the trade balance can improve.

The studies of later 20th century have inversely correlated the volatile nature of exchange rates with the volume of bilateral trade (Baron, 1976; Cushman, 1983; De Grauwe & Verfaille, 1988; Giovannini, 1988; Bini-Smaghi, 1991). Nevertheless, such conclusions have rested on the assumptions as inflexible as perfect competition, the high aversion to risk, the absence of exchange rate hedging financial instruments which added ambiguity to the understanding of the phenomenon of exchange rates.

Exchange rate elasticities vary widely among nations and goods, according to empirical research like Bussiere et al. (2014) and Gopinath (2015). Bussiere et al. (2014) found that trade volumes are inelastic to exchange rate fluctuations. This shows that even large exchange rate depreciations may only slightly enhance export volumes. Thorough research of 51 advanced and emerging-market economies examined export and import trade price and quantity elasticity. With median elasticity of 0.48 for import prices and 0.65 for export prices in the importer's currency, exchange rate fluctuations did not fully affect import prices. This partial pass-through suggests that exporters adjust prices to exchange rate movements, which might limit trade volumes (Bussière, et al., 2014).

REERs are extremely valuable tools for measuring export price competitiveness used by international organizations like BIS, IMF and others producing such data for most countries. Several attempts (Bems & Johnson, 2012; Bems & Johnson, 2017; Patel, et al., 2017; Patel, et al., 2019) at constructing aggregated REER data has focused on reflecting the rise in GVCs, as well as constructing sectoral, or industry-specific REERs (Sato, et al., 2012; Sato, et al., 2013). While Patel et al. (2017, 2019) has recorded better results in incorporating the structure of the individual countries, Sato et al. (2012, 2013) had better industrial results of REERs on a monthly basis. Also, Sato et al. (2020) has recently found that REER appreciation negatively affects exports in Asia when looked at BIS-REER as well as Avg-I-REER by comparing the weighted average of the I-REER to BIS-REERs and relying on a dynamic panel ARDL model.

Balassa-Samuelson Hypothesis explains variances in PPP, one of the most widely used empirical methodologies for studying real exchange rate misalignment, and is employed by several international institutions, including the WB and EU (Proskurnina, et al., 2020). Empirical data showed that prices and productivity are related, but its key thesis was that sectors depending on products tradability alter productivity relative to comparative pricing. However, existence of this effect has been controversial for Central and Eastern European countries due to the country-specific factors, used type model which gave way for significant variance in BS effects on individual countries (Egert, 2005; Dumitru & Jianu, 2009).

Exchange rate fluctuations affect the trade balance, which is the difference between exports and imports. The Marshall-Lerner criterion theoretically determines whether currency depreciation improves trade balance (Navarro, 2024). If the total of export and import price elasticities (absolute value) is larger than one, the trade balance will improve. The Marshall-Lerner condition, proposed by Alfred Marshall, states that an economy's trade balance may improve with the devaluation of its currency, whether strategic or not. This is done by calculating the price elasticities of exports and imports and seeing if their sum exceeds one. If so, the Marshall-Lerner (ML) condition holds true: a depreciation in the lo Since a good trade balance boosts GDP, the economy improves. The J-Curve phenomenon, which represents a downward slope followed by an upward slope like the letter "J," occurs before progress is made. It's important to know if the ML Condition applies to the Philippine economy.

Empirical data supports Marshall-Lerner in several nations. Bussiere et al. (2014) showed that a 10% nominal depreciation improved trade balances by 2% of GDP for their sample nations. Despite modest quantity elasticities, export and import price changes drive this development. The study found that smaller, more open economies are more susceptible to external price fluctuations and have a stronger trade balance reaction to exchange rate changes.

Tsinghua University researchers (Li, et al., 2015) found that export volume response to CNY exchange rate movements is moderate and significant, while the CNY price response being very small in size due to a relatively large conversion of exchange rates to foreign currency denominated prices. Other sources of heterogeneity include import intensity, logistics expenses, and destination income level also played some role.

Exchange rate variations affect exporters' market shares. When a country's currency depreciates, its products become cheaper, potentially boosting its international market share (Sugiharti, et al., 2020). An appreciation of the currency might diminish market share by making items more expensive than foreign ones. Market competitiveness, strategic complementarities, and GVCs affect market share responsiveness to exchange rate

fluctuations. According to Amiti et al. (2016), exporters alter their pricing to maintain market share in reaction to competition price changes in importing nations. This suggests intentional pricing to reduce currency rate risk to market share.

The literature on sectoral analysis of total exports affected by exchange rate volatility is known for showing a stronger negative association, depending on the individual countries and/or industries. Such studies have often marked relatively ambiguous negative effects on export volumes for some industrial sectors and mostly in the short-run, with long-run implications of such volatility not affecting much of the overall trade outcomes (Peridy, 2003; Byrne, et al., 2008; Bahmani-Oskooee & Hegerty, 2008; Bahmani-Oskooee & Hanafiah, 2011) Unlike most of the other studies, Caglayan and Di's (2010) conclusion did not support the claim of systematic effects of unstable rates of exchange on sectoral trade, often offsetting any occurrences of abovementioned negative effects of exchange rate volatility through opposite impacts of income volatility.

Bilateral Trade relations between Türkiye and Azerbaijan

Only Akhan et al. (2018) used precise Turkish firm-level data to estimate the impact of actual exchange rate fluctuations on export volume to assess the import influence on export volume. The study found an inverse link between real exchange rate and export volumes, with the magnitude of change being an increase of 0.3% in total exports in response to depreciation in TRY of 1%. It also indicated that high-productivity enterprises increased their export volume more than low-productivity firms after an exchange rate depreciation, whereas importing firms grew less than non-importers.

Academics are interested in Türkiye-Azerbaijan commerce due to its strategic and economic relevance. Trade agreements, comparative advantages, and economic cooperation have been studied in this connection.

Türkiye, as the first nation to recognize Azerbaijan's independence, established the diplomatic ties and signed an ATEC in 1992, establishing the foundation for bilateral economic cooperation (Embassy of the Republic of Azerbaijan to the Republic of Türkiye, 2021). HLSCC was formed in 2010 to improve ties, leading to the Shusha Declaration, after which mutual affairs between the two have officially started amounting to an alliance (Ministry of Foreign Affairs of Azerbaijan, 2021).

Türkiye-Azerbaijan commercial ties reached a milestone with the 2020 PTA, which reduced customs charges on 15 agricultural goods (Embassy of the Republic of Azerbaijan to the Republic of Türkiye, 2021). The extension of this agreement should boost bilateral trade. Two

decades of trade figures show a dynamic economic connection. From 2003 to 2014, Türkiye's exports to Azerbaijan rose despite global economic changes (Akay, 2023). In contrast, Azerbaijan's exports to Türkiye have grown, particularly in energy, where it supplies oil and gas.

Despite discrepancies, macroeconomic metrics show both countries' economic strength. Azerbaijan's GDP rose 4.6% to $78.7 billion in 2022. The country's non-oil GDP rose 9.1% while oil GDP fell 2.7. Unemployment Azerbaijan's dropped from 5.60% to 5.70% (Trading Economics, 2023).

The BRCA index has helped explain Türkiye-Azerbaijan trade. Türkiye exports 78% of its goods to Azerbaijan in 551 product types, mostly machinery, chemicals, textiles, and base metals (Akay, 2023). Azerbaijan's competitive advantage includes mineral fuels, oil, and agriculture, which account for 80% of its exports to Türkiye.

Studies by Karaalp (2011) and Aslanlı (2018) shed light on the competitiveness and trade trends between Türkiye and Azerbaijan. Karaalp analyzed Türkiye's competitiveness versus CIS nations, highlighting its comparative advantage in several industries, while Aslanlı analyzed trade, investment, and energy connections with Azerbaijan. Balıkçıoğlu (2019) and Doru and Aslan (2019) have studied the development of commercial links between Türkiye and Turkic Republics, including Azerbaijan. The literature implies that the PTA might considerably affect bilateral commerce (Akay, 2023). The agreement's focus on agricultural products and Türkiye's comparative advantage in most included categories could boost exports to Azerbaijan. The agreement covers a small percentage of Azerbaijani products, hence its influence on exports to Türkiye may be minimal. Expanding the agreement to new areas and goods might boost trade and economic cooperation.

As mentioned before through the Gravity Model of Trade theory, the distance and common borders play crucial role in trade, due to decreased shipping costs and faster delivery times (Anderson & Wincoop, 2003). Geographic proximity combined with factors such as cultural ties, and economic integration, in turn, promotes economic cooperation, and build confidence, increasing trade and economic ties. In Türkiye's case, connections with Caucasus countries, especially with Azerbaijan, are essential due to its cultural closeness as well as oil deposits which acts as a cheap source of energy (Goudarzi, et al., 2015). Thus, foreign trade can benefit from language, religion, and historical ties. Cultural similarities improve communication, understanding, and trust, which are essential for trading success. Studies show that nations with related languages or colonial histories trade more due to lower transaction costs and better understanding (Melitz, 2008). Cultural affinity also creates comparable customer preferences,

making it easier for enterprises to serve international markets with familiar tastes. Economic integration through trade agreements, shared markets, and customs unions shapes trade patterns. By reducing or eliminating tariffs, harmonizing regulations, and allowing the free movement of goods, services, and capital, regional trade agreements (RTAs) like the EU, NAFTA, and ASEAN have increased trade among member countries (Park, 2020). These agreements remove trade barriers, increase market access, and create bigger, interconnected markets that attract investment and support economic growth.

When currencies depreciate, countries employ trade and economic policies to reduce its negative impacts and boost economic stability. These policies encourage economic diversity, competitive export pricing, and foreign investment. Countries generally encourage export-oriented businesses when their currencies decline. Depreciation makes exports cheaper and more competitive abroad, potentially increasing export quantities (Mehtiyev, et al., 2021). Currency depreciation gives export-oriented enterprises a competitive edge, therefore governments may provide subsidies, tax incentives, and financial support. In times of high depreciation, export subsidies and tax refunds can assist exporters stay profitable (Reinhart & Rogoff, 2004).

Countries may engage in the foreign currency market with foreign exchange reserves to stabilize their currencies and prevent severe depreciation (Akdogan, 2020). Central banks can support its currency using foreign reserves. Maintaining foreign exchange reserves helps manage currency volatility and provide economic stability (Obstfeld, et al., 2010). Countries prone to currency swings diversify their economies to lessen their dependency on a few export items. Diversification techniques include creating new industries, entering new markets, and investing in currency-insensitive areas (Chang & Lebdioui, 2020). Diversifying their economies can boost resilience to external shocks and improve trade and economic performance (Lederman & Maloney, 2012). BTAs and RTAs can also reduce trade obstacles and promote economic cooperation (Santeramo, 2022). These agreements frequently stabilize exchange rates, coordinate trade policy, and open markets. Countries may reduce currency depreciation and improve commercial ties by signing trade agreements and thus, encouraging investment and long-term economic planning through the creation of predictable and stable terms for the bilateral trading (Baier & Bergstrand, 2007).

Methodology

Variables

The study utilizes dependent and independent variables with the latter including range of control variables for the exploration of the trade dynamics between Türkiye and Azerbaijan. The dependent variables used in this research are Türkiye's exports to Azerbaijan and Azerbaijan's exports to Türkiye. The independent variables include macroeconomic as well as political factors that are crucial in determining the trade flows between these two countries, more specifically:

1. **Core industry exports:** Volume of trade from main export industries (defined as industries making up more than 70% of exports) from the given country of origin to the destination/receiving country,
2. **Exchange Rate**: The monthly exchange rate between the Turkish Lira and Azerbaijani Manat which impacts the affordability of imports and exports between the two countries,
3. **Inflation Rate**: Monthly inflation rates for both Türkiye and Azerbaijan which impacts purchasing power, affecting the demand for goods and services in bilateral trade,
4. **GDP Growth Rate**: Monthly GDP growth rates for both Türkiye and Azerbaijan which can determine and manipulate the capacity for increased trade activities,
5. **Central Bank Reserves:** The level of foreign exchange reserves held by the central banks of Türkiye and Azerbaijan which affects the currency stabilization efforts and, thus, influences trade balances,
6. **Political Stability:** The level of political stability in Türkiye and Azerbaijan which influences investor confidence and the consistency of trade policies,
7. **International Events:** Major international events hosted by Azerbaijan, such as the European Games, Islamic Solidarity Games, UEFA events, F1 Grand Prix, and others, to affect the trade by boosting sectors like tourism, construction, and infrastructure, which leads to an amplified economic and trade opportunities between Türkiye and Azerbaijan,
8. **State of Border Closures:** The status of border closures, particularly due to global health, and security reasons, that significantly impacts the flow of goods and services between the two countries,

9. **Russian-Ukrainian war:** The ongoing conflict between Russia and Ukraine that has the capacity for the disruption of regional trade routes, energy prices to create economic uncertainty leading to indirect effects on the trade between Türkiye and Azerbaijan.

Data

Data collection approach

This research uses a quantitative approach and a secondary method, whereby an analysis of data collected was used to investigate the nature of trade between Türkiye and Azerbaijan. The analysis is aimed at defining and measuring the economic forces that affected the bilateral exports of goods and services with a special focus of the crucial macroeconomic factors, including the exchange rates, inflation rates and the growth rates of the GDP.

The information for this study was obtained from numerous databases that meet the set criterion of reliability. The final dataset for Turkish-Azerbaijani trade includes 120 monthly observations for 25 variables (some have missing data) from 7 separate sources: **UN Comtrade database** was used for Turkish export data; **Federal Reserve Economic Database** was used for GDP growth and CBR in Türkiye, and Azerbaijani exports to Türkiye; **TURKSTAT** was also used for Azerbaijani exports to Türkiye as well as for Turkish exports to Azerbaijan; **Trading Economics** was used for the retrieval of inflation rate data for both Türkiye and Azerbaijan, and GDP growth data for Azerbaijan; **WGI** provided data for political stability in both Türkiye and Azerbaijan; **CBAR** website provided data for CBR in Azerbaijan; **Investing.com** website provided data for the currency exchange rate for AZN and TRY.

Data analysis approach

To investigate the research questions, the empirical analysis is carried out utilizing the multivariate regression method to examine the impact of exchange rate change, inflation rate, GDP growth (all acting as explanatory independent variables) on the bilateral trade of Türkiye and Azerbaijan, structured around two primary regression models in terms of two models, with **Model 1** referring to Azerbaijani exports, and, **Model 2** referring to Turkish exports. Econometric model also includes control variables like Core industry exports, Central Bank Reserves, Political Stability,

and dummy variables like International Events, State of Border Closures, Russian-Ukrainian war on exports of both Türkiye and Azerbaijan.

The estimates of the independent variable coefficients are obtained with the use of OLS regression in both models. The OLS method is selected due to its efficiency in identifying the linear associations and its applicability in obtaining accurate and consistent estimations of the coefficients of the model. The overall models of the research are tested for the statistical significance using F-test statistic which examines if all the coefficients of the independent variables equal zero. Moreover, to assess the performance of the models, the measure of determination (R-squared) has been employed to estimate the degree of variation of the dependent variable that is explained by the independent variables.

Consequently, the regression coefficients are used to explain the direction as well as the extent of influence of each independent variable. The obtained coefficient's significance is evaluated with t-statistics to focus the analysis on the variables that exert a statistically significant impact on export volumes. In this case, results from both models are presented to have a more holistic approach to the analysis of trade between Türkiye and Azerbaijan.

Diagnostics

To avoid getting independent variables that are highly correlated with one another, one must make sure of testing the data for multicollinearity. Variance inflation factor is the ratio within STATA environment that tests variables for multicollinearity, by assigning values from 0 to 10 for the variables that are not highly correlated and values above 10 for the variables that have multicollinearity problem. By using this metric, it is possible to make sure about the mutual independence of the variables in question, while improving the interpretability of the coefficients from the analyses.

To solve for multicollinearity is to remove the variables that has the highest factor of correlation with other independent variables. For example, Table 1 and 2 feature the drastic changes in the model before and after applying diagnostics procedures on variables with the highest variance inflation factors on Model 1 as well as Model 2.

Variable	VIF	1/VIF		Variable	VIF	1/VIF
TL_AZE	28.43	0.035168		PolStab_j	8.83	0.113234
AZN_TL	24.67	0.040534		Quarantine_i	7.66	0.130554
Crimea_g	15.92	0.062806		AZN_TL	5.23	0.191346
Inf_j	15.74	0.063514		CBR_j	4.34	0.230641
PolStab_i	12.70	0.078717		CBR_i	3.82	0.262008
PolStab_j	10.43	0.095912		Inf_i	2.61	0.383213
Quarantine_i	9.86	0.101375		Oil_j_i	2.44	0.410113
CBR_j	8.15	0.122679	→	GG_i	1.97	0.508687
Inf_i	6.38	0.156645		Quarantine_j	1.11	0.898165
CBR_i	6.16	0.162326		IntEvents_i	1.06	0.941344
GG_i	3.65	0.273639		GG_j	1.02	0.978713
Oil_j_i	3.42	0.292178		Mean VIF	3.64	
Quarantine_j	1.14	0.873840				
GG_j	1.10	0.910437				
IntEvents_i	1.08	0.927107				
Mean VIF	9.92					

Table 1. VIF test results for Model 1 before and after solving for multicollinearity

The variables creating the multicollinearity problem in the regression for Model 1 were those assigned for TRY/AZE, inflation in Türkiye, Russian-Ukrainian conflict and political stability in Azerbaijan. Since AZE/TRY values would be an inverse of TRY/AZE values, and inflation constitutes the direct correlation with currency rates movements, these variables would fall short of satisfying the independence requirement. As to Russian-Ukrainian conflict and political stability in Azerbaijan, these variables are unique to Azerbaijan and, in correlation with many other variables present in the equation lead to model distortions.

Variable	VIF	1/VIF		Variable	VIF	1/VIF
Plast_i_j	2205.84	0.000453		TL_AZE	9.78	0.102246
Metal_i_j	1566.30	0.000638		PolStab_j	8.30	0.120476
Chem_i_j	464.95	0.002151		Quarantine_i	8.20	0.121888
Trans_i_j	195.17	0.005124		Inf_i	4.54	0.220370
Food_i_j	139.11	0.007188		CBR_i	4.52	0.221163
AZN_TL	92.44	0.010818		Crimea_g	4.47	0.223620
Inf_i	48.43	0.020648		core_Türkiye	3.68	0.271789
TL_AZE	48.00	0.020835		GG_i	2.91	0.344170
Inf_j	44.02	0.022717		Quarantine_j	1.14	0.880463
Quarantine_i	21.08	0.047448		IntEvents_i	1.05	0.953075
Crimea_g	20.05	0.049882	→	GG_j	1.03	0.971170
PolStab_i	19.43	0.051467		Mean VIF	4.51	
CBR_i	18.44	0.054218				
CBR_j	18.15	0.055093				
PolStab_j	14.11	0.070896				
Mach_i_j	12.60	0.079376				
Text_i_j	8.24	0.121425				
GG_i	7.96	0.125635				
Quarantine_j	1.50	0.666099				
GG_j	1.15	0.866513				
IntEvents_i	1.13	0.884262				
Mean VIF	235.62					

Table 2. VIF test results for Model 2 before and after solving for multicollinearity

Similar with Table 1, the variables creating the multicollinearity problem in the regression for Model 2 were those assigned for AZE/TRY, political stability in Azerbaijan and inflation in Türkiye. CBR in Türkiye (CBR in Azerbaijan was equally creating multicollinearity but the latter was removed in the interest of better modelling). Since Türkiye had more export industries, new variable core_Türkiye was generated to improve the model.

Results and Discussion

Dataset description

Date	1/1/14	2/1/14	3/1/14		4/1/24	5/1/24	6/1/24
Exports_i_j	26356026	26074851	15157517		0	0	0
Oil_j_i	425.808531	463.877793	259.173799		0	0	0
Exports_j_i	209233906	192956964	205554981		0	0	0
Mach_i_j	49358637	45518878.5	48490772.3		0	0	0
Chem_i_j	21159233.1	19513192	20787193.8		0	0	0
Metal_i_j	33670873.8	31051514.2	33078844.5		0	0	0
Plast_i_j	20963156.4	19332368.7	20594564.7		0	0	0
Trans_i_j	6898234.23	6361599.61	6776943.73		0	0	0
Text_i_j	8093640.89	7464011.95	7951331.75		0	0	0
Food_i_j	9904072.79	9133604.84	9729931.13		0	0	0
Inf_j	0.0775	0.0789	0.0839		0	0	0
GG_j	-0.0394971	0.09611263	-0.0175792	...	0	0	0
PolStab_j	11.9047623	11.8671481	11.5574613		0	0	0
TL_AZE	0.3458	0.354	0.3722		0.0517	0.0511	0.0503
CBR_j	6.8195E+10	6.8799E+10	6.8573E+10		6.4525E+10	0	0
Quarantine_j	0	0	0		0	0	0
Inf_i	0.0218	0.0211	0.0198		0	0	0
GG_i	0.008	0.016	0.025		0	0	0
PolStab_i	26.1904755	27.6875045	29.175756		0	0	0
AZN_TL	2.882	2.8164	2.6889		19.1487	19.437	19.7438
CBR_i	14219.3	14444.8	14715.7		0	0	0
IntEvents_i	0	0	0		0	0	0
Quarantine_i	0	0	0		1	1	1
Crimea_g	0	0	0		1	1	1

Table 3. Final dataset used for regression models

The dataset used for the study includes econometric variables which capture different aspects of trade and factors which affect the trade between Türkiye and Azerbaijan. Table 1 features the head and tail observations with the total length of 3 months between January 2014 and June 2024 for readability purposes. Dataset, originally assumed to include only 120 months of observations, have added extra 6 months of data to compensate for the presence of gaps in the data. As mentioned before, measures of total trade volume, specific trade flows in both directions, Turkish demand for Azerbaijani oil, macroeconomic indicators such as inflation rates, GDP growth, and political stability in both countries, as well as exchange rates, central bank reserves, and event-related variables like international events, quarantine regimes, and the impact of Russia-Ukraine conflict are all part of the dataset. One interesting moment of variables that represent Azerbaijani demand for various Turkish products and services is that 7 different industries (machines, chemicals, metals, plastics, transportation, textiles, and foodstuffs) making up at least 75% of total Turkish exports to Azerbaijan (in the meantime exported Azerbaijani products and services that are petroleum related make up over 85% of the total Azerbaijani exports to Türkiye) are coded as separate variables to allow for a thorough examination of the economic and trade relationship between Türkiye and Azerbaijan.

Data analysis

Derivations

This study adopts a comprehensive approach to modeling the trade dynamics between Türkiye and Azerbaijan by examining exports of both countries separately to be able to achieve higher accuracy model. Initially, the key variables representing demand (D_{j_i}, D_{i_j}), local ($F_{i_{i,j}}, F_{j_{i,j}}, F_{i_{j,i}}, F_{j_{j,i}}$), and global factors ($F_g$) influencing bilateral exports were defined, with raw ideas for modelling centered around identifying the impacts exerted by inflation, GDP growth, and exchange rates, alongside the impact of control and dummy variables (more detailed information on modelling and approach, including the variable definitions and processing steps are outlined in the Appendices section). Then, by systematically categorizing these variables into local factors affecting exports from each country and global factors impacting overall trade, a set of comprehensive econometric equations were derived representing the exports in both directions, including the interaction between demand in each country and the relevant economic and geopolitical variables, ensuring a

holistic representation of the trade flows between Azerbaijan and Türkiye. The final derivations, thus, reflect a nuanced synthesis of the initial concepts, refined through consideration of the global, region-specific and country-specific influences on trade:

$$\text{Exports}_{i,j} = D_{j_i} + F_{i_{i,j}} + F_{j_{i,j}} + F_g$$

$$= Oil_{j_i} + Inf_i + GG_i + PolStab_i + \frac{AZN}{TL} + CBR_i + IntEvents_i + Quarantine_i$$

$$+ Inf_j + GG_j + PolStab_j + \frac{TL}{AZE} + CBR_j + Quarantine_j + Crimea_i$$

Equation 1. Model derivation of exports from AZE to TR

$$\text{Exports}_{j,i} = D_{i_j} + F_{i_{j,i}} + F_{j_{j,i}} + F_g$$

$$= Mach_{i_j} + Chem_{i_j} + Metal_{i_j} + Plast_{i_j} + Trans_{i_j} + Text_{i_j} + Food_{i_j} + Inf_j$$

$$+ GG_j + PolStab_j + \frac{TL}{AZE} + CBR_j + Quarantine_j + Inf_i + GG_i + PolStab_i$$

$$+ \frac{AZN}{TL} + CBR_i + IntEvents_i + Quarantine_i + Crimea_j$$

Equation 2. Model derivation of exports from TR to AZE

Data cross-visualization

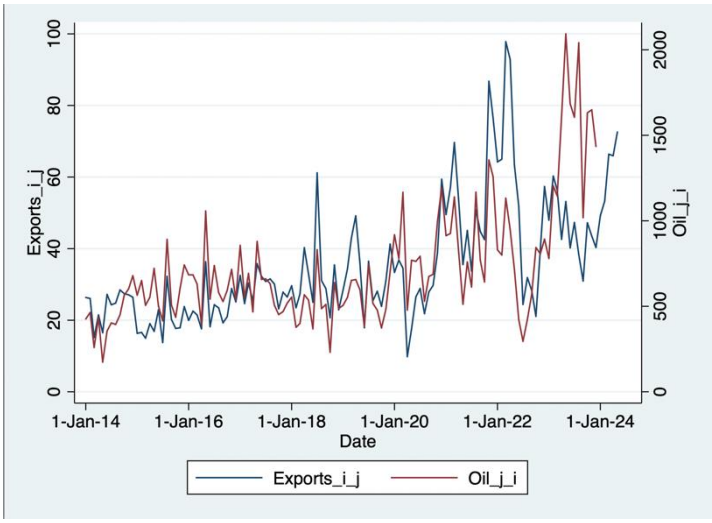

Figure 1. Cross-visualization of oil exports with total AZE exports

	Exports_i_j	Oil_j_i
Exports_i_j	1.0000	
Oil_j_i	0.5677	1.0000

Table 4. Correlation output for oil exports and total AZE exports

As mentioned before, oil exports make up a huge chunk of Azerbaijani exports to Türkiye, as evidenced by the graph and correlation outputs in Figure 1 and Table 2, respectively.

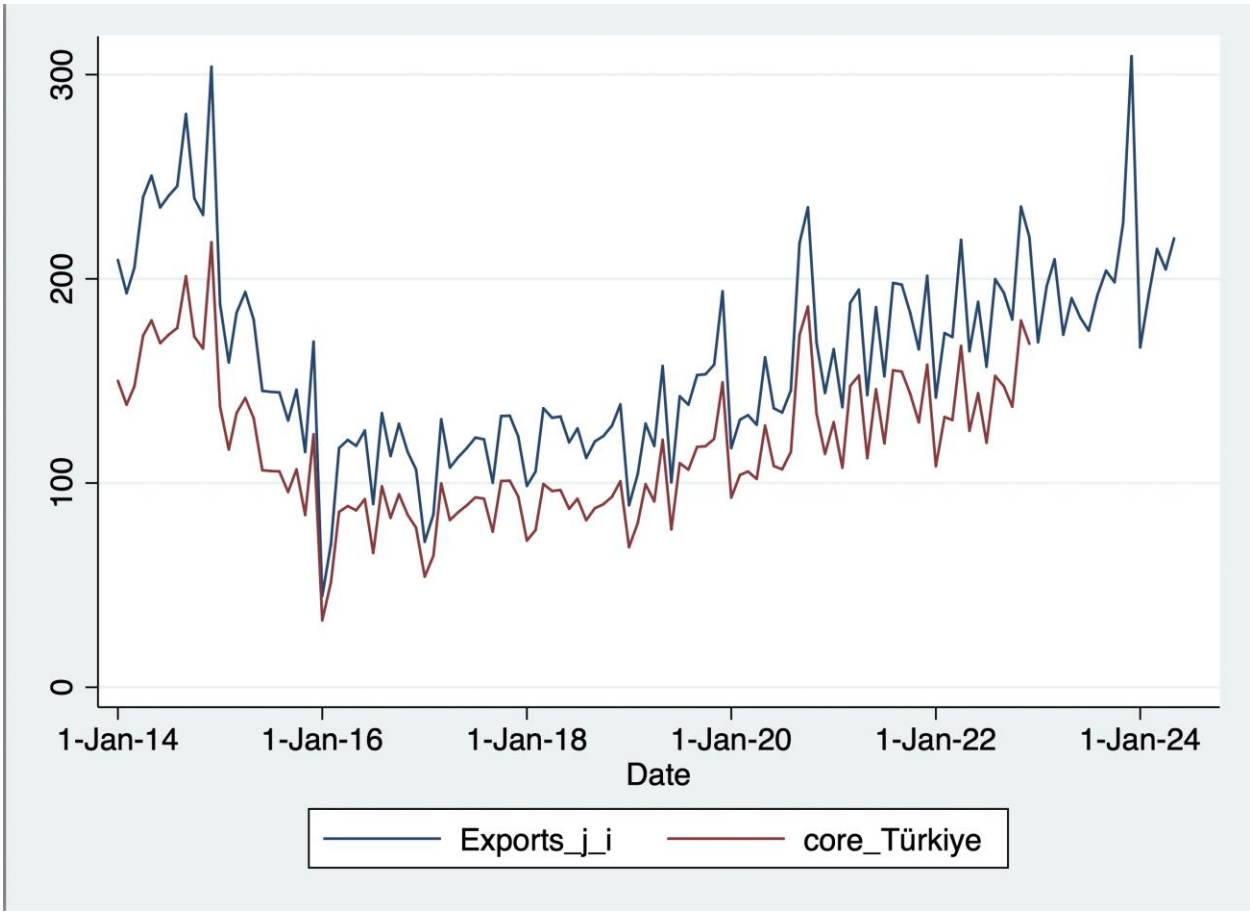

Figure 2. Cross-visualization of core TR exports with total TR exports

	Exports_j_i	core_Türkiye
Exports_j_i	1.0000	
core_Türkiye	0.9920	1.0000

Table 5. Correlation output for core TR exports and total TR exports

To be able to show the similar output as shown with Azerbaijani exports, the variable core_Türkiye was generated through STATA commands and assigned to the sum of the 7 Turkish export industries to Azerbaijan mentioned before. It can be seen from Figure 2 and Table 4, that those core industries end up making at least 75% of Turkish exports to Azerbaijan. These visuals, particularly the tables generated using "corr" command shows the correlation between the two variables. As we can see from the coefficients of both Turkish and Azerbaijani core export product and services (0.5677 and 0.9920, respectively), they serve as the good signatures for representing the bilateral export model.

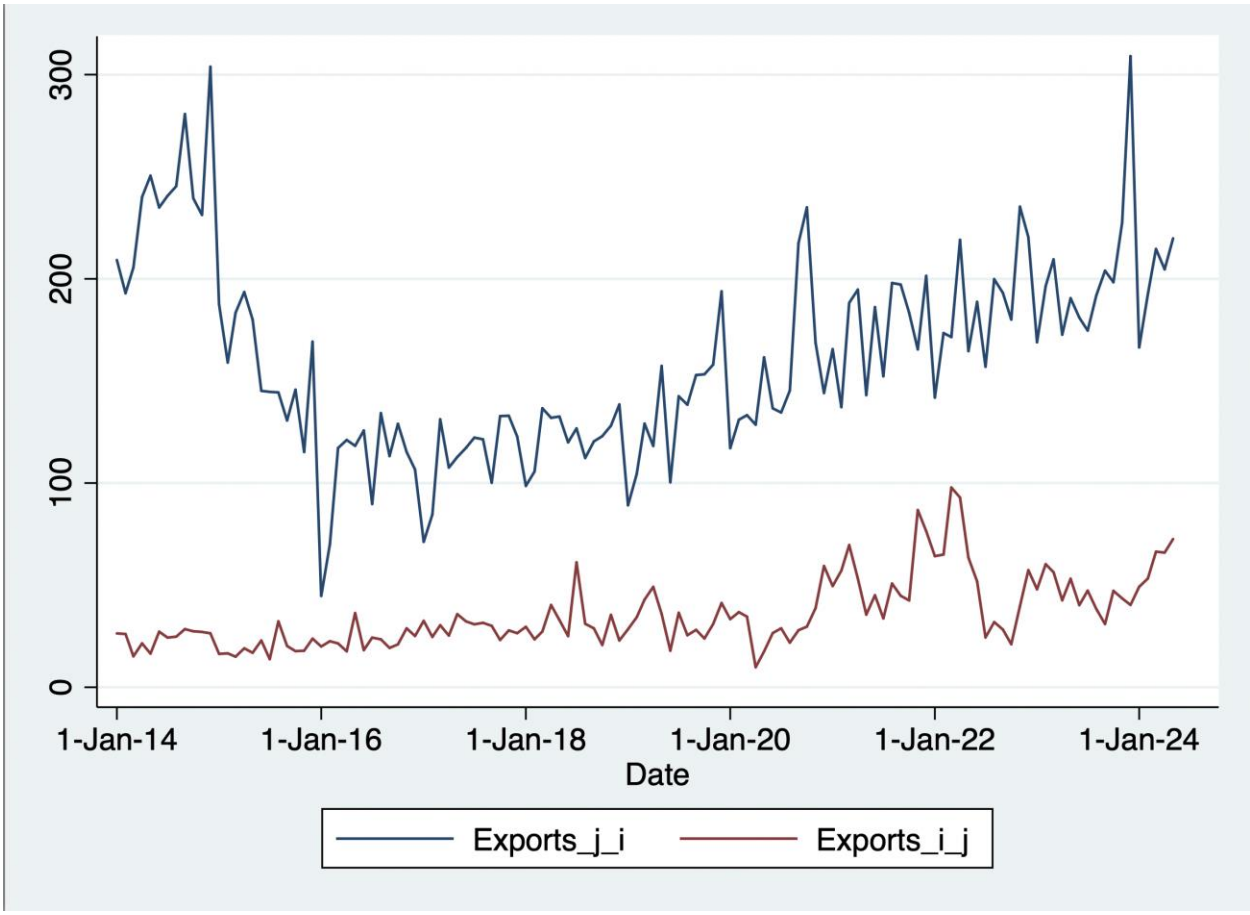

Figure 3. AZE-TR Trade Balance Visualization

As a country with a larger economy than Azerbaijan, Türkiye plays a role of a net exporter while Azerbaijan does the opposite in the mutual trade relationship of the two countries (Shown on Figure 3). This phenomenon can also be explained by the fact that Azerbaijan is a resource-rich country relying on the export of raw materials and mineral resources the revenues of which are usually funneled into the high-value imports of technology and intermediate/final products and services from the developed world. In this case, Türkiye exports various high-end technology and intermediate products like premium and sub-premium textiles to Azerbaijan, amounting, sometimes, tenfold of the exports at any given period. One can also observe that Turkish exports has dropped rapidly before January of 2016, the point in time from since which that statistics has been on the steady rise to finally reach an equalizer with its previous peak point just over 3 billion USD (previously in 2015; and recently in 2023). Exchange rate movements in AZN's value against TRY could potentially explain such dynamic. Figure 4 demonstrates that pattern, although it does not do so in a crystal-clear manner but rather as a generally positive correlation in the appreciation

of AZN versus TRY corresponding to the increase in the Turkish exports. When comparing the Turkish exports to Azerbaijani ones one can clearly see that Azerbaijani exports have rarely changed their attitude (but did change their magnitude) while TRY has been on a steady decline (Figure 5). However, when cross plotting the Turkish exports against the TRY/AZN one can see the clear inverse relationship. This suggests that bilateral trade between Türkiye and Azerbaijan is largely affected by Azerbaijan and the factors affecting the Azerbaijani imports from Türkiye.

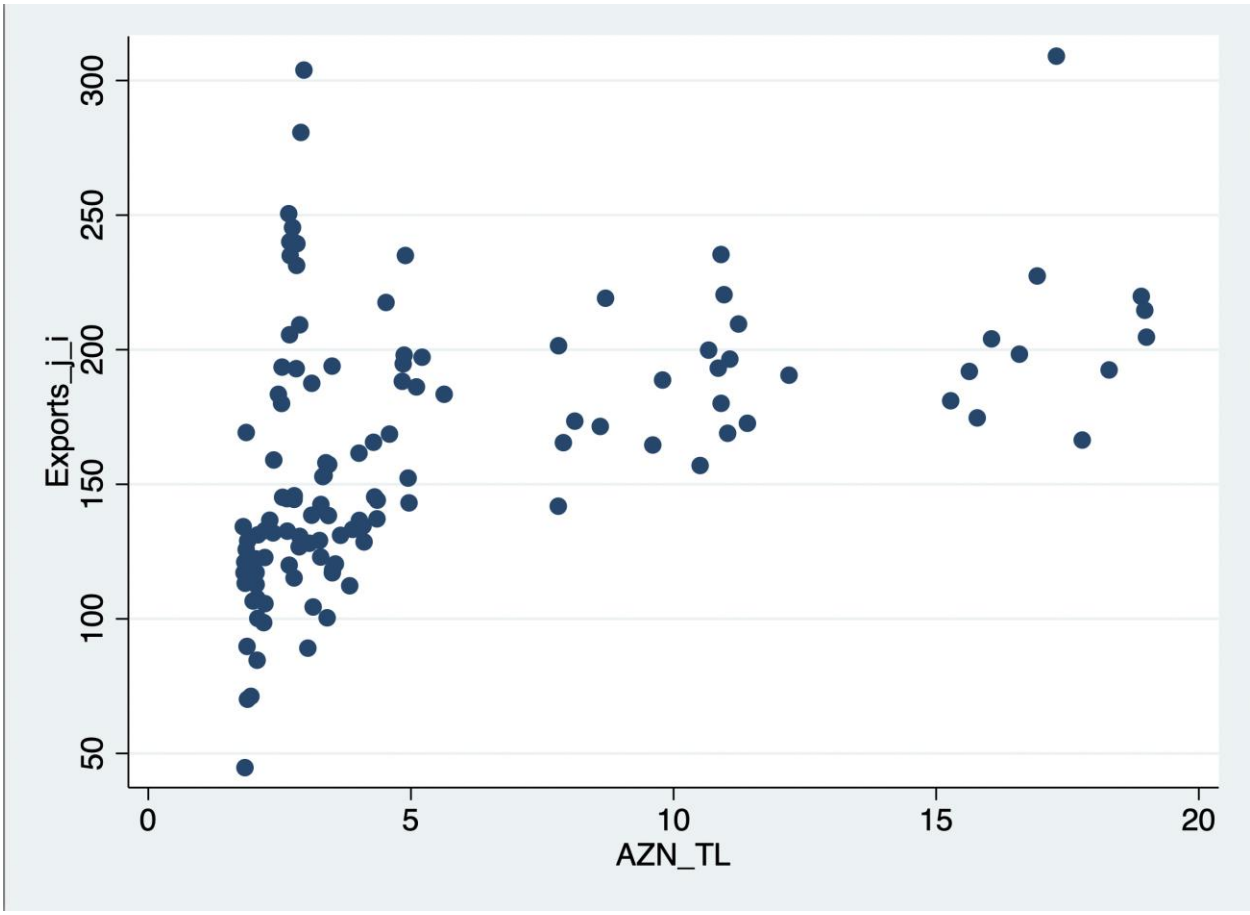

Figure 4. Relationship between AZN/TRY and TR Exports

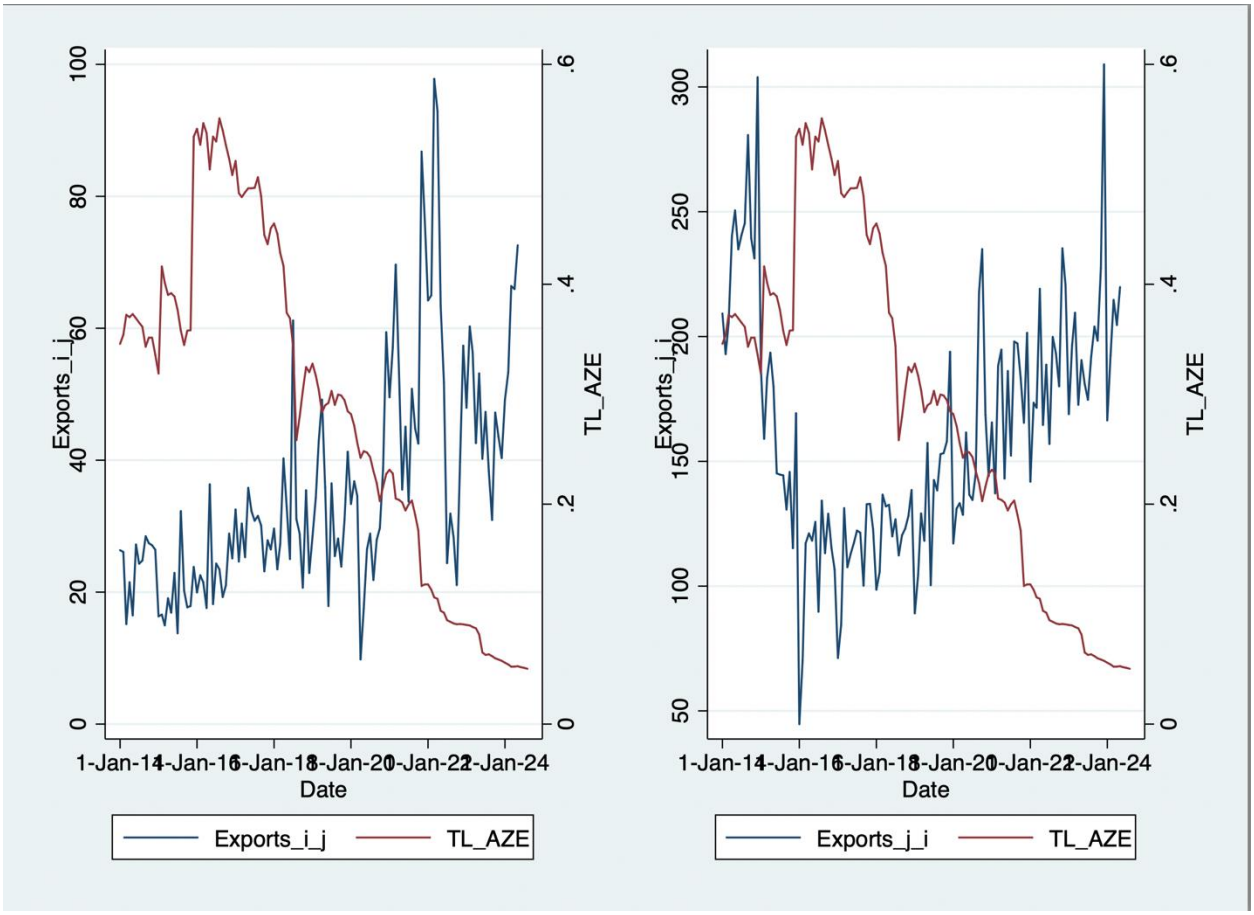

Figure 5. Exports in both directions plotted against TRY/AZN

The dataset also includes 4 dummy variables which correspond to the states of the phenomena affecting the bilateral trade dynamics between Türkiye and Azerbaijan such as the quarantine regimes, international events held in Azerbaijan and Russia-Ukrainian conflict. We can see from the distribution of active and passive states of each dummy variable below that quarantine regime in Azerbaijan and Russia-Ukraine war had much higher incidence of active states compared to quarantine regime in Türkiye and international events in Azerbaijan for the period which the dataset was gathered:

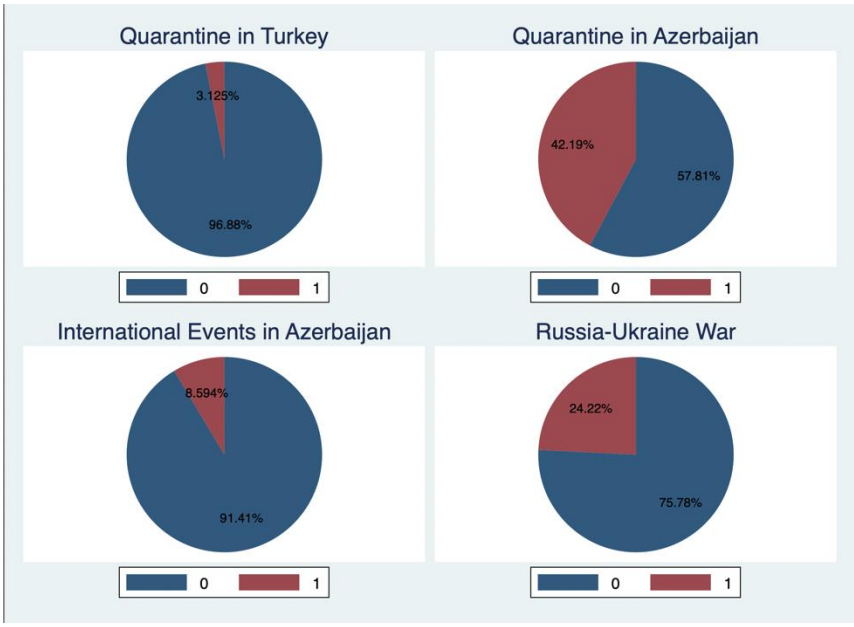

Figure 6. Visualization of Categorical (Dummy) Variables

Regressive analysis

Final Econometric equation (GMT for Türkiye-Azerbaijan trade)

The final econometric model for Türkiye-Azerbaijan trade is grounded in the Armington model, reflecting the importance of product differentiation, which is represented by the idea of core export industries of both countries, and change in the size of the economy represented by GDP growth variable (Anderson & Wincoop, 2003). Exchange rates, particularly the appreciation of the AZN against the TRY, play a critical role in moderating trade volumes, reinforcing the importance of currency stability and its effect on relative pricing of goods, consistent with findings from both gravity model and Kaldorian approaches (Beckmann, et al., 2020; Oreiro, et al., 2020). Moreover, the presence of strict quarantine regimes in Azerbaijan and Türkiye as well as hosting of international events in Azerbaijan alone affects trade, suggesting that external shocks like pandemics can have complex and sometimes counterintuitive effects on bilateral trade flows. Thus, study authors have suggested the inclusion of such variables in the econometric equation. Geographical proximity and cultural ties, which historically facilitate trade through reduced transaction costs and increased mutual understanding, continue to underpin the economic relationship between Türkiye and Azerbaijan, particularly in sectors like oil and core Turkish exports (Melitz, 2008; Goudarzi, et al., 2015). Furthermore, the GMT theory of bilateral trade considers the effects exerted by factors such as political constraints on trade which can be applied both at home and externally (Zhou, 2011; Li, et al., 2020).

$$\begin{aligned}
\text{Trade}_{\text{total}} = \text{Exports}_{\text{i,j}} + \text{Exports}_{\text{j,i}} &= \left(D_{j_i} + F_{i_{i,j}} + F_{j_{i,j}} + F_g\right) + \left(D_{i_j} + F_{i_{j,i}} + F_{j_{j,i}} + F_g\right) \\
&= Oil_{j_i} + Inf_i + GG_i + PolStab_i + \frac{AZN}{TL} + CBR_i + IntEvents_i + Quarantine_i \\
&+ Inf_j + GG_j + PolStab_j + \frac{TL}{AZE} + CBR_j + Quarantine_j + Crimea_g + Mach_{i_j} \\
&+ Chem_{i_j} + Metal_{i_j} + Plast_{i_j} + Trans_{i_j} + Text_{i_j} + Food_{i_j} + Inf_j + GG_j \\
&+ PolStab_j + \frac{TL}{AZE} + CBR_j + Quarantine_j + Inf_i + GG_i + PolStab_i + \frac{AZN}{TL} \\
&+ CBR_i + IntEvents_i + Quarantine_i + Crimea_g \\
&= Oil_{j_i} + Mach_{i_j} + Chem_{i_j} + Metal_{i_j} + Plast_{i_j} + Trans_{i_j} + Text_{i_j} + Food_{i_j} \\
&+ 2 * (Inf_i + GG_i + PolStab_i + \frac{AZN}{TL} + CBR_i + IntEvents_i + Quarantine_i \\
&+ Inf_j + GG_j + PolStab_j + \frac{TL}{AZE} + CBR_j + Quarantine_j + Crimea_g)
\end{aligned}$$

Equation 3. Model econometric derivation of total AZE-TR trade volume

Regression outputs

Model 1

```
. reg Exports_i_j Oil_j_i Inf_j GG_j PolStab_j TL_AZE CBR_j Quarantine_j Inf_i GG_i
> PolStab_i AZN_TL CBR_i IntEvents_i Quarantine_i Crimea_g

      Source |       SS           df       MS      Number of obs   =       120
-------------+----------------------------------   F(15, 104)      =     13.79
       Model |  21183.4432        15  1412.22954   Prob > F        =    0.0000
    Residual |  10651.8459       104  102.421595   R-squared       =    0.6654
-------------+----------------------------------   Adj R-squared   =    0.6171
       Total |  31835.2891       119  267.523437   Root MSE        =     10.12

------------------------------------------------------------------------------
  Exports_i_j |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
--------------+---------------------------------------------------------------
     Oil_j_i |   .0350159   .0048226     7.26   0.000     .0254526    .0445792
       Inf_j |   35.83586   16.97684     2.11   0.037     2.170159    69.50156
        GG_j |   7.800114   14.16294     0.55   0.583    -20.28553    35.88576
   PolStab_j |   .2290712   1.577961     0.15   0.885    -2.900084    3.358226
      TL_AZE |  -79.79465   33.65622    -2.37   0.020    -146.5362   -13.05311
       CBR_j |  -.0281359   .2011869    -0.14   0.889    -.4270971    .3708254
Quarantine_j |  -17.27434   5.505687    -3.14   0.002    -28.19233   -6.356359
       Inf_i |   71.23321   48.84666     1.46   0.148    -25.63154    168.098
        GG_i |   80.13487   58.61429     1.37   0.175    -36.09947    196.3692
   PolStab_i |    -1.2565   1.021217    -1.23   0.221    -3.281611     .768611
      AZN_TL |  -5.495983   1.170188    -4.70   0.000     -7.81651   -3.175456
       CBR_i |   .6823756   .7631411     0.89   0.373    -.8309618    2.195713
 IntEvents_i |   .5012513   3.325154     0.15   0.880    -6.092654    7.095157
Quarantine_i |   .3035076   5.967961     0.05   0.960    -11.53118    12.1382
    Crimea_g |  -4.716907   9.365586    -0.50   0.616    -23.28922    13.8554
       _cons |   67.92412   21.17295     3.21   0.002     25.93737    109.9109
------------------------------------------------------------------------------
```

Figure 7. Regression results for Model 1 before solving for multicollinearity

For the empirical part of the study, two multivariate regressions were conducted. In the first regression, the dependent variable was Azerbaijani exports, which was regressed on the exchange rate change, inflation rate, GDP growth as main factor variables and the rest of the variables that mostly played the role of control. This analysis was based on 120 monthly observations (with extra 6 months of observations to offset the missing data) over a 10-year period. The F-statistic indicates that the model is overall statistically significant. The model explains approximately 66.54% of the variance in Azerbaijani exports. The results show that while inflation in Türkiye has significant effects on Azerbaijani exports at 95% CL, while that of Azerbaijan was significant at 85% CL. Additionally, GDP growth in Azerbaijan has statistically significant at 80% CL while that of

Türkiye being having insignificant effect on Azerbaijani exports. The AZN/TRY and TRY/AZN exchange rate change had statistically significant effects in this model at 99% and 95% CL, respectively. However, this regression result was pre-multicollinearity check and diagnostics which means the variables causing the multicollinearity issue (TRY/AZE, inflation in Türkiye, Russian-Ukrainian conflict, and political stability in Azerbaijan) had to be removed from the model to ensure robustness of the results. After having fixed the problem, **F-statistic** still remained the same; **R-squared** dropped only slightly to 61.21%; **inflation** in Azerbaijan variable became statistically significant at 99% CL after removing the inflation in Türkiye variable; **GDP growth** variable has become highly significant at 99% CL, while that of Türkiye still remained insignificant; **AZN/TRY** variable has also remained statistically significant at 99% CL.

Source	SS	df	MS	Number of obs	=	120
				F(11, 108)	=	15.49
Model	19485.1153	11	1771.37412	Prob > F	=	0.0000
Residual	12350.1738	108	114.353461	R-squared	=	0.6121
Total	31835.2891	119	267.523437	Adj R-squared	=	0.5725
				Root MSE	=	10.694

Exports_i_j	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
Oil_j_i	.0290237	.0043011	6.75	0.000	.0204982	.0375492
GG_j	-1.483569	14.43377	-0.10	0.918	-30.09381	27.12667
PolStab_j	.334738	1.534522	0.22	0.828	-2.70695	3.376426
CBR_j	-.4903678	.1550406	-3.16	0.002	-.7976851	-.1830505
Quarantine_j	-18.21791	5.738232	-3.17	0.002	-29.59208	-6.84374
Inf_i	81.95041	32.99907	2.48	0.015	16.54053	147.3603
GG_i	234.821	45.42508	5.17	0.000	144.7806	324.8614
AZN_TL	-2.030057	.5690929	-3.57	0.001	-3.158097	-.9020157
CBR_i	.1166759	.6347025	0.18	0.854	-1.141414	1.374766
IntEvents_i	-.932424	3.486836	-0.27	0.790	-7.843938	5.97909
Quarantine_i	5.997195	5.556806	1.08	0.283	-5.017358	17.01175

_cons	36.82048	14.99761	2.46	0.016	7.092619	66.54834

Table 6. Regression results for Model 1 after solving for multicollinearity

Model 2

```
. reg Exports_j_i Mach_i_j Chem_i_j Metal_i_j Plast_i_j Trans_i_j Text_i_j Food_i_j
> Inf_j GG_j PolStab_j TL_AZE CBR_j Quarantine_j Inf_i GG_i PolStab_i AZN_TL CBR_i I
> ntEvents_i Quarantine_i Crimea_g
```

Source	SS	df	MS		
				Number of obs	= 108
				F(21, 86)	= 20182.44
Model	2.3777e+17	21	1.1323e+16	Prob > F	= 0.0000
Residual	4.8247e+13	86	5.6101e+11	R-squared	= 0.9998
				Adj R-squared	= 0.9997
Total	2.3782e+17	107	2.2226e+15	Root MSE	= 7.5e+05

Exports_j_i	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Mach_i_j	1.234136	.0231746	53.25	0.000	1.188067	1.280206
Chem_i_j	3.104911	.2494417	12.45	0.000	2.609038	3.600785
Metal_i_j	2.066181	.3446373	6.00	0.000	1.381065	2.751297
Plast_i_j	.5944612	.679678	0.87	0.384	-.7566939	1.945616
Trans_i_j	-.4300355	.1609511	-2.67	0.009	-.7499957	-.1100753
Text_i_j	1.021941	.0795014	12.85	0.000	.8638977	1.179985
Food_i_j	-.7209363	.2396082	-3.01	0.003	-1.197262	-.2446109
Inf_j	1362111	2424991	0.56	0.576	-3458612	6182834
GG_j	95444.25	1122739	0.09	0.932	-2136488	2327376
PolStab_j	522795.3	150403.7	3.48	0.001	223802.6	821788
TL_AZE	9874321	3782889	2.61	0.011	2354186	1.74e+07
CBR_j	.0000133	.0000223	0.60	0.553	-.000031	.0000576
Quarantine_j	421683.1	466036.6	0.90	0.368	-504767	1348133
Inf_i	-3.50e+07	1.09e+07	-3.21	0.002	-5.67e+07	-1.33e+07
GG_i	-9373111	6438683	-1.46	0.149	-2.22e+07	3426568
PolStab_i	-143022.6	99885.48	-1.43	0.156	-341588.4	55543.1
AZN_TL	593781.4	281767.5	2.11	0.038	33646.2	1153917
CBR_i	201.6843	118.1578	1.71	0.091	-33.2056	436.5741
IntEvents_i	-194788	264432	-0.74	0.463	-720461.5	330885.5
Quarantine_i	1903275	712018.6	2.67	0.009	487828.8	3318721
Crimea_g	212117.7	555826.3	0.38	0.704	-892828.4	1317064
_cons	-8198756	2761915	-2.97	0.004	-1.37e+07	-2708251

Figure 8. Regression results for Model 2 before solving for multicollinearity

In the second regression, the dependent variable was Turkish exports, which was regressed on the exchange rate change, inflation rate, GDP growth, as main factor variables and the rest of the

variables that mostly played the role of control. This analysis was based on 120 observations (with extra 6 months of observations to offset the missing data) over a 10-year period. The F-statistic indicates that the model is overall statistically significant. The model explains approximately 99.98% of the variance in Turkish exports. The results show that while inflation in Türkiye had insignificant effects on Turkish exports, that of Azerbaijan was highly significant at 99% CL. Additionally, GDP growth in both countries were insignificant. The AZN/TRY and TRY/AZN exchange rate change had statistically significant effects in this model under 95% and 85% CL, respectively. However, this regression result was pre-multicollinearity check and diagnostics which means the variables causing the multicollinearity issue (AZE/TRY, political stability in Azerbaijan, inflation in Türkiye, and CBR in Türkiye) had to be removed from the model to ensure robustness of the results. After having fixed the problem, **F-statistic** still remained the same; **R-squared** dropped only slightly to 99.75%; **inflation** in Azerbaijan variable is still statistically significant, but under 90% CL as opposed to under 99% before after removing the inflation in Türkiye variable; **GDP growth** variable still remained insignificant for both countries; the statistically significance of **TRY/AZN** variable has improved from 85% to 99% CL after removing the AZN/TRY variable.

Source	SS	df	MS	Number of obs	=	108
				F(11, 96)	=	3505.32
Model	237232.197	11	21566.5633	Prob > F	=	0.0000
Residual	590.641641	96	6.15251709	R-squared	=	0.9975
Total	237822.838	107	2222.64335	Adj R-squared	=	0.9972
				Root MSE	=	2.4804
Exports_j_i	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
core_Türkiye	1.30832	.0132222	98.95	0.000	1.282074	1.334566
GG_j	-1.322752	3.540191	-0.37	0.709	-8.349975	5.704472
PolStab_j	.3237684	.3761763	0.86	0.392	-.4229356	1.070472
TL_AZE	28.75101	5.676664	5.06	0.000	17.48292	40.0191

Quarantine_j	-3.094933	1.346902	-2.30	0.024	-5.768513	-.421353
Inf_i	-20.13777	10.91354	-1.85	0.068	-41.80098	1.525438
GG_i	9.187045	12.89687	0.71	0.478	-16.41304	34.78713
CBR_i	1.130222	.1662025	6.80	0.000	.8003129	1.460131
IntEvents_i	-.5092124	.8434545	-0.60	0.547	-2.183456	1.165032
Quarantine_i	-4.17113	1.471983	-2.83	0.006	-7.092993	-1.249268
Crimea_g	7.679196	1.668785	4.60	0.000	4.366684	10.99171
_cons	-16.54558	3.875084	-4.27	0.000	-24.23756	-8.853597

Table 7. Regression results for Model 2 after solving for multicollinearity

Final Econometric model

$$\begin{aligned}\text{Exports}_{i,j} &= \beta_0 + \beta_1 * Oil_{j_i} - \beta_2 * GG_j + \beta_3 * PolStab_j - \beta_4 * CBR_j + -\beta_5 * Quarantine_j \\ &+ \beta_6 * Inf_i + \beta_7 * GG_i - \beta_8 * \frac{AZN}{TRY} + \beta_9 * CBR_i - \beta_{10} * IntEvents_i + \beta_{11} \\ &* Quarantine_i \\ &= 36.82048 + 0.0290237 * Oil_{j_i} - 1.483569 * GG_j + 0.334738 * PolStab_j \\ &- 0.4903678 * CBR_j + -18.21791 * Quarantine_j + 81.95041 * Inf_i \\ &+ 234.821 * GG_i - 2.030057 * \frac{AZN}{TRY} + 0.1166759 * CBR_i - 0.932424 \\ &* IntEvents_i + 5.997195 * Quarantine_i\end{aligned}$$

Equation 4. Final Econometric Model for AZE exports

$$\begin{aligned}
\text{Exports}_{j,i} &= \beta_0 + \beta_1 * Mach_{i_j} + \beta_2 * Chem_{i_j} + \beta_3 * Metal_{i_j} + \beta_4 * Plast_{i_j} + \beta_5 * Trans_{i_j} \\
&+ \beta_6 * Text_{i_j} + \beta_7 * Food_{i_j} + \beta_8 * GG_j + \beta_9 * PolStab_j + \beta_{10} * \frac{TL}{AZE} + \beta_{11} \\
&* Quarantine_j + \beta_{12} * Inf_i + \beta_{13} * GG_i + \beta_{14} * CBR_i + \beta_{15} * IntEvents_i \\
&+ \beta_{16} * Quarantine_i + \beta_{17} * Crimea_g \\
&= \beta_0 + \beta_1 * core_{Türkiye} + \beta_2 * GG_j + \beta_3 * PolStab_j + \beta_4 * \frac{TL}{AZE} + \beta_5 \\
&* Quarantine_j + \beta_6 * Inf_i + \beta_7 * GG_i + \beta_8 * CBR_i + \beta_9 * IntEvents_i + \beta_{10} \\
&* Quarantine_i + \beta_{11} * Crimea_g \\
&= -16.54558 + 1.30832 * core_{Türkiye} - 1.322752 * GG_j + .3237684 \\
&* PolStab_j + 28.75101 * \frac{TL}{AZE} - 3.094933 * Quarantine_j - 20.13777 * Inf_i \\
&+ 9.187045 * GG_i + 1.130222 * CBR_i - .5092124 * IntEvents_i - 4.17113 \\
&* Quarantine_i + 7.679196 * Crimea_g
\end{aligned}$$

Equation 5. Final Econometric Model for TR-AZE trade

$$\mathrm{Trade}_{\mathrm{total}} = \mathrm{Exports}_{\mathrm{i,j}} + \mathrm{Exports}_{\mathrm{j,i}}$$

$$= \Big(36.82048 + 0.0290237 * Oil_{j_i} - 1.483569 * GG_j + 0.334738 * PolStab_j$$
$$- 0.4903678 * CBR_j + -18.21791 * Quarantine_j + 81.95041 * Inf_i$$
$$+ 234.821 * GG_i - 2.030057 * \frac{AZN}{TRY} + 0.1166759 * CBR_i - 0.932424$$
$$* IntEvents_i + 5.997195 * Quarantine_i\Big)$$
$$+ \Big(-16.54558 + 1.30832 * core_{Türkiye} - 1.322752 * GG_j + .3237684$$
$$* PolStab_j + 28.75101 * \frac{TL}{AZE} - 3.094933 * Quarantine_j - 20.13777 * Inf_i$$
$$+ 9.187045 * GG_i + 1.130222 * CBR_i - .5092124 * IntEvents_i - 4.17113$$
$$* Quarantine_i + 7.679196 * Crimea_g\Big)$$
$$= 20.2749 + 0.0290237 * Oil_{j_i} - 2.806321 * GG_j + 0.6585064 * PolStab_j$$
$$- 0.4903678 * CBR_j - 21.312843 * Quarantine_j + 61.81264 * Inf_i$$
$$+ 244.008045 * GG_i - 2.030057 * \frac{AZN}{TRY} + 1.2468979 * CBR_i - 1.4416364$$
$$* IntEvents_i + 1.826065 * Quarantine_i + 1.30832 * core_{Türkiye} + 28.75101$$
$$* \frac{TL}{AZE} + 7.679196 * Crimea_g$$

Equation 6. Final Econometric Model for TR exports

Interpretation of Results and Real-World Implications of the GMT equation

1. One-thousand-barrel increase in Azerbaijani oil exports will increase bilateral trade between Türkiye and Azerbaijan by 29.024 thousand USD,
2. One per cent increase in GDP of Türkiye will decrease bilateral trade between Türkiye and Azerbaijan by 2.806 million USD,
3. One unit increase in Political Stability index in Türkiye will increase bilateral trade between Türkiye and Azerbaijan by 658.507 thousand USD,
4. One billion USD increase in Central Bank reserves in Türkiye will decrease bilateral trade between Türkiye and Azerbaijan by 490.368 thousand USD,

5. Presence of strict quarantine regime in Azerbaijan will decrease bilateral trade between Türkiye and Azerbaijan by 21.313 million USD,
6. One per cent increase in inflation rate in Azerbaijan will increase bilateral trade between Türkiye and Azerbaijan by 61.813 million USD,
7. One per cent increase in GDP of Azerbaijan will increase bilateral trade between Türkiye and Azerbaijan by 244 million USD,
8. One lira appreciation of AZN against TRY will decrease bilateral trade between Türkiye and Azerbaijan by 2.03 million USD,
9. One billion USD increase in Central Bank reserves of Azerbaijan will increase bilateral trade between Türkiye and Azerbaijan by 1.25 million USD,
10. Presence of actively hosted international events in Azerbaijan will decrease bilateral trade between Türkiye and Azerbaijan by 1.442 million USD,
11. Presence of strict quarantine regime in Türkiye will increase bilateral trade between Türkiye and Azerbaijan by 1.826 million USD,
12. One million USD increase in core Turkish exports will increase bilateral trade between Türkiye and Azerbaijan by 1.31 million USD,
13. One manat appreciation in TRY against AZN will increase bilateral trade between Türkiye and Azerbaijan by 28.75 million USD,
14. Presence of active conflict situation between Russia and Ukraine will increase bilateral trade between Türkiye and Azerbaijan by 7.68 million USD.

Conclusion

All in all, this study provides a comprehensive analysis of the trade dynamics between Türkiye and Azerbaijan, with a particular focus on the influence of macroeconomic variables and geopolitical factors by using regression models to reveal distinct differences in these factors' impact on exports. As for the findings, while inflation in Azerbaijan significantly affects Azerbaijani exports and imports, the variable assigned for inflation in Türkiye was excluded from the model to resolve multicollinearity issue. Moreover, the exchange rate between the AZN and TRY plays a crucial role in shaping trade flows, with both models showing significant effects. Despite the considerable variance explained by the models, other variables like GDP growth

proved to be less influential than expected with only Azerbaijani economic growth showing significant impact on its exports to Türkiye and proving insignificant for the other three cases. These findings highlight the importance of understanding bilateral trade relations and indispensable role of economic policies to affect its dynamics and magnitude. Future research could expand on this by incorporating more recent data and exploring additional variables, such as the impact of international events and border policies, to provide a more nuanced understanding of this dynamic relationship.

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Appendices

Modelling and approach

Model 1: Turkish Exports to Azerbaijan

This model uses monthly Türkiye exports to Azerbaijan as the dependent variable. The monthly TRY/AZN currency rate movement, Azerbaijan and Türkiye inflation rates, and GDP growth rates are independent factors. These factors affect Türkiye's export performance to Azerbaijan, and this model quantifies their impact.

Model 2: Azerbaijani Exports to Türkiye

The second model is same but utilizes Azerbaijani exports to Türkiye as the dependent variable. The same independent variables are employed to preserve consistency and compare bilateral trade patterns. This model investigates Azerbaijan's export performance to Türkiye.

Model variables defined

$$i - AZE$$

$$j - TR$$

$$D_{j_i} - Turkish\ demand\ to\ AZE\ products$$

$$D_{i_j} - Azerbaijani\ demand\ to\ TR\ products$$

$$F_{i_{i,j}} - local\ factors\ in\ AZE\ affecting\ AZE\ exports$$

$$F_{j_{i,j}} - \ local\ factors\ in\ TR\ affecting\ AZE\ exports$$

$$F_{i_{j,i}} - local\ factors\ in\ AZE\ affecting\ TR\ exports$$

$$F_{j_{j,i}} - \ local\ factors\ in\ TR\ affecting\ TR\ exports$$

$$F_g - global\ factors\ affecting\ TR - AZE\ trade$$

$$\text{Exports}_{\text{i,j}} - Azerbaijani\ exports\ to\ TR$$

$$\text{Exports}_{\text{j,i}} - Turkish\ exports\ to\ AZE$$

$$\text{Exports}_{\text{i,j}} = D_{j_i} + F_{i_{i,j}} + F_{j_{i,j}} + F_g\ (TURKSTAT)$$

$$\text{Exports}_{\text{j,i}} = D_{i_j} + F_{i_{j,i}} + F_{j_{j,i}} + F_g\ (TURKSTAT)$$

Econometric variables defined

$\text{Trade}_{\text{total}}$ – total volume of trade among Türkiye and Azerbaijan, billions USD

$\text{Trade}_{\text{i,j}}$ – total volume of goods and services Azerbaijan trades with Türkiye, billions USD

$\text{Trade}_{\text{j,i}}$ – total volume of goods and services Türkiye trades with Azerbaijan, billions USD

$$Oil_{j_i} - Turkish\ demand\ for\ Azerbaijani\ oil, barrels\ (FRED\ +\ TURKSTAT)$$

$$Inf_i - inflation\ rate\ in\ Azerbaijan\ (Trading\ Economics)$$

$$GG_i - GDP\ growth\ in\ Azerbaijan\ (Trading\ Economics)$$

$$PolStab_i - political\ stability\ in\ Azerbaijan\ (The\ Worldwide\ Governance\ Indicators)$$

$$\frac{AZN}{TL} - exchange\ rate\ of\ AZN\ versus\ TL\ (investing.com)$$

$$CBR_i - Central\ Bank\ reserves\ of\ Azerbaijan, billions\ USD\ (CBAR)$$

$$IntEvents_i - state\ of\ the\ international\ events\ held\ in\ Azerbaijan$$

$$Quarantine_i - state\ of\ the\ local\ quarantine\ regime\ in\ Azerbaijan$$

$$Crimea_i - state\ of\ Russia$$

$$- Ukraine\ conflict\ beginning\ from\ Crimean\ annexation\ for\ Azerbaijan$$

$$Mach_{i_j} - Azerbaijani\ demand\ for\ Turkish\ machines\ (UN\ Comtrade)$$

$Chem_{i_j}$ – Azerbaijani demand for Turkish chemical products ($UN\ Comtrade$)

$Metal_{i_j}$ – Azerbaijani demand for Turkish metals ($UN\ Comtrade$)

$Plast_{i_j}$ – Azerbaijani demand for Turkish plastics and rubbers ($UN\ Comtrade$)

$Trans_{i_j}$ – Azerbaijani demand for Turkish transportation services ($UN\ Comtrade$)

$Text_{i_j}$ – Azerbaijani demand for Turkish textiles ($UN\ Comtrade$)

$Food_{i_j}$ – Azerbaijani demand for Turkish foodstuffs ($UN\ Comtrade$)

$$Inf_j - inflation\ rate\ in\ Turkey\ (Trading\ Economics)$$

$$GG_j - GDP\ growth\ in\ Turkey\ (FRED)$$

$$PolStab_j - political\ stability\ in\ Turkey\ (The\ Worldwide\ Governance\ Indicators)$$

$$\frac{TL}{AZE} - exchange\ rate\ of\ TL\ versus\ AZN\ (investing.com)$$

$$CBR_j - Central\ Bank\ reserves\ of\ Turkey, billions\ USD\ (FRED)$$

$$Quarantine_j - state\ of\ the\ local\ quarantine\ regime\ in\ Turkey$$

$$Crimea_j - state\ of\ Russia$$

$$- Ukraine\ conflict\ beginning\ from\ Crimean\ annexation\ for\ Turkey$$

Processing Variables for Econometric Model

Turkish demand for Azerbaijani products

$$\mathrm{D}_{j_i} * 85\% += Oil_{j_i} + FDI_{j_i}$$

Local factors in AZE affecting AZE exports

$$F_{i_{i,j}} = Inf_i + GG_i + PolStab_i + \frac{AZN}{TL} + CBR_i + IntEvents_i$$

Local factors in TR affecting AZE exports

$$F_{j_{i,j}} = Inf_j + GG_j + PolStab_j + \frac{TL}{AZE} + CBR_j$$

Azerbaijani demand for Turkish products

$$\mathrm{D}_{j_i} * 75\% += Mach_{i_j} + Chem_{i_j} + Metal_{i_j} + Plast_{i_j} + Trans_{i_j} + Text_{i_j} + Food_{i_j}$$

Local factors in TR affecting TR exports

$$F_{j_{j,i}} = Inf_j + GG_j + PolStab_j + \frac{TL}{AZE} + CBR_j$$

Local factors in AZE affecting TR exports

$$F_{i_{j,i}} = Inf_i + GG_i + PolStab_i + \frac{AZN}{TL} + CBR_i + IntEvents_i$$

Global factors

$$F_g = Quarantine_i + Crimea_i + Quarantine_j + Crimea_j$$