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## Analyzing Bilateral Trade Dynamics between Azerbaijan and Pakistan: A Robust Least Squares Regression Approach

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### ABSTRACT

The diplomatic relations between Azerbaijan and Pakistan have undergone significant development since the late 1990s. Despite some studies focusing on diplomatic and political relations, the economic dimension of this partnership has not been systematically covered. In this paper, a robust least squares (RLS) approach is used to model bilateral trade between the two countries and identify statistically significant determinants, including economic, institutional, and cultural factors, after analyzing the main economic and subsectoral trade dynamics of both countries. The results reveal that Azerbaijan's imports from Pakistan are significantly associated with the country's higher income and market size, while Pakistan's elevated exchange rate and trade costs hinder bilateral trade. In addition, Pakistan's rising manufacturing output increases exports to Azerbaijan but decreases imports from Azerbaijan. Among institutional determinants, government effectiveness, the trade freedom index (TFI), and political stability play significant roles in bilateral trade. Lastly, it was found that cultural proximity increases Pakistani exports to Azerbaijan but not imports from Azerbaijan. The analysis also indicates that domestic savings stimulate Pakistani exports. These findings underscore the complex nature of bilateral trade between Azerbaijan and Pakistan and highlight the need for institutional arrangements to harmonize trade flows and boost welfare gains from trade. The results may be of great importance to intergovernmental working groups, domestic policymakers, and businesses.

### KEYWORDS

Azerbaijan; Bilateral trade; Robust least squares; Pakistan

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## 1. Introduction

Political and economic relations between Azerbaijan and Pakistan play a crucial role in promoting regional cooperation, fostering trade and investment opportunities, and strengthening diplomatic ties between the two nations. These relations have developed significantly in recent years, particularly in light of the Nagorno-Karabakh War, in which Pakistan sided with Azerbaijan and called for the withdrawal of Armenian occupation forces from the area (Khan and Syed, 2021). In return, Azerbaijan has always supported Pakistan when floods, earthquakes, or other natural disasters have occurred (Report.az, 2022; Mukhtarli, 2017). Moreover, both countries are strongly motivated to cooperate in the defense sector and jointly address geopolitical challenges (Khan, 2017). However, experts believe that bilateral trade between the two countries remains unfulfilled and undersized despite close diplomatic and political ties (Makili-Aliyev and Abbas, 2016; Imran, 2017a). Therefore, this topic deserves further academic research using empirical methods.

Azerbaijan and Pakistan signed an agreement on establishing economic cooperation in 1995, which expired in 1998 (Makili-Aliyev and Abbas, 2016). It is believed that the lack of necessary institutional arrangements affects the actual bilateral relations between the two countries. Moreover, there is no long-term empirical and scientific analysis of the main economic, institutional, and cultural determinants of trade between two countries. However, the recent geopolitical tensions (e.g., between Azerbaijan and Iran; the Russo-Ukrainian war) have brought these two countries together (Shanahan, 2013; Noor, 2020). The results of Abbasi and Rehman's (2011) survey indicate that people in these two countries are optimistic about the bilateral relations between the two countries but still do not know much about their strategic interests. Abbasi and Rehman (2011) clearly pointed out that bilateral trade should be explored by making the two societies more aware of each other. Clarification and categorization of the key economic, institutional, and cultural determinants of bilateral trade between Azerbaijan and Pakistan should have been done in light of the rapidly increasing cooperation, but it remains scarce.

Given this research gap, the main objective of this paper is to examine the main determinants of bilateral trade based on generally accepted theoretical foundations. Due to the nature of the data collected (i.e., presence of outliers, non-normal distribution), this work mainly uses a quantitative research method, namely robust least squares (RLS) estimation. The research question is: what factors (e.g., economic, institutional) influenced bilateral trade and subsequently led to higher trade turnover between Azerbaijan and Pakistan? To the best of the authors' knowledge, there has been no systematic, in-depth empirical, or economic analysis of bilateral trade between Azerbaijan and Pakistan. For this reason, this study contributes to the literature in two ways. First, it adds to the limited empirical evidence analyzing Azerbaijan's new trade partners, such as Pakistan. Second, we test the role of several unconventional explanatory variables (e.g., quality of institutions and governance, countries' interest in each other in search engines). The following hypotheses were tested using the RLS approach:

- Ha1: Economic factors play a statistically significant role in bilateral trade between Azerbaijan and Pakistan;
- Ha2: Institutional factors play a statistically significant role in bilateral trade between Azerbaijan and Pakistan;
- Ha3: Globalization and related factors play a statistically significant role in bilateral trade between Azerbaijan and Pakistan;
- Ha4: Cultural factors play a statistically significant role in bilateral trade between Azerbaijan and Pakistan.

In this paper, it is possible to show that there is a strong link between Azerbaijan's imports from Pakistan and its higher income and market size, whereas Pakistan's increased exchange rate and trade costs act as barriers to bilateral trade. Moreover, Pakistan's growing manufacturing output enhances imports from Azerbaijan but reduces imports to Azerbaijan. Institutional factors such as government effectiveness, TFI, and political stability significantly influence bilateral trade. There is also evidence that both countries are failing to benefit from higher institutional quality to boost bilateral trade and align their national economic interests. Additionally, cultural closeness leads to an increase in Pakistani exports to Azerbaijan, while our analyses reveal that domestic savings stimulate Pakistani

exports.

The next section contains a brief literature review and the theoretical framework of this study. Section 3 is the data and methodology section, where all the specifics of the analytical approach are explained. Section 4 reports the results of both descriptive subsectoral bilateral trade relations between Azerbaijan and Pakistan and RLS estimations. Section 5 is the discussion section, where the results are put into context. Finally, Section 6 provides the conclusions.

## 2. Literature review and theoretical framework

The Azerbaijani economy has gained prominence primarily for its extensive reserves of oil and natural gas, playing a pivotal role in its nation-building and economic recovery following the dissolution of the Soviet Union (Ciaretta and Nasirov, 2012). Despite facing a recessionary phase between 1991 and 1994, Azerbaijan embarked on a trajectory of recovery from transitional upheavals, marking a substantial turnaround since 1995, subsequently characterized by an oil boom era spanning from 2005 to 2014 (Aliyev and Suleymanov, 2015). The oil boom era ushered in a period of robust economic expansion, considerable reduction in poverty levels, marked employment growth, and rapid accumulation of capital (Aras et al., 2016). Notwithstanding its contributions to overall macroeconomic stability and impressive growth statistics, the rapid and fast utilization of oil-derived revenue concurrently triggered domestic inflation and elevated exchange rate levels. Consequently, Azerbaijan found itself entwined within the concepts of Dutch disease and de-industrialization on multiple occasions, driven by factors such as limited non-oil manufacturing, dependence on oil-generated income, and the appreciating trajectory of the real effective exchange rate (REER; Hasanov, 2013).

Azerbaijan's primary phase of industrialization unfolded during the Soviet era, imprinting a distinctive pattern on its foreign economic interactions with the global community (Cornell, 2015). Indeed, the impetus for bilateral and multilateral trade accords was significantly driven by oil and gas resources, resulting in a reduction in the proportional contribution of manufacturing and agriculture to the aggregate exports (Pylín, 2015). Among Azerbaijan's principal trade allies were prominent nations such as Russia, Türkiye, Israel, and Italy, among others. The later part of the 1990s witnessed Azerbaijan transitioning towards exporting commodities, particularly oil and natural gas, while simultaneously increasing its reliance on imported manufactured goods. However, the nation's commitment to international trade remained steadfast, evinced by its persistent quest for fresh trade partners. As such, the focus primarily gravitated towards importing manufactured goods, fostering the establishment of novel economic affiliations, securing bilateral arrangements, and adroitly harnessing its strategically advantageous geographic positioning to optimize welfare dividends stemming from international trade dynamics (Bernardini, 2017).

Pakistan's recent economic trajectory has been punctuated by periods of acute hardship, particularly evident in the late 1990s when the nation stood on the precipice of default and grappled with severe poverty (Husain, 2000). Husain (2000) captures this economic downturn in stark terms: characterized by negative export growth rates, escalating unemployment, a decline in remittances from workers abroad, suspension of World Bank and International Monetary Fund assistance, and a surge in debt ratios. These consequences were the fallout of the deviation from economic realities, compelling the politically elected government to undertake unpopular measures for institutional reforms. The turning point transpired in October 1999, with General Pervez Musharraf's assumption of power, heralding a reversal in the situation (Husain, 2000). Subsequent to the late 1990s, Pakistan's economy rebounded, achieving robust growth rates, notwithstanding the backdrop of tensions with India, elevated oil prices, and recurrent and severe drought conditions (Husain, 2000).

The economic landscape of Pakistan is characterized by a diverse array of sectors, each contributing its distinct hues to the canvas of its economic structure. Predominantly agrarian, Pakistan faces limitations in its international

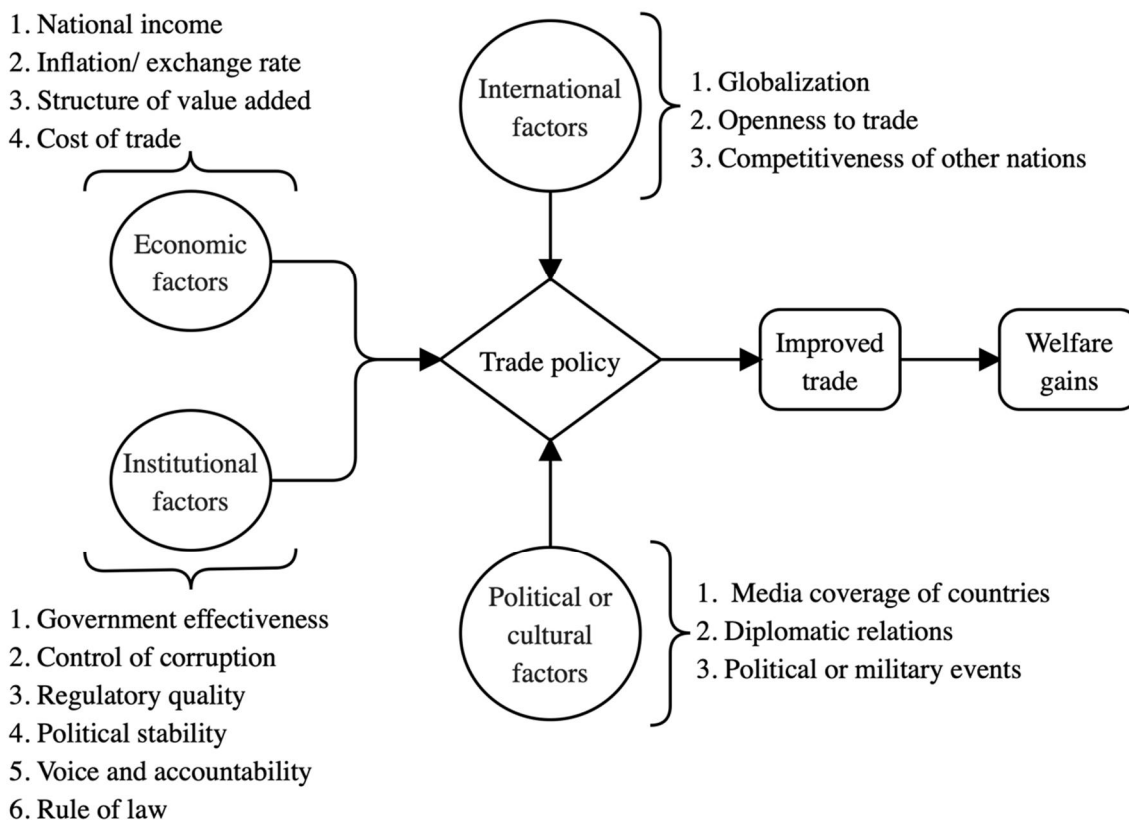
competitive capabilities (Azzam and Shafique, 2017). While the Green Revolution and improved irrigation systems have bolstered its agricultural output (Easterly, 2001), the nation contends with challenges stemming from deficient modern irrigation infrastructure, a scarcity of skilled human capital, inadequate physical facilities, and insufficiency in agricultural inputs (Azzam and Shafique, 2017). Notably, Pakistan demonstrates a degree of self-sufficiency in domestic food production; however, the country remains vulnerable to the vagaries of natural disasters (Husain, 2000). Beyond the agrarian realm, other sectors assume significant roles in the broader trajectory of national economic development. Manufacturing, for instance, has exhibited a notable expansion since the 1960s, with Pakistan emerging as a notable exporter of textile products, comparable to economies in East and Southeast Asia such as Malaysia, Thailand, Indonesia, and the Philippines (Husain, 2000). Likewise, services subsectors, encompassing domains like information technologies, research and development, and trade, are acknowledged as contributors to economic growth and embrace an export-oriented economic paradigm (Ahmed and Ahsan, 2011). Recent developments underscore the pronounced importance of China-Pakistan economic collaboration within Pakistan's external sector (Khan and Khan, 2019; Ali, 2020).

Additional pertinent economic factors merit brief consideration. Afzal (2009) meticulously documented the adverse impact of Pakistan's population growth on its economic expansion, impeding the efficient allocation of resources in productive endeavors. Moreover, investments stand poised to bolster Pakistan's overall welfare (Afzal, 2009), whereas the tandem of political stability and effective governance holds potential to engender enhanced human resource management and the maximization of productivity (Khilji, 2013; Shahbaz, 2017). These assertions find corroboration in the findings of Shahbaz et al. (2008), affirming investments as catalysts for employment creation. Conversely, the nexus between trade openness and economic growth remains elusive, while financial openness and the financial sector are shown to be conducive to Pakistan's growth. Pertinently, Afzal (2007) underscores the potential benefits of trade openness, citing liberalization policies and the deregulation of the economy as potent mechanisms fostering enduring growth effects.

In the context of these succinct portrayals delineating the economic landscapes of Azerbaijan and Pakistan, it is acceptable to acknowledge that the historical trajectory of bilateral trade interactions between these nations remains relatively shallow. Over the past three decades, there have emerged a limited number of pivotal junctures and accords aimed at fostering bilateral trade relations. These instances encompass a spectrum of endeavors, including the formalization of a trade Agreement in 1995, collaborative engagements between the respective ministries of finance in 2005, the establishment of a Memorandum of Understanding in 2016 to catalyze a joint business council between the Chamber of Commerce and Industry of Azerbaijan and the Federation of Pakistani Chambers of Commerce and Industry. Additionally, the discourse on bilateral economic ties between Pakistan and Azerbaijan assumed prominence in 2017, further culminating in the inception of a joint working group dedicated to trade and cooperation during the same year. Pertinent to this progression was the convening of a dedicated business conference between Pakistan and Azerbaijan in 2018, followed by the second conclave of the joint working group on trade cooperation during the same year. As a culmination of this trajectory, the pivotal milestone of a Memorandum of Understanding on trade between Azerbaijan and Pakistan was unveiled in the year 2023.

The theoretical framework derives its foundation from seminal works by Spillan and Verzi (2017), Abdoulrahman and Jun (2021), and Okenna and Adesanya (2020), who comprehensively explored the principal determinants of international trade within the context of emerging economies. Figure 1 elucidates the schematic representation of the theoretical framework that underpins the present study. In adherence to this framework, the variables of interest were carefully selected for incorporation within the linear modeling of bilateral trade. These variables are susceptible to influence from four overarching factors, specifically economic, institutional, international, and political or cultural determinants. To elaborate, variables assessing national income metrics (e.g., GDP per capita), inflation indices, exchange rates, value-added structures, and trade costs stand as pivotal economic

determinants shaping bilateral trade dynamics between Azerbaijan and Pakistan. Concurrently, the institutional facet encompasses variables indicative of government effectiveness, political stability, and adherence to the rule of law. Furthermore, the weight of international factors, encompassing dimensions of globalization, trade openness, and competitive prowess, cannot be underestimated. Notably, the innovative dimension of this research lies in the incorporation of political and cultural determinants, whose manifestations are often evident through media narratives, diplomatic interplay, and geopolitical occurrences. The forthcoming section expounds upon the comprehensive explication of the variables that remain integral within this robust theoretical framework.



**Figure 1.** Theoretical framework of the current study.

Source: Author's own construction.

### 3. Data and methodology

#### 3.1. Model specification

The modeling approach closely resembles that of Cebeci and Ghorbani (2020), who extensively examined the bilateral trade relations between Türkiye and Iran. Following the underlying theoretical framework, we posit that bilateral trade ( $Y$ ) is influenced by a combination of economic ( $E$ ), institutional ( $Inst.$ ), international ( $Inter.$ ), and political or cultural ( $C$ ) factors, represented by the function below:

$$Y = F(E, Inst., Inter., C) \tag{1}$$

The above functional specification can be rewritten in a different form, as shown below:

$$y_{i,t} = \beta_0 + \sum_k \beta_k X_{k,i,t} + \epsilon_{i,t} \tag{2}$$

In the context of this study, the variable  $y_i$  represents either Azerbaijan's imports from Pakistan or Pakistan's imports from Azerbaijan at time  $t$ . The coefficient  $\beta_0$  pertains to the intercept, while  $X_{k,i,t}$  denotes the vector of explanatory variables, encompassing individual or combined representations of economic, institutional, globalization, and cultural factors in either Azerbaijan or Pakistan ( $i$ ) at time  $t$ . The error term ( $\epsilon_{i,t}$ ) accounts for the unexplained variability in the model.

### 3.2. Data description

The initial dataset encompassed the time span from 1992 to 2021. Nevertheless, we excluded the years 1992 to 1995 due to numerous missing values, extreme outliers, and their limited relevance to the bilateral trade dynamics between Azerbaijan and Pakistan. This period coincided with Azerbaijan's severe recession, attributed to the dissolution of the Soviet Union and military conflicts with Armenia. Consequently, our analysis focused on the years from 1996 to 2021, comprising a total of 26 observations. In light of Jenkins and Quintana-Ascencio's (2020) suggestions, who recommended a minimum of 8 observations for linear modeling with low variance in the variables of interest and 25 observations for modeling with high variance, our dataset of 26 observations offers an adequate basis for applying the RLS methodology, considering the constraints posed by data availability.

The data source for this study includes the State Statistical Committee of the Republic of Azerbaijan (SSCRA), the World Bank, Bruegel datasets (i.e., REER of Azerbaijan and Pakistan based on 65 trading partners), the Heritage Foundation (i.e., Trade Freedom Index), and the Observatory of Economic Complexity (OEC; various subsectoral trade data for both countries). The names of the variables, their abbreviations, units of measure, summary statistics, and the exact sources used for the linear estimates are listed in Table 1.

**Table 1.** Descriptive statistics and detailed information of the variables of interest, 1996–2021.

Variable name	Variable abbreviation	Measurement	Min.	Max.	Mean	St.Dev.	Source
Imports from Pakistan to Azerbaijan	ImpFrPak	in current Azerbaijani Manat	251.6	14,487.3	3,882.9	3,951.6	SSCRA
Exports to Pakistan from Azerbaijan	ExpToPak		4.4	3584.3	663.3	903.2	
Inflation rate in Azerbaijan	AzeInfl		-18.8	27.8	8.2	11.2	The World Bank
Inflation rate in Pakistan	PakInfl	in %, for REER	3.3	38.5	9.9	7.3	
Real effective exchange rate in Azerbaijan	AzeREER	2007=100%	75.7	140.6	101.1	19.9	Bruegel Datasets
Real effective exchange rate in Azerbaijan	PakREER		90.9	133.8	107.0	11.2	
GDP per capita in Azerbaijan	AzeGDPpc	in current USD	409.2	7,891.3	3,596.8	2,595.7	The World Bank
GDP per capita in Paksitan	PakGDPpc		420.7	1620.7	928.8	401.4	
Azerbaijan's population growth rates	AzePopGr	in %	0.4	2.1	1.1	0.4	
Pakistan's population growth rates	PakPopGr		1.2	3.1	2.1	0.6	

Share of manufacturing value added in Azerbaijan's GDP	AzeMan		4.0	10.4	6.0	1.7	
Share of manufacturing value added in Paksitan's GDP	PakMan		10.2	14.8	12.7	1.4	
Trade openness of Azerbaijan	AzeTrOpp		69.5	121.5	85.7	14.0	
Trade openness of Paksitan	PakTrOpp		24.7	38.3	30.7	3.8	
Trade freedom index of Azerbaijan	AzeTFI	Index value	55.0	78.4	70.7	8.4	Heritage Foundation
Trade freedom index of Pakistan	PakTFI		29.0	67.2	58.0	12.0	
Trade cost in Azerbaijan (as a proxy to overall trade cost)	TradeCost	in current Azerbaijani Manat	-407673.0	566432.0	-0.1	187302.2	SSCRA
Share of savings in Azerbaijan's GDP	AzeSavings		2.1	49.9	30.5	13.0	
Share of savings in Pakistan's GDP	PakSavings		11.4	22.3	16.3	3.0	
Share of agriculture value added in Azerbaijan's GDP	AzeAgr	in %	5.1	25.0	9.7	5.8	The World Bank
Share of agriculture value added in Pakistan's GDP	PakAgr		20.7	25.6	23.2	1.3	
Interest in Pakistan in Azerbaijan	InterestInAze	index value, 0 (low)-	2.7	18.8	7.7	4.5	Google Trends
Interest in Azerbaijan in Pakistan	InterestInPak	100(high)	4.4	27.1	11.3	6.9	
Azerbaijan's political stability	AzePolSt		-1.6	-0.3	-0.8	0.4	
Azerbaijan's government effectiveness	AzeGovEff		-0.7	0.8	0.1	0.5	
Azerbaijan's institutional quality	AzeInsQ	index value; -2.5 (low)-+2.5 (high)	-1.1	0.4	-0.2	0.5	The World Bank, Worldwide Governance Indicators
Paksitan's government effectiveness	PakGovEff		-0.8	-0.4	-0.6	0.1	
Paksitan's political stability	PakPolSt		-2.8	-1.1	-2.0	0.6	
Paksitan's institutional quality	PakInsQ		-1.2	-0.8	-1.0	0.1	
REER of the main	PakREERTrP	in %,	93.8	122.2	106.6	9.3	Bruegel

tradeing partners of Paksitan		2007=100%					Datasets
REER of the main tradeing partners of Azerbaijan	AzeREERTrP		79.7	110.3	95.4	9.3	
Oil boom period in Azerbaijan	AzeOilBoom	Dummy variable, 2005–2014=1			—		Constructed based on The World Bank data

Before proceeding with the modeling, the Augmented Dickey-Fuller (ADF) unit root test was conducted on the variables to assess their integration level. The findings indicated that most of the variables were non-stationary in their level form, but all of them exhibited stationarity in their first difference. Hence, for the RLS estimations, we utilized the first difference of the variables in all models.

**Table 2.** Augemented Dickey-Fuller unit root test results of the variables of interest based on Akaike Information Criterion with constant.

	<b>ImpFrPak</b>	<b>ExpToPak</b>	<b>AzeInfl</b>	<b>PakInfl</b>	<b>AzeREER</b>	<b>PakREER</b>
At level	-0.72	-2.71*	-5.02***	-5.20***	-1.75	-2.21
1st diff.	-4.72***	-5.49***	-4.47***	-8,23***	-3.51**	-3.62**
	<b>AzeGDPpc</b>	<b>PakGDPpc</b>	<b>AzePopGr</b>	<b>PakPopGr</b>	<b>AzeMan</b>	<b>PakMan</b>
At level	-1.41	0.79	-1.59	-2.73*	-2.22	-2.40
1st diff.	-3.11**	-2.95*	-4.70***	-4.13***	-3.22*	-5.12***
	<b>AzeTrOpp</b>	<b>PakTrOpp</b>	<b>AzeTFI</b>	<b>PakTFI</b>	<b>TradeCost</b>	<b>AzeSavings</b>
At level	-2.56	-2.38	-2.38	2.27	-4.92***	-2.40
1st diff.	-3.15**	-5.06***	-7.60***	-7.28***	-2.79*	-5.07***
	<b>PakSavings</b>	<b>AzeAgr</b>	<b>PakAgr</b>	<b>InterestInAze</b>	<b>InterestInPak</b>	<b>AzePolSt</b>
At level	-0.32	-5.44***	-1.76	-1.98	-1.98	-2.58
1st diff.	-4.88***	-3.23**	-4.55***	-4.28***	-4.28***	-5.36***
	<b>AzeGovEff</b>	<b>AzeInsQ</b>	<b>PakGovEff</b>	<b>PakPolSt</b>	<b>PakInsQ</b>	<b>PakREERTrP</b>
At level	-1.04	-1.46	-2.12	-1.61	-1.72	-0.77
1st diff.	-5.67***	-4.21***	-3.44**	-2.95*	-4.15***	-4.63***
	<b>AzeREERTrP</b>					
At level	-3.06**					
1st diff.	-4.37**					

Note: "diff" denotes difference; T-statistics are reported at their levels and their first differences; The symbols \*, \*\*, and \*\*\* indicate statistical significance at 10%, 5%, and 1% levels, respectively; All numbers were rounded to the second decimal point for compactness.

### 3.3. Estimation techniques

Several prior studies have centered on Pakistan's bilateral trade relations with different countries, including India, China, and Central Asian countries, utilizing various forms of linear modeling (Taneja, 2006; Irshad et al., 2018; Kan et al., 2019). However, when examining bilateral trade relations with Azerbaijan, we observed that the



conventional ordinary least squares (OLS) method proves inadequate in capturing meaningful and anticipated relationships, mainly due to the presence of outliers and the non-normal distribution of variables. For this reason, we preferred RLS to OLS after considering the methodological literature on the subject. In fact, Robust regression techniques enhance the model's fit to the data, particularly when encountering outliers or non-normality in the data (Khan et al., 2021). These methods demonstrate greater efficiency compared to classical linear regression methods when dealing with such challenging data patterns, resulting in more accurate coefficient estimates even with limited data (Kiefer et al., 2000). Furthermore, robust regression methods are versatile and applicable to various data types, such as non-normal, outlier-prone, and heteroscedastic data (Kiefer et al., 2000).

Here modifications to the RLS procedure throughout the estimation process are also reported. For example, prior to the estimations, it was decided to use H-matrix scaling in the estimations, as the work of Stock and Watson (2008) found that the error variance in the data varied systematically with the values of the independent variables. This improved the robustness of the estimated standard errors and mitigated the effects of outliers or influential observations on the estimated covariance matrix. In addition, scaling the covariance matrix using the H-matrix can lead to more efficient estimates in the presence of heteroskedasticity (Li et al., 2018). This can lead to more precise inference and hypothesis testing.

The majority of the linear models were estimated using the bisquare objective function for RLS. However, due to the non-normal distribution and presence of significant outliers, the Welsch function was also employed when deemed appropriate. According to Chen et al. (2017), the Welsch function demonstrates favorable performance compared to other objective functions, such as Fair, Huber, Cauchy, and Talworth. In simpler terms, Kelly (1992) defines the Welsch function as a scaled version of the Huber function, which can be mathematically represented as follows:

$$W(x) = e^{-\frac{x^2}{2c^2}} \quad (3)$$

Where the Welsch function is represented by the tuning constant "c," which determines its width. It falls within the category of M-estimators, a part of the broader class of estimators that includes traditional least squares estimation (De Menezes et al., 2021). M-estimators find applications in diverse contexts, such as handling outliers in linear regression, analyzing high-dimensional data, and conducting variable selection (Zhang et al., 2019). Additionally, the MM estimation technique was employed for certain models to address the significant biasing influence of outliers among the independent variables. As described by Chen (2002), the MM estimation procedure involves a combination of S and M estimation methods to estimate regression parameters. It first minimizes the scale of residuals from S estimation and then proceeds with M estimation. The primary goal of MM estimation is to obtain parameter estimates with high breakdown values and improved efficiency. The breakdown value measures the proportion of outliers that the model can accommodate before their presence significantly impacts the estimation process. In this regard, our approach shares similarities with Susanti et al. (2014), who used RLS, particularly MM estimations, to predict maze availability in Indonesia. However, our focus is not on forecasting but rather on comprehending the direction of the relationship between theoretically supported variables of interest to determine the bilateral trade relations between Azerbaijan and Pakistan.

In modern econometric software, RLS algorithms typically use the bisquare weighting by default, with a default tuning constant of 4.685, which is significantly higher than that of other weighting functions (see the paper by Ul-Saufie et al., 2012, for more details). The Tukey bisquare estimator, which is widely used in economic studies (Pratiwi et al., 2018), is a well-known method. These technical aspects were addressed by experimenting with RLS and the collected data on bilateral trade relations between Azerbaijan and Pakistan, focusing on the "best models" that effectively explain and describe the situation. The Akaike information criterion was also evaluated when assessing the estimated models with different objective functions and estimators (e.g. M or MM estimation).

## 4. Results

This section commences with an exhaustive analysis of overarching economic and trade indicators, along with bilateral trade balances for specific commodity categories in both the Azerbaijani and Pakistani economies. Subsequently, the RLS results are presented, with particular emphasis on Azerbaijan's exports to Pakistan (or Pakistan's imports from Azerbaijan) and Pakistan's exports to Azerbaijan (or Azerbaijan's imports from Pakistan).

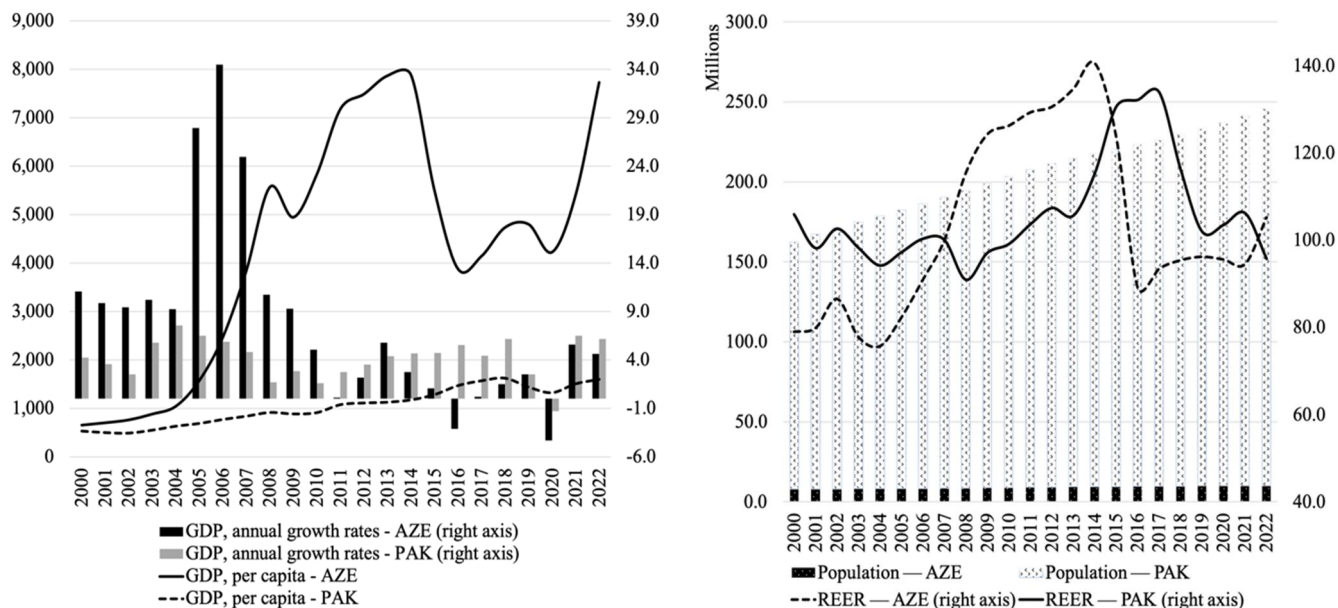
### 4.1. Figure and frequency analysis

Prior to conducting a direct analysis of the bilateral trade relations between Azerbaijan and Pakistan, it is essential to compare and describe their respective key economic indicators. Starting with Azerbaijan's GDP per capita, a steady and notable increase is observed from 2005 (1,578 USD) to 2014 (7,890 USD), while Pakistan's GDP per capita witnessed improvement from lower levels, such as 489 USD in 2002, to 1,596 USD in 2022 (see Figure 2, panel *a*). Azerbaijan's GDP per capita displays a strong and positive correlation with the commodity super cycle, which spanned approximately from 2005–06 to 2014. Conversely, crisis periods, like the global financial crisis and the COVID-19 pandemic, significantly impacted Pakistan's GDP per capita in 2010 and 2020, respectively. Moreover, Pakistan's GDP per capita is less volatile than Azerbaijan's, reflecting Pakistan's substantial demographic size and lower dependence on export revenues from commodities.

Figure 2, panel *a*, also shows the annual GDP growth rates in Azerbaijan and Pakistan from 2000 to 2022. Azerbaijan recorded remarkable GDP growth rates of 28.0%, 34.5%, and 25.0%, respectively, in certain years such as 2005, 2006, and 2007, mainly due to the implementation of extractive industry projects and the inflow of initial petrodollars. Moreover, until 2011, Azerbaijan consistently outperformed Pakistan and achieved higher GDP growth rates each year. However, from 2011, Pakistan's average annual GDP growth rate stabilized at 4.2%, while Azerbaijan recorded only 1.6%, with sharp recessions in 2016 and 2020 at –3.1% and –4.3%, respectively. In 2021 and 2022, both countries had relatively comparable GDP growth rates of 5.7%. Although Azerbaijan has a significantly higher GDP per capita compared to Pakistan, Pakistan has had more stable GDP growth rates overall since 2000.

In terms of population, the two countries have significant differences, with Pakistan's population of 236 million significantly higher than Azerbaijan's 10 million (see Figure 2, panel *b*), as shown by 2022 data. Nonetheless, both countries exhibit remarkable population growth dynamics, which serve as a valuable indicator for assessing the size of the domestic market and can potentially motivate bilateral trade activities. Another important economic indicator shown in Figure 2, panel *b*, is the REER of Azerbaijan and Pakistan between 2000 and 2022. In Azerbaijan, the general trend of REER increased from 2004 to 140.6% in 2014, coinciding with the oil boom period and leading to lower export competitiveness. A similar pattern is observed in the case of Pakistan, but between 2008 and 2017 with a peak of 133.8%. Subsequently, Pakistan's REER showed a declining trend since 2017, while Azerbaijan's REER started to increase again from 2022, which could potentially affect the country's foreign trade.

In terms of trade openness, Pakistan overtook Azerbaijan between 1995 and 2005 (see Figure 3, panel *a*). However, Azerbaijan recorded a significant increase in its export value index due to the oil boom. Since 2014, both countries have had similar values in terms of the export value index. However, when looking at merchandise trade as a percentage of GDP, Azerbaijan was consistently more open to trade compared to Pakistan between 1995 and 2022 (see Figure 3, panel *b*). While Pakistan's trade openness showed a slight downward trend, Azerbaijan's trade openness was more volatile over the same period.

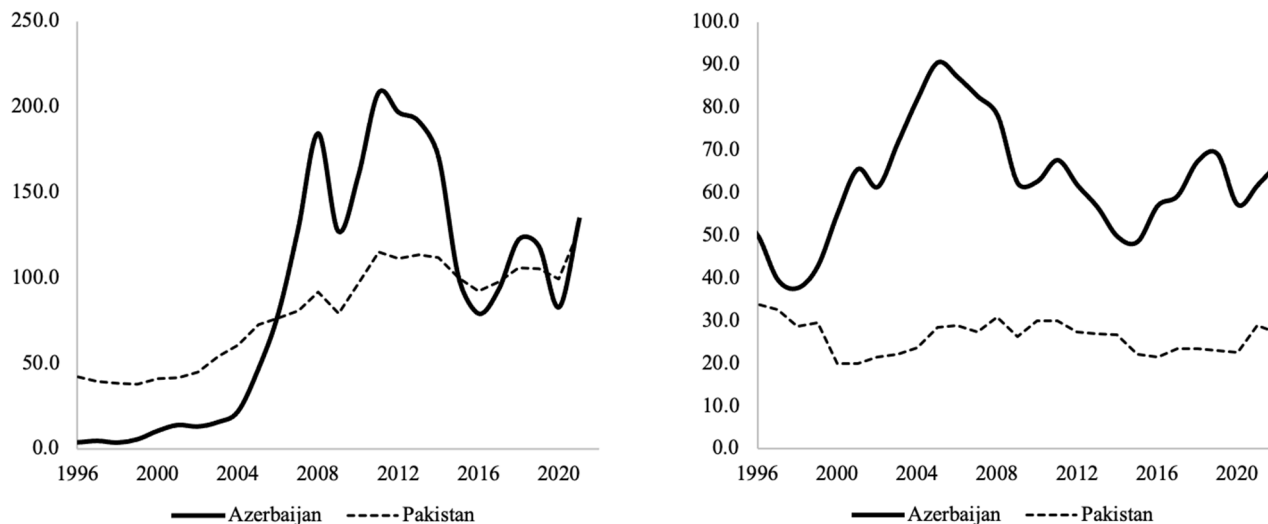


a. GDP per capita, in current USD and GDP annual growth rates, in %

b. Total population, in million persons and real effective exchange rate (REER), in %, 2007=100%

**Figure 2.** Gross domestic product (GDP), population and exchange rate dynamics of Azerbaijan (AZE) and Pakistan (PAK), 2000–2022.

Source: The World Bank and Bruegel Data Sets.



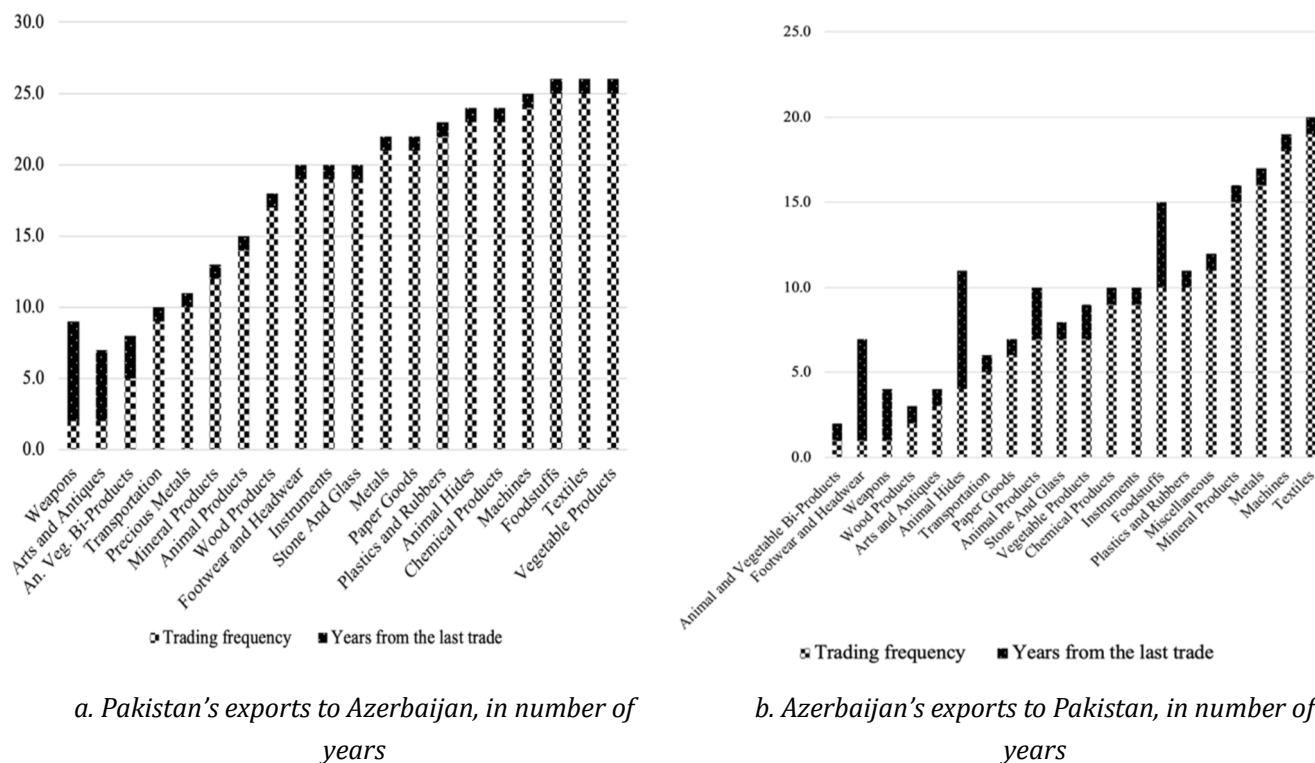
a. Export value index, in % (2015=100%)

b. Merchandise trade as a share of GDP, in %

**Figure 3.** Trade openness in the Azerbaijani and Pakistani economies, 1995–2022.

Source: The World Bank.

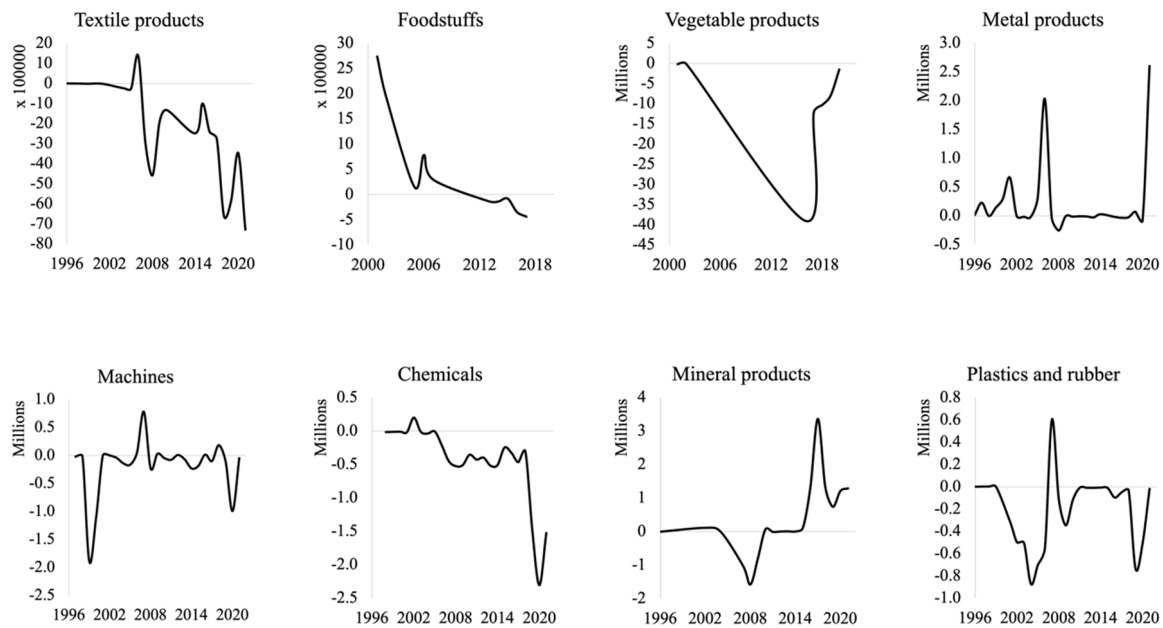
Next, descriptive and figure analysis focuses on the bilateral trade dynamics between Azerbaijan and Pakistan. During the period from 1992 to 2021, Pakistan exported mostly vegetable products, textiles, foodstuffs, machinery, and chemical products to Azerbaijan (see Figure 4, panel a). However, in rare cases, Pakistan also exported weapons, art objects and antiques, and means of transportation. It is noteworthy that the most frequently traded products have low values for "years since last trade," indicating the recency of these transactions. Certain categories, such as arms, works of art and antiques, and means of transport, were traded mainly in 2009 and 2015, with no systematic pattern evident. On the other hand, Azerbaijan's main exports to Pakistan were textiles, machinery, metals, mineral products, and foodstuffs (see Figure 4, panel b). Rarely, Azerbaijan also exported footwear and headgear, animal skins, and animal products, as these categories had high values in the years of recent trade indicator.



**Figure 4.** Sectoral decomposition of trade between Azerbaijan and Pakistan in terms of the number of years since the last trade year, 1992–2021.

Source: The Observatory of Economic Complexity.

Lastly, a look at the subsectoral trade balance between Azerbaijan and Pakistan can also provide valuable insights. As shown in Figure 5, which includes data from 1996 to 2021, the indicators were obtained by calculating the difference between Azerbaijan's exports to Pakistan and its imports from Pakistan. It is noteworthy that in 2020 and 2021, Azerbaijan had a trade surplus in metal and mineral products, while Pakistan had a trade surplus in textiles and chemical products. Moreover, Azerbaijan's trade surplus in food products began to decline in 2013 in favor of Pakistan. Trade categories such as machinery, plastics, and rubber products showed fluctuations between 1996 and 2020. More recently, trade in crop products has become more balanced, and Azerbaijan has seen a significant increase in imports of chemicals from Pakistan. The sharp increase in metal exports to Pakistan is also noteworthy. These observations shed light on the subsectoral dynamics of bilateral trade relations between Azerbaijan and Pakistan.



**Figure 5.** Subsectoral trade balances between Azerbaijan and Pakistan.

Source: *The Observatory of Economic Complexity*.

#### 4.2. Linear modeling

This subsection presents the RLS results for the analysis of the economic determinants of Azerbaijan's imports from Pakistan. Table 2 provides an overview of the linear models that focus on these imports. To start, the model based solely on GDP per capita of both countries (Model M1) shows only one statistically significant coefficient, which is positive, indicating a positive impact of Azerbaijan's GDP per capita (AzeGDPPC) on imports from Pakistan in a statistically significant manner. However, when trade costs (Model M2; TradeCost), Pakistan's REER (Model M3; PakREER), and Azerbaijan's population growth rates (Model M4; AzePopGR) are included, more meaningful results emerge. In particular, Azerbaijani GDP per capita has a positive and significant impact on imports in the M1 and M2 models. Conversely, trade costs and REER have a negative and statistically significant impact on imports in all models where they were included. Finally, Azerbaijan's market size is found to be positively and significantly associated with Pakistan's exports to Azerbaijan. These results shed light on the complex economic interactions between Azerbaijan and Pakistan and highlight the role of various factors in shaping their trade relations.

The following analysis examines how the economic structure of the two countries affects Azerbaijan's imports from Pakistan. Model M5 showed that Azerbaijan's share of manufacturing in GDP (AzeMan) is negatively correlated with imports from Pakistan, while Pakistan's share of manufacturing in GDP (PakMan) has a positive relationship with the same variable. However, agriculture did not play a statistically significant role in this relationship. Model M6 found that both countries' domestic inflation (AzeInfl; PakInfl) and REER of their main trading partners (AzerREERTrP; PakREERTrP) were not statistically significantly associated with imports from Pakistan. Finally, the savings of both countries (PakSavings; AzeSavings) were found to negatively and significantly affect imports from Pakistan to Azerbaijan. These results provide valuable insights into the complicated economic dynamics between Azerbaijan and Pakistan and provide a nuanced understanding of the factors affecting their trade relations.

Table 2 presents diagnostic tests for the model estimations. The Jarque-Bera test, along with its associated

probability values, indicates that all models are devoid of heteroscedasticity issues while demonstrating relatively high values for model fit as measured by adjusted and weighted robust R-squared values. However, two models, namely M1 and M6, did not pass the Wald test. Nevertheless, excluding M1 and M6, all models exhibit statistically significant Rn-squared statistic values, signifying a strong rejection of the null hypothesis that all non-intercept coefficients are equal to zero. Consequently, the majority of the linear models can be considered reliable and valid in this analysis without any serial correlation issue.

**Table 2.** Economic determinants of Azerbaijan's imports from Pakistan (dependent variable), 1996–2021.

	<b>M1</b>	<b>M2</b>	<b>M3</b>	<b>M4</b>	<b>M5</b>	<b>M6</b>	<b>M7</b>
Intercept	-152.74 (29046)	265.66 (4.41)	336.43 (412.82)	368.74 (351.62)	316.32 (452.36)	494.23 (484.74)	701.81* (395.90)
PakGDPPC	-0.27 (3.64)	-4.47 (4.41)	1.81 (4.70)	4.56 (3.99)			
AzeGDPPC	0.32* (0.19)	0.77* (0.42)	0.10 (0.46)	-0.47 (0.39)			
TradeCost		-0.01** (0.01)	-0.01** (0.01)	-0.01* (0.01)			
PakREER			-157.52*** (59.61)	-176.11*** (50.83)			
AzePopGR				2625.59** (1160.62)			
AzeAgr					306.36 (197.36)		
AzeMan					-454.11** (225.08)		
PakAgr					33.83 (353.18)		
PakMan					349.31* (192.19)		
AzeInfl						36.67 (31.57)	
PakInfl						10.24 (44.52)	
AzeREERTrP						-212.61 (153.12)	
PakREERTrP						-54.93 (129.52)	
PakSavings							-858.37*** (252.68)
AzeSavings							-124.16* (67.94)
Adjusted Rw-squared	0.09	0.33	0.56	0.67	0.30	0.29	0.59
Rn-squared statistic	3.00	8.01**	12.86**	25.97**	9.38*	3.21	11.78***
Wald Test–F statistic value	1.29	2.04**	2.78**	4.56**	3.10**	0.77	4.75**

Jarque-Bera value	0.96	4.81	0.36	0.12	0.60	0.33	0.54
Jarque-Bera prob.	0.62	0.09	0.84	0.94	0.74	0.85	0.76
Estimation method	S-est.			M-estimation			
Weight				Bisquare			
Serial correlation (Q-stat)	No						

Note: "M" denotes model; "est." denotes estimation; Significant coefficients are highlighted; Standard errors are given in the parentheses; The symbols \*, \*\*, and \*\*\* indicate statistical significance at 10%, 5%, and 1% levels, respectively; All numbers were rounded to the second decimal point for compactness; "prob" denotes probability.

In terms of trade openness, only Pakistan's indicator (PakTradeOpp) yielded a statistically significant result, along with both countries' GDP per capita (PakGDPPC; AzeGDPPC) showing positive and statistically significant coefficients (refer to Table 3, model M8). Models M9 and M10 focused solely on country-specific institutional dimensions of bilateral trade, with the former examining Azerbaijan and the latter focusing on Pakistan. For Azerbaijan, government effectiveness (AzeGovEff), political stability (AzePolSt), and GDP per capita (AzeGDPPC) demonstrated positive and statistically significant coefficients, while Azerbaijan's trade freedom index (AzeTFI) did not yield significant results. Conversely, Pakistan's GDP per capita (PakGDPPC) was not statistically significant, and both government effectiveness (PakGovEff) and TFI (PakTradeOpp) were negatively associated with Azerbaijan's imports from Pakistan (see model M10). Model M11 expanded this approach to a more aggregated level, incorporating additional institutional and governance variables (e.g., control of corruption, rule of law) into the explanatory variable named "institutional quality." Accordingly, Azerbaijan's institutional quality (AzeInsQ) exhibited a positive association, while Pakistan's institutional quality (PakInsQ) demonstrated a negative and statistically significant association with Azerbaijan's imports from Pakistan. Almost all coefficients of models M12 and M13 were statistically significant, assessing the relevance of Azerbaijan's oil boom period (AzeOilBoom) and the countries' interest in each other on search platforms (IntInPak; IntInAze) along with fundamental variables such as GDP per capita and population growth rates. Interestingly, Azerbaijan's oil boom period was found to be negatively and statistically significantly associated with Azerbaijan's imports from Pakistan, while both countries' market sizes were positively and statistically significantly associated with the indicated variable (see model M12). Model M12 also reveals that Pakistan's GDP per capita is negatively associated with Azerbaijan's imports from Pakistan in a larger linear model. Finally, model M13 clearly indicates that as both countries' interest in each other rises along with their respective GDP per capita, Azerbaijan imports more from Pakistan.

The adjusted and weighted robust R-squared values of models ranging from M8 to M13 appear to be lower when compared to the estimated models presented in Table 2. Notably, models M10, M12, and M13 demonstrate a good model fit. However, models M10 and M12 are affected by the issue of heteroskedasticity. Despite this, all coefficients in these models exhibit statistically significant differences from zero, as confirmed by the results of the Wald test. Moreover, all Rn-squared statistic values are found to be statistically significant. There is no any issue related to serial correlation.

**Table 3.** Institutional and other determinants of Azerbaijan's imports from Pakistan (dependent variable), 1996–2021.

	<b>M8</b>	<b>M9</b>	<b>M10</b>	<b>M11</b>	<b>M12</b>	<b>M13</b>
Intercept	173.65*** (60.06)	-43.97 (41.75)	108.89 (408.15)	216.29 (55.43)	729.60*** (51.95)	-65.10 (60.45)
PakGDPPC	1.44** (0.73)		-1.00 (4.36)		-2.95*** (0.46)	6.78*** (0.63)
AzeGDPPC	0.16**	0.19**			0.48***	0.54***

	(0.07)	(0.09)		(0.52)	(0.06)	
AzeTradeOpp	9.37 (22.27)					
PakTradeOpp	90.91*** (22.27)					
AzeGovEff		1148.26*** (227.06)				
AzeTFI		11.00 (8.53)				
AzerPolSt		706.44** (314.49)				
PakPolSt			-13878.00*** (4271.46)			
PakGovEff			-147.38*** (64.64)			
PakPolSt			992.78 (2202.63)			
AzeInsQ				1339.29** (530.72)		
PakInsQ				-8828.67*** (747.37)		
AzerPopGR					3784.17*** (143.15)	
PakPopGR					998.24*** (223.51)	
AzeOilBoom					-1076.66*** (93.39)	
IntInPak						258.68*** (18.51)
IntInAze						159.50*** (9.43)
Adjusted Rw-squared	0.04	0.05	0.49	0.10	0.44	0.29
Rn-squared statistic	49.03***	141.41***	15.43***	147.79***	943.56***	436.87***
Wald Test–F statistic value	13.68***	28.44***	3.13***	64.38***	160.98***	95.39***
Jarque-Bera value	0.97	0.76	19.10	1.19	6.31	1.44
Jarque-Bera prob.	0.62	0.68	0.00	0.55	0.04	0.49
Estimation method	M-estimation					
Weight	Welsch					
Serial correlation (Q-stat)	No					

Note: "M" denotes model; Significant coefficients are highlighted; Standard errors are given in the parentheses; The symbols \*, \*\*, and \*\*\* indicate statistical significance at 10%, 5%, and 1% levels, respectively; All numbers were rounded to the second decimal point for compactness; "prob" denotes probability.



Table 4 shows the RLS results for Azerbaijani exports to Pakistan. Similar to Table 2, all models are linear estimates. Surprisingly, Pakistan's GDP per capita (PakGDPPC) shows a negative and statistically significant relationship with Azerbaijani exports to Pakistan in all models. Azerbaijan's GDP per capita (AzeGDPPC), on the other hand, is not statistically significant in most models, except for M17, where it is statistically significant and shows a positive relationship. Pakistan's population growth rate (PakPopGR) is consistently positively and statistically significantly related to the dependent variable in all estimated models (M15–17). Interestingly, Azerbaijan's REER (AzeREER) and trade costs (TradeCost) also show statistically significant and positive associations with Azerbaijani exports to Pakistan.

In terms of economic structure, Azerbaijan's agricultural value added (AzeAgr) has a positive effect on its exports to Pakistan, while a decline in the share of manufacturing in GDP (AzeMan) reduces its exports (model M18). Conversely, both manufacturing (PakMan) and agricultural value added (PakAgr) in Pakistan show a negative relationship with its imports. Model M19 shows that only Azerbaijan's domestic inflation rates (AzeInfl) show a negative and statistically significant relationship with its exports to Pakistan, while Pakistan's domestic inflation rates (PakInfl) show no statistical significance. Moreover, model M19 shows that Azerbaijan's exports to Pakistan increase when the REER of its main trading partners appreciates. Finally, only Pakistan's savings (PakSavings) as a share of GDP show a statistically significant and positive relationship with imports from Azerbaijan.

Models M17 and M18 exhibit high adjusted and weighted robust R-squared values of 0.63 and 0.45, respectively. Similar to the previously presented RLS models, all Rn-squared statistic values in the models from M14 to M20 are statistically significant. Despite passing the Wald test in all these models, it is unfortunate that the models concerning Azerbaijan's exports to Pakistan do not pass the heteroscedasticity test, indicating non-normally distributed residuals. Also, there are multiple issues regarding serial correlation.

**Table 4.** Determinants of Azerbaijan's exports to Pakistan, 1996–2021.

	<b>M14</b>	<b>M15</b>	<b>M16</b>	<b>M17</b>	<b>M18</b>	<b>M19</b>	<b>M20</b>
Intercept	37.35** (18.43)	04.57*** (20.54)	00.17*** (21.02)	136.08*** (8.67)	-60.70*** (17.67)	5.82 (15.69)	-10.50 (18.39)
PakGDPPC	-0.30*** (0.02)	-0.32*** (0.02)	-0.32*** (0.30)	-0.12*** (0.01)			
AzeGDPPC	0.25 (0.20)	-0.10 (0.21)	0.01 (0.25)	0.20* (0.10)			
PakPopGR		1048.09*** (100.00)	973.45*** (102.56)	71.90* (43.19)			
AzeREER			0.85 (2.68)	7.54*** (1.09)			
TradeCost				0.01*** (0.01)			
AzeAgr					196.19*** (13.29)		
AzeMan					-635.23*** (17.87)		
PakAgr					-138.61*** (17.31)		
PakMan					-313.77*** (12.96)		

AzeInfl						-1.75*	(1.02)
PakInfl						2.01	(1.44)
AzeREERTrP						13.70***	(4.96)
PakREERTrP						14.81***	(4.19)
PakSavings							114.12*** (11.78)
AzeSavings							1.05 (3.16)
Adjusted Rw-squared	0.15	0.19	0.19	0.63	0.45	0.03	0.07
Rn-squared statistic	256.08***	325.96***	293.21***	1663.72***	1746.46***	24.96***	107.20***
Wald Test-F statistic value	85.56***	81.66***	58.72***	332.90***	355.65***	5.34***	36.03***
Jarque-Bera value	16.98	16.62	16.99	16.47	64.54	12.53	10.56
Jarque-Bera prob.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Estimation method	M-estimation						
Weight	Welch			Bisquare		Welch	
Serial correlation (Q-stat)	Yes (Lags: 2; 3)			Yes (Lag: 2)		Yes (Lags: 2; 3)	

Note: "M" denotes model; Significant coefficients are highlighted; Standard errors are given in the parentheses; The symbols \*, \*\*, and \*\*\* indicate statistical significance at 10%, 5%, and 1% levels, respectively; All numbers were rounded to the second decimal point for compactness; "prob" denotes probability.

The final section of linear estimations encompasses the examination of institutional and other determinants impacting Azerbaijan's exports to Pakistan. Model M21 in Table 5 indicates that Pakistan's trade openness (PakTradeOpp) did not play a significant role in Azerbaijan's exports to Pakistan, while Azerbaijan's trade openness (AzeTradeOpp) had a statistically significant and negative impact. Models M22 and M23 in Table 5 present contrasting pictures concerning the institutional determinants of Azerbaijan's exports. Specifically, government effectiveness (PakGovEff) and TFI of Pakistan (PakTFI) positively influenced its imports from Azerbaijan, whereas the same variables (AzeGovEff; AzeTFI) had negative and statistically significant effects on Azerbaijan's exports. Additionally, Azerbaijan's political stability (AzePolSt) exhibited a positive and statistically significant coefficient, while Pakistan's political stability (PakPolSt) did not. In the case of model M24, the aggregated institutional quality indicator (AzeInsQ; PakInsQ) was only statistically significant and positive for Azerbaijan. Lastly, Azerbaijan's oil boom period (AzeOilBoom) coincided with increased exports to Pakistan (see model M25), whereas the mutual interest of the population in each other on internet search engines (InterestInPak; InterestInAze) did not show statistical significance.

The models spanning from M21 to M26 display notably high adjusted and weighted robust R-squared values, and all Rn-squared statistic values in these models demonstrate statistical significance. Similar to the models between M14 and M20, all the models in this range fail the heteroscedasticity test but successfully pass the Wald test.

**Table 5.** Institutional and other determinants of Azerbaijan's exports to Pakistan (dependent variable), 1996–2021.

	M21	M22	M23	M24	M25	M26
Intercept	9.76 (173.88)	-76.27 (124.09)	117.47 (130.37)	-296.57** (134.90)	-132.60 (195.41)	28.41 (249.15)
PakGDPPC	3.42 (2.11)		-1.07 (1.39)		0.24 (1.74)	0.12 (0.24)
AzeGDPPC	-0.63*** (0.20)	-0.39*** (0.14)			-0.47** (0.20)	-0.30 (0.24)
AzeTradeOpp	-40.13** (20.33)					
PakTradeOpp	-16.17 (64.47)					
AzeGovEff		-1355.30** (654.12)				
AzeTFI		-6.21 (34.534)				
AzePolSt		1316.93** (588.42)				
PakGovEff			3646.36** (1511.92)			
PakTFI			59.13*** (20.65)			
PakPolSt			-116.50 (703.55)			
AzeInsQ				4250.70*** (1291.64)		
PakInsQ				2760.10 (1818.92)		
AzePopGR					-335.68 (538.44)	
PakPopGR					1216.00 (84.70)	
AzeOilBoom					615.55* (351.29)	
IntlnPak						34.54 (76.28)
IntlnAze						-16.81 (38.86)
Adjusted Rw-squared	0.38	0.48	0.53	0.35	0.36	0.17
Rn-squared statistic	14.57***	14.16***	14.84***	12.85***	8.16	2.32
Wald Test–F statistic value	2.93**	2.84**	2.98**	4.38**	3.58**	0.48
Jarque-Bera value	30.37	43.77	30.39	35.10	35.77	8.92
Jarque-Bera prob.	0.00	0.00	0.00	0.00	0.00	0.01

Estimation method	MM-estimation		
Weight	Bisquare		
Serial correlation (Q-stat)	Yes (Lags: 2; 3)	No	Yes (Lag: 2)

Note: "M" denotes model; Significant coefficients are highlighted; Standard errors are given in the parentheses; The symbols \*, \*\*, and \*\*\* indicate statistical significance at 10%, 5%, and 1% levels, respectively; All numbers were rounded to the second decimal point for compactness; "prob" denotes probability.

## 5. Discussion

The objective of this study was to model the dynamics of bilateral trade between Azerbaijan and Pakistan, considering exports and imports separately. The following research question was the main guideline of the study: what factors (e.g., economic, institutional, etc.) influenced bilateral trade and subsequently led to higher trade turnover between Azerbaijan and Pakistan during the period of 1996–2021? The results allow us to expand our understanding of Azerbaijani and Pakistani economic relations as analyzed using RLS estimates. Different variants (e.g., M- or MM -estimation; bisquare or Welsch weighting) of RLS helped to find theoretically and statistically meaningful models in the case study of bilateral trade to shed light on the main determinants, which has not been done before.

Since the Azerbaijani economy is oil-based and highly dependent on international commodity prices, it exerts a significant influence on important macroeconomic variables such as GDP per capita and REER in trade with Pakistan. In the aftermath of the Soviet Union's collapse, Azerbaijan initiated trade relations with Pakistan, albeit lacking robust institutional arrangements to bolster bilateral trade. Pakistan's main exports to Azerbaijan comprise vegetables, foodstuffs, and textiles, while Azerbaijan exports textiles, machines, metals, and mineral products. Pakistan possesses numerous opportunities to enhance its exports to Azerbaijan; for instance, exploring the export of transportation products can be a viable option, given the historical cooperation between Pakistan and Toyota since 1993 (Pomfret, 1997). Though the prospects for an export-oriented vehicle industry were once deemed "speculative" (Pomfret, 1997), this research reveals that even modest yet growing market sizes can be advantageous for Pakistan. The bilateral trade demonstrates some balanced trade categories, such as foodstuffs, machines, and plastics and rubber, while others result in a surplus for Azerbaijan (e.g., mineral and metal products) or provide Pakistan with leverage (e.g., textiles, vegetables, and chemical products). Subsequent sections of the analysis delve into detailed linear modeling of the presumed key determinants influencing bilateral trade.

The initial step involved estimating the key economic determinants influencing bilateral trade. In the realm of economics, GDP and GDP per capita stand as the most fundamental indicators. Therefore, the initial empirical models of exports and imports between Azerbaijan and Pakistan focused exclusively on these variables. Notably, Azerbaijan's GDP per capita demonstrated a positive association with its imports from Pakistan, while exhibiting no statistically significant association with exports to Pakistan. Building upon prior research, one could argue that this phenomenon might be attributed to Azerbaijan's industrial lopsidedness (Hasanov, 2013; Ahmadov, 2022a). Despite its transformation into a prosperous economy, Azerbaijan continues to export primarily oil and gas, without high-value-added products that a significant market like Pakistan would import. Surprisingly, the positive association between trade cost and Azerbaijan's imports from Pakistan, and the negative impact of Pakistani REER and trade cost on its exports, deviate from the main theoretical expectations, albeit coinciding with them. One plausible explanation is that Azerbaijan's imports from Pakistan are influenced by specific industries or goods with higher transportation or transaction costs, leading to the positive relationship with trade cost. Conversely, Pakistan's REER and trade cost may negatively affect its exports to Azerbaijan due to changes in relative price levels or increased competition from other exporters. Additionally, fluctuations in exchange rates and trade policies between the two countries could play a pivotal role in shaping these relationships.

In the case of both countries, an increase in market size was found to be positively associated with augmented trade, highlighting the significance of economic structure. Notably, when Pakistan's manufacturing output rises, it imports fewer goods from Azerbaijan, and interestingly, Azerbaijan's own manufacturing value added showed a negative association with Pakistan's imports from Azerbaijan. This can be attributed to Pakistan's relative self-sufficiency in agriculture and manufacturing compared to Azerbaijan, hence the negative association between Azerbaijan's exports to Pakistan's agriculture and manufacturing outputs aligns with our expectations. However, surprisingly, an increase in Azerbaijan's agriculture value added resulted in more exports to Pakistan. This could indicate that Pakistan continues to express interest in importing agricultural products to ensure its food security. Moreover, this shows how structural changes in Azerbaijan and possibly the South Caucasus affect bilateral trade, using Pakistan as an example (Ahmadov, 2022b).

The impact of domestic inflation and the competitiveness of main trading partners on Azerbaijan's imports from Pakistan was found to be relatively limited in our analysis. This suggests that Azerbaijan's import motivations from Pakistan are robust enough to withstand certain domestic and international factors. However, our findings indicated that Azerbaijan's exports to Pakistan may decline as Pakistan's domestic inflation rises. Nevertheless, the competitiveness of both countries' main trade partners does not impede Azerbaijan's exports to Pakistan; instead, it may lead to higher trading levels. Moreover, it was observed that savings as a share of GDP exhibited a negative association with Azerbaijan's imports from Pakistan, whereas only Pakistan's own savings showed a positive association with its imports from Azerbaijan. One potential explanation for this disparity is that a higher share of savings in the economy reflects a greater level of domestic investment, leading to increased production capacity and reduced reliance on imports. Consequently, there may be reduced demand for foreign goods, thus explaining the negative correlation with imports. Conversely, the positive association between Pakistan's own savings and its imports from Azerbaijan can be attributed to higher domestic savings providing households and businesses with increased purchasing power. This augmented purchasing power, in turn, can result in greater demand for imported goods from Azerbaijan.

Traditionally, bilateral trade is positively influenced by trade openness (Peter, 2012). However, in the case of Azerbaijan, the analysis revealed a statistically significant negative association between trade openness and exports to Pakistan. Similarly, Pakistan's trade openness also exhibited a negative but statistically insignificant association. These findings suggest that Azerbaijan could not capitalize on the trade openness of either country. The constrained trade opportunities between Azerbaijan and Pakistan may be attributed to their distinctive economic structures, reliance on non-complementary industries, the presence of non-tariff barriers, bureaucratic obstacles, and the influence of geopolitical factors, regional conflicts, and historical relations. These factors deviate from the typical trade openness and bilateral trade relationships observed in other nations. Conversely, Pakistan's trade openness exhibited a positive association with its own exports to Azerbaijan. This may indicate the existence of more effective institutional regulations and mechanisms implemented by the Pakistani government, allowing them to benefit from increased trade openness both generally and in relation to Azerbaijan. Consequently, this study extensively focused on exploring the institutional determinants as well.

The disparities in the relationships observed between government effectiveness, TFI, political stability, and aggregated institutional quality with trade flows between Azerbaijan and Pakistan can be attributed to variations in their economic structures, institutional setups, and policy implementations. For Azerbaijan, government effectiveness seems to exert a stronger positive influence on its trade with Pakistan, while Pakistan's government effectiveness primarily impacts its exports to Azerbaijan. The lack of significance of TFI in Azerbaijan's models suggests that other factors may predominantly influence its trade dynamics, while higher TFI in Pakistan positively affects its exports to Azerbaijan. Furthermore, Azerbaijan's political stability encourages both exports and imports with Pakistan, but the reverse is not evident. The inclusion of additional institutional variables contributes to

Azerbaijan's higher imports from Pakistan and overall bilateral trade, whereas Pakistan's exports do not show significant dependency on its institutional quality when trading with Azerbaijan. These findings underscore the complexities inherent in trade interactions between the two countries and underscore the significance of diverse economic, political, and institutional factors in shaping their trade relationships.

The statistically significant negative impact of the dummy variable "AzeOilBoom" on imports from Pakistan may be attributed to the period from 2005 to 2014, characterized by high oil prices that discouraged trade between Pakistan and Azerbaijan. Given the considerable geographical distance between the two countries, increased transportation costs resulting from expensive fuel might have hindered their trade interactions during this time. Conversely, the oil boom period saw a rise in Azerbaijan's exports to Pakistan. This can be attributed to the additional income or state subsidies earned from higher commodity revenues, which were then redirected towards enhancing trade with Pakistan. The increased export activity during this period may have been facilitated by the favorable economic conditions resulting from the oil boom.

One surprising finding was that the mutual interest of Azerbaijani and Pakistani societies, as measured by Google Trends index values, exhibited a positive association with Pakistani exports to Azerbaijan, but conversely, it had a negative effect on Azerbaijani exports to Pakistan. Several reasons can be named for this. Firstly, economic factors such as differences in production capabilities and industries between the two countries might limit the scope for trade in certain goods and services despite mutual cultural interest. Additionally, trade barriers, tariffs, and non-tariff barriers could hinder the growth of bilateral trade. Furthermore, geopolitical factors, regional instability, and conflicts in neighboring regions may also impact trade dynamics between the two nations. Fluctuations in global commodity prices and exchange rates can also influence the trade patterns between Azerbaijan and Pakistan. Moreover, logistical challenges, transportation costs, and infrastructural limitations can hinder the smooth flow of goods and impede trade growth. Differences in regulatory frameworks and bureaucratic hurdles might create obstacles for businesses from both countries to engage in trade activities. All in all, economic factors are likely to be more decisive in this respect than mutual cultural and religious reasons for trade since these two countries have no common border and language.

This study provides a comprehensive examination of bilateral trade dynamics between Azerbaijan and Pakistan from 1996 to 2021, using RLS estimates to identify the key determinants. Azerbaijan's oil-based economy has a significant impact on macroeconomic variables such as GDP per capita and REER, which influence trade with Pakistan. Despite historical trade relations, institutional arrangements remain limited, which affects trade volumes. Pakistan's exports to Azerbaijan, consisting mainly of vegetables and textiles, offer untapped opportunities, especially in transportation products. However, structural imbalances, including Azerbaijan's dependence on oil exports and Pakistan's self-sufficiency in manufacturing, shape trade patterns. The analysis reveals nuanced relationships, such as Azerbaijan's imports being influenced by certain higher cost industries and Pakistan's exports being influenced by changes in relative price levels. Trade openness, which is generally beneficial, shows mixed effects, possibly due to different economic structures and geopolitical factors. Institutional determinants, including government effectiveness and political stability, play different roles in trade dynamics. In addition, the study highlights the impact of external factors, such as periods of oil boom and cultural interest, on trade flows and emphasizes the complexity of bilateral trade interactions.

The determinants of bilateral trade between Azerbaijan and Pakistan exhibit notable differences. Despite the positive trend in bilateral trade, there remains considerable untapped potential between the two countries. To fully capitalize on this potential, it is imperative to stimulate mutual economic relations through comprehensive institutional arrangements that go beyond single-sector-based motives. Addressing challenges related to industrial diversification, enhancing English language proficiency, and resolving the Nagorno-Karabakh issue are believed to have positive impacts on Azerbaijan's overall trade relations (Imran, 2017a; Imran, 2018). Azerbaijan's favorable

brand image among Pakistani intellectuals with the label "Made in Azerbaijan" and its aspiration for heightened global competitiveness (Imran, 2018) are additional assets that can positively contribute to trade relations. Moreover, Pakistan's supportive stance on political issues has bolstered its reputation in Azerbaijan, leading to a positive perception and enriching the circle of friendly nations (Noor, 2020).

## 6. Concluding Remarks

This paper empirically examined the bilateral trade relations between Azerbaijan and Pakistan using RLS method for the period of 1996 and 2021. The possible key determinants were grouped under four broad categories, namely, economic, institutional, international, and cultural. Azerbaijan's GDP per capita, population growth rate, and Pakistan's manufacturing value added in overall GDP were unequivocally key economic determinants in Pakistan's exports to Azerbaijan. While Pakistan's trade openness also were positively associated with its exports, REER and trade cost diminish the trade, and savings do not influence Azerbaijan's imports in an expected way. Moreover, while Azerbaijan's main institutional variables such as government effectiveness, political stability, and overall institutional quality (excluding TFI) were positively associated with Pakistan's exports to this country, Pakistan's own institutional quality cannot be said that played a positive role in this regard.

While Azerbaijan's exports benefit from Pakistan's population growth and institutional quality, it cannot be said that the welfare of Pakistani society (measured by GDP per capita) and the countries' economic structure (e.g., value added in manufacturing or agriculture) have contributed to Azerbaijan's exports to Pakistan. Nevertheless, saving levels in Pakistan might stimulate Azerbaijan's exports to this country. Azerbaijan's exports also do not improve as its own economy become richer and oil boom period (i.e., 2004–2014) boosts its exports due to additional rents that cover trade costs. After all, Azerbaijan and Pakistan do not share a common border and language and transaction costs remain high. Although, certain regular developments have been occurring during the last 3–4 years, institutional arrangement and more efficient regulations lack to regulate the bilateral trade. This study is a mere trial to systematically evaluate this situation despite its all limitations indicated below and further studies should be implemented to gain in-depth and systematic knowledge about the bilateral trade between two countries.

Based on the empirical results, trade policy suggestions for Azerbaijan and Pakistan emerge. Strengthening economic relations between the two countries is of utmost importance. Areas such as GDP per capita growth, population dynamics and value added in the manufacturing sector should be considered to strengthen bilateral trade. Addressing institutional deficiencies by improving quality and stability can facilitate smoother trade flows and reduce transaction costs. Policies to promote trade openness and reduce trade barriers should be encouraged to increase exports between the two countries. In addition, investment in infrastructure projects to reduce transportation costs and improve connectivity is essential. Efforts to improve the regulatory framework, including more efficient regulations and institutional arrangements, are necessary to facilitate bilateral trade and overcome language and transaction barriers. These measures aim to promote stronger trade relations that lead to mutual economic benefits and greater prosperity for both countries.

The nature of bilateral trade between two countries thus remains complex due to geographical and linguistic barriers that cannot be fully captured by RLS. The limitations of the current empirical work can be listed as follows: first, the use of Welsch function especially helped to identify underlying patterns for the institutional determinants for imports from Pakistan to Azerbaijan. However, Welsch function might undermine the efficiency of the model, so any conclusions must be drawn carefully. Second, this study used the statistical data on exports and imports available through SSCRA. These indicators may differ in their relative variance and degree, so it must be kept in mind that Pakistani statistical data might provide slightly different picture of the bilateral trade with Azerbaijan. However, in general, there should not be any significant deviations from the estimated coefficients and directions.

Third, the models are based on highly aggregated data that might undermine more finer nuances in the bilateral trade between Azerbaijan and Pakistan. Therefore, further studies should use subsectoral trade data and include investment, tourism or migration data as well via other types of linear modeling, for example, Autoregressive Distributed Lags, quantile regression, etc. based on high frequency (e.g., monthly, quarterly) trade data. Furthermore, further studies could shed a deeper light on this matter and include the political economy aspects of the subject, which are key to unveiling new aspects of this economic relationship.

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### Conflict of interest

The author claims that the manuscript is completely original. The author also declares no conflict of interest.

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