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The Trade Effects of the EU-Algeria FTA on Turkey: A Difference-in-Differences Approach

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Abstract
This paper investigates the trade effects of the free trade agreement (FTA) signed between Algeria and the European Union (EU) on Turkish exports to Algeria, using a difference-in-differences (DID) approach. The agreement parties signed the FTA in 2005, which helped significantly reduce tariffs and non-tariff barriers between Algeria and the EU but not between Algeria and Turkey, which put Turkey in an asymmetric position. This created a trade diversion effect, which may potentially have harmed Turkey's exports to Algeria. The paper uses data on trade flows between Turkey and Algeria and between Turkey and a control group of 14 countries that did not sign the FTA with the EU for the period 2000–2022. The paper estimates the DID estimator, which represents the difference in Turkish exports towards Algeria (treated group) and other countries (control group) before and after the FTA. The paper also calculates the counterfactual exports, which are the exports that would have occurred if there had been no FTA between Algeria and the EU. The paper finds that the FTA had a negative and significant effect on the exports of Turkey to Algeria, relative to the control group. The paper concludes that the FTA resulted in a trade loss for Turkey.
Keywords: FTA, Turkey's exports, Difference-in-differences, Counterfactual analysis

1. Introduction

Algerian-Turkish relations, which are anchored in history, have accelerated in recent years with the strengthening and diversification of areas of bilateral cooperation and the intensification of official visits between officials of the two countries, having made it possible to establish a lasting and global partnership.
The working visit that the President of the Republic, Mr. Abdelmadjid Tebboune, will make, Friday and Saturday, to this friendly country, is part of the strong dynamic experienced by bilateral

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relations and the attachment of the leaders of the two countries to develop them in the best interests of the two countries and their peoples.

This was also affirmed during the visit of President Tebboune to Ankara in May 2022 and the visit of the Turkish President, Mr. Recep Tayyip Erdogan, to Algiers in January 2020. The state visit of the President of the Republic to Turkey was an important step, which saw the signing of several agreements and memorandums of understanding, which contributed to the acceleration of bilateral cooperation in different areas. This visit highlighted a convergence of views around issues of common interest and gave new impetus to bilateral cooperation, supported by a Treaty of Friendship and Cooperation, since 2006.

In addition, the holding, in December 2022, of the 1st Meeting of the Commission for Planning, Cooperation and Global Partnership between Algeria and Turkey contributed to the improvement of the strategic relationship between the two countries. On this occasion, the two parties agreed on current international issues and agreed to support peace and solutions based on international law.

The meeting highlighted the clear evolution in the volume of trade, which increased by 30% in 2022, which will contribute to achieving the objective of 10 billion dollars in trade between the two countries. The Turkish Ambassador to Algiers, Ms. Mahinur Ozdemir Goktas in Juin 2023 reported the presence in Algeria of around 1,560 Turkish companies compared to only 900 in January 2020, adding that the volume of trade also experienced a significant increase, going from 3 .3 billion to $5 billion currently, with hopes of reaching $10 billion in the near future. “Trade increased to 5.3 billion dollars, despite the period of stagnation in world trade,” she noted, welcoming the “constantly evolving number of Turkish companies in Algeria: some 1,550 entities active in various sectors. Turkey is “the foreign country with the largest number of companies present in Algeria, with investments of more than 5 billion dollars and more than 30,000 jobs,” she said (Algeria Press Service, 2023). In addition to Building, Public Works and Hydraulics (BTPH) and industry, the ambassador expressed the interest of the Turkish side to invest “in the short and medium term in the energy sectors and agriculture, to which the Algerian State attaches particular importance.

Indeed, economic cooperation relations between the two countries have progressed significantly in recent years, Turkey having become the first foreign investor in Algeria outside of hydrocarbons, and Algeria representing Turkey's second trading partner in Africa and the first destination Turkish foreign direct investments on the continent.

According to the former ambassador of the Republic of Turkey to Algeria, Mrs. Mahinur Ozdemir Goktas, to whom President Tebboune awarded, last month, the "Djadir" medal of the Order for the great actions accomplished in the interest of both brother countries throughout his years of exercise in Algeria, "political and economic relations between the two countries have intensified in a remarkable way, particularly after the visit of President Tebboune to Turkey".

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Furthermore, the deep and historic relations of friendship between the two countries were illustrated in the humanitarian field, Algeria having been one of the first countries to come to the aid of the Turkish people following the earthquake which struck this country in last February. The members of the Algerian mission who participated in the disaster rescue operations received numerous praise from the Turkish Government and society and were decorated by the President of the Republic with the medal of the Order of national merit at the rank of "Achir".

Algeria is nominally the 4th largest economy in Africa and the 58th largest economy in the world. Algeria, the world's 36th largest economy by purchasing power parity (PPP), has a large consumer market and growing spending power. Algeria, the country with the largest surface area on the African continent, has an economy that develops year by year with its modernization reforms, development plan targeting strong and sustainable growth, and foreign exchange reserves obtained from oil and natural gas. The national currency is the dinar (DZD). It ranks 3rd in Africa in the United Nations "Human Development" index. It ranks 157th out of 190 countries in the World Bank "Ease of Doing Business" index.

Algeria is the 33rd most populous country in the world with a population of 44.4 million. The labor force participation rate of 42.2% is below the world average and there is a shortage of skilled workers in the country. The unemployment rate is 13.3%. 60% of the workforce is employed in the services sector, 31% in the industrial sector and 9% in the agricultural sector. Algeria has a GDP size of 164.5 billion dollars at current prices as of 2021. According to International Monetary Fund (IMF) data, growth in the Algerian economy, which grew by 4% in real terms annually in 2021, is expected to slow down to 2.4% in 2022.

While increased gas exports will boost Algeria's overall economic activity, prospects are expected to remain weak, undermined by over-centralized management and an opaque business environment dominated by a few vested interests. In addition, a wide fiscal deficit due to high levels of social instability, rapidly falling reserves and limited space for fiscal reform strengthen expectations that Algeria will have to borrow externally in 2022-2026, first from bilateral allies and eventually from the IMF. A possible increase in the cost of living in Algeria is also likely to trigger social discontent and related unrest.

Beyond its bilateral dimension, the Algerian-Turkish trade relationship offers a useful natural experiment for a broader question in international trade policy: what happens to a country's exports to a partner when that partner signs a free trade agreement (FTA) with a third party, and the exporting country is bound, by virtue of a separate customs union, to align its own external trade policy with that third party's terms without being a signatory itself? Turkey's customs union with the European Union (EU), in force since 1996, places Turkey in precisely this position. When the EU concludes a new FTA, Turkey is obliged to open its own market to the EU's new partner and to negotiate a parallel agreement with that partner, but it has no seat at the table when the EU-partner agreement is negotiated and no guarantee of reciprocal access in the interim. The Euro-

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Mediterranean Association Agreement between Algeria and the EU, signed in April 2002 and phased in from September 2005, is a direct illustration of this mechanism: it progressively dismantled tariffs on industrial goods between Algeria and the EU while leaving the Turkey-Algeria tariff schedule untouched, creating an asymmetry that, in principle, could divert Turkish exports toward EU competitors in the Algerian market.

This paper asks whether that theoretical possibility materialized in practice. Using bilateral export data for Turkey and a difference-in-differences (DID) design embedded in a gravity framework, the paper compares the evolution of Turkish exports to Algeria (the treated unit) with the evolution of Turkish exports to a group of structurally comparable countries that did not sign an FTA with the EU, before and after the Association Agreement took effect. The remainder of the paper is organized as follows. Section 2 reviews the theoretical and empirical literature on trade creation, trade diversion, and the specific asymmetry created by Turkey's customs union with the EU. Section 3 describes Algeria's economic profile, the historical depth of Algerian-Turkish relations, and the data used in the analysis. Section 4 sets out the empirical strategy and reports the DID and counterfactual results. Section 5 discusses the findings in light of the literature and their policy relevance, and Section 6 concludes.

2. Literature Review

2.1.Trade Creation and Trade Diversion: Theoretical Foundations

The theoretical starting point for evaluating any preferential trade arrangement remains Viner's (1950) distinction between trade creation, whereby a member country substitutes a higher-cost domestic producer for a lower-cost partner producer, and trade diversion, whereby a member country substitutes a lower-cost non-member producer for a higher-cost partner producer purely because of the preferential tariff. Because a preferential agreement lowers trade costs only between its signatories, it mechanically raises the relative price faced by non-member exporters in the protected market; whether this translates into an observable decline in the non-member's exports is an empirical question that depends on substitutability between suppliers, the size of the tariff cut, and the non-member's own trade costs with the market in question. Gravity-model treatments of regional trade agreements (RTAs) have consistently shown that this diversion effect is not automatic: several studies find that RTAs can be either trade-creating or trade-diverting depending on the country pair and sector examined, so the sign and magnitude of the effect for any specific bystander country has to be estimated rather than assumed.

2.2.Empirical Evidence on the EU's Mediterranean and Algerian Agreements

A substantial literature has evaluated the trade effects of the EU's Euro-Mediterranean Association Agreements on their North African signatories, with more mixed conclusions than the simple trade-creation narrative might suggest. Haddoud, Jones and Newbery (2015) combine an ex-ante Lloyd-McLaren welfare assessment with an ex-post Vinerian analysis of the Algeria-EU Association Agreement and find that it raised non-oil Algerian trade and welfare, while a European Commission

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ex-post evaluation of the trade chapters of six Euro-Mediterranean agreements, including Algeria's, reports more modest and uneven gains once hydrocarbons are excluded. Other assessments are considerably more critical: a general-equilibrium evaluation of the Algeria-EU agreement finds an aggregate terms-of-trade loss for Algeria of roughly $2.7 billion attributable to the agreement, and a broader review of EU-Algeria trade concludes that EU-led liberalization has coincided with a widening, hydrocarbon-dependent trade deficit for Algeria rather than balanced diversification, noting that Algerian imports from the EU rose far faster than Algerian non-oil exports to the EU after the agreement's entry into force. Taken together, this literature establishes what the Algeria-EU agreement did to Algeria's own trade and welfare, but it is silent on the question this paper investigates: what the agreement did to a large, geographically and institutionally proximate exporter, Turkey, that stood outside it.

2.3.Turkey's Customs Union Asymmetry and Trade Deflection with Third-Country FTAs

The mechanism most directly relevant to this paper is documented in the literature on Turkey's customs union with the EU. Because the customs union requires Turkey to apply the EU's common external tariff while giving Turkey no voice in the EU's subsequent trade negotiations, every new EU FTA with a third country creates a structural asymmetry: the third country's exports can enter Turkey duty-free by first clearing EU customs, while Turkish exporters continue to face that same third country's ordinary external tariff. This dynamic, commonly labelled trade deflection, has been documented for the EU's more recent agreements with large trading partners and is widely cited as a structural weakness of the customs union that has periodically reopened debates on its modernization. Larch, Schmeißer and Wanner (2021) provide the most granular structural-gravity assessment of the customs union's own trade effects, estimating a rich set of heterogeneous, sector- and partner-specific coefficients that show the union's benefits accruing unevenly across Turkey's trading partners. El-Sahli (2025) tests the asymmetric-FTA channel directly using a three-way fixed-effects PPML gravity model and, in a finding that stands in useful tension with the mechanism motivating the present paper, reports no statistically significant aggregate effect of the EU's asymmetric FTAs on Turkish trade overall, attributing the null result partly to Turkey's low compliance with the EU's external tariff schedule for goods in which Turkey itself specializes. The European Parliament's own policy assessment of the customs union likewise finds that full alignment with new EU FTAs would produce only a small aggregate GDP effect for Turkey, while conceding that the impact is highly concentrated in specific export sectors. This body of work suggests that any Turkey-Algeria trade-diversion effect identified in this paper should be interpreted as one instance of a mechanism whose average effect across all of the EU's trading partners appears to be small and heterogeneous, rather than as evidence of a uniformly large and predictable channel.

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2.4.Difference-in-Differences and Gravity-Model Evidence on FTAs Elsewhere

Outside the EU-Mediterranean and EU-Turkey context, difference-in-differences and gravity-based evaluations of FTAs report a similarly heterogeneous picture, underlining the point that trade agreement effects are context-specific rather than universal. Uzair and Nawaz (2019) apply a gravity specification with panel-corrected standard errors to Pakistan's imports and find that the Pakistan-China FTA produced trade creation and welfare gains for Pakistani consumers, even as Pakistan's own exporters gained less than China's. For the EU-South Korea FTA, results differ by estimation strategy and trade direction: firm-level triple-difference evidence shows the agreement raising French exporters' sales in Korea substantially more for large firms than for small ones, while aggregate gravity estimates find that EU exports to Korea rose significantly more than Korean exports to the EU, an asymmetry the authors attribute to differences in each partner's trade policy prior to the agreement. Evidence on preferential agreements more generally, including the Pakistan-China, ASEAN-China and NAFTA experiences, confirms that the same legal instrument, a bilateral or regional FTA, can generate trade creation for one partner and trade diversion for excluded third countries simultaneously, and that the split typically depends on relative production costs, existing trade shares, and the depth of non-tariff liberalization achieved. This body of evidence motivates the present paper's use of a DID-gravity design applied specifically to Turkey's bystander position vis-a-vis the Algeria-EU agreement, rather than relying on the aggregate, average effects reported for the customs union as a whole.

3. Data and Methodology

This study employs an annual panel dataset covering the period 2000–2022. Bilateral export data were obtained from the IMF Direction of Trade Statistics (DOTS), while macroeconomic indicators were collected from the World Bank and other international databases. The sample consists of Turkey's exports to Algeria (the treated unit) and Turkey's exports to fourteen comparison countries that did not conclude a free trade agreement with the European Union during the study period.

The selection of the control group follows the logic of Difference-in-Differences estimation. Countries were chosen because they share several structural characteristics with Algeria, including emerging-market status, comparable levels of economic development, dependence on commodity exports, and geographical proximity to Turkey. These similarities improve the credibility of the counterfactual by ensuring that the treated and control groups were exposed to comparable global shocks, including fluctuations in oil prices, the Global Financial Crisis, and the COVID-19 pandemic.

The treatment year is defined as 2005, corresponding to the implementation of the Algeria–EU Association Agreement. Although the agreement was signed in 2002, tariff liberalization became effective in September 2005, making this the appropriate intervention date for identifying policy effects.

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The empirical analysis combines a Difference-in-Differences (DID) estimator with the gravity model of international trade. The gravity model has become the workhorse of empirical international trade analysis because it explains bilateral trade flows as a function of economic size and trade costs while accounting for geographical, cultural, and institutional factors. Following Anderson and van Wincoop (2003), bilateral trade is determined not only by direct trade costs between countries but also by multilateral resistance terms that capture each country's trade barriers with the rest of the world. Although the present analysis follows the traditional gravity specification, the implications of multilateral resistance are considered when interpreting the empirical results.

The Difference-in-Differences (DID) framework estimates the causal impact of the Algeria–EU Association Agreement by comparing the evolution of Turkish exports to Algeria before and after the implementation of the Agreement with the corresponding evolution of Turkish exports to a control group of countries that were not directly affected by the policy. The interaction between the treatment indicator (Algeria) and the post-treatment period (2005 onward) captures the average treatment effect while controlling for observable determinants of bilateral trade through the gravity model.

Following the gravity model framework and the Difference-in-Differences methodology, the empirical specification estimated in this study is expressed as follows:

$$\ln(\text{Exports}_{it}) = \beta_0 + \beta_1(\text{Treatment}_i \times \text{Post}_t) + \beta_2 \ln(\text{GDP}_{it}) + \beta_3 \text{Border}_i + \beta_4 \text{Language}_i + \beta_5 \text{Religion}_i + \beta_6 \text{OilExporter}_i + \beta_7 \text{FTATR}_{it} + \varepsilon_{it} \quad (1)$$

Where:

- $\ln(\text{Exports}_{it})$ is the natural logarithm of Turkish exports to country i in year t;
- β_0 is the intercept;
- Treatment_i is a dummy variable equal to 1 for Algeria (the treated country) and 0 for the control countries;
- Post_t is a dummy variable equal to 1 for the post-treatment period (2005–2022) and 0 for the pre-treatment period (2000–2004);
- $(\text{Treatment}_i \times \text{Post}_t)$ is the Difference-in-Differences interaction term capturing the effect of the Algeria–EU Association Agreement on Turkish exports;
- $\ln(\text{GDP}_{it})$ is the natural logarithm of the importing country's Gross Domestic Product, representing market size;
- Border_i is a dummy variable indicating whether Turkey shares a common border with the trading partner;
- Language_i is a dummy variable indicating whether Turkey and the partner country share a common official language;

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- Religion$_i$ is a dummy variable indicating whether Turkey and the partner country share a common dominant religion;
- OilExporter$_i$ is a dummy variable identifying major oil-exporting countries;
- FTATR$_{it}$ is a dummy variable indicating whether Turkey has a preferential trade agreement with the partner country in year t; and
- ε_{it} is the stochastic error term.

The coefficient of primary interest is β_1, which measures the average treatment effect of the Algeria–EU Association Agreement on Turkish exports. A negative and statistically significant estimate of this coefficient indicates that Turkish exports to Algeria grew more slowly after the implementation of the Agreement than exports to the control group, providing evidence of trade diversion.

To reduce omitted-variable bias, the model controls for standard gravity variables including GDP, common borders, common language, common religion, oil-exporting status, and Turkey's own preferential trade agreements. All trade values are expressed in natural logarithms, allowing estimated coefficients to be interpreted approximately as percentage changes and reducing heteroskedasticity commonly observed in trade data.

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Table 1: Top 20 Countries of Turkish Exports to Countries that have FTA with the EU (US million Dollar)

	1996	2000	2005	2010	2014	2015	2016	2017	2018	2019	2020	2021	2022
Iraq	188.21		2,748.52	6,036.36	13,154.13	9,966.66	8,496.08	10,109.83	9,437.01	10,223.29	9,142.05	11,125.65	13,750.28
Ukraine	267.37	258.12	821.03	1,260.42	1,855.87	1,181.15	1,330.65	1,465.92	1,684.16	2,156.45	2,090.33	2,900.54	3,059.41
Lebanon	182.89	129.27	195.91	618.32	864.61	766.96	802.37	959.42	963.66	1,111.51	930.69	1,694.52	2,678.00
Azerbaijan	240.96	230.38	528.04	1,550.48	3,061.22	2,092.21	1,387.89	1,476.52	1,701.93	1,788.40	2,085.34	2,342.79	2,504.42
Algeria	278.69	383.46	807.14	1,504.59	2,231.21	1,932.39	1,830.25	1,828.14	2,120.93	2,016.44	1,449.57	1,698.26	2,068.12
Canada	100.26	173.39	364.79	479.50	987.06	718.12	778.82	1,099.78	1,338.68	985.97	1,005.39	1,687.17	1,887.73
SouthAfrica	65.19	71.05	315.74	369.23	593.24	522.53	423.28	492.43	554.24	569.56	574.03	861.26	1,715.03
Kazakhstan	189.07	118.70	459.95	818.90	1,086.99	882.33	713.83	840.34	790.32	900.14	985.61	1,288.14	1,606.30
Switzerland	284.97	238.68	553.46	2,065.02	3,250.45	5,712.68	2,740.01	924.67	1,785.92	1,042.02	1,095.42	1,257.50	1,341.10
Mexico	18.03	41.30	163.67	145.50	343.14	371.91	475.73	477.59	652.29	668.36	538.58	839.84	1,080.91
Jordan	147.43	99.53	288.47	571.33	947.53	868.64	747.70	706.60	889.67	667.33	585.37	780.81	966.07
Norway	57.99	80.48	245.16	343.91	562.09	456.16	569.52	564.86	522.26	729.18	733.35	937.57	744.02

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Japan	166.70	149.49	234.23	272.22	380.66	341.11	359.20	416.37	493.79	502.85	441.24	521.77	664.44
Ghana	5.96	12.80	31.60	96.48	187.21	235.32	303.19	229.34	279.98	374.34	477.53	461.84	421.25
Peru	1.44	4.23	7.21	159.27	290.11	199.06	88.15	110.73	174.10	180.92	231.52	577.65	420.52
Côted'Ivoire	6.02	4.12	26.60	47.93	94.99	121.95	119.05	154.42	179.20	227.67	307.90	430.91	416.79
Vietnam	31.16	3.89	44.00	106.20	175.76	161.77	242.39	247.90	321.14	351.41	244.32	336.66	343.76
DominicanRepublic	5.69	22.54	6.00	29.95	66.42	40.73	42.16	74.80	109.61	123.81	124.98	233.20	324.47
Colombia	5.48	4.73	45.37	52.86	184.42	188.94	188.57	189.88	247.22	255.91	216.48	420.66	324.40
Cameroon	2.82	9.55	16.90	48.61	117.45	89.94	69.45	101.14	156.71	156.63	158.86	184.30	214.74
Jamaica	12.37	13.23	13.26	22.75	46.76	18.37	17.50	52.54	76.82	91.30	76.29	168.02	188.22

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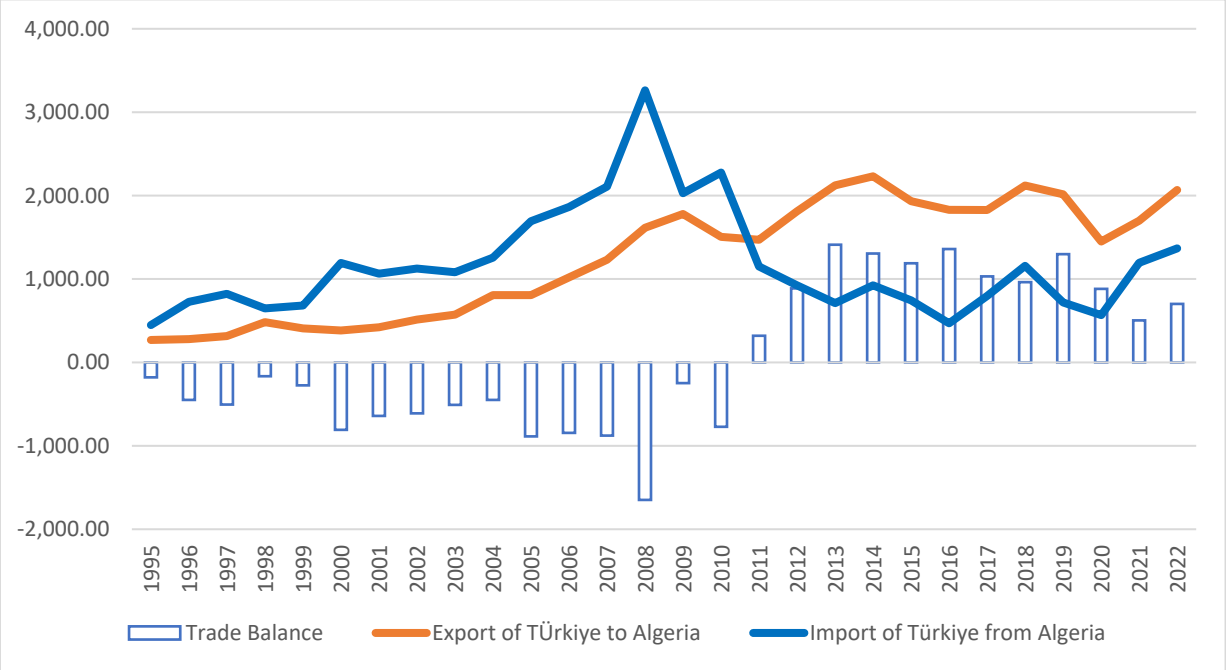
Table 1 situates Algeria within the wider set of markets that absorb Turkish exports and that are, like Algeria, bound by an EU free trade agreement. Several of the top twenty destinations for Turkish exports among EU-FTA partners, such as Iraq, Ukraine, Lebanon and Azerbaijan, are geographically or historically close to Turkey and have overtaken Algeria in absolute export value over the sample period, while Algeria's own trajectory is comparatively flat after an initial surge between 1996 and 2014. This pattern is consistent with, though not sufficient on its own to prove, a relative loss of competitiveness for Turkish exporters in the Algerian market from the mid-2000s onward, precisely the period in which the Algeria-EU Association Agreement began to be phased in. The table also illustrates why a synthetic control group drawn from these comparator countries is informative: most are, like Algeria, hydrocarbon-exporting or resource-dependent economies with broadly similar income levels and trade structures, which makes them reasonable counterfactuals for how Turkish exports to Algeria might have evolved absent the EU agreement.

Figure 1: Trade Flow Between Türkiye and Algeria Between 1995-2022



Source: prepared by the author using data from IMF-DOTS. https://data.imf.org/?sk=9d6028d4-f14a-464c-a2f2-59b2cd424b85&sid=1409151240976

Figure 1 plots the level of bilateral trade between Turkey and Algeria from 1995 to 2022 and shows a broad upward trend interrupted by two visible inflection points: a slowdown that coincides with the phasing-in of the Algeria-EU Association Agreement after 2005, and a sharper contraction around 2015-2016 that is more plausibly linked to the collapse in oil prices and the resulting contraction in Algerian import demand than to the FTA itself. Disentangling these two influences,

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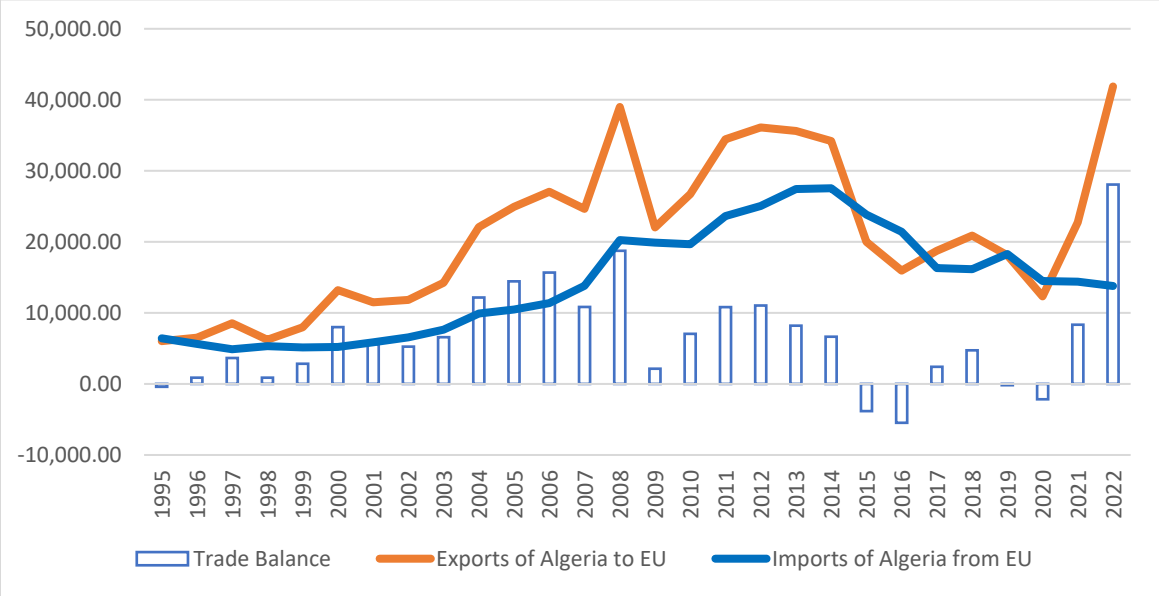
a common trade-cost shock reducing Algeria's overall import demand versus a partner-specific diversion of Turkish exports toward EU competitors, is precisely the identification problem that motivates the difference-in-differences design used in Section 4: by comparing Turkey's exports to Algeria against Turkey's exports to countries with similarly oil-linked import demand but no EU FTA, the DID estimator nets out common shocks such as the oil-price cycle and isolates the component of the trend attributable specifically to the Algeria-EU agreement.

According to United Nations (UN) Comtrade data, Algeria exported a total of 35 billion dollars and imported 46 billion dollars in 2017. It established its closest commercial relations with France, Italy and Spain. While Turkey exported 1.6 billion dollars to Algeria in 2021, it imported 1.1 billion dollars from Algeria. Algeria, where our bilateral trade volume exceeds 2.8 billion dollars, is our 36th largest commercial partner. To date, Turkish companies have undertaken 377 important projects worth 16.1 billion dollars in Algeria.

Figure 2: Import and Export Between Algeria and the EU



Source: prepared by the author using data from IMF-DOTS.

Figure 2 illustrates the evolution of trade between Algeria and the European Union before and after implementation of the Association Agreement. A clear expansion in bilateral trade is observed following 2005, particularly in Algeria's imports from the EU. This pattern is consistent with the expected trade-creation effects of preferential liberalization, whereby reductions in tariff and non-tariff barriers increase market access for member countries.

At the same time, the faster growth of EU exports relative to Algeria's exports suggests an increasingly asymmetric trade relationship. The widening import bill indicates that European

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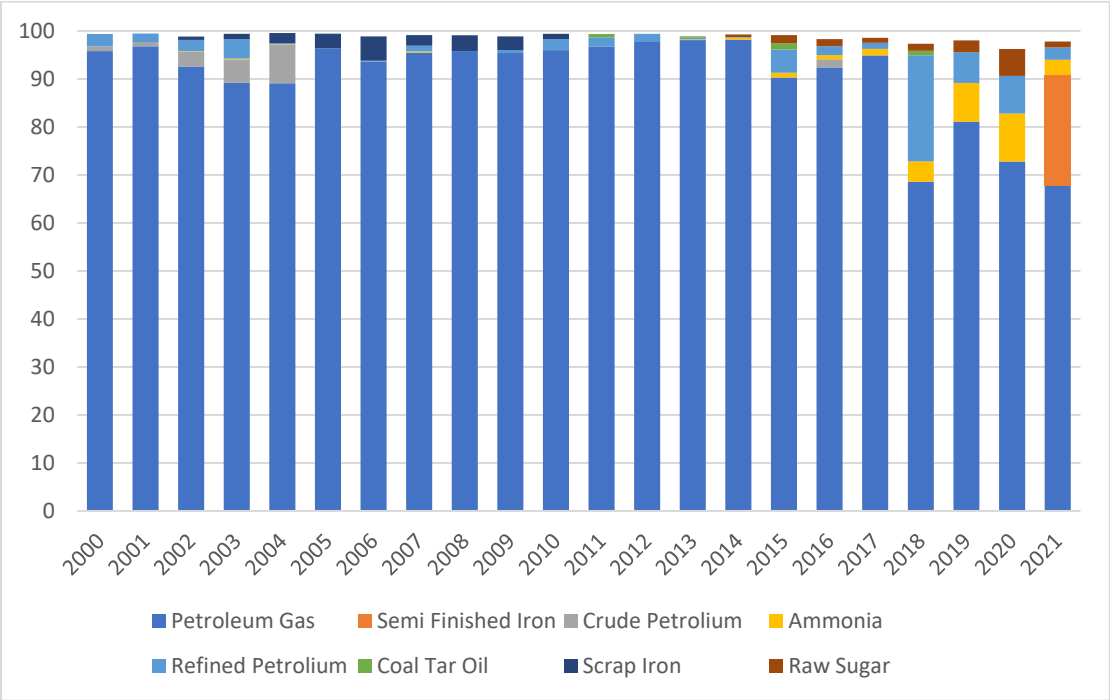
producers substantially improved their competitive position within the Algerian market. From Turkey's perspective, this development represents the mechanism through which trade diversion may occur: as EU products become relatively cheaper due to tariff preferences, Turkish exporters lose part of their competitive advantage despite no deterioration in their own productive capacity. Consequently, Figure 2 provides descriptive evidence supporting the hypothesis tested econometrically in Section 4.

Figure 3: Exports From Algeria to Turkey by Sector



Source: prepared by the author using data from IMF-DOTS.

Figure 3 highlights the highly concentrated composition of Algeria's exports to Turkey. Petroleum gas consistently dominates bilateral exports throughout the sample period, followed by crude petroleum, refined petroleum products, ammonia, and semi-finished iron. This concentration confirms Algeria's heavy dependence on hydrocarbons and relatively limited export diversification. The dominance of energy products implies that bilateral trade between the two countries is largely complementary rather than competitive. Turkey primarily imports energy and intermediate inputs while exporting manufactured goods and industrial products. Such complementarity reduces direct product competition but also increases the sensitivity of bilateral trade to international oil-price fluctuations. Consequently, periods of declining oil prices, such as 2014–2016, likely reduced Algeria's purchasing power and import demand, independently of the FTA. This observation

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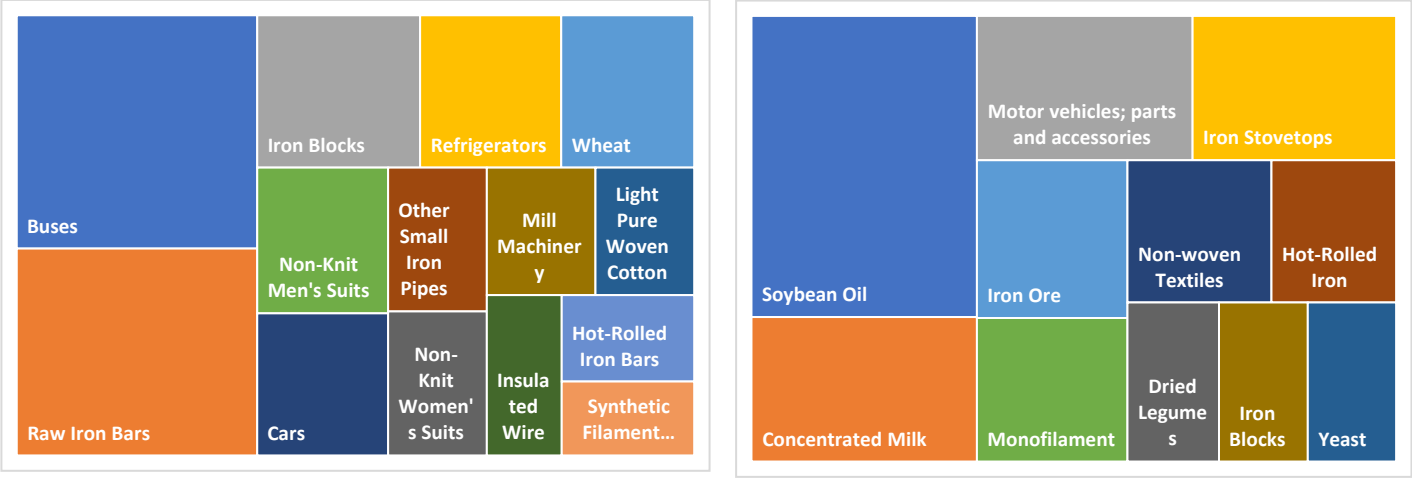
further justifies the use of the DID framework to separate oil-price effects from policy-induced trade diversion.

Figure 4: Exports of Turkey to Algeria, development between 2000 and 2021

a: exports of Turkey to Algeria in 2000 **b: Exports of Turkey to Algeria in 2021**



Source: Source: prepared by the author using data from IMF-DOTS.
https://oec.world/en/profile/bilateral-country/dza/partner/tur?dynamicBilateralTradeSelector=year2000&depthSelector=HS4Depth

Figure 4 compares the composition of Turkish exports to Algeria in 2000 and 2021. Although manufactured products dominate in both years, the export basket became substantially more diversified over time. Machinery, electrical equipment, iron and steel, construction materials, household appliances, textiles, and processed food products occupy a larger share of exports in 2021 than at the beginning of the sample.

This structural upgrading reflects the increasing sophistication of Turkish manufacturing over the last two decades and demonstrates that Turkey maintained competitiveness across a wide range of industrial sectors. Nevertheless, despite this diversification, total exports to Algeria grew less rapidly than predicted by the counterfactual scenario. This suggests that improvements in export quality alone were insufficient to offset the preferential market access granted to European competitors following implementation of the Algeria–EU FTA.

4. Empirical Analysis

One of the key assumptions underlying Difference-in-Differences estimation is the Parallel Trends Assumption, which states that, in the absence of treatment, exports to Algeria and exports to the comparison countries would have followed similar trajectories over time. Although this assumption cannot be tested directly for the post-treatment period, inspection of the pre-2005 export trends

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suggest no systematic divergence between the treated and control groups before implementation of the agreement. Consequently, deviations observed after 2005 can reasonably be attributed to the policy intervention rather than to pre-existing differences in export dynamics.

Furthermore, the DID estimator removes common shocks affecting all countries simultaneously, including fluctuations in world demand, exchange rate movements, commodity price cycles, and global financial crises. This considerably strengthens the causal interpretation of the estimated treatment effect.

Table 2: Difference-in-Differences Gravity Estimates of Turkish Exports

Regressors	Coefficient
Difference-in-differences Türkiye ⟶ Algeria	-0.573*** (0.002)
language	0.537 (0.313)
religion	0.089 (0.880)
oilexp	0.584 (0.316)
borders	1.107*** (0.012)
FTATR	1.513*** (0.003)
loggdp	0.248 (0.241)

Table 2 reports the estimates obtained from Equation (1), and presents the Difference-in-Differences (DID) gravity model estimates evaluating the impact of the Algeria–EU Association Agreement on Turkish exports. The coefficient of primary interest is the interaction term capturing the post-2005 treatment effect for the Turkey–Algeria trade relationship. The estimated coefficient is negative (-0.573) and statistically significant at the 1 percent level, providing strong evidence

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that the implementation of the Algeria–EU FTA adversely affected Turkish exports to Algeria relative to the control group. The high level of statistical significance indicates that the estimated effect is highly unlikely to be the result of random variation, thereby lending considerable support to the hypothesis of trade diversion generated by the preferential agreement.

Beyond statistical significance, the estimated coefficient is also economically meaningful. Since the dependent variable is expressed in logarithmic form, the estimated coefficient implies a substantial reduction in Turkish export performance relative to the counterfactual scenario. Rather than suggesting a temporary decline immediately following implementation, the DID estimate indicates a persistent deterioration in export growth throughout the post-treatment period. This finding implies that the competitive advantage enjoyed by European exporters after receiving preferential market access generated a long-term erosion of Turkey's relative position in the Algerian market.

The estimated effect is fully consistent with Viner's (1950) theory of trade diversion. According to this framework, preferential trade agreements not only create additional trade among member countries but may also divert imports away from more efficient non-member suppliers toward member countries benefiting from tariff preferences. In the present case, Turkish exporters did not necessarily become less competitive in terms of productivity or product quality; instead, the institutional advantages granted to European exporters reduced the relative competitiveness of Turkish products within Algeria. Consequently, the observed decline reflects a policy-induced change in market access rather than a deterioration in Turkey's export capacity.

The estimated gravity variables generally exhibit the expected signs predicted by international trade theory. The coefficient associated with Turkey's own free trade agreements (FTATR) is positive and statistically significant, confirming that preferential trade agreements facilitate bilateral trade by lowering trade costs and improving market access. Similarly, the common-border variable is positive and highly significant, highlighting the importance of geographical proximity in reducing transportation costs, delivery times, and informational barriers between trading partners. These findings are fully consistent with the standard gravity literature, which consistently identifies geographical proximity and institutional integration as major determinants of bilateral trade.

By contrast, the coefficients for common language, common religion, and oil-exporting status are statistically insignificant. Although these variables display the expected positive signs, their lack of significance suggests that cultural proximity and similarities in resource endowments play a relatively limited role in explaining Turkish exports once economic size and institutional variables are taken into account. This result is not surprising given that Turkey's exports to Algeria are dominated by manufactured goods, where competitiveness depends more heavily on production costs, logistics, and trade policy than on cultural affinity.

The coefficient on GDP is positive but statistically insignificant. While conventional gravity models generally predict a strong positive relationship between economic size and bilateral trade,

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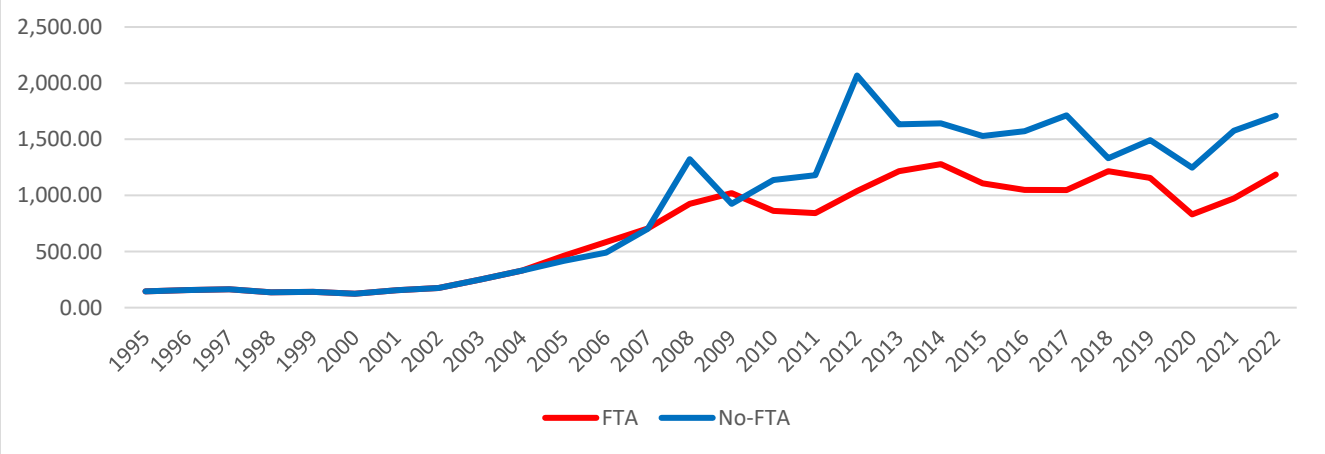
the weaker result obtained here may reflect the inclusion of treatment effects and the relatively homogeneous structure of the comparison countries. In addition, part of the income effect may already be captured by the DID specification and the control variables, thereby reducing the marginal explanatory power of GDP. Similar findings occasionally appear in panel gravity models where country-specific characteristics absorb a substantial portion of cross-sectional variation.

Overall, the empirical estimates strongly support the existence of a trade-diversion effect following the implementation of the Algeria–EU Association Agreement. More importantly, the consistency between the estimated treatment effect and the theoretical expectations of the gravity model enhances the credibility of the empirical results. The fact that most gravity variables display theoretically consistent signs while the treatment variable remains highly significant suggests that the observed decline in Turkish exports cannot simply be attributed to broader macroeconomic developments but reflects the structural consequences of the preferential agreement itself.

Finally, although the estimated coefficient provides compelling evidence of trade diversion, it should be interpreted within the limitations of the empirical framework. The model does not explicitly account for multilateral resistance terms through exporter-year and importer-year fixed effects, as recommended by recent structural gravity literature (Larch et al., 2021). Consequently, future research employing PPML estimation with high-dimensional fixed effects could further validate the robustness of the estimated treatment effect. Nevertheless, the current results provide strong evidence that the Algeria–EU FTA generated a statistically and economically significant disadvantage for Turkish exporters.

Figure 5: The Counterfactual Analysis



Source: prepared by the author

Figure 5 illustrates the counterfactual estimation, projecting the expected outcome following the difference-in-differences analysis. The graph traces the path of Turkish exports to Algeria under the hypothetical scenario where the Free Trade Agreement (FTA) is never signed. Notably, a significant deviation was observed starting in 2005, suggesting that, according to the analysis,

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Turkey faced a decline of 24% in its exports to Algeria due to the implementation of the FTA between Algeria and the EU in that year.

This 24 percent counterfactual gap is larger than the annualized DID coefficient because it cumulates the yearly trade-diversion effect over the full post-2005 period rather than reporting a single-year marginal effect; the two numbers are therefore complementary rather than contradictory, with the DID coefficient identifying the average annual growth penalty and the counterfactual gap showing its compounded effect on the level of exports by the end of the sample. Even so, the counterfactual estimate should be read as an upper-bound illustration rather than a precise dollar figure: it holds all other gravity determinants at their estimated values and does not allow for general-equilibrium adjustment, for example, a reallocation of Turkish exporters toward other Maghreb or Gulf markets that could partially offset the loss in Algeria specifically.

5. Discussion

The empirical findings provide robust evidence that the Algeria–EU Association Agreement generated a statistically significant trade-diversion effect for Turkish exports. Rather than reducing the absolute value of bilateral trade between Turkey and Algeria, the agreement appears to have reduced the relative growth of Turkish exports compared with similar countries that were not affected by the preferential arrangement. This distinction is particularly important because bilateral trade between Turkey and Algeria continued to increase throughout much of the sample period. The DID estimates therefore indicate that Turkish exports grew, but at a significantly slower pace than would have been expected in the absence of the agreement.

These findings are strongly consistent with Viner's (1950) theory of customs unions and preferential trade agreements. Viner argued that preferential liberalization generates two opposing forces: trade creation among member countries and trade diversion away from excluded trading partners. The evidence presented in this study suggests that the Algeria–EU Association Agreement produced both effects simultaneously. While European exporters benefited from lower tariff barriers and improved market access, Turkish exporters—despite remaining competitive producers—experienced a relative deterioration in their position within the Algerian market because they continued to face less favourable trading conditions.

The results also complement the findings of Haddoud et al. (2015), who concluded that the Algeria–EU Association Agreement increased trade between Algeria and the European Union and generated welfare gains through greater economic integration. However, while Haddoud et al. focused primarily on the consequences for the member countries themselves, the present study extends the analysis by examining the external effects on an important non-member trading partner. The evidence suggests that part of the increased integration between Algeria and the EU may have come at the expense of Turkish exporters, illustrating that preferential agreements can generate important spillover effects beyond their signatory countries.

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Similarly, the findings are consistent with the heterogeneous trade effects identified by Larch, Schmeißer and Wanner (2021). Their structural gravity analysis demonstrated that the impact of the EU–Turkey Customs Union varies substantially across sectors, countries, and trading partners, implying that aggregate estimates may conceal important bilateral differences. The present study supports this interpretation by providing evidence from a specific bilateral relationship where the negative effects of asymmetric trade liberalization appear considerably stronger than average. Rather than contradicting the structural gravity literature, the results reinforce its conclusion that preferential trade agreements often generate highly heterogeneous outcomes depending on the characteristics of individual markets.

At first glance, the results appear to differ from those reported by El-Sahli (2025), who found no statistically significant aggregate impact of asymmetric EU free trade agreements on Turkish trade. However, these findings are not necessarily contradictory. El-Sahli's analysis estimates an average treatment effect across a broad set of countries, each characterized by different market sizes, sectoral compositions, and institutional arrangements. Such an aggregate estimate may naturally mask substantial bilateral heterogeneity. By contrast, the present paper concentrates exclusively on Algeria, one of Turkey's most important trading partners in Africa and a country where European exporters received significant preferential access following the Association Agreement. Consequently, the stronger treatment effect identified here can be interpreted as evidence that the costs of asymmetric liberalization are concentrated in particular markets rather than being evenly distributed across all trading partners.

Furthermore, the descriptive evidence presented in Figures 1–4 supports the econometric results. Figure 1 illustrates that although Turkish exports to Algeria continued to expand after 2005, their growth trajectory slowed noticeably over time, particularly following the implementation of the agreement. Figure 2 shows the substantial expansion of trade between Algeria and the European Union after tariff liberalization, providing descriptive evidence of increased European penetration into the Algerian market. Figures 3 and 4 reveal that bilateral trade remains characterized by a complementary structure, with Algeria exporting predominantly hydrocarbons while Turkey specializes in manufactured goods. Nevertheless, even this complementarity was insufficient to prevent a deterioration in Turkey's relative export performance once European exporters obtained preferential market access.

It is also important to recognize that the observed trade diversion cannot be attributed exclusively to the Algeria–EU FTA. Other external factors, particularly the collapse in international oil prices between 2014 and 2016, significantly reduced Algeria's export revenues and weakened its overall import demand. Because Algeria remains highly dependent on hydrocarbon exports, fluctuations in global energy prices directly affect its purchasing capacity. Although the Difference-in-Differences methodology controls for common macroeconomic shocks by comparing Algeria with a carefully selected control group, some country-specific effects may still remain. Consequently,

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the estimated treatment effect should be interpreted as the average impact of the preferential agreement after accounting for common external shocks rather than as the sole determinant of Turkish export performance.

From a policy perspective, the findings contribute to the ongoing debate regarding the modernization of the EU–Turkey Customs Union. The evidence suggests that asymmetric preferential agreements can generate measurable economic costs for Turkey when reciprocal market access is delayed or absent. This supports long-standing arguments that Turkey should either participate more actively in negotiations involving new EU free trade agreements or automatically receive equivalent market access once such agreements enter into force. At the bilateral level, the results also highlight the importance of strengthening direct economic cooperation between Turkey and Algeria through expanded investment partnerships, sector-specific trade agreements, and the eventual negotiation of a comprehensive bilateral FTA. Such measures would help restore competitive neutrality and reduce the structural disadvantages identified in this study.

6. Conclusion

This paper set out to test, using a difference-in-differences design embedded in a gravity model, whether the free trade agreement between Algeria and the European Union diverted Turkish exports away from the Algerian market. The empirical results support this hypothesis: Turkish exports to Algeria grew significantly more slowly after the Association Agreement's implementation than exports to a synthetic control group of structurally comparable, non-EU-FTA economies, and a counterfactual simulation suggests a cumulative export loss of approximately 24 percent relative to the no-FTA scenario. The mechanism underlying this result, Turkey's customs union with the EU, which requires alignment with EU external trade policy without reciprocal participation in EU trade negotiations, is well documented in the broader literature on EU-Turkey trade relations, and this paper's contribution is to show that the mechanism has a quantifiable bilateral signature in the specific, economically significant case of Algeria.

The paper also cautions against over-generalizing from this single bilateral estimate. Aggregate evidence on Turkey's asymmetric FTA exposure across all of the EU's trading partners finds much smaller or statistically insignificant average effects, implying that the Algeria case may sit toward the more severe end of a highly heterogeneous distribution rather than representing a typical outcome. Future research extending this analysis with sector-level trade data, exporter-year and importer-year fixed effects, and a longer post-treatment window that captures the eventual conclusion of a Turkey-Algeria bilateral FTA, should it materialize, would help to pin down both the precision and the external validity of the estimates presented here.

For policymakers, the results reinforce the case, long argued by Turkish trade officials, for modernizing the EU-Turkey customs union to give Turkey either a consultative role in the EU's future FTA negotiations or automatic reciprocal market access when those agreements enter into

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force. In the interim, Turkey's own bilateral trade diplomacy with Algeria, including the trade-volume targets and investment commitments reaffirmed during the 2022 and 2023 high-level visits discussed in Section 3, offers the more immediately actionable channel for offsetting the structural disadvantage documented in this paper.

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