JCMS 2020 pp. 1–19 DOI: 10.1111/jcms.13058

A Tale of (almost) 1001 Coefficients: The Deep and Heterogeneous Effects of the EU-Turkey Customs Union

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Abstract
In view of the deferred start of negotiations for the modernization of the customs union between the EU and Turkey (CU-EUT), we looked back and analysed the ex post trade consequences of the CU-EUT. Employing up-to-date econometric best practices for regional integration agreements, we quantified both the total and the heterogeneous trade effects of the CU-EUT. In contrast with most previous studies, our results indicate that the CU-EUT made a significantly positive, large and robust impact, implying there was an additional increase in EU-Turkey trade in manufacturing by 55–65 per cent compared with that during the previously active Ankara Agreement. We also provide evidence that the CU-EUT significantly increased Turkey's trade with non-member countries of the CU-EUT. Additionally, a substantial heterogeneity in the CU-EUT effect was found across different industries as well as for each of its member countries and the direction of trade. We linked the heterogeneity of up to 911 coefficient estimates to the differences in initial trade costs and show that it cannot be ascribed to reductions in bilateral tariff rates.

Keywords: gravity model; European integration; country-specific effects

Introduction

In May 2015 the Turkish government and the European Commission officially started a process for the modernization and expansion of the customs union (CU) between the EU and Turkey (hereafter called CU-EUT) that had entered into force almost 20 years previously on 31 December 1995. In December 2016 the European Commission asked the European Council for a mandate to launch negotiations. However, in August 2017 the German government publicly opposed this decision and announced the suspension of any preparatory work for the reform of the CU-EUT over concerns about democratic development and the human rights situation in Turkey (Höhler, 2017; Tastan, 2017). Consultations in the European Council about opening negotiations are still in process (European Commission, 2020).[1] Amidst recent political tensions between the EU and Turkey, an effort to look back and assess the economic consequences that the CU-EUT has hitherto brought about for both parties seemed worthwhile and well timed. We wanted to contribute to this debate by taking up the following main research question: how successful has the CU-EUT been in spurring on trade flows between Turkey and the EU?

We are not the first to tackle this question. In preparation for the opening of negotiation talks the European Commission asked for two external studies by the World Bank (2014) and by BKP, Panteia and AESA (2016). In their empirical ex post evaluations these studies reached sobering conclusions about the effect of the CU-EUT on bilateral trade

[1]http://ec.europa.eu/trade/policy/countries-and-regions/countries/turkey/

flows in a gravity modelling framework. While the World Bank (2014, pp. 93–96) found no statistically significant effect, BKP, Panteia and AESA (2016, pp. 66–67) found an overall negative impact of the CU-EUT on two-way goods trade.

In addition to these two large-scale studies, other academic works in the literature on gravity modelling are inconclusive about the trade effects of the CU-EUT. Table A1 in the Appendix (together with a discussion in Section A) summarizes the underlying data, empirical methods and results of the World Bank (2014) and BKP, Panteia and AESA (2016), as well as seven other gravity studies. While Antonucci and Manzocchi (2006), Nowak-Lehmann *et al*. (2007), Magee (2016), Mumcu Akan and Engin Balin (2016) as well as Frede and Yetkiner (2017) found no evidence for a significant and relevant trade-enhancing effect of the CU-EUT, Neyaptı *et al*. (2007) and Adam and Moutos (2008) estimated there was a significantly positive and economically large impact. These inconclusive findings in the literature motivated our second research question: which methodological differences can explain the considerable divergence of results across these studies? This and all following additional research questions aimed to help provide a better and more detailed understanding of the overall effect considered in the main research question.

Turkey's process of continuous economic integration into the EU dates back to 1963, when both parties signed the Association Agreement, known as the Ankara Agreement, in which they agreed to establish a customs union. The Additional Protocol was signed in 1970, setting out the timetable for the progressive abolition of bilateral customs duties over a period of 22 years. The protocol required both parties to remove all bilateral tariffs and quantitative restrictions on all industrial goods and the industrial components of processed agricultural products. The implementation of the CU-EUT committed Turkey to align itself to the EU's customs tariffs and rules and to its commercial policy vis-à-vis third countries, as well as to the EU's *acquis* in the areas covered by the CU-EUT. As the World Bank (2014, p. 19) confirms, the CU-EUT has harmonized and decreased Turkey's import tariffs by applying the EU's common external tariff for most industrial products. Moreover, the approximation of laws resulted in improvements in Turkey's internal technical legislation and provided an important impetus to customs reforms and trade facilitation in Turkey (World Bank, 2014, pp. 32, 46).

One heavily debated feature of the CU-EUT that is uncommon for a customs union is its asymmetric decision-making structure. Under the CU-EUT harmonization is unilaterally determined by the EU, meaning that Turkey must align itself with the EU rules as they are, without being able to participate in the EU's decision-making mechanisms. Turkey is required to recognize all trade policies taken by the EU vis-à-vis third countries, such as free trade agreements (FTAs), tariff reductions or preferential market access. At the same time, as Turkey is not a member of the EU it does not receive automatic reciprocal access to these markets and it is not permitted to participate in the negotiations on trade liberalizations with outsiders. Consequently, Turkey has yielded part of its trade-policy sovereignty to the EU. If this feature of the CU-EUT has asymmetric effects on Turkish imports and exports, Turkish consumers may benefit from cheaper imports from third countries, while Turkish producers may be confronted with higher competition without receiving easier access to non-EU markets than in the absence of the CU-EUT (Yalcin *et al*., 2016, pp. 12, 16). These considerations on the CU-EUT's third-country effects led to our next research question: did the CU-EUT directly affect imports and exports between Turkey and non-EU member countries?[2]

While up to this point we have focused on the differential effects on Turkish trade with EU members and non-members, policymakers are often particularly interested in heterogenous effects across countries and sectors. Although economic theory suggests that, generally, countries gain from trade liberalization, recently many political debates on regional trade agreements (RTAs) have raised concerns about one-way trade deals and challenged the view that RTAs bring prosperity to individual nations. Therefore, we asked the following final research question: are there heterogeneous directional impacts of the CU-EUT observed for each pair of member countries within the customs union, both for aggregate and sectoral trade flows, and do these differences follow systematic patterns?

Our analysis yields the following answers to the outlined research questions: when taking into account the latest developments in structural gravity estimation; namely non-linear estimates with exporter-time, importer-time and country-pair fixed effects with both international and intranational trade flows and controlling for a general globalization trend – we found there is a strong, highly significant and positive effect of the CU-EUT on trade between Turkey and the EU.[3] Deviations from these best practices can help explain the diverse results in the literature. Based on recent contributions in the literature on structural gravity, we are the first to demonstrate that the CU-EUT also significantly fostered Turkish trade with non-EU member countries. We found some support for the concerns about asymmetric third-country effects: while Turkish exports experience an economically and statistically significant increase, imports to Turkey are indeed more strongly affected. Estimating country-specific and sector-specific effects reveals substantial heterogeneity in both dimensions, which can partly be explained by pre-liberalization openness.

The rest of this article is structured as follows. Section I describes the structural gravity framework and its estimation challenges. In Section II we briefly introduce the data-set. Section III then displays and discusses our results. Finally, Section IV adds concluding remarks. A more detailed discussion of the literature, data description and additional results can be found in the Appendix.

I. Estimation Strategy

Over the past four decades, the structural gravity equation has become the workhorse empirical model for studying the determinants of bilateral trade flows and the ex post effects of trade policies in particular. The gravity equation owes its prominence in the empirical literature on trade both to its remarkable predictive power and to its theoretical

[2]Neyaptı *et al*. (2007) also report some results for the trade effects with EU and non-EU countries. However, their identification of the non-EU country effect rests upon the complete omission of time controls, contradicting, for example, the authors' arguments on global trade trends, financial crises and the effects of the earthquake of 1999.

[3]Under the CU-EUT, deep trade liberalization is secured only in the industrial goods sector, which is subject to great legislative alignment, but its coverage of other policy areas – mainly primary agriculture, services and public procurement – is incomplete. In our analysis we therefore focused on the effects of the CU-EUT on manufacturing trade flows.

microeconomic foundations. We follow representation Anderson and van Wincoop (2003) who derive a gravity equation in a setting with nationally differentiated goods:

$$X_{ij,t} = \frac{Y_{i,t}E_{j,t}}{Y_t}\left(\frac{t_{ij,t}}{\Pi_{i,t}P_{j,t}}\right)^{1-\sigma}, \tag{1}$$

$$\Pi_{i,t}^{1-\sigma} = \sum\nolimits_j \left(\frac{t_{ij,t}}{P_{j,t}}\right)^{1-\sigma}\frac{E_{j,t}}{Y_t}, \tag{2}$$

$$\mathrm{P}_{j,t}^{1-\sigma} = \sum\nolimits_i \left(\frac{t_{ij,t}}{\Pi_{i,t}}\right)^{1-\sigma}\frac{Y_{i,t}}{Y_t}, \tag{3}$$

where $X_{ij,t}$ denotes international ($i \neq j$) and intranational ($i = j$) nominal trade flows from exporter i to destination j, $E_{j,t}$ is the total expenditure in j and $Y_{i,t}$ the value of total production in i, Y_t denotes the value of world output, $t_{ij,t}$ are bilateral trade friction between i and j (all for a specific year t), and $\sigma > 1$ indicates the elasticity of substitution among goods from different countries.

The right-hand side of equation 1 is the product of two ratios: first, the size term that is interpretable as the predicted frictionless trade flow as if there were no trade costs and second, the trade cost term, which is the ratio of predicted to hypothetical frictionless trade. In an analogy with Newtonian gravity, equation 1 predicts that international trade (gravitational force) between two countries (objects) increases with the product of their sizes (masses) and decreases with the trade costs (the square of distance) between them (Anderson, 2011, p. 144; Yotov *et al*., 2016, pp. 5, 16).

Importantly, the trade cost term in Equation 1 also depends on the two structural terms Π_i and P_j that were called multilateral resistance terms (MRTs) by Anderson and van Wincoop (2003). The MRTs formalize the intuitive argument that two countries will trade more with each other the more remote they are from all other countries. By capturing the general remoteness of the exporters and importers, these terms imply that bilateral trade flows depend on relative trade costs.

Yotov *et al*. (2016) compile best-practice solutions to translate the gravity system given by equations (1)–(3) into the following empirical specification that we used to estimate the CU-EUT trade effects:

$$X_{ij,t} = \exp\left(\pi_{i,t} + \chi_{j,t} + \mu_{ij} + \boldsymbol{z}_{ij,t}'\boldsymbol{\beta} + \gamma \mathrm{CU} - \mathrm{EUT}_{ij,t}\right) + \varepsilon_{ij,t} \tag{4}$$

$\varepsilon_{ij,t}$ denotes a remainder error term. The terms $\pi_{i,t}$ and $\chi_{j,t}$ are time-varying exporter and importer fixed effects that control for the MRTs Π_i and P_j which are not directly observable. In addition to capturing the MRTs, the exporter-time and importer-time fixed effects absorb $Y_{i,t}$ and $E_{j,t}$ and further control for any other observable and unobservable exporter-specific and importer-specific factors that may influence trade flows and are not specifically related to bilateral trade friction, such as national policies or productivity shocks.[4] Furthermore, our specifications include asymmetric country-pair fixed effects μ_{ij} to tackle potential endogeneity concerns due to unobserved heterogeneity or selection into trade policies.[5] To allow trade flows to be adjusted and errors to be correlated, we estimated equation 4 using three-year intervals and report multiway clustered standard errors by exporter, importer and year.

$z_{ij,t}$ (with corresponding parameter vector $\boldsymbol{\beta}$) collects time-varying bilateral trade cost factors, such as an indicator variable $RTA_{ij,t}$ that equals 1 if i and j at time t belong to an RTA, including the CU-EUT, and zero otherwise. It also contains an international border dummy (equal to one for international trade and zero otherwise) interacted with period dummies that hence flexibly control for changes of international trade costs relative to intranational trade costs over time.

Further, the main variable of interest is the indicator variable $\mathrm{CU-EUT}_{ij,t}$ which becomes 1 for all trade flows between Turkey and EU members, starting with the introduction of the CU-EUT in 1996. γ hence captures the trade liberalization between the EU and Turkey of the CU-EUT.

Besides estimating the overall impact of the CU-EUT, we identified the heterogeneous effects of the CU-EUT by (1) including separate indicators for Turkish exports and imports to and from the EU after 1996 (‘CU-EUT: EU → TUR’ and ‘CU-EUT: TUR → EU’), (2) adding indicators for Turkish trade flows with non-EU countries after the introduction of the CU-EUT (‘CU-EUT: TUR ↔ Non-EU’ or ‘CU-EUT: Non-EU → TUR’ and ‘CU-EUT: TUR → Non-EU’), (3) allowing the CU-EUT effect to differ for every EU partner and (4) considering the general CU-EUT effect as well as the aforementioned heterogeneous effects at a more disaggregated industry level.

This breakdown of effects according to trade directions, partners and sectors follows recent contributions in the general RTA literature by Baier *et al*. (2019) and Zylkin (2016). In estimating the third-country effects, we drew upon recent advances in the gravity literature that make use of intranational trade flows to identify the effects of unilateral, non-discriminatory policies. Heid *et al*. (2017) and Beverelli *et al*. (2018) demonstrate that the multicollinearity of variables capturing such policies with the importer-time and exporter-time fixed effects can be overcome by interacting the policy variable with an international border dummy. Similarly, in our setting, the ‘CU-EUT’ and the ‘TUR↔Non-EU’ variables would be jointly collinear with the set of fixed effects if we included only international trade flows in our analysis. By adding internal trade and introducing the same international border dummy interaction as Heid *et al*. (2017), we were able to identify both the direct and the third-country effect of the CU-EUT. Our application of this method is similar in spirit to that of Larch *et al*. (2018) who also investigate the unilateral effect of a multilateral variable; in their case, the effect of joining the eurozone on trade flows between the new members and non-eurozone member countries.

[4]Therefore, the fixed effects also control for macroeconomic disturbances that occurred in the period after the the CU-EUT entry into force, mainly Turkey’s balance of payments crisis in 2001 and the 2007–08 global financial crisis, and were mentioned by the World Bank (2014, p. 94) and BKP, Panteia and AESA (2016, p. 27) as a concern for the identification of the CU-EUT effects in their gravity estimates.

[5]Note that our extensive sets of fixed effects also capture several dimensions of another important determinant of trade flows; namely, the existence of migrant populations. Specifically, the country-pair fixed effects control for time-invariant level differences, while country-time varying fixed effects capture general exporter-time or importer-time specific migration trends.

Most previous studies on CU-EUT effects estimate a log-linearized version of the gravity equation using the ordinary least squares (OLS) estimate. As Santos Silva and Tenreyro (2006) point out, this leads to inconsistent estimates in the presence of heteroscedasticity or systematic zero trade flows. We followed their suggestion and estimated the gravity model in its original multiplicative form with the Poisson pseudo-maximum likelihood (PPML) estimator. In order to overcome computational challenges associated with the PPML estimator with three types of high-dimensional fixed effects that until recently prevented the estimation of this specification, we used Tom Zylkin's *ppml_panel_sg*- command, introduced by Larch *et al*. (2019).

II. Data

The data-set used was kindly provided by Thomas Zylkin and is an industry-level version of the data-set employed by Baier *et al*. (2019). The database is a balanced panel that covers bilateral trade in the manufacturing sector for a sample of 69 countries over the period 1988–2006.[6] Importantly, it contains both international and intranational trade data. The intranational trade data are consistently constructed as the difference between gross production and total exports, that were originally obtained from UN COMTRADE, the Centre d'Études Prospectives et d'Informations Internationales TradeProd database, the United Nations Industrial Development Organization IndStat and the World Bank Trade, Production and Protection database.

Note that most commonly used standard trade data-sets cannot be utilized for our analysis as they do not provide intranational trade data. Our high requirements on the data in terms of sectoral, country and intranational coverage left us with a data-set that did not contain the period 2007–19. However, the introduction of the CU-EUT falls well into our available data period, leaving us with enough variation to estimate the effect of interest.

RTA data were taken from Mario Larch's RTA database from Egger and Larch (2008). In addition, standard gravity covariates (distance, contiguity, common language, World Trade Organization [WTO] membership and colonial ties) were taken from the Centre d'Études Prospectives et d'Informations Internationales GeoDist database.

Finally, we retrieved bilateral tariff data for the EU and Turkey from the United Nations Conference on Trade and Development's trade analysis information system database. Specifically, we used data on effectively applied tariffs at the two-digit and three-digit manufacturing industry level from the World Integrated Trade Solution (wits.worldbank.org). Summary statistics are shown in Table A2 in the Appendix.

III. Results of Calculations

Main Results

Table 1 reports the main results for the estimates in model 4 with aggregate trade data. The coefficient of the CU-EUT in Column 1 is highly significant and indicates a large

[6]A list of included countries is provided in Section B of the Appendix.

Table 1: Main Results

	1	*2*	*3*	*4*	*5*	*6*
CU-EUT	0.472*** (0.041)	0.444*** (0.045)		0.499*** (0.045)	0.501*** (0.045)	
All RTAs	0.243** (0.113)		0.243** (0.113)	0.242** (0.113)	0.242** (0.113)	
EU		0.338** (0.157)				0.274 (0.182)
CU		0.539* (0.297)				0.501 (0.308)
FTA or EIA or PS		0.243** (0.113)				0.151 (0.148)
CU-EUT: EU → TUR			0.402*** (0.121)			0.479*** (0.051)
CU-EUT: TUR → EU			0.555*** (0.140)			0.517*** (0.065)
CU-EUT: TUR ↔ Non-EU				0.247*** (0.061)		0.277*** (0.072)
CU-EUT: Non-EU → TUR					0.273*** (0.065)	
CU-EUT: TUR → Non-EU					0.212*** (0.064)	
WTO						0.456*** (0.078)
N	33026	33026	33026	33026	33026	33026

Notes: All estimates were performed with exporter-time, importer-time and country-pair fixed effects, using the Poisson pseudo-maximum likelihood estimator. Additionally, *international border* × *period* dummies are included in the regressions, but omitted in the table for brevity. Standard errors are multiway clustered by importer, exporter and year and reported in parentheses. CU-EUT, customs union between the EU and Turkey; EIA, economic integration agreements; FTA, free trade agreement; *N*, number of observations; PS, partial scope agreements; RTA, regional trade agreements; TUR, Turkey; WTO, World Trade Organization. * $P < 0.1$ ** $P < 0.05$ *** $P < 0.01$

economic effect: the CU-EUT increased bilateral trade between the EU and Turkey by $(e^{0.472} - 1) \times 100$ per cent = 60 per cent. The effect of the CU-EUT is additional to the average trade effect of the RTAs included in the data-set (which also covers the Ankara Agreement). These initial results demonstrate that the CU-EUT was much more successful in promoting trade than other RTAs, which on average increased bilateral trade by 28 per cent. Overall Turkish-European liberalization efforts hence increased bilateral trade flows by $(e^{0.472+0.243} - 1) \times 100$ per cent = 104 per cent.

Roy (2010) and Baier *et al.* (2018) find that a customs union and other types of deep agreements (such as common markets or economic unions) have larger average effects than FTAs.[7] Motivated by these findings, in Column 2 of Table 1 the RTA dummy is split in CUs and other RTAs (FTAs, economic integration agreements and partial scope agreements), as well as a separate EU dummy. The results suggest that these deep agreements promote trade more strongly.

Column 3 of Table 1 shows the possible asymmetry of trade effects of the CU-EUT in the direction of trade, that is, for EU versus Turkish exports. The results indicate that while the CU-EUT has increased EU exports to Turkey by 49 per cent, Turkish exports to the EU have risen by 74 per cent. These results contradict the findings of Neyaptı *et al.* (2007), Adam and Moutos (2008) and Frede and Yetkiner (2017), who find larger benefits from the CU-EUT for EU exports than for Turkish exports.

The CU-EUT required Turkey to align itself with the EU's common external tariff, which led to a reduction of Turkey's import tariffs for third countries and thereby reduced the EU's preferential access to the Turkish market. Moreover, some provisions of the CU-EUT, for example, Turkey's adoption of the EU *acquis* and the improvement of customs procedures in Turkey, may have a unilateral liberalization component and may have stimulated Turkey's trade with the rest of the world. Our international and intranational trade data allowed us to implement a specification that quantifies this unilateral component while still rigorously sticking to the theoretical constraints of structural gravity. Specifically, we did so by adding in Column 4 a dummy variable that is equal to one for Turkey's international trade flows with all non-EU countries after 1996, and zero otherwise (that is, for trade between other partners as well as for all observations before 1996), seeking to control for Turkey's overall liberalization vis-à-vis third countries as a consequence of the CU-EUT. The indicator for Turkey's outside trade is highly significant and suggests that the reductions in bilateral trade frictions between Turkey and non-EU countries after the entry into force of the CU-EUT have increased trade flows by 28 per cent. This finding provides evidence that the CU-EUT is rightly 'generally credited with Turkey's openness to the world' (BKP, Panteia and AESA, 2016, p. 11).

Column 5 further shows whether the effects of the CU-EUT on Turkey's bilateral market access with the rest of the world are asymmetric in the direction of trade. A larger increase is found for Turkish imports from non-EU countries than for its exports, which may be explained by the required lowering of Turkey's import tariffs. Although the hypothesis of asymmetric third-country effects is confirmed by our estimates, the results also show benefits for Turkish exporters gaining market access in non-EU countries as a consequence of the CU-EUT. In an additional robustness test reported in the Appendix, we

[7] Deep agreements go beyond mere tariff reductions and additionally contain agreements concerning, for example, public procurement, technical barriers to trade or intellectual property rights.

found evidence that Turkey faces a higher competitive pressure from EU-RTA partners who gain preferential access to the Turkish market without reciprocity.[8]

Column 6 also shows how the asymmetric effects of the CU-EUT on member trade flows are changed by the inclusion of the dummy for Turkey's trade with non-EU countries after 1996. The estimate of EU exports to Turkey increases considerably when taking into account the preference erosion faced by EU exporters in the Turkish market. Overall, the asymmetry in the CU-EUT effects shrinks and now indicates that Turkish exports benefited only a little more than EU exports. A Wald test on the equality of both coefficients gives a P value of 0.64 and does not thereby provide any evidence that the CU-EUT's trade effects are significantly different for EU exports to Turkey versus Turkish exports to the EU.[9] The World Bank (2014, p. 94) and BKP, Panteia and AESA (2016, p. 28) were concerned that China's accession to the WTO and general tariff reductions due to WTO agreements reduced relative preferences in the EU-Turkey trade relation. Therefore, we additionally included a WTO dummy in Column 6, which is positive and highly statistically significant.

We investigated the robustness of the large and positive CU-EUT effects by additionally considering specifications with consecutive years, three-year lags and leads of the policy variables, as well as bilateral time trends. The robustness experiments strongly confirm the significant bilateral CU-EUT effect and the CU-EUT's additional non-EU liberalization impact.[10]

Overall, our estimates provide strong evidence that the CU-EUT increased trade flows between their members significantly more than an average RTA. In the following, we offer potential reasons for the relatively strong impact of the CU-EUT. As mentioned before, as a result of the Additional Protocol in 1970 bilateral tariffs in EU-Turkey trade had been widely removed before the entry into force of the CU-EUT. Therefore, tariff reductions are unlikely to explain the large effect of the CU-EUT. The strong impact of the CU-EUT may be explained by the structural advantage of a customs union compared with an FTA, which lies in the removal of the requirement for certificates of origin. Extensive checks to ascertain the origin of goods can cause substantial monitoring and compliance costs for firms in FTA member countries and thereby impair intertwined production networks. As members of a customs union apply the same external tariff to third countries, there is no need for such certificates. Using a partial equilibrium model, the World Bank (2014, pp. 22–24) estimated that if the CU-EUT was replaced by an EU-Turkey FTA, certificates of origin would decrease EU exports to Turkey by 2.0 to 4.2 per cent and Turkish exports to the EU by 3.0 to 7.2 per cent.[11] In addition, the

[8]Specifically, Table A3 adds to specifications 4 to 6 of Table 1 the variable 'CU-EUT: EU-RTA partners → TUR', capturing differential trade effects of imports from EU-RTA partners to Turkey after the entry into force of the respective RTA from 1996 onwards. While the results for this effect are highly statistically significant, the other CU-EUT effects remain very robust.

[9]The specification with asymmetric CU-EUT effects of Column 6 cannot be estimated with two asymmetric dummies for Turkey's trade with non-EU countries after 1996 which were included in Column 5. Even with intranational trade data, these four indicators would be perfectly collinear with the exporter-time and importer-time fixed effects.

[10]Detailed results are shown in Table A4 in the Appendix. The only specifications where there is no significant unilateral effect are those including bilateral time trends, leaving very little variation for identifying unilateral effects.

[11]The current CU-EUT, however, was unable to eliminate origin requirements completely. To claim preferences in EU-Turkey trade, firms are still required to present ATR movement certificates (HM Revenue and Customs, 2018). While the CU-EUT clearly simplifies border controls compared with a FTA, these certificates indicate that trade costs from documentation remain.

CU-EUT – in combination with Turkey's EU accession process – has led to an extensive legislative harmonization that is not comparable to many other RTAs. Regulatory approximations constitute an important part of removing trade barriers in the EU single market. Turkey's far-reaching alignment with the EU *acquis* covers a wide range of policy areas, including standards in quality infrastructure, customs administration, intellectual property rights and competition policy (BKP, Panteia and AESA, 2016, p. 22), and is likely to play a key role in the promotion of large trade flows. Our empirical approach, however, cannot disentangle these different channels of influence for the estimated trade effects of the CU-EUT.

Explaining Differences between This and Previous Studies

Our estimates indicate that the CU-EUT trade effects are considerably higher than suggested by many previous gravity studies on the CU-EUT.[12] In order to analyse to what extent the recent methodological innovations of the gravity literature incorporated in our specifications can explain the differing findings, Table 2 depicts the results for various changes in the model specification. Column 1 replicates our preferred specification from Column 4 in Table 1. Column 2 reproduces Column 1 of Table 1, following all best practices but without controlling for the unilateral liberalization component. Altering the control group in this way slightly reduces the magnitude of the CU-EUT effect. Column 3 follows all previous studies on the trade effect of the CU-EUT by not considering intranational trade flows. Due to the exclusion of observations for intranational trade, the coefficient of the CU-EUT shrinks and is now interpreted as a partial effect of the CU-EUT of 39 per cent. This indicates that the CU-EUT enhanced bilateral trade at the expense of domestic sales among its member countries (Yotov *et al*., 2016, p. 50). Mattoo *et al*. (2017), p. 26) provide another reason for the diverging estimates with and without internal flows: if deep agreements also promote trade with third countries, the unilateral effect of deep agreements is absorbed by the exporter-time and importer-time fixed effects when including only international trade. As the CU-EUT is generally credited with Turkey's commitment to an open trading regime and its unilateral liberalization to the rest of the world, the inclusion of intranational trade data is crucial for the identification of the overall impact of the CU-EUT on bilateral trade flows. No previous CU-EUT gravity study includes intranational trade, which is an important explanation for the fact that their estimates are typically lower than ours.

Columns 4 to 6 in turn each add one other deviation from the best practice specification. Specifically, Column 4 reports results from the specification of Column 3 based on Turkish trade flows only (see Magee, 2016, for such an application). With this restriction no exporter-time and importer-time fixed effects can be estimated and hence MRTs are not properly controlled for. Column 5 estimates the specification from Column 3 in log-linearized form with OLS (see Adam and Moutos [2008] for such a model). The omission of the zero trade flows from the reference group as well as heteroskedasticity are two aspects that may bias estimates of the effects of the CU-EUT. Column 6 repeats the specification from Column 3, not including any country-related fixed effects but

[12]Section A and Table A1 in the Appendix thoroughly review the findings and underlying empirical methods of all previous studies that we refer to in the main text and explicitly point out their methodological differences compared with our main specification, as well as differences in data coverage, both concerning the country sample and the covered time period.

Table 2: Explaining Differences between This and Previous Studies

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
CU-EUT	0.499***	0.472***	0.326***	0.256**	0.242**	−0.045	0.038	0.125	0.160	0.144
	(0.045)	(0.041)	(0.030)	(0.130)	(0.077)	(0.046)	(0.118)	(0.098)	(0.098)	(0.122)
All RTAs	0.242**	0.243**	−0.057	0.478***	0.164*	0.499***	−0.020	0.414***	0.176	0.199
	(0.113)	(0.113)	(0.088)	(0.123)	(0.076)	(0.060)	(0.126)	(0.101)	(0.120)	(0.133)
CU-EUT:	0.247***									
TUR ↔ Non-EU	(0.061)									
ln(Y)				0.755***		0.931***	0.597***	1.075***	1.211***	1.226***
				(0.207)		(0.012)	(0.173)	(0.022)	(0.032)	(0.051)
ln(E)				0.473**		0.882***	0.328*	0.870***	0.934***	0.910***
				(0.220)		(0.016)	(0.191)	(0.039)	(0.033)	(0.053)
ln (distance)						−0.398***		−0.923***	−0.966***	−1.196***
						(0.028)		(0.065)	(0.081)	(0.114)
Contiguity						0.588***		0.032	0.534**	0.021
						(0.066)		(0.183)	(0.198)	(0.395)
Common language						0.363***		0.286	0.839***	−0.076
						(0.053)		(0.283)	(0.168)	(0.604)
Colony						−0.008		0.137	0.644***	0.372
						(0.044)		(0.192)	(0.157)	(0.306)
N	33026	33026	32543	952	30182	32844	933	952	30233	933
Unilateral effect	x									
X_{ii} and globalization trend	x	x								
MRT controlled	x	x	x		x					
Unobs. heterogeneity controlled	x	x	x	x	x		x			
PPML	x	x	x	x		x		x		
All trade flows	x	x	x		x	x			x	

Notes: We included at least year-fixed effects in all specifications. Standard errors are reported in parentheses. ln(Y) and ln(E) denote the natural logarithm of the value of production and expenditure, respectively, and are captured by the logarithm of the exporter's and importer's gross domestic products. In data columns 1, 2, 3, 5 and 9 standard errors are multiway clustered by importer, exporter and year. In data columns 4, 7 and 10 standard errors are clustered by country pair. In data columns 6 and 8 standard errors are robust. CU-EUT, customs union between the EU and Turkey; MRT, multilateral resistance terms; *N*, number of observations; PPML, Poisson pseudo-maximum likelihood; RTAs, regional trade agreements; TUR, Turkey; Unobs., unobserved; x, "yes/included". * $P < 0.1$ ** $P < 0.05$ *** $P < 0.01$

adding standard gravity covariates instead. In line with the RTA results of Baier and Bergstrand (2007) and Yotov *et al*. (2016), pp. 51–52), the estimated CU-EUT effect may be underestimated without properly taking into account the endogeneity of the trade policy variable. Indeed, in the first two cases the estimated CU-EUT effect is lowered a little further. In the specification without any fixed effects (Column 6), the CU-EUT completely loses its significance and is estimated to be close to zero.

Column 7 follows Antonucci and Manzocchi (2006), Neyaptı *et al*. (2007), Nowak-Lehmann *et al*. (2007) and Mumcu Akan and Engin Balin (2016) by estimating a model using only a sample for Turkey's bilateral trade with all other countries in the log-linearized version using OLS (by combining the shortcomings from columns 4 and 5. In line with most of these studies, we found no economically or statistically significant effect of the CU-EUT in this case.

In Column 8 we combined the shortcomings of columns 4 and 6 and estimated a specification with Turkish trade flows that does not control for unobserved bilateral heterogeneity. This specification resembles the one used in BKP, Panteia and AESA (2016). This specification also turns out to be clearly downward biased with an insignificant estimated coefficient of 0.125. The direction of the bias provides a (partial) rational for the finding of BKP, Panteia and AESA (2016) who estimate an even significantly negative effect of 0.14. A plausible explanation for the remaining discrepancy is that BKP, Panteia and AESA (2016) use a sample from 1990 to 2015 (that is, also capturing the Turkish balance of payments crisis as well as the global trade collapse during the financial crisis starting in 2008) without controlling for time effects. In their consideration of the pre-crisis period from 1990 to 2000 they find a positive significant effect of 0.33.

Column 9 combines the shortcomings of columns 5 and 6 and estimates a log-linearized model without fixed effects. This is comparable to the specification of World Bank (2014).[13] Our estimated coefficient is reduced to 0.16 and turns insignificant. World Bank (2014) find a similar insignificant coefficient of 0.2.

Finally, Column 10 combines all deviations from the best practices considered before; that is, it reports the results of estimating a log-linearized gravity equation of Turkish international trade flows only without any country-related fixed effects, similar to the specification by Frede and Yetkiner (2017). In this specification we again do not find a significant impact of CU-EUT on its members' trade flows.

Heterogeneous Effects across Sectors and Members

Up to this point, we have evaluated the trade effects of the CU-EUT for aggregate manufacturing trade flows. However, the implied trade cost changes may have quite heterogeneous effects across different sectors. Table 3 shows the results for the CU-EUT effects across eight different manufacturing industries, each analysed in a separate regression. It reveals that the CU-EUT has very different impacts across industries. The largest effects of the CU-EUT are found for trade in machinery and wood, whereas the smallest coefficients are estimated for minerals, chemicals and food. In all sectors except

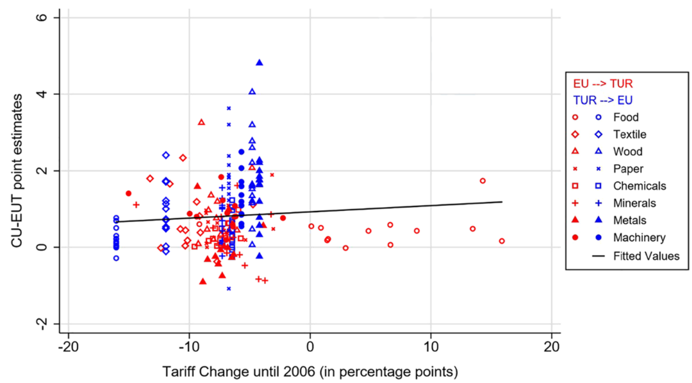
[13]Note that strictly speaking, the World Bank (2014) estimates a Heckman model following Helpman *et al*. (2008). This, however, also features a log-linearized intensive margin component that faces the same heteroscedasticity bias as a simple OLS estimation (Santos Silva and Tenreyro, 2015).

Table 3: Heterogeneity across Sectors

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*
	Food	*Textile*	*Wood*	*Paper*	*Chemicals*	*Minerals*	*Metals*	*Machinery*	*Aggregate*
CU-EUT	0.288***	0.547***	0.881***	0.664***	0.270***	0.250**	0.362	0.948***	0.499***
	(0.044)	(0.091)	(0.072)	(0.0S84)	(0.066)	(0.114)	(0.268)	(0.090)	(0.045)
CU-EUT:	−0.140***	0.557***	0.824***	0.845***	0.209**	0.747***	0.134	0.606***	0.247***
TUR $\leftrightarrow$ Non-EU	(0.036)	(0.108)	(0.133)	(0.161)	(0.089)	(0.067)	(0.201)	(0.077)	(0.061)
All RTAs	0.145	0.325	0.346**	0.216	0.0835	0.333***	0.131	0.320**	0.242**
	(0.145)	(0.321)	(0.143)	(0.153)	(0.158)	(0.113)	(0.089)	(0.143)	(0.113)
N	30940	31724	29337	29995	31920	28896	27902	32473	33026

Notes: All estimates are performed with exporter-time, importer-time, and exporter-importer fixed effects, using the Poisson pseudo-maximum likelihood estimator. Additionally, *international border* × *period* dummies are included in the regressions, but ommitted in the table for brevity. Standard errors are multiway clustered by importer, exporter, and year and reported in parentheses. *N*, number of observations; CU-EUT, customs union between the EU and Turkey; RTA, regional trade agreement; TUR, Turkey. * $P < 0.1$ ** $P < 0.05$ *** $P < 0.01$

Figure 1: Tariff Changes and Heterogeneous Effects in the Customs Union between the EU and Turkey (CU-EUT) [Colour figure can be viewed at wileyonlinelibrary.com]



metals the CU-EUT has significantly promoted trade flows. The elimination of the need for certificates of origin in the CU-EUT is likely to explain the large impact in the machinery sector, because industries that feature deep integration with multiple border crossings along the value chain tend to benefit disproportionately from this trade cost reduction. The relatively weak performance in the food and metals sectors is not surprising, as the CU-EUT has liberalized trade in these sectors to a very limited extent. The 'Decision of the EU-Turkey Association Council No 1/98' of 1998 and the 'Agreement between the European Coal and Steel Community and Turkey of 1996' were signed as two additional FTAs in order to provide preferential access for many agricultural and fisheries as well as all coal and steel products that were excluded from the CU-EUT. Trade cost reductions from these two FTAs are also captured by our bilateral CU-EUT dummy. However, under the first-mentioned FTA Turkey continued to protect its agricultural sector by granting very few preferential tariffs (BKP, Panteia and AESA, 2016, pp. 20–21). As shown in Figure 1, Turkey actually increased its tariffs on food imports from the EU after the entry into force of the CU-EUT.

Moreover, both FTAs require different certificates of origin from those that are necessary for products covered by the CU-EUT (HM Revenue and Customs, 2018). The relatively small effects in the minerals and chemicals sector might be explained by the remaining technical barriers to trade resulting from the complex EU regulations that imply high compliance costs for Turkish firms, as well as by the lack of Turkey's participation in the EU's decision-making bodies that shape the technical regulations in these sectors (World Bank, 2014, pp. 36, 105). For pharmaceuticals, for example, trade frictions remain due to the lack of recognition of good manufacturing practices and marketing authorization requirements of both parties (BKP, Panteia and AESA, 2016, pp. 54–55).[14] Table 3 additionally shows significant liberalization effects with third countries in almost

[14]There are other factors that might explain the revealed sector heterogeneity. Baier *et al*. (2019) have considered, including the role of revealed market power, the range of traded products ex ante and factor endowment differences. However, their analysis seeks to detect determinants of RTA effect heterogeneity across member states (i.e. why RTAs reduce trade costs more strongly for some countries than for others), not across sectors. Due to the limited number of sectors we considered in our study, an empirical investigation of potential explaining factors for the heterogeneous CU-EUT sector effects was not feasible.

all sectors, except for an insignificant increase in metals and a significant negative effect in food. The World Bank (2014, p. 19) demonstrates that after the formation of the CU-EUT Turkey increased its applied most-favoured nation tariffs for many products that are not covered by the CU-EUT, which might drive the differential third-country effects in the metals and food sector.

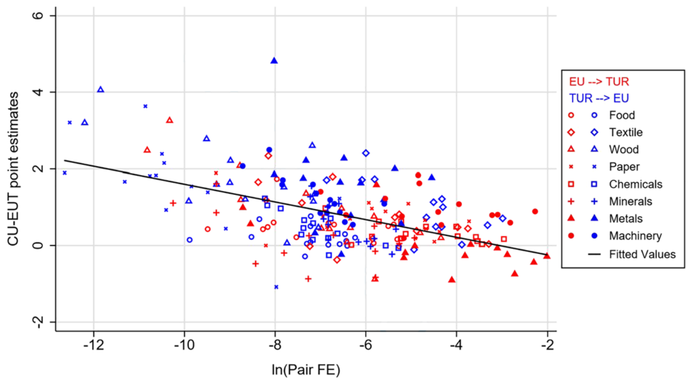
Table A5 in the Appendix analyses the heterogeneity in the effects of the CU-EUT for each EU member's exports and imports. For aggregate manufacturing trade flows, we found that for almost all country pairs the CU-EUT has significantly increased trade flows (with negatively affected imports from Malta and Cyprus as two notable exceptions).[15] At the same time, the results also demonstrate that much variation is missed when looking solely at the average CU-EUT effect. The largest effects are found for trade between Turkey and Ireland, Portugal, Belgium and Finland, while the impact of the CU-EUT is lowest for Turkey's trading partners Italy, Austria and Germany. Besides the heterogeneity across member pairs, our results indicate that within most pairs the trade effect is larger for Turkish exports than for the exports of the respective EU partner. Highly asymmetric impacts are found for Turkish trade with Malta, Cyprus, Ireland, Denmark and the UK, in each case in favour of Turkish exports. In contrast, Belgium, the Netherlands and Germany received more or less the same amount of access to the Turkish market that it offered in return to Turkish exporters.

Columns 1 to 8 of Table A5 combine the two dimensions of heterogeneity, allowing for different export and import effects in each sector and country pair. Overall the 286 coefficients on the two-digit level confirm the robustness of the CU-EUT effect with an average point estimate of 0.697. Two-thirds of the coefficients are significantly positive (at the 10 per cent level). At the same time, the standard deviation of 1.022 shows the substantial heterogeneity across pairs, directions and sectors. A similar pattern emerges when re-estimating at the three-digit level. The average of the 911 coefficients is 0.766, with again a share of two-thirds of significantly positive estimates and a somewhat higher variation (standard deviation of 1.346). We next made use of the two-digit coefficients to highlight graphically potential underlying patterns and determinants of the heterogeneous CU-EUT trade effects.

Baier *et al*. (2019) and Zylkin (2016) analyse a variety of possible determinants of heterogeneous trade effects within the same RTA. As Zylkin (2016) states, a typical approach in ex ante studies on the effects of RTAs is to assume that heterogeneous member effects arise from differences in their ex ante tariff levels. However, in the case of the North American Free Trade Agreement Zylkin (2016) has shown that the ex post estimates of heterogeneous trade effects are not correlated with what projections based on tariffs would have suggested. For the CU-EUT there are two reasons that make it unlikely that ex ante tariffs explain the estimated heterogeneous member effects. Firstly, as noted above, due to the large tariff reductions determined by the Additional Protocol few tariffs remained before the CU-EUT went into force. Secondly, within the EU all member countries applied the same import tariffs in 1995, while at the same time there is a large

[15]Note that the estimated effects for Turkey's trade with Cyprus, Malta, Hungary and Poland should be interpreted with caution, as these countries joined the EU in 2004, which is why the identification of their dummies rely on a single post-CU-EUT observation. To maximize comparability between EU member states considered and to reduce outliers, we limit our sample in our graphical analysis in Figures 1 and 2 to countries that were already EU members at the introduction of the CU-EUT in 1996.

Figure 2: Bilateral Openness and Heterogeneous Effects in the Customs Union between the EU and Turkey (CUEUT)



Note: ln(Pair FE) refers to the natural logarithm of the estimated bilateral fixed effects. [Colour figure can be viewed at wileyonlinelibrary.com]

variation in the estimated CU-EUT effects for EU imports from Turkey. Figure 1 is a scatterplot showing the bilateral tariff changes between the introduction of CU-EUT and the time our sample ends. If tariffs were to explain the heterogeneity in estimated coefficients, we would see a negative correlation as stronger tariff reductions should go hand in hand with higher trade effects. The figure indicates that bilateral sectoral tariff changes do a poor job of explaining heterogeneous changes in trade friction from the CU-EUT and contribute to the overall conclusion that the effects of the CU-EUT on bilateral trade go far beyond the removal of tariffs.

A different source for the observed heterogeneity may be the initial level of sectoral bilateral trade costs. Similar to Baier *et al.* (2019), we used the estimated asymmetric pair fixed effects from the regressions in columns 1 to 8 of Table 3 as an inverse measure for bilateral trade costs. If the CU-EUT has stronger effects in sectors and for country pairs that had a high liberalization potential (that is, a low initial openness), we expect a negative correlation between the estimated coefficients and estimated fixed effects. Figure 2 confirms this hypothesis. It further illustrates the asymmetries between Turkish exports and imports. Turkish exports tended to face higher initial trade friction and experienced stronger increases after the introduction of the CU-EUT, while EU exports were on average more open to begin with and thus increased to a smaller extent.

Baier *et al.* (2019) developed a two-stage estimation procedure to analyse more formally the effects of multiple determinants of the heterogeneous member effects of RTAs. We followed their approach and ran regressions of our almost 1001 estimated CU-EUT coefficients at the two-digit and three-digit level on tariff reductions, bilateral trade costs, a Turkish export indicator variable and a set of sector dummies. In line with the graphical evidence, the important drivers of heterogeneity are initial bilateral trade costs and the direction of trade. Additionally, the regressions confirm sectoral heterogeneity. Tariff cuts, in contrast, do not explain the observed differences in trade effects.[16]

[16]For the detailed regression results, see Table A5 in the Appendix for the full sample and Table A6 for the sample including only EU member countries from 1996 (as used in Figures 1 and 2).

Conclusion

Has the CU-EUT actually increased trade flows between the EU and Turkey? Many academic studies in the gravity literature as well as the two large-scale studies on the CU-EUT by the World Bank (2014) and by BKP, Panteia and AESA (2016) do not find a significantly positive and economically relevant trade effect of the CU-EUT.

We here provide a thorough reassessment of the CU-EUT, estimating both total and heterogeneous effects using a non-linear structural gravity specification with three-way fixed effects and intranational trade flows. We found the CU-EUT had a significant, strongly positive and robust impact. We are also able to quantify the CU-EUT effect on trade flows between Turkey and non-EU members. Remarkably, due to import tariff reductions Turkey's adoption of the EU *acquis* and improved customs procedures, both Turkish exports to and imports from third countries are positively affected, though less strongly than European-Turkish trade flows. These results show that both the EU and Turkey gained considerably from the CU-EUT. This illustrates that trade liberalization beyond mere RTAs may be a worthwhile endeavour.

The strong trade-enhancing effect is confirmed in a more disaggregated bilateral and sectoral consideration. While confirming the overall robustness, it also reveals substantial heterogeneity. In order to understand the potentially underlying mechanisms driving these differences, we related our 277 bilateral, directional, two-digit industry-level coefficients and our 911 three-digit level coefficients to tariff changes, initial bilateral trade cost proxies, the direction of trade and sectors. This second-stage analysis revealed that only tariff changes do not contribute to explaining the observed differences, suggesting that the CU-EUT effects are not driven by mere tariff cuts. The comparatively small trade effects in some sectors (food, chemicals, minerals, and metals) indicate a potential for the additional liberalization of manufacturing trade in an upcoming renegotiation of the CU-EUT.

Furthermore, despite our finding of large average impacts on manufacturing trade, the CU-EUT cannot be considered an exceedingly deep agreement in terms of the provisions covered as it misses, among other things, liberalization in primary agriculture, services, public procurement and investment. There is room for more far-reaching commitments that may stimulate trade flows between the EU and Turkey even more.

While the application of recent advances in gravity estimation turned out to be crucial in identifying the magnitude of the CU-EUT trade effect, the data required to implement these advances limited our sample choice, specifically in terms of years, countries and parts of the economy covered. With increasing data availability, it would be worthwhile to consider more recent developments, as well as effects on non-manufacturing sectors. Furthermore, taking international migration and foreign direct investment into account might yield a more complete picture of the effects of the CU-EUT.

Acknowledgements

We thank editor Richard Whitman for the excellent handling of our manuscript and for his useful comments and guidance. We also thank the anonymous referees who reviewed our article and who offered a series of great suggestions. We are grateful to participants at the Göttingen Trade Workshop, 2019, the European Trade Study Group in Bern, 2019, and the Deep FTAs Workshop at the Paris School of Economics in Paris, 2020, for useful suggestions. We also thank Thomas Zylkin for sharing data with us.

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Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Table A1. Review of Gravity Studies on the Partial Trade Effects of the CU-EUT
Table A2. Summary Statistics for the Aggregate Trade Dataset
Table A3. Robustness Tests for the Third-country CU-EUT Effect
Table A4. Robustness Tests
Table A5. Heterogeneity across Members
Table A6. Explaining Heterogeneous CU-EUT Effects, All CU-EUT Members
Table A7. Explaining Heterogeneous CU-EUT Effects