

Gravity Model–Based Export Potential

An Application to Turkey

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Abstract

This paper presents a framework to study countries' export potentials. It uses a gravity model to develop measures of export and trade policy potentials at the aggregate, bilateral, and industry levels. The methodology is applied to the case of Turkey. The analysis finds that Turkey was moderately under-exporting over 2010–17. The United States, China,

and Japan are important untapped destination markets, accounting for US\$29 billion (16–17 percent of total exports) of missing exports. Industry-level results suggest that Turkey has high export potential in the electronics and chemical industries.

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Gravity Model–Based Export Potential: An Application to Turkey[†]

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1. Introduction

The gravity model has become a workhorse tool for empirical analysis of international trade. The model has been widely used to estimate impact of geography and institutions on trade flows since the first application by Tinbergen (1962). More recent theoretical efforts, which started with Anderson (1979), have provided theoretical foundations for the gravity equation which can be derived from various theoretical models of international trade. These recent theoretical developments helped in the refinement of the original gravity equation which is now widely used to assess the effects of policy variables on trade flows as well as welfare (see Head and Mayer, 2014).

This paper presents a framework to analyze countries' export potentials using a gravity model. Our analysis incorporates recent developments of the empirical literature on the gravity model and proposes different measures of export potential that can be used to benchmark countries' exports. In terms of empirical contribution, the paper addresses some of the issues of previous estimations of export potential. First, we estimate the gravity equation using the Poisson Pseudo Maximum Likelihood (PPML) estimator which corrects for the issues of zero trade flows and heteroskedasticity error terms (Silva and Tenreyro, 2006) which are typical of the log-linear form of the gravity equations used in the ordinary least squares (OLS) estimation. Second, in addition to the standard gravity variables, we proxy for multilateral resistance terms with measures of remoteness terms instead of only controlling for countries' GDPs. The inclusion of remoteness terms has two implications: (i) it mitigates the bias outlined by Baldwin and Taglioni (2006), and (ii) it allows the model to predict aggregate under-exporting, which is not possible when fixed effects are included in a PPML model (Fally, 2012).

We illustrate the framework analyzing Turkey's export performance.¹ First, we use predicted and observed trade flows to construct an index of missing exports which varies between -100 and 100.

¹ A number of studies estimate gravity equations to study Turkey's export potential. For instance, Karagoz and Saray (2010) analyze trade between Turkey and Asia-Pacific countries and find that trade is below its

We find that Turkey is moderately under exporting relative to other countries. Countries with the highest export potential are Nepal, Burundi, and Rwanda. Second, we analyze bilateral trade flows to identify destination markets in which Turkey is under-exporting. We estimate that during the 2010-2017 period Turkey had on average 12 billion dollars of missing exports to the United States. This value is 30 percent higher than the current level of Turkish exports to the United States. Other important destination markets are China and Japan with 10 billion dollars (3 times higher than the current level of exports) and 7 billion dollars (14 times higher than the current level of exports), respectively. Third, industry-level results suggest that Turkey has a high export potential in electronics and chemical industries.

Finally, we exploit data on the content of deep trade agreements to develop a measure of trade policy potential. First, we use a gravity model to assess the impact of deep trade agreements on Turkey's trade. The results suggest that Turkey's trade is more sensitive to deep agreements than that of other countries. Second, using the gravity estimates we investigate the possible impact on Turkey's exports of deeper trade arrangements with its current preferential trade agreement (PTA) partners. Turkey could increase its exports from 1.8 percent to 9.2 percent by modernizing its existing trade agreements. To achieve this, Turkey would need to address in its existing trade agreements issues related to customs, export taxes, technical barriers to trade (TBT), sanitary and phytosanitary standards as well as more complex issues related to competition policy, intellectual property rights (IPR) protection, and movement of capital.

The rest of the paper is organized as follows. The next section discusses the data and empirical strategy. Sections 3 and 4 present the aggregate and industry level results. The trade policy potential results are presented in Section 5. Concluding remarks follow.

potential with Guinea, Peru, Myanmar, Mexico, the Lao People's Democratic Republic, and Brunei. Ata (2012) estimates a gravity equation covering 67 countries and finds that Turkey under exports to 48 of 67 the countries in the sample. Finally, a World Bank (2014) report assesses the potential of services trade between Turkey and the EU by using a gravity model of trade in services. According to the results, Turkey is found to be under-trading services with nearly all EU member states, suggesting untapped potential to increase bilateral trade.

2. Data Sources and Empirical Strategy

In this section, we provide details on the empirical methodology, data sources and measurement of the variables used in the empirical analysis.

Our data on trade flows, reported imports, at the HS 6-digit (HS 1988/1992) are from the World Bank's World Integrated Trade Solution (WITS). The data cover 105 countries across all geographic regions for the 2000-2018 period and cover 82 percent of world trade.² The sample is restricted to countries with population greater than 5 million in year 2000. Population data are from the World Development Indicators (WDI) database.

In order to analyze industries that are of strategic interest to Turkey, we aggregate the HS 6-digit trade flows to obtain a new classification that covers 20 sectors. The Turkish Ministry of Trade identified 6 strategic sectors (in grey in Table 1) for which the goal is to expand Turkey's global share. The sector "1-24 Food" covers all processed products in HS chapters 1-24, "28-38 Chemical" includes the sum of all 767 products in HS chapters 28-38, "84-85 Electronics" are all the electronics products under chapters 84-85, "84 Machinery" includes machinery and mechanical appliances in chapter 84, "85 Electrical" covers electrical machineries and equipment in chapter 85, and "86-89 Automotive" are all the products in chapters 86-89.³

² Specifications which include controls for capital stock per worker from the Penn World Tables 9.1 are restricted to the 2000-2017 period due to lack of data.

³ The concordance table between HS 1988/92 products and the new sectors is available upon request.

Table 1: Strategic Sectors in Grey

Sectors (HS Chapters)	Number of HS 6-digit Products
01-05 Animal	96
06-15 Vegetable	226
1-24 Food	381
16-24 Foodstuffs	26
25-27 Minerals	173
28-38 Chemicals	767
39-40 Plastic / Rubber	191
41-43 Hides, Skins	76
44-49 Wood	238
50-63 Textiles, Clothing	819
64-67 Footwear	55
68-71 Stone / Glass	196
72-83 Metals	597
84-85 Mach/Elec	23
84-85 Electronics	156
84 Machinery	438
85 Electrical	150
86-89 Automotive	133
90-97 Miscellaneous	389
98-99 Special	99

To empirically assess if Turkey is under exporting, we estimate a simple gravity model, which is widely used in the trade literature to assess the effects of trade policy changes on trade flows (Head and Mayer, 2014). As shown in Costinot and Rodríguez-Clare (2014), the following gravity equation emerges from different theoretical frameworks:

$$X_{ij} = \frac{Y_i E_j}{Y} \left(\frac{\tau_{ij}}{\Pi_i P_j} \right)^{1-\sigma} \quad (1)$$

$$(\Pi_i)^{1-\sigma} = \sum_j \left(\frac{\tau_{ij}}{P_j} \right)^{1-\sigma} \frac{E_j}{Y} \quad (2)$$

$$(P_j)^{1-\sigma} = \sum_i \left(\frac{\tau_{ij}}{\Pi_i} \right)^{1-\sigma} \frac{Y_i}{Y} \quad (3)$$

where X_{ij} is the bilateral trade flow from country i to country j , E_j is country j 's total expenditure, $Y_i = \sum_j X_{ij}$ is country i 's income, σ is the elasticity of substitution among different product varieties, and τ_{ij} is the bilateral trade costs between i and j . Π and P are the outward and inward multilateral resistances that capture i 's and j 's market access respectively.

Log-linearizing Equation (1) and assuming the equation holds in each year t , we obtain the following gravity equation:

$$\ln(X_{ijt}) = \ln(Y_{it}) + \ln(E_{jt}) - \ln(Y) + (1 - \sigma) \ln(\tau_{ijt}) - (1 - \sigma) \ln(P_{jt}) - (1 - \sigma) \ln(\Pi_{it}) \quad (4)$$

Exports X_{ijt} , for 105 reporters, come from UN Comtrade.⁴ As it is common in the gravity literature, we use exporter's and importer's nominal gross domestic products (GDPs), from the World Bank's World Development Indicators (WDI), to proxy for total production (Y_{it}) and expenditure (E_{jt}). We also assume that bilateral trade costs are a function of the following observable variables:

$$(1 - \sigma) \ln(\tau_{ijt}) = \beta_1 \ln(1 + \text{tariff}_{ijt}) + \beta_2 RTA_{ijt} + \beta_3 \ln(\text{Dist}_{ij}) + \beta_4 \text{Contig}_{ij} + \beta_5 \text{Lang}_{ij} + \beta_6 \text{Colony}_{ij} \quad (5)$$

tariff_{ijt} are bilateral applied tariff duties, RTA_{ijt} is an indicator variable that takes value of 1 if i and j have a trade agreement in year t from Mario Larch's Regional Trade Agreements Database from Egger and Larch (2008), Dist_{ij} is the geographical distance between i and j , Contig_{ij} is a variable that takes value of 1 for country-pairs that share a border, Lang_{ij} is a binary variable equal to 1 if i and j share the same language, and Colony_{ij} captures the presence of any colonial ties. Bilateral tariff duties are interpolated using data from the Market Access Map (MAcMap) database while all the other variables come from CEPII's gravity database.

⁴ See Table A1 in the appendix for the descriptive statistics for the main variables used in the empirical analysis.

To control for the unobservable multilateral resistance terms defined in Equations (2) and (3), we construct “remoteness indexes” (Baier and Bergstrand, 2007; Wei, 1996). A popular alternative to this method requires the inclusion of exporter-year and importer-year fixed effects. These fixed effects account for multilateral resistance terms as well as any country specific time determinants of trade. However, in a PPML model fixed effects impose a perfect fit in terms of total exports and total imports for each country, which implies that countries’ total exports would be always perfectly predicted and never departing from their potential. The two indexes of remoteness are defined as the GDP weighted distance for exporters i and importer j :

$$Rem\ Exp_{it} = \sum_j \frac{Dist_{ij}}{\left(\frac{E_{jt}}{Y_t}\right)} \quad (6)$$

$$Rem\ Imp_{jt} = \sum_i \frac{Dist_{ij}}{\left(\frac{Y_{it}}{Y_t}\right)} \quad (7)$$

Finally, we include additional controls for factor endowments: natural resources and capital per worker (Chor, 2010; Romalis, 2004). First, to control for the presence of resource rich countries, we use data from the World Bank to construct variables equal to 1 if average rents from oil, coal, and mineral exceed 10 percent of GDP for the 2000-2018 period. Second, we follow Levchenko and Zhang (2014) and construct variables for capital stock per worker based on data from the Penn World Tables 9.1. In addition, we also include exporters’ and importers’ GDP per capita from the WDI to account for countries’ level of development, which can affect the composition and quality of imports and exports.

3. Is Turkey Under-Exporting Given Its Observable Characteristics?

In this section we use estimates from the gravity model to benchmark Turkish exports.

a. Gravity Model

As it is standard in the recent trade literature, we use a PPML estimator to estimate the following gravity equation:

$$\begin{aligned}
 X_{ijt} = \exp & \left(\beta_1 \ln(1 + \text{tariff}_{ijt}) + \beta_2 \text{RTA}_{ijt} + \beta_3 \ln(\text{Dist}_{ij}) + \beta_4 \text{Contig}_{ij} + \beta_5 \text{Lang}_{ij} \right. \\
 & + \beta_6 \text{Colony}_{ij} + \beta_7 \ln(\text{GDP}_{it}) + \beta_8 \ln(\text{GDP}_{jt}) + \beta_9 \text{Resource Rich}_i \\
 & + \beta_{10} \text{Resource Rich}_j + \beta_{11} \ln(\text{Rem Exp}_{it}) + \beta_{12} \ln(\text{Rem Exp}_{jt}) \\
 & \left. + \beta_{13} \ln\left(\frac{K_{it}}{L_{it}}\right) + \beta_{14} \ln\left(\frac{K_{jt}}{L_{jt}}\right) + \beta_{15} \ln(\text{GDPpc}_{it}) + \beta_{16} \ln(\text{GDPpc}_{jt}) \right) + \varepsilon_{ijt}
 \end{aligned} \tag{8}$$

Equation (8) is obtained by substituting (5), (6), and (7) in the exponential form of Equation (4), and by adding the error term ε_{ijt} . Additional controls include exporters' and importers' GDPs, per capita GDPs, dummy variables for resource rich economies and capital stock per worker ratios. Important features of the PPML estimator are that it accounts for the problems of zero trade flows, as not all countries trade with all the countries in the world, and issues related to the heteroskedasticity of trade data, which together can make the OLS estimates biased and inconsistent.

Table 2 reports the PPML estimates from the gravity Equation (8). Results are in line with the trade gravity literature in terms of signs and magnitude of the coefficients. First, the results point to a significant effect of trade policy variables. RTAs are estimated to increase trade between 16 and 24 percent. The RTA coefficients are lower in Columns 2, 4 and 6 as tariff liberalizations are accounted for by the $\ln(\text{tariff} + 1)$ variable. Thus, in those specifications the RTA variable only captures reductions in non-tariff barriers. A one percent reduction in bilateral tariffs is estimated to increase trade between 1.6 and 2.5 percent. Distance is estimated to reduce bilateral trade, while sharing a border and speaking the same language has a positive impact on trade flows. The coefficients on the remoteness indexes suggest that larger and more remote countries trade more

intensively among themselves. Finally, more developed countries tend to export less while importers' economic development and colonial ties are not statistically significant.

Table 2: PPML Gravity Estimates

VARIABLES	(1) Trade	(2) Trade	(3) Trade	(4) Trade	(5) Trade	(6) Trade
RTA	0.211*** (0.057)	0.171** (0.066)	0.215*** (0.059)	0.154** (0.067)	0.209*** (0.059)	0.148** (0.067)
ln(distance)	-0.728*** (0.031)	-0.714*** (0.034)	-0.763*** (0.037)	-0.755*** (0.038)	-0.766*** (0.037)	-0.758*** (0.038)
Border	0.454*** (0.086)	0.452*** (0.086)	0.423*** (0.088)	0.405*** (0.087)	0.412*** (0.088)	0.396*** (0.087)
Language	0.201** (0.097)	0.194** (0.096)	0.242*** (0.094)	0.250*** (0.093)	0.273*** (0.093)	0.280*** (0.093)
Colony	-0.124 (0.106)	-0.125 (0.106)	-0.112 (0.100)	-0.111 (0.098)	-0.135 (0.102)	-0.134 (0.100)
ln(GDP exp.)	0.849*** (0.021)	0.852*** (0.022)	0.892*** (0.034)	0.899*** (0.035)	0.889*** (0.034)	0.896*** (0.035)
ln(GDP imp.)	0.824*** (0.030)	0.818*** (0.030)	0.828*** (0.032)	0.836*** (0.031)	0.830*** (0.031)	0.837*** (0.031)
Mineral rich exp.	0.023*** (0.003)	0.022*** (0.003)	0.021*** (0.003)	0.020*** (0.003)	0.020*** (0.004)	0.019*** (0.004)
Mineral rich imp.	-0.010** (0.005)	-0.007* (0.004)	-0.009** (0.004)	-0.008** (0.004)	-0.011** (0.004)	-0.010** (0.004)
ln(Remoteness exp.)	0.548*** (0.086)	0.555*** (0.086)	0.516*** (0.090)	0.522*** (0.090)	0.559*** (0.100)	0.566*** (0.100)
ln(Remoteness imp.)	0.554*** (0.098)	0.545*** (0.096)	0.533*** (0.096)	0.504*** (0.095)	0.651*** (0.114)	0.615*** (0.113)
ln(GDP pc exp.)			-0.126** (0.050)	-0.127** (0.050)	-0.177*** (0.049)	-0.183*** (0.049)
ln(GDP pc imp.)			0.005 (0.032)	-0.048 (0.030)	-0.189*** (0.054)	-0.228*** (0.053)
ln(K/L exp.)					0.074 (0.065)	0.081 (0.064)
ln(K/L imp.)					0.280*** (0.086)	0.261*** (0.083)
ln(tariff+1)		-1.591* (0.870)		-2.449*** (0.891)		-2.419*** (0.900)
Observations	168,581	168,581	166,908	166,908	152,515	152,515

Robust standard errors, clustered at the country-pair level, are in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

b. Aggregate Results

Does Turkey under export given its observable characteristics? To answer this question, we implement a two-step procedure based on estimates from Table 2. In a first step, we use the coefficients from Table 2 to predict bilateral trade flows based on countries' observable characteristics. In a second step, we aggregate exports at the country level to calculate the aggregate index of missing exports which is defined as follows:

$$\begin{aligned}
 \hat{X}_{ijt} = \exp & \left(\hat{\beta}_1 \ln(1 + \text{tariff}_{ijt}) + \hat{\beta}_2 \text{RTA}_{ijt} + \hat{\beta}_3 \ln(\text{Dist}_{ij}) + \hat{\beta}_4 \text{Contig}_{ij} \right. \\
 & + \hat{\beta}_5 \text{Lang}_{ij} + \hat{\beta}_6 \text{Colony}_{ij} + \hat{\beta}_7 \ln(\text{GDP}_{it}) + \hat{\beta}_8 \ln(\text{GDP}_{jt}) \\
 & + \beta_9 \text{Resource Rich}_i + \beta_{10} \text{Resource Rich}_j + \beta_{11} \ln(\text{Rem Exp}_{it}) \\
 & + \beta_{12} \ln(\text{Rem Exp}_{it}) + \beta_{13} \ln\left(\frac{K_{it}}{L_{it}}\right) + \beta_{14} \ln\left(\frac{K_{jt}}{L_{jt}}\right) + \beta_{15} \ln(\text{GDPpc}_{it}) \\
 & \left. + \beta_{16} \ln(\text{GDPpc}_{jt}) \right)
 \end{aligned} \tag{9}$$

$$\begin{aligned}
 \text{2nd Step} \quad \text{Index of Missing Exports}_{i,t} & = \left(\frac{\sum_j \hat{X}_{ij,t} - \sum_j X_{ij,t}}{\sum_j \hat{X}_{ij,t} + \sum_j X_{ij,t}} \right) * 100
 \end{aligned} \tag{10}$$

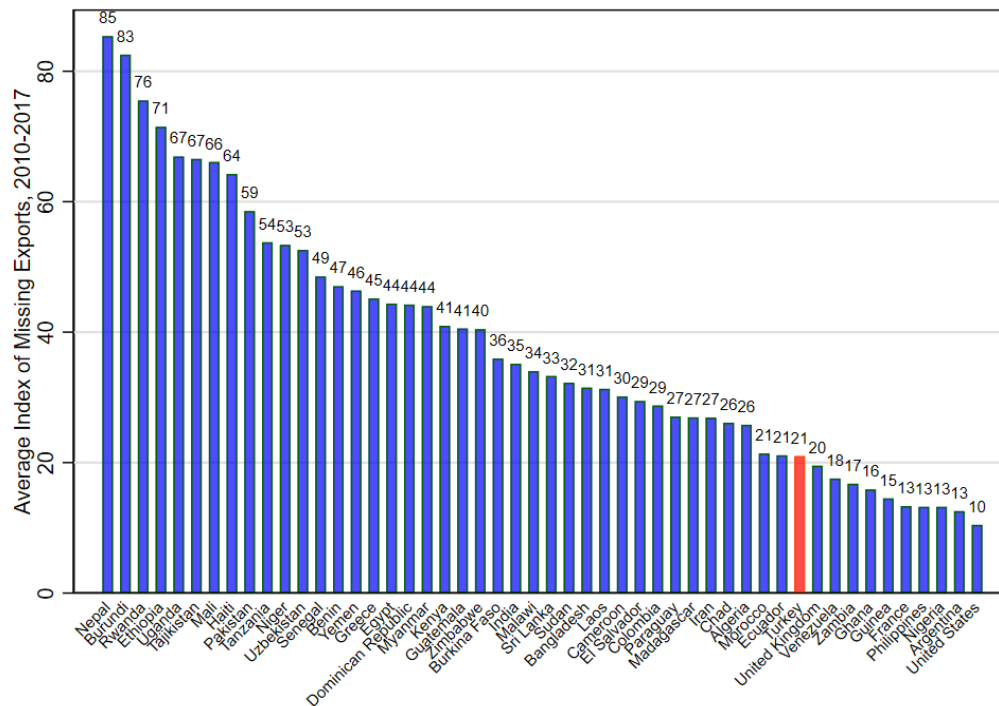
Figure 1 presents the result from Equation (10). The index of missing exports varies between 100 and -100. The maximum value of the index is obtained when observed bilateral trade flows are equal to 0, but the model predicts positive exports; while the minimum value (i.e., -100) is obtained when the predicted value is equal to 0 and we observe positive export values. Panel A includes countries with an average index of missing exports greater than 10 percent over the 2010-2017 period, while Panel B shows the results for the other countries.

The estimates suggest that Nepal, Burundi, and Rwanda have the highest export potential given their observable characteristics. The gravity model predicts these countries should be exporting at

least more than seven times what they exported.⁵ At the other extreme, there are Malaysia, Vietnam, and South Africa that export more than what we would expect given their economic size, trade costs, geographic location, and other observable characteristics. Turkey is moderately under exporting. The index is equal to 21 which suggests that exports should have been 53 percent higher than what we observe in the data. Other countries in the same under-exporting range are the United Kingdom, the República Bolivariana de Venezuela, and Morocco.

Figure 1: Country Level Index of Missing Exports

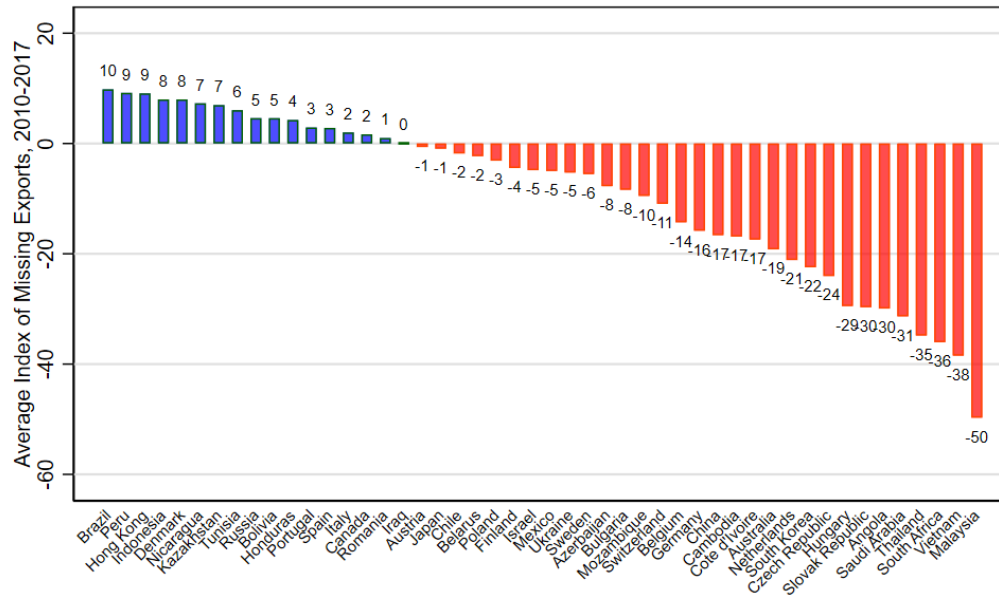
Panel A



⁵ For a given export potential, we can calculate the relationship with respect to the observed trade flows using the following formula:

$$\hat{X} = \frac{1 + \frac{\text{Index of Missing Exports}}{100}}{1 - \frac{\text{Index of Missing Exports}}{100}} * X$$

Panel B



c. Index of Missing Exports by Destination Countries

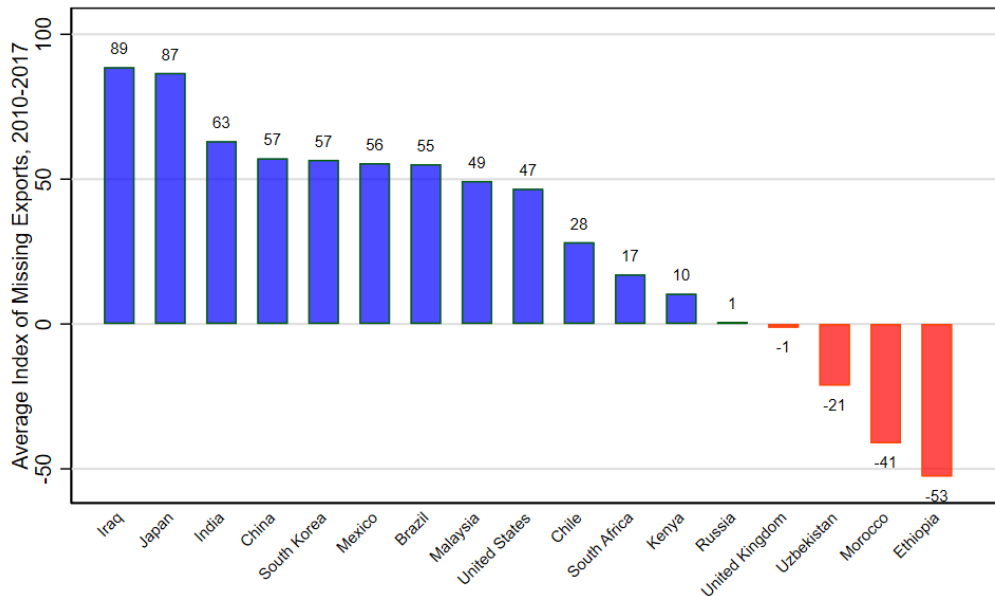
The aggregate results suggest that Turkey is exporting below its potential. To identify with which destination countries Turkey has the highest export potential, we take a closer look at differences between predicted and observed trade flows at the bilateral level. Also, we use the framework to understand if Turkey is under exporting to the target countries identified in the Export Master Plan. The Master Plan is based on macroeconomic data, market growth, and other factors, and it identified 17 countries which present the highest potential for Turkish exporters.⁶ We use the predicted trade flows from Equation (9) and construct country-pair indicators of export potential as follows:

⁶ The 17 countries in the Turkish Export Master Plan are the United States, Brazil, China, Ethiopia, Morocco, South Africa, the Republic of Korea, India, Iraq, the United Kingdom, Japan, Kenya, Malaysia, Mexico, Uzbekistan, the Russian Federation and Chile.

$$\text{Index of Missing Exports}_{TUR j,t} = \left(\frac{\hat{X}_{TUR j,t} - X_{TUR j,t}}{\hat{X}_{TUR j,t} + X_{TUR j,t}} \right) * 100 \quad (11)$$

where $\hat{X}_{TUR j,t}$ are the predicted exports from Turkey to country j in year t and $X_{TUR j,t}$ are the observed exports. Figure 2 presents the estimated trade potential for the 17 target countries identified in the Export Master Plan. Turkey is predicted to be over exporting to 4 out of the 17 countries in the plan. These countries are Ethiopia, Morocco, Uzbekistan, and the United Kingdom. One way to interpret these results is that expanding trade in these destinations could be difficult given their geography and size. However, the model does not account, for instance, for improvements in bilateral relations between Turkey and Uzbekistan and their strategic partnerships in the textile, metallurgical and automotive industries, which can increase trade in the future.

Figure 2: Index of Missing Exports for Countries in the Export Master Plan



There are other countries that could provide export opportunities for Turkish exporters. Figure 3 presents the results from Equation (11) for countries not included in the master plan. Turkey does not almost export to the Lao People’s Democratic Republic, which is ranked first in terms of

percent of missing exports. Other countries are Myanmar, a country with a big export potential, and Cambodia, a very competitive exporter according to the results in Figure 1. One issue with the export potential defined in Equation (11) is that the index fails to capture the size of the market defined in dollar terms. For instance, an index of missing exports equal to 99 for Lao PDR could be smaller in dollar terms than an index of 20 for Peru.

To better understand the market size in destination countries, we take a closer look at deviations of observed trade flows from the predicted ones. That is to say, we look at the numerator of Equation (10). The dollar value figures of “missing” exports provide a better measure of opportunities and are more informative in case the government is planning activities aimed at promoting Turkish exporters in specific destinations (e.g., trade events), which might not be justified for smaller markets.

Figure 3: Bilateral Index of Missing Exports (>20% only)

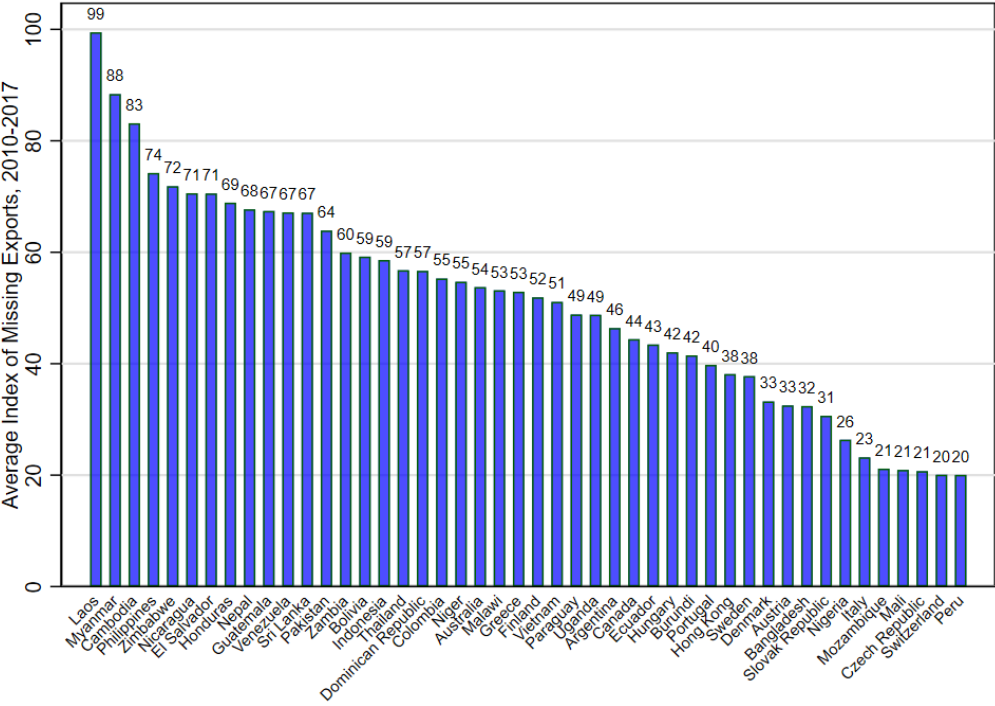
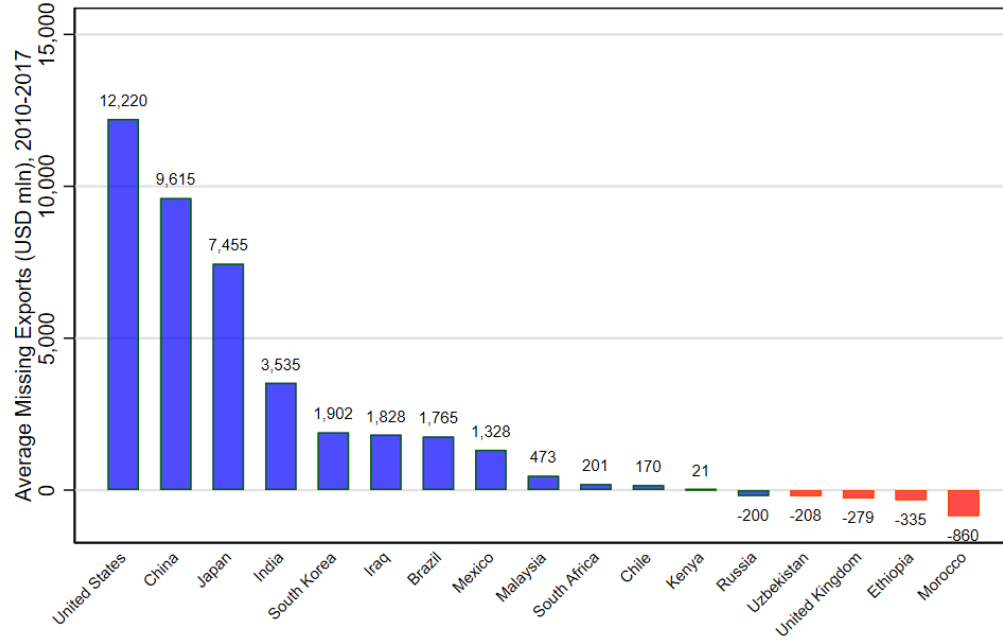


Figure 4 Panel A shows that ranking of countries changes dramatically when we look at missing exports. The United States is ranked first with around 12 billion dollars of missing exports, followed by China and Japan with 10 billion dollars and 7 billion dollars respectively.⁷ Among the non-targeted countries, we find some important destination markets which have a relatively low index of missing exports but rank high in terms of market size. This is the case for Italy and France, ranked first and third, which together have missing exports of almost 8 billion dollars. Other important markets that are ranked high in terms of both the index and missing exports are Greece and Canada. The comparison between Panel A and Panel B indicates that the Turkish government identified the most important countries in terms market size and suggests that the list could have aimed at Canada, Indonesia, and Australia in case the aim is to diversify exports away the European Union. Table A2 shows that China is the top “over exporter” in Canada and Australia, while Thailand over exports around 4 billion dollars to Indonesia. Other important exporters in these three countries are Mexico, the Republic of Korea, and Malaysia. Germany is the only European country listed among the top five “over exporters” in Canada and Australia.

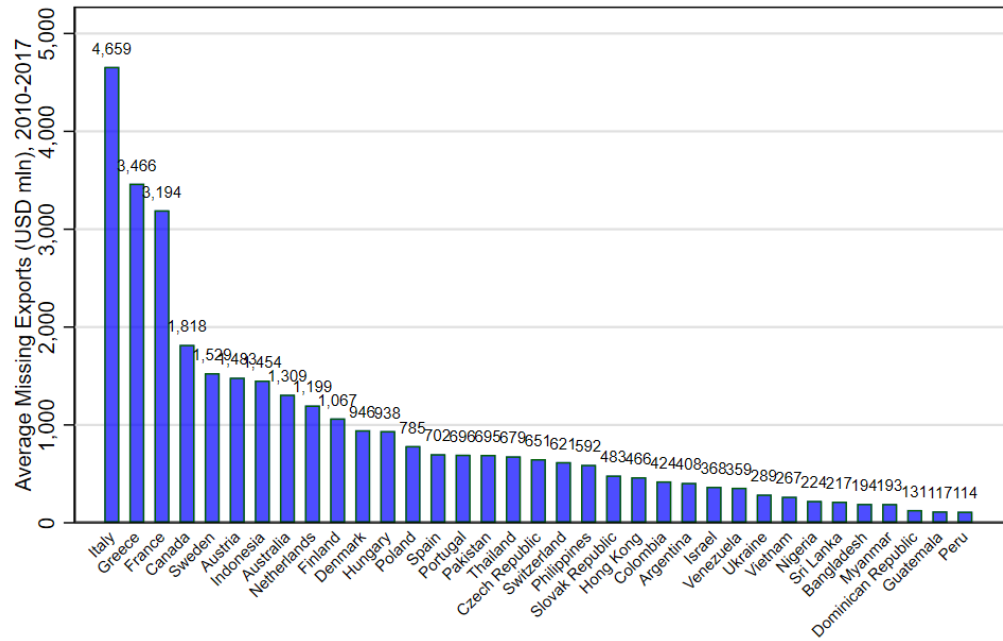
⁷ The average missing exports can produce inconsistent results when compared to the average index of missing exports. These inconsistencies are explained by the non-linear transformation used to construct the index of missing exports in which changes in missing exports can differ in magnitude from changes of the index. For instance, the Russian Federation has a positive average index of missing exports but negative average missing exports. In year 2017, missing exports declined by 32 percent while the index dropped by 48 percent.

Figure 4: Missing Exports (USD)

Panel A: Target Countries



Panel B: Other Countries (>200 USD mln)



4. Industry-Level Export Potential

This section presents the industry level analysis. We extend the gravity model to the sectors described in Table 1. As it is standard in the gravity literature, we modify Equation (8) and estimate the following sector level gravity equation:

$$\begin{aligned}
 X_{ijt}^k = \exp & \left(\beta_1^k \ln(1 + \text{tariff}_{ijt}^k) + \beta_2 \text{RTA}_{ijt}^k + \beta_3^k \ln(\text{Dist}_{ij}) + \beta_4^k \text{Contig}_{ij} + \beta_5^k \text{Lang}_{ij} \right. \\
 & + \beta_6^k \text{Colony}_{ij} + \beta_7^k \ln(\text{GDP}_{it}) + \beta_8^k \ln(\text{GDP}_{jt}) + \beta_9^k \text{Resource Rich}_i \\
 & + \beta_{10}^k \text{Resource Rich}_j + \beta_{11}^k \ln(\text{Rem Exp}_{it}) + \beta_{12}^k \ln(\text{Rem Exp}_{jt}) \\
 & \left. + \beta_{13}^k \ln\left(\frac{K_{it}}{L_{it}}\right) + \beta_{14}^k \ln\left(\frac{K_{jt}}{L_{jt}}\right) + \beta_{15}^k \ln(\text{GDPpc}_{it}) + \beta_{16}^k \ln(\text{GDPpc}_{jt}) \right) \\
 & + \varepsilon_{ijt}
 \end{aligned} \tag{12}$$

where X_{ijt}^k is the bilateral trade flow from country i to country j at time t in sector k . We estimate Equation (12) for each sector k allowing each explanatory variable to have a sector specific impact. For instance, the impact on trade of speaking the same language, β_5^k , for the automotive industry may differ from the impact language has on trade in vegetables.

Table 3 presents the industry level estimates from a PPML model. The estimates are qualitatively similar to the aggregate results, but there is heterogeneity in terms of magnitudes across industries.⁸ The coefficient on the RTA indicator variable varies between 0.064, and not statistically significant, for electronics to 0.602, and highly statistically significant, for the automotive industry which translate to an increase in exports of 7 and 83 percent respectively. The results show that trade in the automotive industry is less sensitive with respect to distance, conditional on the fact that trade in the automotive is concentrated among neighboring countries – i.e., the coefficient on the border indicator variable is the largest for the automotive industry. Finally, the results suggest

⁸ The estimates for non-targeted industries are reported in Table A3 in the appendix.

that countries with relatively high capital per worker tend to export more electronics and products in the automotive industry.

Table 3: Industry Level PPML Gravity Estimates Targeted Sectors

VARIABLES	(1) Food 1-24	(2) Chemicals 28-38	(3) Machinery 84	(4) Electronics 84-85	(5) Electrical 85	(6) Automotive 86-89
RTA	0.438*** (0.090)	0.108 (0.084)	0.137* (0.082)	0.064 (0.160)	0.075 (0.130)	0.602*** (0.134)
ln(distance)	-0.623*** (0.057)	-0.864*** (0.039)	-0.702*** (0.043)	-0.856*** (0.111)	-0.859*** (0.073)	-0.619*** (0.060)
Border	0.598*** (0.107)	0.184** (0.080)	0.383*** (0.110)	0.003 (0.323)	0.487*** (0.177)	0.620*** (0.164)
Language	0.293*** (0.087)	0.424*** (0.081)	0.017 (0.088)	0.411 (0.327)	0.016 (0.228)	-0.123 (0.151)
Colony	0.099 (0.124)	-0.079 (0.103)	0.112 (0.122)	-0.692*** (0.202)	-0.222 (0.170)	-0.282 (0.182)
ln(GDP exp.)	0.681*** (0.025)	0.921*** (0.023)	1.019*** (0.028)	1.048*** (0.080)	1.056*** (0.054)	0.907*** (0.038)
ln(GDP imp.)	0.718*** (0.030)	0.765*** (0.023)	0.798*** (0.029)	0.825*** (0.102)	0.756*** (0.064)	0.895*** (0.045)
ln(tariff+1)	-1.838*** (0.369)	3.120** (1.395)	-0.899 (1.295)	0.426 (2.945)	-0.030 (1.225)	-2.852** (1.407)
ln(GDP pc exp.)	-0.226*** (0.070)	0.254*** (0.066)	-0.101 (0.072)	-0.693*** (0.115)	-0.477*** (0.091)	-0.306*** (0.099)
ln(GDP pc imp.)	-0.110* (0.059)	-0.202*** (0.049)	-0.126** (0.053)	-0.286** (0.140)	-0.267*** (0.092)	0.029 (0.093)
Mineral rich imp.	0.175* (0.103)	-0.301*** (0.086)	0.296*** (0.099)	-0.920*** (0.228)	-0.251* (0.133)	0.516*** (0.135)
Mineral rich exp.	-0.877*** (0.175)	-0.302** (0.122)	-2.219*** (0.277)	-4.080*** (0.278)	-2.761*** (0.323)	-2.350*** (0.270)
ln(Remoteness exp.)	0.719*** (0.125)	-0.491*** (0.137)	-0.075 (0.174)	1.704*** (0.283)	0.525** (0.243)	0.924*** (0.263)
ln(Remoteness imp.)	0.102 (0.129)	0.977*** (0.121)	0.886*** (0.120)	0.642** (0.295)	0.953*** (0.222)	0.632*** (0.191)
ln(K/L exp.)	0.278*** (0.079)	-0.062 (0.077)	0.277*** (0.100)	0.347** (0.172)	0.229* (0.137)	0.815*** (0.137)
ln(K/L imp.)	0.188*** (0.071)	0.277*** (0.062)	0.075 (0.067)	0.490* (0.297)	0.428** (0.175)	0.061 (0.105)
Observations	152,515	152,515	152,515	152,515	152,515	152,515

Robust standard errors, clustered at the country-pair level, are in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

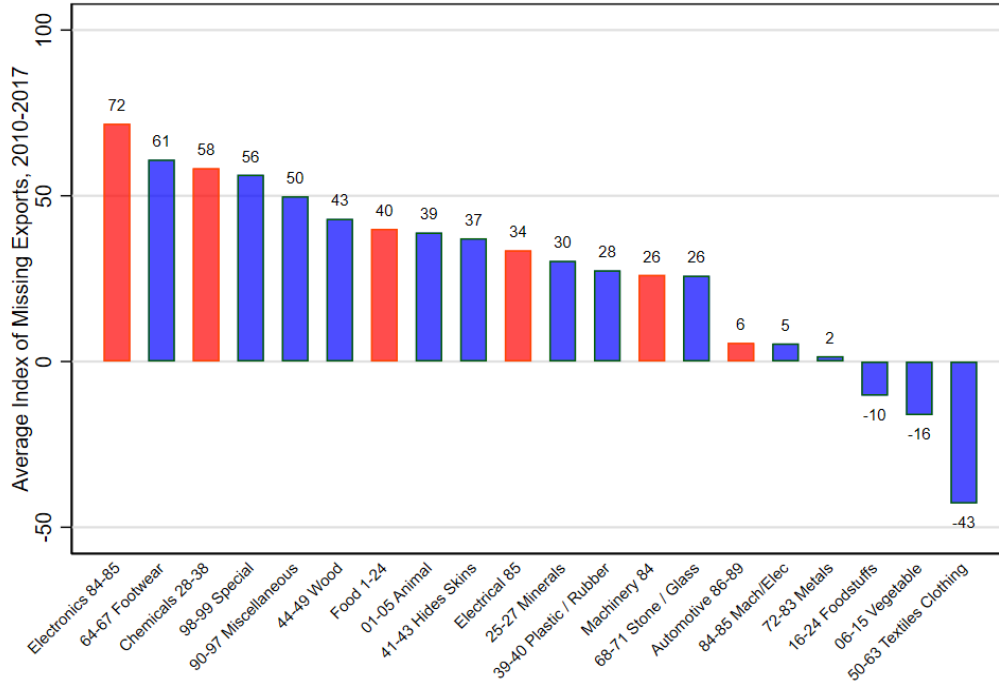
Similarly to the aggregate analysis, we use the estimates from Table 3 and Table A3 to calculate industry-level export potentials. We construct the industry level indexes of missing exports and calculate the difference between predicted and observed export flows to obtain the dollar figures for missing exports.

Figure 5 presents the industry level export potential results. Panel A plots the index of missing exports for each sector outlined in Table 1, with the strategic industries in red (i.e., industries targeted in the Turkish Export Master Plan). The results suggest that Turkey under exports in all the targeted industries. Electronics, chemical, and processed food products are among the industries with the highest index of missing exports. These sectors, particularly electronics and chemical sectors have a significant share in total exports of Turkey (20 percent of total exports). Another important industry in terms export potential is footwear, while Turkey, given its observable characteristics, appears to be already exporting intensively in the textile, vegetables, and non-processed food (“16-24 foodstuffs”) industries. Other industries other than automotive in which Turkey is predicted to be under exporting are special products, and the miscellaneous category. These industries include exports of works of art, and military weapons which might be difficult to expand.

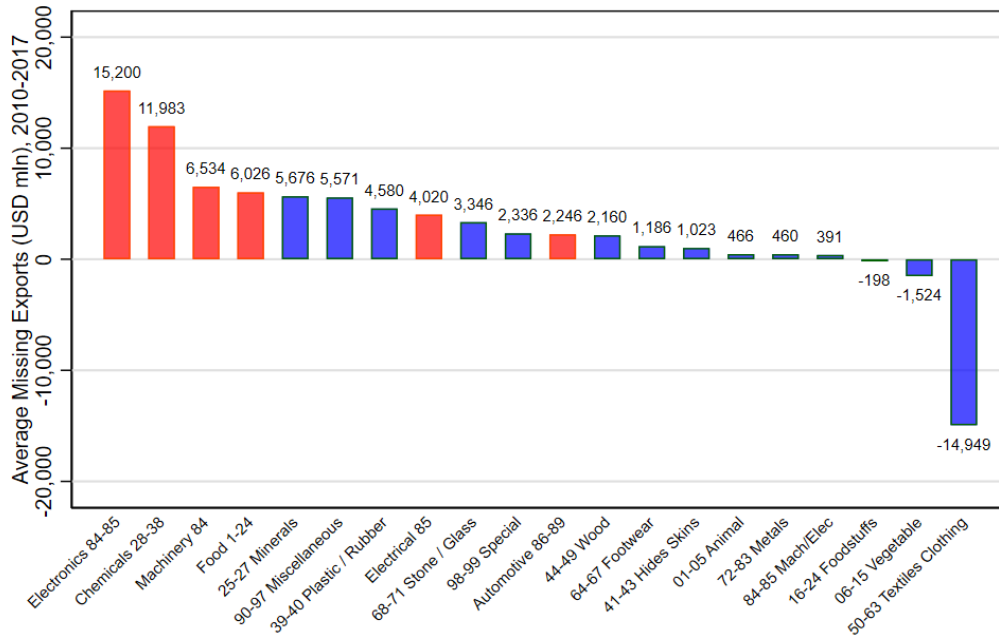
In addition to having a high index of missing exports, the electronics and chemical industries are also important in terms market size (Figure 5 Panel B). Interestingly, the dollar figures show that the processed food industry has 6 billion dollars of missing exports, while it only ranks seventh in terms of the index. The high value of the index of the footwear industry translates into relatively small values of missing exports, equal to 1.2 billion dollars.

Figure 5: Industry Level Export Potential

Panel A: Index of Missing Exports



Panel B: Missing Exports (USD)



To understand the potential of insertion in global value chains (GVCs), we classify products according to archetypal GVCs using the conversion tables based on Ferrantino and Schmidt (2018). Ferrantino and Schmidt (2018) extend the mapping between intermediate and final goods developed by Sturgeon and Memedović (2011) to cover GVC trade in electronics, vehicles, machinery, electrical equipment, footwear, textile, and apparel. The original mapping uses the U.N. Statistical Division's Broad Economic Categories (BEC) classification and the opinion of industry experts to classify products as belonging to one of three GVCs: apparel and footwear, electronics, and motor vehicles.

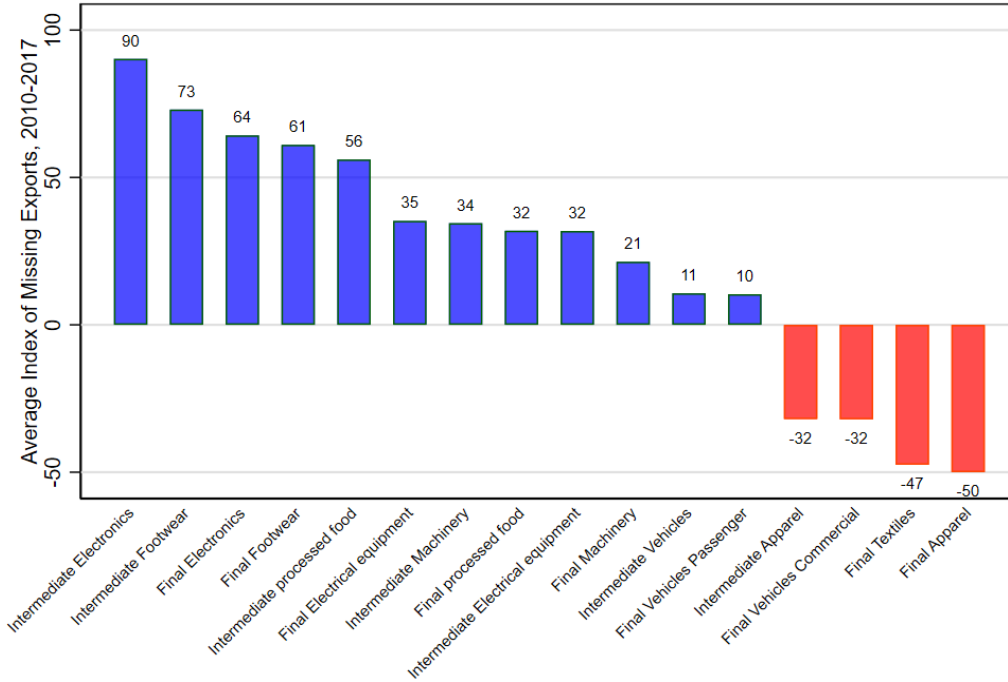
Figure 6 presents the export potential results for different GVCs. Similarly to the industry-level results (Figure 5), we find that Turkey has a high export potential in electronics, footwear, and processed food. Electronics is the most important industry in terms of missing exports.⁹ Turkey has a particularly low forward participation in electronics.¹⁰ As exports of final electronics are also below potential, this industry could potentially benefit from an improved access to foreign intermediate inputs with lower local content requirements linked to subsidies. Finally, the GVC results show that Turkey is particularly competitive in the automotive and textile industries both in terms of intermediate and final goods exports.

⁹ The most important destinations in terms of missing exports for both final and intermediate electronics are the United States, China, and Italy.

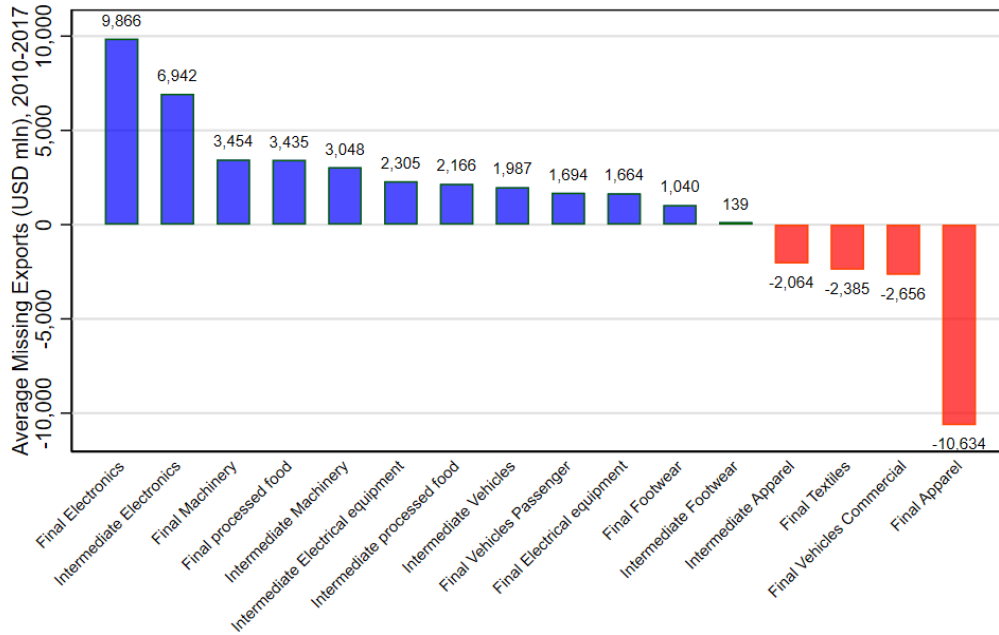
¹⁰ In the context of archetypal GVCs, forward participation in GVCs are proxied by exports of intermediate products. While the intensity of backward linkages can be inferred by how much a country imports of intermediate goods.

Figure 6: Global Value Chains Export Potential

Panel A: Index of Missing Exports



Panel B: Missing Exports (USD)



5. Trade Policy Potential

This section studies the impact of deep agreements on Turkey's exports. We use a standard gravity model to assess the effect RTAs had on trade and then use the estimates from this analysis to evaluate the future of Turkish trade relations under different scenarios. As in Mulabdic et al. (2017) and Mattoo et al. (2017), we build a measure of depth of agreements between PTA members using information from the content of PTAs (Hofmann et al., 2019; WTO, 2011). The database covers all preferential trade agreements notified to the World Trade Organization (WTO) and in force up to December 2015 (i.e., 279 trade agreements). For each agreement, the data provide information on the coverage and legal enforceability of 52 policy areas.¹¹

Currently Turkey has 20 free trade agreements (FTAs) in force and there are 5 additional agreements under ratification process. According to the Ministry of Trade, Turkey has been engaged in the negotiation of new agreements as well as in negotiations aimed extending the scope of its current agreements.¹²

Table 4 provides information on the content of Turkey's agreements that were notified to the WTO before December 2015. The Content of Deep Trade Agreements database cover 18 trade agreements of which Turkey is a member country: 17 FTAs and the customs union with the EU. The most extensive agreement in terms of coverage of policy areas is the agreements with Morocco which covers 13 policy areas, while the agreements with the Arab Republic of Egypt and Jordan cover only 8 areas. To put these numbers in perspective, the Peru-Chile FTA includes 11 legally enforceable provisions, the United States-Korea Free Trade Agreement (KORUS FTA) signed in 2007 includes 15 provisions, and the EU, which comprises eight agreements—i.e., the Treaty of Rome and successive EU enlargements—cover 43 legally enforceable provisions.

¹¹ See Table A4 in the appendix for the description of the 52 policy areas.

¹² Turkey has been engaged in negotiations with Japan, Ukraine, Peru, Indonesia, Colombia, Ecuador, Mexico, Thailand, Pakistan, the Democratic Republic of Congo, Djibouti, Cameroon, Chad, the Seychelles, the Gulf Cooperation Council, Libya, and MERCOSUR. Available at: <https://www.trade.gov.tr/free-trade-agreements> (Accessed August 22, 2020).

Table 4: Content of Turkish Trade Agreements

	Morocco	Albania	EFTA	EU	Bosnia and Herzegovina	Chile	Montenegro	Korea, Republic of	Palestinian Authority
	2006	2008	1992	1996	2003	2011	2010	2013	2005
	FTA	FTA	FTA	CU	FTA	FTA	FTA	FTA	FTA
FTA Industrial	✓	✓	✓	✓	✓	✓	✓	✓	✓
FTA Agriculture	✓	✓	✓	✓	✓	✓	✓	✓	✓
Customs	✓	✗	✓	✗	✗	✓	✓	✓	✓
Export Taxes	✓	✓	✓	✗	✓	✓	✓	✓	✓
Sanitary and phytosanitary (SPS)	✓	✓	✗	✗	✓	✓	✓	✗	✓
Technical barriers to trade (TBT)	✓	✓	✗	✓	✓	✓	✓	✓	✓
State trading enterprises (STE)	✓	✓	✓	✓	✓	✗	✗	✗	✓
Antidumping (AD)	✓	✓	✓	✓	✓	✓	✗	✗	✓
Countervailing measures (CVM)	✓	✓	✓	✓	✗	✓	✗	✗	✗
State Aid	✓	✓	✓	✓	✓	✓	✓	✗	✓
Public Procurement	✓	✓	✓	✗	✓	✗	✓	✗	✗
Trade in services agreement (GATS)	✗	✗	✗	✗	✗	✗	✗	✗	✗
Trade-related intellectual property rights (TRIPs)	✓	✓	✓	✓	✓	✓	✓	✓	✓
Competition Policy	✓	✓	✓	✓	✓	✓	✓	✓	✓
Environmental Laws	✗	✗	✗	✗	✗	✗	✗	✗	✗
Intellectual Property Rights (IPR)	✗	✗	✓	✓	✗	✓	✗	✓	✗
Labour Market Regulation	✗	✗	✗	✗	✗	✗	✗	✗	✗
Movement of Capital	✗	✗	✗	✗	✗	✗	✓	✗	✗
Agriculture	✗	✗	✗	✗	✓	✓	✗	✗	✗
Approximation of Legislation	✗	✗	✗	✓	✗	✗	✗	✗	✗

	Israel	Mauritius	Serbia	Syria	Georgia	North Macedonia	Tunisia	Egypt	Jordan
	1997	2013	2010	2007	2008	2000	2005	2007	2011
	FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA
FTA Industrial	✓	✓	✓	✓	✓	✓	✓	✓	✓
FTA Agriculture	✓	✓	✓	✓	✓	✓	✓	✓	✓
Customs	✓	✓	✓	✓	✓	✗	✓	✓	✓
Export Taxes	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sanitary and phytosanitary (SPS)	✗	✓	✗	✗	✗	✗	✗	✓	✗
Technical barriers to trade (TBT)	✗	✓	✗	✗	✓	✓	✓	✗	✓
State trading enterprises (STE)	✓	✗	✓	✓	✓	✓	✓	✓	✗
Antidumping (AD)	✓	✓	✗	✓	✗	✓	✗	✗	✗
Countervailing measures (CVM)	✗	✓	✗	✗	✗	✗	✗	✗	✓
State Aid	✓	✗	✓	✓	✓	✓	✓	✗	✓
Public Procurement	✗	✗	✓	✗	✗	✓	✗	✗	✗
Trade in services agreement (GATS)	✓	✗	✗	✗	✗	✗	✗	✗	✗
Trade-related intellectual property rights (TRIPs)	✗	✓	✓	✓	✓	✗	✓	✓	✗
Competition Policy	✓	✗	✓	✓	✓	✓	✓	✓	✓
Environmental Laws	✗	✗	✗	✗	✗	✗	✗	✗	✗
Intellectual Property Rights (IPR)	✗	✗	✗	✗	✗	✗	✗	✗	✗
Labour Market Regulation	✗	✗	✗	✗	✗	✗	✗	✗	✗
Movement of Capital	✓	✓	✓	✓	✗	✗	✗	✗	✗
Agriculture	✗	✗	✗	✗	✗	✗	✗	✗	✗
Approximation of Legislation	✗	✗	✗	✗	✗	✗	✗	✗	✗

We use a gravity model to analyze the impact of deep trade agreements on Turkey's trade. As it is standard in the trade literature, we include importer-time and exporter-time fixed effects to account for country-time specific determinants of trade (e.g., market size) as well as multilateral resistance terms (Anderson and Wincoop, 2004, 2003). We also construct intra-national trade flows using GDP data from the WDI as in Bergstrand et al. (2015). To control for all the time-invariant determinants of trade costs (e.g., distance) and address endogeneity concerns in the formation of PTAs (Baier and Bergstrand, 2007), we include country-pair fixed effects.

Table 5 presents the PPML gravity estimates of depth using importer-time, exporter-time, and country-pair fixed effects. To ease interpretation, we transform the *depth* variable to be equal to 1 for the average depth in our sample. The results in column (1) suggest that signing an agreement with average depth increases bilateral trade by 18 percent. The impact of an average trade agreement is similar in magnitude to the estimated impact of a PTA in Table 2. In columns (2)-(3) we include interaction terms to allow for heterogeneous effects of deep PTAs for Turkey. The results suggest Turkey's trade is more sensitive to deep agreements than other countries (column 2), especially its exports (column 3).

Table 5: Deep Trade Agreements and Trade

VARIABLES	(1) Trade	(2) Trade	(3) Trade
Depth	0.168*** (0.020)	0.167*** (0.020)	0.167*** (0.020)
Depth*TUR exp			0.536*** (0.203)
Depth*TUR imp			0.470** (0.191)
Depth*TUR exp/imp		0.508*** (0.139)	
Observations	174,146	174,146	174,146
exporter-year FE	YES	YES	YES
importer-year FE	YES	YES	YES
exporter-importer FE	YES	YES	YES

Robust standard errors, clustered at the country-pair level, are in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Finally, we use the estimates from Table 5 column (3) to investigate the possible impact on Turkey's exports of future trade arrangements with its current PTA partners. Figure 7 presents the results for different scenarios in which Turkey deepens the scope of its current trade agreements. In the first case, we assume that increases the depth of its shallow agreements to be at least as deep as its average agreement. In the second scenario, we assume that Turkey updates all its agreements to cover as many areas as in its deepest agreement (i.e., 13 provisions as in the Turkey-Morocco FTA). Finally, the third scenario assumes that all the trade agreements are updated to cover all the provisions that have been included in at least one Turkish agreement (i.e., 18 provisions).

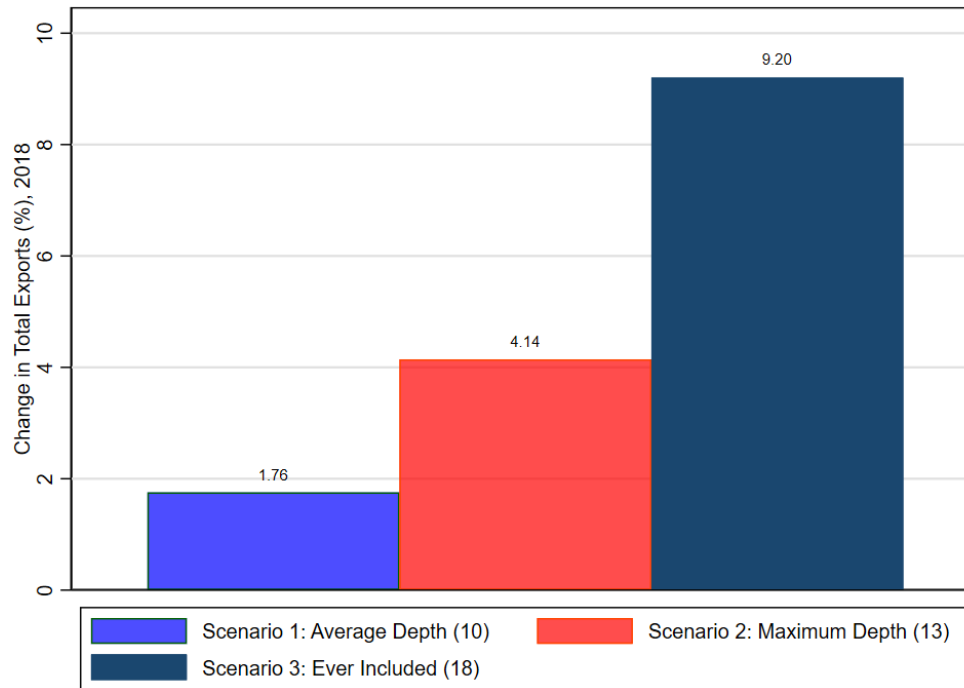
We find that total exports increase under all three scenarios and that this increase is greater the higher the depth of the future arrangements. The increase in total exports ranges from 1.8 percent to 9.2 percent in the case Turkey modernizes all its trade agreements. To achieve this increase, Turkey would need to address in its trade agreements issues which are already partially addressed at the WTO such as customs, export taxes, technical barriers to trade (TBT), and sanitary and phytosanitary standards as well as new areas such as competition policy, intellectual property rights (IPR) protection, and movement of capital.

There are two important caveats to be kept in mind. First, these calculations only account for the partial effects and do not have general equilibrium or welfare implications.¹³ Second, the empirical model assumes that the marginal effect of an additional provision is the same regardless of what type of provision is included.¹⁴

¹³ We do not account for possible re-direction of exports to and from other countries (i.e. trade diversion and deflection), price adjustments or changes in wages.

¹⁴ It is possible that provisions on standards, investment or competition are likely to have a larger impact on trade than provisions that do not pertain to trade such as visa and asylum.

Figure 7: Trade Policy Potential



6. Conclusion

In this paper, we present a framework to assess countries' export potentials. We use a standard gravity model, which incorporates recent developments of the empirical trade literature, to construct export potential indicators at the aggregate, country-pair, and industry levels. To illustrate this framework, we analyze Turkey's export potential. The results suggest Turkey had on average 12 billion dollars of missing exports to the United States over the 2010-2017 period. Other important destinations in terms of missing exports are China and Japan with 10 billion dollars and 7 billion dollars, respectively. Industry level results suggest that Turkey has a high export potential in electronics and chemical industries which are important in terms of both the index of missing exports and market size.

The paper also investigates the potential impact of deep agreements on trade. We find that Turkey could achieve higher levels of exports through deeper trade arrangements with its current preferential trade agreement (PTA) partners. A modernization of Turkey's existing trade

agreements has the potential of increasing its total exports between 1.8 to 9.2 percent. This would require Turkey to address in its trade agreements issues related to customs, export taxes, technical barriers to trade (TBT), sanitary and phytosanitary standards as well as more complex issues related to competition policy, intellectual property rights (IPR) protection, and movement of capital.

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Appendix A: Additional Tables

Table A1: Summary Statistics

VARIABLES	N	Mean	S.D.	Min.	Max.
Exports (USD millions)	152,515	1,248.189	8,753.074	0.000	525,764.710
Border	152,515	0.031	0.174	0.000	1.000
Language	152,515	0.119	0.323	0.000	1.000
Mineral rich exp.	152,515	0.159	0.366	0.000	1.000
Mineral rich imp.	152,515	0.142	0.349	0.000	1.000
ln(distance)	152,515	8.696	0.763	5.081	9.886
ln(tariff+1)	152,515	0.059	0.057	0.000	0.455
ln(K/L exp.)	152,515	10.947	1.446	7.242	13.445
ln(K/L imp.)	152,515	11.062	1.433	7.283	13.445
RTA	152,515	0.283	0.451	0.000	1.000
ln(Remoteness exp.)	152,515	21.381	0.348	20.713	22.291
ln(Remoteness imp.)	152,515	21.388	0.349	20.713	22.291
ln(GDP exp.)	152,515	25.185	2.011	20.481	30.601
ln(GDP imp.)	152,515	25.373	1.975	20.481	30.601
ln(GDP pc exp.)	152,515	8.110	1.653	4.682	11.385
ln(GDP pc imp.)	152,515	8.262	1.646	4.682	11.385
Depth SLE	152,515	0.146	0.457	0.000	2.433

Table A2: Top "Over Exporters" in Markets with High Missing Exports for Turkey (USD millions)

Top "Over Exporters" (USD millions)												
Importer	Turkey's missing exports	1st	2nd	3rd	4th	5th						
1	United States	12,220	China -265,943	Mexico -99,059	Germany -46,505	Canada -37,014	Japan -35,643					
2	China	9,615	Korea, Rep. -68,766	Australia -66,046	Germany -56,274	Malaysia -36,202	Brazil -31,413					
3	Japan	7,455	Australia -30,129	Saudi Arabia -29,034	Malaysia -18,150	Thailand -11,445	Vietnam -8,121					
4	Italy	4,659	Germany -18,072	Netherlands -12,548	Belgium -10,089	Azerbaijan -6,425	Romania -2,650					
5	India	3,535	Saudi Arabia -21,323	Switzerland -21,070	Iraq -11,530	Nigeria -8,270	Venezuela, RB -8,080					
6	Greece	3,466	Russian Federation -2,692	Iraq -2,369	Netherlands -1,497	Kazakhstan -1,391	Korea, Rep. -1,048					
7	France	3,194	China -15,186	Belgium -9,988	Netherlands -3,566	Kazakhstan -3,338	Tunisia -3,317					
8	Korea, Rep.	1,902	Saudi Arabia -28,430	Australia -16,399	United States -11,442	Germany -11,028	Malaysia -7,463					
9	Iraq	1,828	China -5,353	Korea, Rep. -2,110	Thailand -94	Ukraine -61	Argentina -58					
10	Canada	1,818	China -21,070	Mexico -11,632	Germany -2,777	Korea, Rep. -1,916	Vietnam -1,647					
11	Brazil	1,765	China -12,070	Germany -4,679	Korea, Rep. -4,530	Nigeria -3,058	Bolivia -1,413					
12	Sweden	1,529	Germany -10,884	Denmark -8,830	Netherlands -7,391	Belgium -3,846	Finland -3,726					
13	Austria	1,483	Germany -22,334	Czech Republic -2,458	Slovak Republic -1,794	Hungary -1,527	Switzerland -1,496					
14	Indonesia	1,454	Thailand -4,270	Korea, Rep. -2,923	Saudi Arabia -2,604	Malaysia -1,186	Azerbaijan -1,034					
15	Mexico	1,328	China -41,689	Korea, Rep. -10,267	Malaysia -5,538	Germany -4,976	Thailand -3,149					
16	Australia	1,309	China -11,214	Thailand -7,518	Malaysia -6,351	Germany -5,552	Korea, Rep. -4,511					
17	Netherlands	1,199	China -26,014	Belgium -12,600	United States -12,135	Russian Federation -12,039	Malaysia -6,994					
18	Finland	1,067	Russian Federation -5,006	Sweden -3,886	Germany -2,739	Netherlands -1,993	Denmark -954					
19	Denmark	946	Sweden -7,804	Netherlands -2,453	Belgium -412	Finland -274	Bangladesh -250					
20	Hungary	938	Germany -17,681	Russian Federation -3,889	Slovak Republic -3,827	Austria -3,433	Poland -2,998					

Table A3: Industry Level PPML Gravity Estimates non-Targeted Sectors

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
VARIABLES	01-05 Animal	06-15 Vegetable	16-24 Foodstuffs	25-27 Minerals	39-40 Plastic / Rubber	41-43 Hides Skins	44-49 Wood	50-63 Textiles Clothing	64-67 Footwear	68-71 Stone / Glass	72-83 Metals	84-85 Mach/Elec	90-97 Miscellaneous	98-99 Special
RTA	0.021 (0.132)	0.366*** (0.115)	0.063 (0.145)	0.243* (0.131)	0.292*** (0.099)	-0.499*** (0.136)	0.288** (0.123)	-0.009 (0.089)	-0.179 (0.180)	-0.033 (0.260)	0.360*** (0.102)	0.868*** (0.145)	-0.049 (0.149)	0.352 (0.227)
ln(distance)	-0.949*** (0.061)	-0.494*** (0.081)	-0.725*** (0.100)	-0.777*** (0.087)	-0.928*** (0.047)	-0.652*** (0.081)	-0.747*** (0.052)	-0.828*** (0.055)	-0.749*** (0.105)	-0.375*** (0.129)	-0.898*** (0.048)	-0.752*** (0.068)	-0.750*** (0.091)	-0.654*** (0.138)
Border	0.707*** (0.178)	0.575*** (0.176)	0.167 (0.255)	0.588*** (0.191)	0.403*** (0.111)	0.699** (0.312)	0.795*** (0.145)	0.275 (0.196)	0.552 (0.348)	0.124 (0.263)	0.490*** (0.086)	0.585*** (0.194)	0.336 (0.208)	0.802*** (0.247)
Language	0.304* (0.178)	0.072 (0.132)	-0.126 (0.154)	0.441** (0.185)	0.148 (0.091)	-0.063 (0.308)	0.294** (0.147)	0.207 (0.190)	-0.456 (0.428)	1.243*** (0.199)	0.076 (0.088)	-0.361 (0.234)	0.146 (0.182)	0.250 (0.196)
Colony	-0.048 (0.163)	-0.125 (0.183)	-0.172 (0.225)	-0.009 (0.202)	-0.200 (0.149)	-0.655*** (0.238)	-0.029 (0.166)	-0.187 (0.202)	-0.499 (0.333)	-0.493* (0.271)	0.140 (0.133)	0.003 (0.270)	-0.261* (0.153)	0.945*** (0.277)
ln(GDP exp.)	0.682*** (0.032)	0.661*** (0.041)	0.552*** (0.050)	0.677*** (0.047)	0.923*** (0.035)	1.126*** (0.062)	0.680*** (0.045)	0.974*** (0.049)	1.170*** (0.115)	0.690*** (0.062)	0.871*** (0.032)	0.847*** (0.044)	1.054*** (0.060)	0.650*** (0.068)
ln(GDP imp.)	0.820*** (0.044)	0.857*** (0.066)	0.627*** (0.051)	0.952*** (0.052)	0.820*** (0.036)	0.647*** (0.097)	0.810*** (0.048)	0.762*** (0.060)	0.810*** (0.131)	0.698*** (0.078)	0.806*** (0.029)	0.882*** (0.050)	0.855*** (0.073)	1.131*** (0.052)
ln(tariff+1)	-5.808*** (1.163)	-0.987 (0.759)	0.229 (0.479)	4.369 (9.536)	-2.835** (1.297)	-3.049 (2.491)	-4.652*** (1.002)	-2.592** (1.120)	-3.910* (2.026)	-1.927 (2.222)	-0.813 (1.236)	-3.276** (1.547)	2.535 (1.834)	
ln(GDPpc exp.)	-0.354*** (0.101)	-0.032 (0.090)	0.229 (0.149)	0.093 (0.106)	-0.490*** (0.062)	-0.649*** (0.104)	0.046 (0.090)	-0.910*** (0.083)	-0.841*** (0.145)	0.086 (0.225)	-0.319*** (0.067)	-0.559*** (0.129)	0.002 (0.117)	0.106 (0.227)
ln(GDPpc imp.)	-0.591*** (0.096)	-0.239*** (0.084)	-0.167 (0.118)	-0.443*** (0.113)	-0.353*** (0.063)	-0.443*** (0.113)	-0.193*** (0.070)	0.001 (0.098)	0.176 (0.142)	-0.106 (0.218)	-0.323*** (0.054)	-0.277** (0.110)	0.098 (0.103)	0.146 (0.240)
Mineral rich imp.	-0.535*** (0.201)	0.013 (0.134)	-0.025 (0.175)	-1.368*** (0.254)	-0.212** (0.094)	-1.354*** (0.250)	-0.042 (0.112)	-0.621*** (0.171)	0.025 (0.282)	-1.239*** (0.206)	-0.118 (0.112)	-0.185 (0.176)	-0.535*** (0.154)	-0.061 (0.521)
Mineral rich exp.	-0.194 (0.230)	-0.301* (0.180)	-1.041*** (0.223)	2.515*** (0.131)	-0.650*** (0.184)	-2.097*** (0.261)	-0.143 (0.213)	-2.905*** (0.155)	-3.761*** (0.346)	-1.096*** (0.251)	0.361** (0.165)	-2.962*** (0.436)	-2.919*** (0.231)	0.512 (0.461)
ln(Remoteness exp.)	1.549*** (0.207)	1.284*** (0.177)	-0.437 (0.279)	0.370 (0.281)	0.708*** (0.146)	-0.438 (0.285)	0.960*** (0.189)	0.915*** (0.170)	0.659* (0.345)	-0.445 (0.294)	0.753*** (0.136)	1.142*** (0.287)	0.430* (0.224)	0.900** (0.379)
ln(Remoteness imp.)	0.248 (0.212)	-0.574*** (0.178)	0.435* (0.259)	0.837*** (0.263)	0.614*** (0.122)	1.575*** (0.371)	0.501*** (0.145)	0.232 (0.227)	0.480 (0.492)	0.334 (0.298)	0.468*** (0.124)	0.920*** (0.206)	0.790*** (0.231)	-0.422 (0.299)
ln(K/L exp.)	0.074 (0.111)	-0.118 (0.098)	-0.600*** (0.167)	-0.060 (0.100)	0.644*** (0.096)	0.103 (0.179)	0.065 (0.101)	0.213* (0.109)	-0.130 (0.240)	-0.040 (0.209)	0.284*** (0.079)	0.708*** (0.165)	-0.350* (0.181)	0.166 (0.231)
ln(K/L imp.)	1.318*** (0.146)	0.191* (0.102)	0.561*** (0.164)	0.497*** (0.145)	0.231*** (0.082)	0.951*** (0.268)	0.120 (0.100)	0.204 (0.181)	0.553** (0.277)	0.281 (0.229)	0.283*** (0.075)	0.517*** (0.136)	0.268 (0.189)	-0.336 (0.324)
Observations	152,515	152,515	152,515	152,515	152,515	152,515	152,515	152,515	152,515	152,515	152,515	152,515	152,515	152,515

Robust standard errors, clustered at the country-pair level, are in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Table A4: Description of the 52 provisions in the Content of Deep Trade Agreements Database

WTO-plus areas	
FTA Industrial	Tariff liberalization on industrial goods; elimination of non-tariff measures
FTA Agriculture	Tariff liberalization on agriculture goods; elimination of non-tariff measures
Customs	Provision of information; publication on the Internet of new laws and regulations; training
Export Taxes	Elimination of export taxes
SPS	Affirmation of rights and obligations under the WTO Agreement on SPS; harmonization of SPS measures
TBT	Affirmation of rights and obligations under WTO Agreement on TBT; provision of information; harmonization of regulations; mutual recognition agreements
STE	Establishment or maintenance of an independent competition authority; nondiscrimination regarding production and marketing condition; provision of information; affirmation of Art XVII GATT provision
AD	Retention of Antidumping rights and obligations under the WTO Agreement (Art. VI GATT).
CVM	Retention of Countervailing measures rights and obligations under the WTO Agreement (Art VI GATT)
State Aid	Assessment of anticompetitive behaviour; annual reporting on the value and distribution of state aid given; provision of information
Public Procurement	Progressive liberalisation; national treatment and/or non-discrimination principle; publication of laws and regulations on the Internet; specification of public procurement regime
TRIMs	Provisions concerning requirements for local content and export performance of FDI
GATS	Liberalisation of trade in services
TRIPs	Harmonisation of standards; enforcement; national treatment, most-favoured nation treatment
WTO-X areas	
Anti-Corruption	Regulations concerning criminal offence measures in matters affecting international trade and investment
Competition Policy	Maintenance of measures to proscribe anticompetitive business conduct; harmonisation of competition laws; establishment or maintenance of an independent competition authority
Environmental Laws	Development of environmental standards; enforcement of national environmental laws; establishment of sanctions for violation of environmental laws; publications of laws and regulation
IPR	Accession to international treaties not referenced in the TRIPs Agreement
Investment	Information exchange; Development of legal frameworks; Harmonisation and simplification of procedures; National treatment; establishment of mechanism for the settlement of disputes
Labour Market Regulation	Regulation of the national labour market; affirmation of International Labour Organization (ILO) commitments; enforcement
Movement of Capital	Liberalisation of capital movement; prohibition of new restrictions
Consumer Protection	Harmonisation of consumer protection laws; exchange of information and experts; training
Data Protection	Exchange of information and experts; joint projects
Agriculture	Technical assistance to conduct modernisation projects; exchange of information
Approximation of Legislation	Application of EC legislation in national legislation
Audio Visual	Promotion of the industry; encouragement of co-production
Civil Protection	Implementation of harmonised rules
Innovation Policies	Participation in framework programmes; promotion of technology transfers
Cultural Cooperation	Promotion of joint initiatives and local culture
Economic Policy Dialogue	Exchange of ideas and opinions; joint studies
Education and Training	Measures to improve the general level of education
Energy	Exchange of information; technology transfer; joint studies
Financial Assistance	Set of rules guiding the granting and administration of financial assistance
Health	Monitoring of diseases; development of health information systems; exchange of information
Human Rights	Respect for human rights
Illegal Immigration	Conclusion of re-admission agreements; prevention and control of illegal immigration

Illicit Drugs	Treatment and rehabilitation of drug addicts; joint projects on prevention of consumption; reduction of drug supply; information exchange
Industrial Cooperation	Assistance in conducting modernisation projects; facilitation and access to credit to finance
Information Society	Exchange of information; dissemination of new technologies; training
Mining	Exchange of information and experience; development of joint initiatives
Money Laundering	Harmonisation of standards; technical and administrative assistance
Nuclear Safety	Development of laws and regulations; supervision of the transportation of radioactive materials
Political Dialogue	Convergence of the parties' positions on international issues
Public Administration	Technical assistance; exchange of information; joint projects; Training
Regional Cooperation	Promotion of regional cooperation; technical assistance programmes
Research and Technology	Joint research projects; exchange of researchers; development of public-private partnership
SME	Technical assistance; facilitation of the access to finance
Social Matters	Coordination of social security systems; non-discrimination regarding working conditions
Statistics	Harmonisation and/or development of statistical methods; training
Taxation	Assistance in conducting fiscal system reforms
Terrorism	Exchange of information and experience; joint research and studies
Visa and Asylum	Exchange of information; drafting legislation; training

Source: WTO (2011).