THE POSITION OF COUNTRIES IN GLOBAL VALUE CHAINS

A Master's Thesis

by

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Ankara
July 2019

To my family,

THE POSITION OF COUNTRIES IN GLOBAL VALUE CHAINS

The Graduate School of Economics and Social Sciences
of
İhsan Doğramacı Bilkent University

by

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July 2019

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Arts in Economics.

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ABSTRACT

THE POSITION OF COUNTRIES IN GLOBAL VALUE CHAINS

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To detect the position of countries in global value chains in a consistent manner, we propose that export and import upstreamness measures of a country should be varying across its trade partners over time. To formalize our argument, we define the notion of *bilateral upstreamness* between any pair of countries and show how its measure is affected from country-specific factors. Moreover, we incorporate the variables in gravity literature into our estimation equations to account for how the geographical factors can have an impact on their bilateral production line position. Following Antrás et al. (2012), we also consider the hypotheses tested in their paper with our more aggregated and recent data set. Similar to their results, we find that better rule of law, higher level of financial development and investment in human capital lead the export composition of countries to be more final good-oriented in international markets. Finally, we portray Turkey's production line position in comparison with different country blocks and income groups to illustrate our bilateral analysis.

Keywords: Bilateral Upstreamness, International Trade, Global Value Chains, Production Line Position

ÖZET

ÜLKELERİN KÜRESEL DEĞER ZİNCİRLERİNDEKİ POZİSYONU

Erdoğan, Oğuzhan
Yüksek Lisans, İktisat Bölümü
Tez Danışmanı: Dr. Öğr. Üyesi Fitnat Banu Pakel

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Bu tezde ülkelerin küresel değer zincirlerindeki yerlerini tutarlı bir şekilde tespit edebilmek için bir ülkenin ihracat ve ithalat ürünlerinin yukarı doğru eğilimi ölçütlerinin o ülkenin ticaret partnerlerine göre zaman içinde değiştiği savunulmaktadır. Bu argümanı formal bir şekilde ileriye sürebilmek için iki taraflı yukarı eğilim ölçütü tanımlanmakta ve bu ölçütün ülkeye özgü faktörlerden nasıl etkilendiği gösterilmektedir. Aynı zamanda, yerçekimi yazınındaki değişkenlerin tahmin modellerine dahil edilmesiyle coğrafi faktörlerin ülkelerin iki taraflı üretim çizgisi pozisyonlarında nasıl etkili olduğu açıklanmaktadır. Antrás et al. (2012) çalışması takip edilerek, bu çalışmadaki hipotezler daha geniş ve yeni bir veri seti ile test edilmiştir. Bulgular bu çalışmanın sonuçlarıyla örtüşmekte; hukukun üstünlüğünün, finansal gelişmişlik seviyesindeki artışın ve insan sermayesine yatırımın ülkelerin ihraç ürünleri kompozisyonunu uluslararası piyasalarda nihai ürün odaklı yönde değiştirdiği gözlenmiştir. Son olarak Türkiye'nin üretim çizgisi pozisyonu iki taraflı yukarı eğilim analizini örneklendirmek amacıyla farklı ülke blokları ve gelir gruplarıyla kıyaslanmıştır.

Anahtar Kelimeler: İki Taraflı Yukarı Eğilim, Küresel Değer Zincirleri, Uluslararası Ticaret, Üretim Çizgisi Pozisyonu

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CHAPTER 1

INTRODUCTION

The rising trend in international trade has been the fragmentation of production over the last two decades. The production process now requires sourcing of inputs and components from multiple suppliers. The fact that these multiple suppliers are located in different countries allows different stages of production to be conducted in different countries. Such a phenomena is called Global Value Chains (GVC) in the literature of international trade. Countries in need of the intermediate goods to complete a series of production stages demand inputs in factor markets. This demand driven outbreak has enhanced worldwide trade volume of intermediate goods and raised new policy questions about the position that countries take along the global value chains: Do countries engage in relatively more upstream or downstream trade activities when different manufacturing stages take place in different countries? Can we find a formal way to determine the bilateral trade pattern between any pair of countries? What are the implications of this disintegration of production in terms of country specific factors and variables?

These kinds of questions are particularly important in terms of the strategic trade interactions between countries in international markets. Countries try to bring more value added to the products that they import from the world markets, undertaking a great deal of processing in industrial plants to convert them into a high-valued final goods. Therefore, countries which import relatively upstream products, implement

a sequence of stages on the imported products and finally supply the goods targeting the final customers in international markets are positioned in the upper portion whereas those who supply raw materials and cannot conduct a large span of production stages within their domestic borders are positioned in the lower portion of global value chains. Hence, terms of trade between countries is largely influenced by the actions of the countries located at relatively upper portions.

The main motivation of this paper is to detect the position of countries in global value chains using the notion of *upstreamness*. Developed as a metric to measure the distance of a product to its final use, the idea of upstreamness has recently occupied the international trade literature and helped researchers determine the position of countries in GVCs. Based on the input-output tables to account for the input usage in each industry, the measure of upstreamness is used to estimate the number of stages required for a certain industry until it meets the final demand. Therefore, it implicitly explains the characteristics of industries or outputs procured in those industries in terms of their usage as intermediary or final good. The more upstream a product is, the more industries it visits until meeting the final demand. Similarly, the less upstream a product is, the fewer stages are conducted until its usage as a final good.

The upstreamness literature can be traced back to the very first concepts of forward and backward linkages. Blair and Miller (2009) define the forward and backward linkages in terms of the backward or forward production opportunities resulting from an expansion of output in a given sector. An expansion of output in an industry leads that sector to demand more inputs in factor markets. That means it requires a higher level of output produced in the precedent sectors. This is called backward linkages. On the other hand, in case of an expansion, the more output of this sector becomes available for the industries in subsequent stages. Thus, later stages can enjoy an increase in the availability of the factor that they use to complete the production of their own products. Working in the opposite direction to the previous terminology,

it is called forward linkages. The more upstream an industry is, the more it could be said to cause forward linkages. Likewise, if an industry shows a downstream pattern, a positive output shift in that industry induces a demand increase in the already few number of goods it uses as an input. In his search for an optimal policy a country should adopt to develop, Hirschman (1958) argues that countries should invest in the sectors which have the largest amount of forward and backward linkages, supporting a renowned theory of "*Unbalanced Growth*". Instead of subsidizing all industries in the economy in a balanced way, he contends that industries generating maximum linkages ought to be developed first. In this respect, those who create the highest number of linkages work as a "*self-propelling*" mechanism, elevating the production in other sectors and bringing about the maximum benefit to the overall economy.

One of the first efforts to properly compute the upstreamness using Input Output Tables is done by Antrás et al. (2012). They construct the upstreamness measure for 426 industries in United States using 2002 Input-Output (I-O) Tables. They list the most upstream and downstream industries in US in terms of their 6-digit I-O codes. Beside that, using OECD STAN database they compute the industry level upstreamness for a sample of countries and provide the rank correlations of industry upstreamness between any pair of countries, asserting that upstreamness measure is a stable attribute of industries across different countries. Moreover, they apply this concept to trade, calculating the weighted export upstreamness measure for 181 countries between 1996-2005 and try to estimate how the export upstreamness is affected from various country specific factors. One important evidence they come up with is that the presence of good institutions and prevailing rule of law lead countries to export in more downstream industries, meaning that the products they export are considered as final goods within the whole production process.

Moving to another paper focusing on the position of China in GVCs using a firm-level analysis, Chor et al. (2017) deal with the position of Chinese firms in the global value chains, using firms level customs and balance sheet data. They use the notion

of upstreamness and compute the upstreamness measure for 135 IO sectors from Chinese Input-Output Tables, similar to reasoning of previous paper for the sectors in US. However; they calculate the weighted export and import upstreamness measure using the volume of exports and imports of firms in each specific industry category. More importantly, they introduce a concept of *the span of production stages*, formally $U^M - U^X$, to capture the span of production stages conducted by Chinese firms within China. In contrast to the estimation approach used by Antràs et al. (2012), they use firm specific factors in their estimation to account for how the export-import upstreamness and the span of production stages depend on firm specific characteristics. They argue that firm experience, productivity and size are positively correlated with the downstream characteristics of firms' exports. For the other direction, looking for any impact of the enlargement of the span of production stages on firm specific characteristics, they find that firms adopting more production stages in domestic economy, i.e. bringing more value added to the imported goods, are exposed to higher level of fixed production costs. In a macro sense, their empirical findings show that Chinese import upstreamness steadily increases between 1992 and 2011 though export upstreamness follows a moderate pattern, which implies that there is a rapid expansion in production stages conducted in China.

Antràs and Chor (2017) take a formal step to combine the empirical exercises on the GVCs with the theoretical models of input flows across countries. They first introduce four different measures to elaborate on the methodologies of upstreamness and downstreamness and then provide an empirical investigation on the position of countries between 1995-2011 using 2013 edition of World Input Output Database (WIOD). For 41 countries and 35 industries provided in WIOD for whole period, they present how the GVC positioning of countries changes over time. In their empirical assessments, they find that countries whose export composition mainly targets the final consumers, i.e. having a low level of export upstreamness, are indeed those who can contribute much value added to the products that they process in their

domestic industries, ie., having a higher level of import upstreamness. Finally, they conduct a series of counterfactual analyses to look for how the correlation between export and import upstreamness changes within the context of alternative scenarios such as trade cost reduction and increasing share of spending on service sectors.

This thesis contributes to the literature in two ways. Our first aim is to test the hypotheses outlined in Antrás et al. (2012) using a more aggregate and recent UN Commodity Trade data set covering the period from 2003 to 2014. We examine whether the country specific factors can have an impact on the export and import upstreamness measures using country level and panel regressions. Thus, this paper is in a sense a modification of the results of previous works with an updated data set. Second, more importantly, we deviate from the existing literature via a bilateral analysis to explain how at a point in time the bilateral upstreamness between any pair of countries is affected from the country specific factors, controlling for the source and destination year fixed effects. Based on the empirical findings that the export and import upstreamness of a certain country can vary across its different trade partners over time, we compute the bilateral upstreamness values between any pair of countries and show how these values are affected from country specific factors. Moreover, we add gravity variables provided in Head et al. (2010) to the estimation equations to account for the impact of geographical variables on the production line position of a country against its trade partners. To best of our knowledge, this will be the first attempt to introduce the gravity variables to upstreamness literature. Using such a bilateral framework, we will be able to compare the production line position of any pair of countries and answer how the bilateral upstreamness value of a certain country alters with respect to its trade partners.

The rest of the paper is organized as follows: In the next section, we explain the concept of upstreamness and the reasons why the usptreamness values we calculate across countries are reliable predictors to measure the production line positions. Moreover, we describe the data sets used to obtain the weighted export and import

upstreamness values and explain the procedure of combining data sets subject to our analysis. Third section discusses the empirical findings and how country specific factors are correlated with export and import upstreamness measures using basic correlation plots of average upstreamness values for each country. Moving to a more formal assessment, two different estimation approaches are employed to answer whether these country specific factors are effective in changing the position of countries in global value chains (GVCs) and how bilateral upstreamness between any pair of countries respond to these country level characteristics. A separate subsection is also included to point out where Turkey is located in GVCs and moves over time compared to a subset of developed countries (OECD and EU15) and developing countries (BRICS and NewEU). We also conduct a similar analysis by categorizing the trade partners of Turkey across five different income groups. The last section concludes.

CHAPTER 2

METHODOLOGY AND DATA DESCRIPTION

2.1 Upstreamness Measure

Following Fally (2011) and Antrás et al. (2012), we begin by considering N industry closed economy and extend this to an open economy framework. For each industry $i \in 1,2,...,N$ the value of gross output (Y_i) equals the sum of its final use as a final good (F_i) and its use as an intermediate input to other industries (Z_i)

$$Y_i = F_i + Z_i = F_i + \sum_{j=1}^{N} d_{ij} Y_j \tag{2.1}$$

where d_{ij} is the dollar amount amount of sector i's output needed to produce one dollar's worth of industry j's output. Iterating this identity, we can write it as

$$Y_i = F_i + \sum_{j=1}^{N} d_{ij} F_j + \sum_{j=1}^{N} \sum_{k=1}^{N} d_{ik} d_{kj} F_j + \sum_{j=1}^{N} \sum_{k=1}^{N} \sum_{l=1}^{N} d_{il} d_{lk} d_{kj} F_j + ... \tag{2.2}$$

Building on this identity, Antrás and Chor (2013) suggest computing the (weighted) average position of an industry's output in the value chain, by multiplying each term in (2) by their distance from final use plus one and dividing by Y_i:

$$U_i = 1 \cdot \frac{F_i}{Y_i} + 2 \cdot \frac{\sum_{j=1}^{N} d_{ij} F_j}{Y_i} + 3 \cdot \frac{\sum_{j=1}^{N} \sum_{k=1}^{N} d_{ik} d_{kj} F_j}{Y_i} + 4 \cdot \frac{\sum_{j=1}^{N} \sum_{k=1}^{N} \sum_{l=1}^{N} d_{il} d_{lk} d_{kj} F_j}{Y_i} + ... \tag{2.3}$$

To implement the open economy adjustment, Antrás et al. (2012) propose the following expression (see the paper for further discussion), replacing d_{ij} with:

$$\hat{d}_{ij} = d_{ij} \frac{Y_i}{Y_i - X_i + M_i} \tag{2.4}$$

where X_i and M_i are exports and imports of sector i, respectively.

If U_i is higher, then the industry is further upstream in terms of its contribution to production chains. For instance, petrochemical product (325110) [1] can be refined in petroleum industry and served to the consumers (2 stages to final use) or it can be used in the Plastic industry (325211) and then used as an input to Alumina refining (33131A) and then finally sold to Automobile industry (336111) to be consumed as a final good (4 stages to final use). On the other hand, Breakfast Cereal (311230) can be directly served to the customers (one stage to final use).

2.2 Data

The main data set we use to classify the position of countries along the GVC is United Nation's Commodity Trade Data, which provides the export and import value of HS4-code products available for each country from 2003 to 2014. Furthermore, we use the industry-level upstreamness measures computed from 2002 US I-O Tables, which is provided in 6-digit I-O codes for 426 industries. As Antrás et al. (2012) put forward, this upstreamness measure is not considered as only a US specific measure. They compute a spearman rank correlation test for industry level upstreamness of US with countries in European Union and OECD. They find that the rank correlation is always large and positive in all country pairs, verifying the consistency of industry upstreamness across countries. In aggregate terms, this finding makes sense when we consider the share of US in world trade volume as it exports and imports a large

[1] The value in parenthesis denotes 6-digit I-O code

set of products, providing a better coverage of industries. US is also assumed to be governing frontier technologies, which makes US based measures more standardized compared to the measures constructed based on other countries' data. [2] In terms of the estimation approach, harnessing US based uspreamness measure alleviates any sort of endogeneity concern in the econometric analysis of section 3.4. Therefore, these findings allow us to readily use US industry upstreamness measure to reach a more generalized result for the export and import upstreamness of any country in the world. Formally, we compute the import and export upstreamness measure for each country c in year $t \in 2003, ..., 2014$ in the following manner:

$$U_{ct}^{M} = \sum_{i=1}^{N} \frac{M_{cit}}{Mct} U_i, \qquad U_{ct}^{X} = \sum_{i=1}^{N} \frac{X_{cit}}{Xct} U_i \tag{2.5}$$

and

$$U_{ct}^{M} - U_{ct}^{X} = \sum_{i=1}^{N} \left(\frac{M_{cit}}{Mct} - \frac{X_{cit}}{Xct} \right) U_i \tag{2.6}$$

where N is the number of available HS4 products provided in UN Comtrade Data. M_{cit} (X_{cit}) denote the import (export) value for product i in year t from destination (for source) country c. $M_{ct} = \sum_{i=1}^{N} M_{cit}$ and $X_{ct} = \sum_{i=1}^{N} X_{cit}$ are total value of imports and exports for that product i in question. The lower value of export upstreamness shows that the export composition of countries tend to include more downstream products, ready to be directly served to final consumers. On the other hand, the greater value of that is associated with more upstream exports to the world markets. By expression (2.5), import upstreamness is defined as the weighted average of the upstreamness of imported products, describing whether the import volume comprises relatively intermediate or final goods. The higher value of import upstreamness shows that countries purchase more upstream products which require a series of

[2] It is not uncommon to construct standard industry-level measures using U.S. data. For instance, Rajan and Zingales (1998) construct an industry-level index of external finance dependence using balance sheet data on U.S. firms.

production stages to be converted to final use. Therefore, countries having a higher import upstreamness can seize the opportunity to bring more value added on their imported products. As the import upstreamness measure is an analytical tool to characterize the distance of imported goods from their final usage, the number of stages operated domestically does not necessarily correlate with the amount of value added created on different types of imported materials. Not all raw material importers could have the essential technology or factors of production to implement value added on the purchased materials from the foreign markets. To rely on a better ground, using the definition in Chor et al. (2017), we suppose that the expression (2.6) captures the span of production stages operated within the domestic borders, showing the depth of the production process for any type of commodity [3]. Hence, a country having a positive $U_M - U_X$ is said to process its imported products at a sufficiently great number of industries within its domestic plants before supplying to the world markets. Thus, that country will have a better chance to create more value added on those imported materials at quite a few number of industries, which will subsequently increase the amount of value added in domestic economy.

Note that U_i is the industry level upstreamness for each i from 426 different industries. It might be the case that the data for HS4 products does not exactly match with the upstreamness data, which is made up of upstreamness value for 426 industries and their corresponding I-O code. Thus, to merge the upstreamness data with UN Comtrade data we use a concordance table provided in data replication files of Antrás et al. (2012). [4] Then, we obtain a new data set consisting of HS6 product codes and their respective upstreamness values. In order to use this new data set together with UN Comtrade data, we reduce HS6 to HS4 and merge UN Comtrade data with this

[3]Henceforth, we assume that the difference between import and export upstreamness measures is used as a proxy for value added produced domestically.

[4]This concordance table gives us a mapping between HS6 type product categories and IO codes. When we merge the upstreamness data with concordance table, there are 122 IO codes in master data which do not match with the using data and there are 6 HS6 codes in the using data which do not match with master data. Thus, we take the remaining number of industries which are exactly matched.

new data set. [5] Finally, we obtain a generic data set which shows the upstreamness value of exported and imported products recorded in HS4 category for each country in year t. From this data set, we can readily compute the export and import upstreamness using (5). Hence, using these usptreamness measures, we can compare the position of countries along GVC. For instance, between 2003 and 2014 average export upstreamness of Saudi Arabia is 3.28 whereas Japan has an average export upstreamness of 2.03. We can interpret these numbers as the number of stages required for the exported products to be converted to final usage. Thus, we can verify that while Japanese exports are processed at most two industries in the importer countries, the products purchased from Saudi Arabia visit at least three sectors until they meet the final demand. This result points out that Japanese exports show a more downstream pattern in world markets. Furthermore, the import upstreamness of Saudi Arabia is 1.98, which is relatively below the value of Japanese import upstreamness, 2.48. Based on these numbers, we can assert that Japan has a positive span of production stages, meaning that it has a better capability to induce value added on the imported products compared to what Saudi Arabia can do, which places Japan at a higher position along the global value chains.

In order to account for the variations in export and import upstreamness of each country, we use the following country characteristics. To look for how the education attainment affects the export and import upstreamness, we use Barro and Lee (2013)'s education attainment data, which is available from 1950 to 2010 in 5-year intervals. Since our main data set covers the period from 2003 to 2014, we fill this period paying attention to the proximity of the years available. For instance, we use the estimate years of schooling in 2005 for the interval [2003,2007] and the estimate years of schooling in 2010 for the interval [2008,2014]. To understand how the ratio

[5] HS6 is a broader product-level classification than HS4. Thus, when reducing HS6 to HS4, there might be more than one upstreamness value corresponding to each HS4 code. To circumvent this multiplicity problem, we take the average of upstreamness measure and obtain a new data set in which each HS4 product code has a unique upstreamness value.

of private credit to GDP as an instrument for financial development has an impact on the span of production stages, we use World Global Financial Database from Bartelsman et al. (2013). This is also available between 2003 and 2014. Additionally, we include real GDP per capita from World Development Indicators (WorldBank, 2019) in our analysis to understand how the trade upstreamness evolves over time in response to the changes in per capita real GDP. Using the same data set, we also incorporate total factor productivity to observe how the productivity gains could have an impact on country level upstreamness. Antrás et al. (2012) augment the physical capital per worker, which is constructed using perpetual inventory method, from Penn World Tables (Feenstra et al., 2015), into their estimation approach to measure the response of export upstreamness to the changes in factor endowments. We also use the same variable from PWT. As the production stages are largely affected from the quality of the contracts and institutions, we use the estimate of rule of law in the specified time period using World Governance Indicators from Kaufmann et al. (2017).

CHAPTER 3

EMPIRICAL RESULTS

3.1 An Overview on Initial Findings

Table 1: Summary Statistics

	All goods			Manufacturing goods		
	2003-2014	2003	2014	2003-2014	2003	2014
Number of Observations	35,343,621	2,425,154	3,176,235	18,912,807	1,293,303	1,705,942
Number of HS4 Products	1244	1244	1242	555	555	555
Number of Countries	221	215	219	221	215	219
Log (Trade Volume), Mean	4.24	4.06	4.33	4.38	4.20	4.47
	[2.62]	[2.52]	[2.68]	[2.67]	[2.57]	[2.73]
Export Upstreamness (U_X), Mean	2.37	2.27	2.41	2.12	2.06	2.15
	[0.56]	[0.59]	[0.57]	[0.49]	[0.46]	[0.50]
Import Upstreamness (U_M), Mean	2.13	2.08	2.12	1.91	1.87	1.92
	[0.24]	[0.23]	[0.22]	[0.20]	[0.20]	[0.18]
$U_M - U_X$, Mean	-0.24	-0.19	-0.29	-0.21	-0.18	-0.23
	[0.61]	[0.63]	[0.62]	[0.21]	[0.46]	[0.52]

Notes: Summary Statistics are reported for all goods and manufacturing goods available in *UN Comtrade Database*. The values in square brackets denote standard deviations. The values for manufacturing goods are generated using NBER-CES Manufacturing Industry Database from Becker et al. (2016). It comprises a list of 473 NAICS industries similar to 6-digit IO codes. Using a concordance mapping provided in BEA website, we create another concordance table between HS6 and available NAICS codes. Merging this regenerated concordance table with upstreamness measures, the upstreamness values of manufacturing goods are expressed in terms of HS6 codes. Finally, after reducing HS6 to HS4 and applying a similar reasoning mentioned in footnote 3, upstreamness measures for HS4 manufacturing products (555 in total) are obtained. The mean of log (trade volume) is calculated only within the sample of manufacturing goods.

Table 1 presents the summary statistics on the UN Comrade data set and upstreamness measures we compute using the procedure in the data section with respect to the entire period (2003-2014), initial year (2003) and terminal year (2014). The average log world trade volume has drastically increased during this 12-year period and its dispersion around the mean level has also experienced a significant rise. The first implication for the overall position of countries in GVC comes from the fourth to six rows in Table 1. On average export pattern is relatively more upstream than import

pattern for the entire time period. That is, countries mostly sell products, which are also processed by others to enhance the amount of value added. However, the countries are more scattered around the mean level of export upstreamness than they are around that of import upstreamness. This could happen if there is a significant difference between export upstreamness of countries. While a group of countries produces goods which are directly put into final use, others might export products necessarily used in intermediate stages of the production process. This discrepancy can account for the pattern of trade between a raw material supplier who cannot add much value added to its exports and an importer who contributes to the imported products and converts them to final usage after a certain number of stages. For the case of import upstreamness, the position of countries in production line is more moderate.

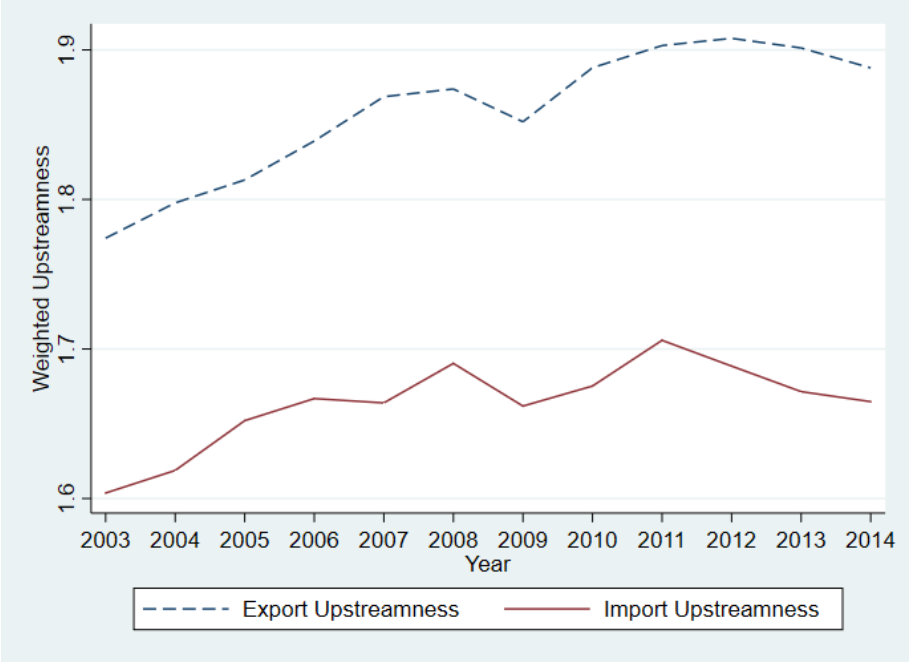


Figure 1: The Movement in World's Production Line Position

To understand how on average the production line position of the countries changes over time, Figure 1 presents the world export and import upstreamness weighted by the countries' income level for all goods provided in UN Comtrade. Thus, the export and import upstreamness of high income level countries have a larger impact in determining the shape of the graphs in Figure 1. Similar to what we observe in Table 1, exports are on average more upstream than imports. However; they almost move

parallel to each other during the specified time period. Both of the lines show an increasing trend up to 2008. However; with the advent of the global financial crisis, we could see a fall both in both of the upstreamness measures, implying that the exported products show a tendency to be supplied more downstream and the share of intermediate goods in the trade volume of countries declines as well. Because the production level contracts all over the world, this reflects the decrease in the volume of trade for input materials. Though import upstreamness recovers after the crisis period, it steadily falls in the period starting with 2011. Exports, on the other hand, become more upstream after the crisis period, but start targeting final customers especially towards the end of our time period.

Table 2: Upstreamness of Manufacturing Exports by Country Income Quartiles

Income quartile	Mean	S.D.	Min	Max
Bottom	2.11	0.58	1.12	4.15
2nd	2.22	0.47	1.07	4.16
3rd	2.17	0.48	1.09	3.71
Top	2.08	0.41	1.04	3.06

Table 3: Upstreamness of Manufacturing Imports by Country Income Quartiles

Income quartile	Mean	S.D.	Min	Max
Bottom	1.90	0.20	1.14	2.92
2nd	1.96	0.18	1.22	2.44
3rd	1.93	0.18	1.38	2.47
Top	1.88	0.20	1.19	2.65

Table 4: Span of Production Stages ($U_M - U_X$) of Manufacturing Goods by Country Income Quartiles

Income quartile	Mean	S.D.	Min	Max
Bottom	-0.21	0.55	-2.29	0.66
2nd	-0.26	0.51	-2.25	0.63
3rd	-0.24	0.51	-1.83	0.65
Top	-0.20	0.45	-1.38	0.71

Following the empirical strategy of Antrás et al. (2012), we consider the summary statistics of export and import upstreamness by country income groups, as described

in Table 2 and 3. Additionally, we extend this analysis including the summary statistic of the difference between import and export upstreamness to drive some implications on the number of production stages operated domestically (Table 4). Countries are grouped into income quartiles based on the average log PPP-adjusted Real GDP per capita over 2003-2014, from World Bank World Development Indicators. The average upstreamness of all these three measures togerther with their respective standard deviations and min-max values within each income quartile are reported in Table 2, 3 and 4, respectively. [1]

Here the interesting point is that poorer countries appear to be exporting in more upstream industries compared to richer ones. Therefore, richer countries tend to export products aimed to be directly served in final markets. Another interesting result of Table 2 is that the standard deviation of export upstreamness in each income group decreases as it moves from bottom to top. Countries in the bottom quartile thus vary in terms of the average position they occupy in global production lines. To illustrate, Haiti and Zambia are both included in bottom income group. However; based on the export composition of goods they supply to world markets in 2014, we can see that their respective export upstreamness demonstrates a large difference (1.14 vs 3.98). This difference can be attributed to the types of products which occupy a larger share in the export content of both countries. While coffee, as a perishable food served to the final customers after few number of stages, constitutes a great portion of the exports of Haiti, Zambia is a major exporter of unrefined copper, which is processed by a greater number of industries until meeting the final demand. When we consider upstreamness of manufacturing imports by each income quartile, we cannot observe such a pattern. If we have a look at Table 4, we also see a slight increase in mean

[1] When we download the PPP-adjusted GDP per capita from World Bank's Data Bank and merge it with the upstreamness data, there are 385 observations in the upstreamness data that cannot be matched with the GDP per capita data set. Similarly, 644 observations from the second data set are missing in the fist one. Thus, we move on our analysis using the remaining number of 2216 observations, which comprise 189 countries between 2003-2014. Distributing the export and import upstreamness into 4 income group in ascending order yields almost 47-48 countries for each quartile.

level of $U_M - U_X$, arguing that richer countries might have a potential to process the upstream import materials until targeting the foreign markets. The finding that top group has the maximum possible value of this difference is also in line with the observation that considerable portion of the procurement process of manufacturing goods occurs in the rich countries.

3.2 Correlation with Country Characteristics

This subsection mainly depicts how the average export and import upstreamness are correlated with the average country characteristics between 2003-2014. [2] Figure 2 [3] indicates how average export and import upstreamness are correlated with the estimates of rule of law. Countries who have a higher quality of governance index tend to export in more downstream industries, consistent with the findings in Antrás et al. (2012). On the other hand, there is not a certain pattern for average import upstreamness.

Another important feature in characterizing the position of countries in production line is to look at how upstreamness measures respond to changes in real GDP per capita. Figure 3 gives us a blurring picture between the average upstreamness and log of Real GDP per capita, PPP adjusted. Though we can observe a slightly downward sloping line for export upstreamness, such a trend disappears for import upstreamness. Thus, consistent with what we find in Table 2, rich countries have a propensity to export more downstream products. Furthermore, the years spent in school on average have a positive impact on the downstreamness of the exported products (Figure

[2] We take the average of export and import upstreamness between 2003-2014. The same procedure is also applicable for the estimates of rule of law and log of Real GDP per capita. Here the fact that Barro-Lee's education attainment data is available for 5-year intervals drives us to calculate average years of schooling between 2003 and 2014 using the values in 2005 and 2010, using the procedure described above.

[3] Dots stand for the average values for each country in our data set.

4), implying that investment in education might play a role in changing the position of a country's production line position. The observation that export upstreamness is more responsive to the country level characteristics than import upstreamness might suggest that country characteristics mostly affect the span of production stages from production channel rather than demand channel.

Figure 2: Export-Import Upstreamness and Rule of Law

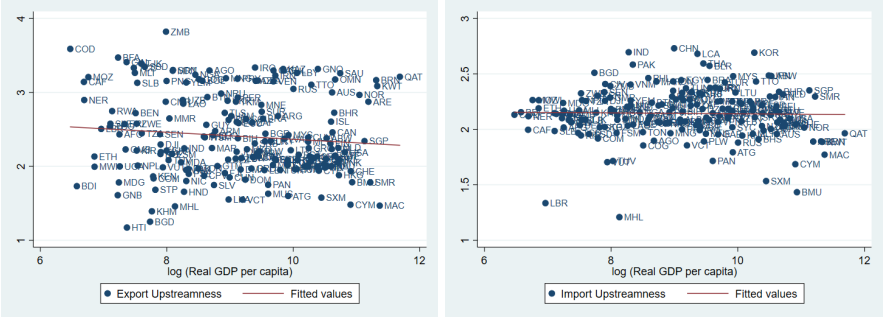


Figure 3: Export-Import Upstreamness and Real GDP per capita

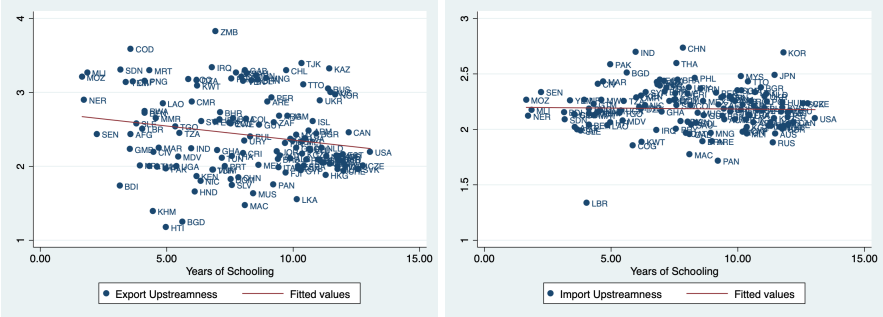


Figure 4: Export-Import Upstreamness and Years of Schooling

3.3 Econometric Analysis

The subsection 3.2 was a rough treatment of the effect of country characteristics on average upstreamness values using a cross country examination. This section em-

braces a more formal approach in analyzing the upstreamness measures and other country characteristics. Our estimation consists of two approaches:

3.3.1 Estimation with Country Level Factors

The first approach comprises two main specifications, in the first of which we aim to do a cross country regression following estimation procedure of Antrás et al. (2012), taking the average of all variables over whole period, to examine how the export and import upstreamness are related to the country characteristics and in second of which we intend to do a fixed-effect panel OLS estimation. Formally,

$$Y_c = \alpha + \beta Z_c + \varepsilon_c \tag{3.1}$$

where Y_c is one of the average country upstreamness variables in $\left\{U_c^M, U_c^X, U_c^M - U_c^X\right\}$. Z_c is a combination of variables, including the average of log of Real GDP per capita, private credits/GDP, years of schooling, log of physical capital per worker and the estimate of rule of law during the specified time period. [4] ε_c is the error component for any country c. For the second specification, we consider the following panel regression for all $t \in 2003, ...2014$:

$$Y_{ct} = \alpha + \delta_c + \gamma_t + \Gamma Z_{ct} + \varepsilon_{ct} \tag{3.2}$$

where the dependent variables are the upstreamness measures (U_{ct}^M, U_{ct}^X and $U_{ct}^M - U_{ct}^X$) for each country c at time t. δ_c and γ_t are country and year specific fixed effects. Z is the same generic vector depending on time, additionally including total factor productivity from PWT. The last term is the usual cluster error by country and year.

[4] Here notice that the variable for years of schooling is again calculated as the average of the filled values between 2003 and 2014 using the values of 2005 and 2010. The log of physical capital per

Table 5: Export Upstreamness and Country Characteristics

	(1)	(2)	(3)	(4)	(5)
All Exports	U_X	U_X	U_X	U_X	U_X
Log (Real GDP per capita)	-0.0476	0.129***	0.0334	0.141***	0.109
	(0.0359)	(0.0458)	(0.0529)	(0.0486)	(0.165)
Rule of Law		-0.305***		-0.263***	-0.207***
		(0.0481)		(0.0621)	(0.0749)
Private Credit / GDP			-0.368**	-0.144	-0.122
			(0.146)	(0.101)	(0.0974)
Log (Capital per worker) (PWT)					0.0715
					(0.145)
Years of Schooling					-0.0377
					(0.0243)
N	189	187	178	178	130
R^2	0.01	0.15	0.08	0.15	0.13
Manufacturing Exports					
Log (Real GDP per capita)	-0.00748	0.125***	0.0644*	0.125***	0.114
	(0.0292)	(0.0365)	(0.0333)	(0.0375)	(0.130)
Rule of Law		-0.230***		-0.145***	-0.102
		(0.0407)		(0.0508)	(0.0642)
Private Credit / GDP			-0.360***	-0.233***	-0.246***
			(0.0821)	(0.0608)	(0.0618)
Log (Capital per worker) (PWT)					-0.00223
					(0.120)
Years of Schooling					-0.0181
					(0.0181)
N	189	187	178	178	130
R^2	0.0004	0.12	0.10	0.13	0.12

Notes: ***,**, and * denote significance at the 1%, 5% and 10% levels respectively. The values in parentheses are robust standard errors.

Table 5 tests the same hypotheses put forward in Antrás et al. (2012) to understand in which direction the country level characteristics can have an impact on the export upstreamness for all and manufacturing goods. Considering the second column, we can verify that as the strength of contracting institutions rises, the countries export relatively more downstream though per capita GDP works in the opposite direction. As countries move to the higher stages of income, their exports become relatively more upstream. The usage of private credits over GDP, as a proxy for financial development has a negative and significant effect only in the third column when we do the estimation for all goods. However; when we pay a close attention to the estimation done only using manufacturing goods, we can observe that it becomes significant and theoretically consistent in all models, suggesting that export upstreamness for manufacturing goods is more sensitive to the financial development level than it is for all goods, the rest of which consists of mostly agricultural and service products. One possible explanation is that as the producers increase the amount of credit they borrow, they might be willing to invest loans in the manufacturing sectors, which have relatively more favorable terms of trade than the sectors of agriculture or service. This upward investment shift can create an incentive for the manufacturers to operate the upper stages of production in domestic plants before supplying to foreign markets during the intermediate stages. In contrast, they might have less incentive to export agricultural goods after conducting the final stages in their home countries or since the output of the service sector is mainly served to domestic markets, they might not be willing to supply service goods to foreign markets. Thus, the pure effect of manufacturing goods can be more precise in reducing the export upstreamness. The estimate of rule of law has a significant and negative effect on export upstreamness of manufacturing goods though the statistical significance of its coefficient considerably falls in the last model. Model 5 also allows us to make some inference on how investing in human capital can play a role in a country's production line position. Though we cannot observe a statistically significant impact, as the years of schooling

worker is computed dividing the real capital stock with the number of employed population.

increases, the export activities on average seem to be targeting final demand. However; the significance level is not sufficient to reach this conclusion. The results in Table 5 are consistent with what Antrás et al. (2012) find testing the same specifications. Though the explanatory power of the coefficients of private credits over GDP is slightly lower compared to their results, the coefficient of rule of law is more significant in each of the models tested above.

Table 6: Upstreamness and Country Characteristics

	(1) U_X	(2) U_M	(3) $U_M - U_X$
All Goods			
log (Real GDP per capita)	0.109	-0.0882*	-0.197
	(0.165)	(0.0461)	(0.180)
Rule of Law	-0.207***	0.0424	0.250***
	(0.0749)	(0.0363)	(0.0952)
Private Credit / GDP	-0.122	-0.112	0.00995
	(0.0974)	(0.0931)	(0.180)
Log (Capital per worker) (PWT)	0.0715	0.0620*	-0.00953
	(0.145)	(0.0362)	(0.158)
Years of Schooling	-0.0377	0.00508	0.0428
	(0.0243)	(0.00864)	(0.0280)
Constant	1.975	3.184***	1.208
	(1.832)	(0.493)	(1.993)
N	130	130	130
R^2	0.13	0.08	0.10

Notes: ***,**, and * denote significance at the 1%, 5% and 10% levels respectively. The values in parentheses are robust standard errors.

Table 6 introduces the import upstreamness and the span of production stages, $U_M - U_X$, in addition to the last specification of Table 4. The only variables that could have an impact on import upstreamness are GDP per capita and capital per worker though their explanatory powers are less precise. The increase in capital per worker is associated with an rise in import upstreamness but model (3) does not support our previous claim that high income countries tend to contribute more value added to the imported products. Still, it yields an important implication for the production stages conducted within domestic industries. The better institutions allow countries to process the intermediate stages within their own boundaries, which might trigger an in-

crease in the value of production.

Table 7 reveals the estimation results for specification (8), tested with country and year specific effects. It also includes total factor productivity from PWT. The impact of GDP per capita on upstreamness measures is still in line with the results of Table 6 and does not match with our prior claim. The coefficient of rule of law in the model for export upstreamness is theoretically meaningful, but insignificant. We also do not see the effect of total factor productivity in explaining the variations in production line position. The models other than (3) and (4) produce significant estimates for years of schooling but they are inconsistent with theoretical predictions. The models of import upstreamness (3-4) fail to truly capture the impact of rule of law on import upstreamness but still they make sense considering the finding that higher capital intensity per worker could lead a certain country to import relatively intermediate goods from the world markets (Model 3-4). Yet, the second model of Table 6 together with third and fourth models of Table 7 should be interpreted cautiously as "the relevance of these country variables in explaining trade patterns is thus specific to the supply side, and does not appear to be driven by differences in the composition of demand" (Antrás et al., 2012:16 in longer version). Therefore, country-level characteristics are more meaningful and prevailing in production channel instead of demand channel.

3.3.2 The Impact of Country Level Characteristics on Bilateral Upstreamness

Theoretically inconsistent and imprecise estimates of Table 5 and 6 do not bring convincing results in analyzing the direction of correlation from country level variables to upstreamness measures. Thus, rather than looking at the overall variation in upstreamness measures in response to country characteristics, we propose that a country's export and import upstreamness measure could be varying across its different trade partners. For instance, Turkey could concentrate on the exports of final goods

Table 7: Panel Regressions

	(1) U_X	(2) U_X	(3) U_M	(4) U_M	(5) $U_M - U_X$	(6) $U_M - U_X$
Log (Real GDP per capita)	0.131*	0.182***	-0.169**	-0.0681	-0.299***	-0.250***
	(0.0705)	(0.0639)	(0.0658)	(0.0582)	(0.0882)	(0.0805)
Rule of Law	-0.0135	-0.0248	-0.0496**	-0.0781***	-0.0361	-0.0533
	(0.0424)	(0.0396)	(0.0213)	(0.0210)	(0.0477)	(0.0447)
Private Credit / GDP	0.000493	0.00442	-0.00931	0.0136	-0.00981	0.00918
	(0.0327)	(0.0314)	(0.0424)	(0.0388)	(0.0400)	(0.0367)
Log (Capital per worker)	0.160**	0.138**	0.258***	0.221***	0.0986	0.0826
	(0.0743)	(0.0650)	(0.0424)	(0.0414)	(0.0840)	(0.0728)
TFP at constant national prices (2011=1)	0.0588	0.0558	-0.0877	-0.0914	-0.146	-0.147
	(0.100)	(0.0998)	(0.0833)	(0.0834)	(0.114)	(0.115)
Years of Schooling	0.0666***	0.0610***	0.0113	0.0142	-0.0553***	-0.0468***
	(0.0162)	(0.0133)	(0.00945)	(0.00924)	(0.0180)	(0.0143)
Country Fixed Effects?	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects?	Yes	No	Yes	No	Yes	No
N	1240	1240	1240	1240	1240	1240
R^2	0.93	0.93	0.85	0.85	0.93	0.93

Notes: ***,**, and * denote significance at the 1%, 5% and 10% levels respectively. The values in parentheses show robust standard errors. Model (1) and (2) take export upstreamness, model (3) and (4) take import upstreamness and model (5) and (6) take $U_M - U_X$, span of production stages, as a dependent variable.

to less developed countries while its exports tend to comprise more raw materials when it exports to more developed countries, necessarily increasing its export upstreamness. On the other hand, it could bring more value added to the imported products from the poorer countries, but there might not exist much opportunities to process the goods imported from richer countries. This fact could also be sensitive to the changes in country level factors. The relative production line position of a country might alter with respect to its trade partners in case of a change in not only its own but also its trade partners' characteristics. This finding leads us to employ a bilateral approach in examining such a direction of causality. In what follows, we define the *bilateral upstreamness measure* from the perspective of exportation. For any source country i and destination country j at time t

$$U_{ijt} = \sum_{k=1}^{N} \frac{X_{ijkt}}{X_{ijt}} U_k$$

where X_{ijkt} is the volume of exports from the source country i to the destination country j for a specific product category k at time t. X_{ijt} is the total volume of exports. Similar to the formula we use to define the export and import upstreamness, we weight the volume of exports from i to j by the industry upstreamness measure of N-available number of product k. Similarly, we can also define the bilateral upstreamness from the perspective of importation:

$$U_{ijt} = \sum_{k=1}^{N} \frac{M_{jikt}}{M_{jit}} U_k$$

where M_{jikt} is the volume of imports to the destination country j from the source country i for a specific product category k at time t. M_{jit} is the total volume of imports.

To illustrate our findings, we return to comparison of Japan and Saudi Arabia in global value chains. Previously, we examined the average position of each of these countries taking into account their export and import pattern with the rest of the

world. Now we consider the bilateral trade pattern between Japan and Saudi Arabia at a point in time, particularly in 2014. Import upstreamness of Saudi Arabia to Japan (export upstreamness of Japan to Saudi Arabia) is around 1.73 whereas the import upstreamness of Japan to Saudi Arabia (export upstreamness of Saudi Arabia to Japan) is around 3.31. This implies Japan can contribute to the value of the materials it purchases from Saudi Arabia within more than three sectors while Saudi Arabia mostly purchases goods from Japan ready to be sold to final customers and cannot bring much value added to its imports from Japan.

Our approach in this section consists of the regression equations accounting for the bilateral upstreamness at a point in time between a source and a destination country. We aim to test two different bilateral specifications. The main purpose of conducting the first bilateral analysis is to explain how the upstreamness between a source and a destination country changes in response to the variables in source or destination countries, controlling for destination-year and source-year fixed effects. In addition to that, our estimation equations consist of *gravity variables* [5] to account for the geographical impact on bilateral production line position between two different countries. Thus, we can explain how GDP per capita, rule of law, the ratio of private credits to GDP, capital stock per worker, total factor productivity and years of schooling in a certain country could affect the bilateral upstreamness between any trade partners, controlling for the country fixed effects and gravity terms. Formally,

$$U_{ijt} = \alpha_0 + \alpha_1 X_{it} + \alpha_2 Z_{ij} + \Gamma_{jt} + \varepsilon_{ijt} \tag{3.3}$$

[5]CEPII Gravity Database is harnessed to include the gravity variables for estimation procedure from Head et al. (2010). The variables of interest are the distance (km) between the source and destination country, a dummy variable for common language to explain whether the same language is spoken between the trade partners, a dummy variable for contiguity to show if there is a common border and a dummy variable for the presence of a free trade agreement.

and

$$U_{ijt} = \beta_0 + \beta_1 X_{jt} + \beta_2 Z_{ij} + \Gamma_{it} + u_{ijt} \tag{3.4}$$

where the dependent variable is the bilateral upstreamness measure between a source country i and a destination country j at time t. X_{it} (X_{jt}) is a vector of country specific factors in source country i (destination country j). Z_{ij} is a vector of gravity variables between a source i and destination j. Γ_{jt} and Γ_{it} denote the destination and source fixed effects at time t, respectively.

Table 8: The Impact of Source and Destination Specific Variables on Bilateral Upstreamness

	(1) U_{ijt}	(2) U_{ijt}	(3) U_{ijt}	(4) U_{ijt}
Log (Real GDP per capita)	0.129***	-0.0230***	0.129***	-0.0230**
	(0.00537)	(0.00425)	(0.0137)	(0.00983)
Rule of Law	-0.124***	-0.0455***	-0.124***	-0.0455***
	(0.00258)	(0.00267)	(0.00616)	(0.00620)
Private Credit / GDP	-0.138***	0.0901***	-0.138***	0.0901***
	(0.00350)	(0.00483)	(0.00809)	(0.0119)
Log (Capital per worker)	-0.0148***	0.0598***	-0.0148	0.0598***
	(0.00448)	(0.00379)	(0.0111)	(0.00867)
TFP at constant national prices (2011=1)	0.225***	-0.285***	0.225***	-0.285***
	(0.0238)	(0.0209)	(0.0408)	(0.0338)
Years of Schooling	-0.00397***	-0.0152***	-0.00397*	-0.0152***
	(0.000928)	(0.000810)	(0.00229)	(0.00182)
Log (Distance)	-0.0715***	-0.0303***	-0.0715***	-0.0303***
	(0.00215)	(0.00228)	(0.00549)	(0.00539)
Common Language (=1)	-0.00585	-0.0236***	-0.00585	-0.0236**
	(0.00379)	(0.00434)	(0.00908)	(0.0102)
Contiguity (=1)	0.0400***	0.106***	0.0400*	0.106***
	(0.00740)	(0.00923)	(0.0206)	(0.0262)
Free Trade Agreement (=1)	-0.0265***	0.0108**	-0.0265**	0.0108
	(0.00435)	(0.00451)	(0.0108)	(0.0105)
Destination - Year Fixed Effects?	Yes	No	Yes	No
Source - Year Fixed Effects?	No	Yes	No	Yes
N	184948	179004	184948	179004
R^2	0.17	0.24	0.17	0.24

Notes: ***,**, and * denote significance at the 1%, 5% and 10% levels respectively. The values in parentheses show robust standard errors, except in column (3) and (4) where they are clustered by source and destination country instead.

Table 8 displays the estimates of coefficients in both specifications above. Model (1-2) use robust standard errors while (3-4) cluster the standard errors by source-destination country pairs to take into account any inflation in standard errors result-

ing from the unobservable impact of possible clustering of trade partners . Though the significance of the estimates comparably falls in models (3-4), they could still explain the variation in bilateral upstreamness. One of the stark findings from models 1 and 3 is that an increase in per capita real GDP in a source country is associated with an increase in its export upstreamness, i.e., import upstreamness of the destination country given that destination specific characteristics are fixed. Thus, as the income level of the exporter country increases, its trade partner tends to import more upstream products. The strength of contracting institutions and financial development in exporting countries can induce them to specialize in the production of goods directly targeting the final markets in importer countries. If the productivity rises in the source country, import upstreamness of the destination country also increases, meaning that the share of intermediate goods in importer's trade volume significantly rises. The investment in human capital in exporter country slightly changes its export pattern, making the export composition more downstream. Here the gravity terms are also effective in changing the bilateral position between two trade partners. As the source and destination countries are located further away from each other, this can make the types of products exported by the source country more downstream. This result is consistent with the implications of gravity models on the impact of distance on the value of products exported to foreign markets. Increasing distance can lead the producers in the source country to change the composition of exports towards high value commodities, for which it is more profitable to incur fixed and variable trade costs of servicing the remote markets. Thus, the incentive of exporting high value commodities to remote destinations can increase the number of subsequent stages of production undertaken in domestic plants and induce a more downstream pattern for the types of products subject to exportation. Furthermore, free trade agreements can also allow the exporter countries to supply more downstream goods in the destination markets. If there is a common border between the trading partners, we could observe a rise in the import upstreamness of destination countries relative to exporters.

The other models in Table 8 (2 and 4) consider the impact of destination specific factors on bilateral upstreamness, taking the characteristics of source country at time t fixed. As the destination country gets richer and the quality of institutions increases, it imports more downstream products from its exporter partner. The share of private credits in GDP significantly improves its ability to import more upstream products. While the intensity of capital per worker in importer country might create an impetus to enlarge the number of production stages conducted within its home plants, the productivity increase works in the other way around. The increase in years of schooling in the destination country seem to be leading the source country to concentrate on the sale of final goods. The inclusion of gravity terms also yields interesting results for the second specification. The increase in the distance between source and destination country allows the source country to export more downstream products. Unlike the first specification, the coefficient for common language dummy is significant for this model. If the trading partners share the same language, this could allow the exporter country to sell final products to the importer. In case of a common border, we can observe a rise in the import upstreamness of the destination country. When we examine the effect of signing a free trade agreement between two trade partners, we see alternating results depending on the fixed effects we use in the estimation. If we fix the destination-year effects, we find a relatively more downstream characteristics for the products of exporter country. However; fixing the source-year effects, free trade agreement might bring about a rise in the import upstreamness of the destination country.

We also test the following specification to combine the bilateral estimation equations above to examine the joint impact of source and destination specific variables on bilateral upstreamness in one specification:

$$U_{ijt} = \delta_0 + \delta_1 X_{it} + \delta_2 X_{jt} + \delta_3 Z_{ij} + \Gamma_i + \Gamma_j + \gamma_t + e_{ijt} \tag{3.5}$$

where X_{it} and X_{jt} are the same source and destination country specific variables in

source i and destination j at time t. Z_{ij} is the gravity variables in the first specification. We also include Γ_i and Γ_j to control for the source and destination country fixed effects [6]. Time fixed effect γ_t is also added to our specification. e_{ijt} is the usual error term.

Table 9 displays the estimation results of this specification. Using a similar strategy to the previous bilateral analysis, we also test the model with clustered standard errors to account for the impact of any unobserved factors regarding with source destination country pairs. Even if the standard errors are inflated due to the usage of clustering, the coefficients do not lose their statistical significance tough there is a mild fall in the explanatory power of TFP for the source country. The increase in income level and years of schooling in source country appear to be leading to more upstream exports while the strength of institutions and productivity gains bring about more downstream exports. By definition of bilateral upstreamness, the same variables affect the import upstreamness of the destination country in the other way around. When we examine the impact of destination characteristics on the bilateral upstreamness, real income level and capital intensity per worker are the only effective variables. The higher income level of the destination causes it to import less upstream products whereas the higher capital intensity allows it to import more upstream products. When we consider the gravity variables, they are totally consistent with the results previous table. The distance between two trade partners, the presence of a common language and a free trade agreement reduce the export upstreamness of the source country. If trade partners are two neighbor countries with a common border, this would help the destination country import relatively more upstream products.

[6] Notice that they do not vary across time unlike the specifications considered in the first analysis.

Table 9: The Joint Impact of Source and Destination Specific Variables on Bilateral Upstreamness

	(1) U_{ijt}	(2) U_{ijt}
Log (Real GDP per capita) in Source	0.0903***	0.0903***
	(0.0314)	(0.0344)
Rule of Law in Source	-0.0299**	-0.0299*
	(0.0150)	(0.0155)
Private Credit / GDP in Source	0.00104	0.00104
	(0.0120)	(0.0122)
Log (Capital per worker) in Source	0.0131	0.0131
	(0.0262)	(0.0292)
TFP (2011=1) in Source	-0.106**	-0.106**
	(0.0432)	(0.0480)
Years of Schooling in Source	0.0221***	0.0221***
	(0.00568)	(0.00621)
Log (Real GDP per capita) in Destination	-0.136***	-0.136***
	(0.0305)	(0.0352)
Rule of Law in Destination	0.00606	0.00606
	(0.0132)	(0.0140)
Private Credit / GDP in Destination	-0.00498	-0.00498
	(0.0131)	(0.0137)
Log (Capital per worker) in Destination	0.118***	0.118***
	(0.0239)	(0.0273)
TFP (2011=1) in Destination	-0.0149	-0.0149
	(0.0356)	(0.0420)
Years of Schooling in Destination	-0.001000	-0.001000
	(0.00644)	(0.00682)
Log(Distance)	-1.36e-05***	-1.36e-05***
	(5.19e-07)	(1.24e-06)
Common Language (=1)	-0.0343***	-0.0343***
	(0.00555)	(0.0132)
Contiguity (=1)	0.0710***	0.0710***
	(0.00817)	(0.0230)
Free Trade Agreement (=1)	-0.0242***	-0.0242**
	(0.00484)	(0.0111)
Destination Fixed Effects?	Yes	Yes
Source Fixed Effects?	Yes	Yes
Year Fixed Effects?	Yes	Yes
N	109558	109558
R^2	0.35	0.35

Notes: ***,**, and * denote significance at the 1%, 5% and 10% levels respectively. The first model is estimated using robust standard errors whereas in the second model they are clustered by source destination country pairs instead.

3.4 The Production Line Position of Turkey

3.4.1 The Movement relative to OECD, BRICS and EU members

The computation of bilateral upstreamness between any pair of countries allows us to keep track of how production line position of a certain country or a block of countries changes over time. In this section, we compare the evolution of Turkey's production line position with both developed and developing country groups. For developed group, we consider the countries in OECD [7] and 15 members of European Union [8]. For developing country groups, we consider BRICS [9] and new members of European Union [10]. Taking the average of all countries involved in each group at a point in time, we sketch how Turkish position on average evolves over time against these blocks. This will allow us to portray the changes in relative position of Turkey in global value chains with respect to two different income groups.

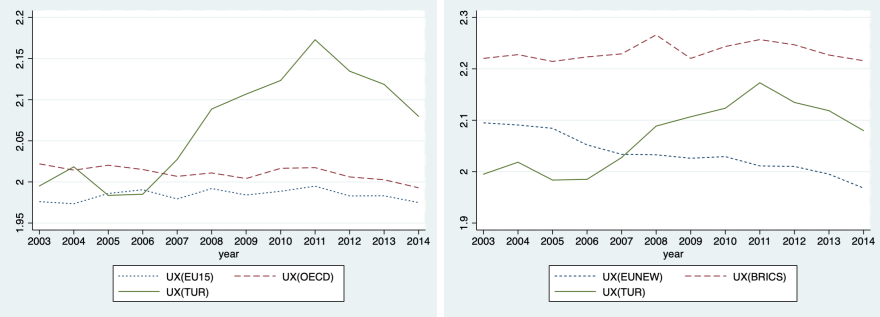
Figure 5 illustrates the movement of Turkish export upstreamness compared to both developed and developing groups. On average Turkish exports to the rest of the world are processed by at least two industries and it shows the most drastic change among all the other country groups during the period between 2006 and 2011. Turkish exports, especially after 2006, become more upstream, concentrating on the sale of intermediate goods in world markets. While this pattern increasingly continues until

[7] Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden Switzerland, the United Kingdom and the United States. Since Turkey is also a member of OECD, we exclude that to obtain the average of remaining countries. OECD (2019).

[8] Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom. European-Commission (2019)

[9] Brazil, Russia, India, China and South Africa.

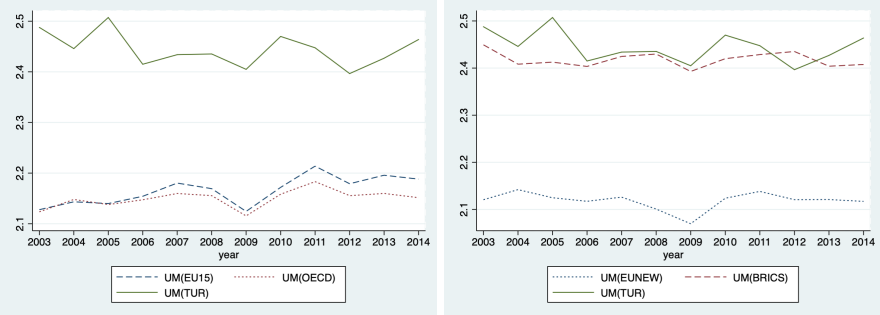
[10] EU countries which became members after 2004 enlargement: Czech Republic, Estonia, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Slovakia, Slovenia, Romania, Bulgaria and Croatia (European Commission, 2019).



(a) Panel A: Developed Group **(b) Panel B: Developing Group**

Figure 5: Evolution of Export Upstreamness

2011, Turkish exports start targeting final demand during the last three years in our data set. Turkey together with BRICS is located in the intermediate stages of production chains compared to the other country blocks on average. As we observe a relatively flat movement of BRICS countries, EU15 and OECD countries have a tendency to follow a more downstream pattern in exporting. The fact that EU15 countries follow the most downstream pattern highlights an important implication: export composition of the most developed EU members is mostly final good oriented in international markets.



(a) Panel A: Developed Group **(b) Panel B: Developing Group**

Figure 6: Evolution of Import Upstreamness

The picture becomes more interesting when we analyze how Turkish import upstreamness on average moves compared to the same set of countries (Figure 6) and investigate which one of these country groups resembles Turkey in terms of the production line position. While OECD and EU15 members move parallel to each other, Turkey and BRICS countries follow an exactly opposite pattern. Turkey similar to BRICS average imports mostly upstream products from world markets. Towards

2014, as both of them experience a fall in export upstreamness, accompanied by a rise in import upstreamness, they could have increased the number of production stages conducted domestically. Thus, when we consider the position of Turkey in GVCs, it is more similar to BRICS countries than EU15 or OECD members. Apart from this, Turkish imports on average are slightly more upstream than those of BRICS. Even though this pattern vanishes during the period between 2011-2012, Turkey earns its previous position back, pursuing a more upstream pattern 2013 onward.

3.4.2 Upstreamness of Turkey by Income Quintiles

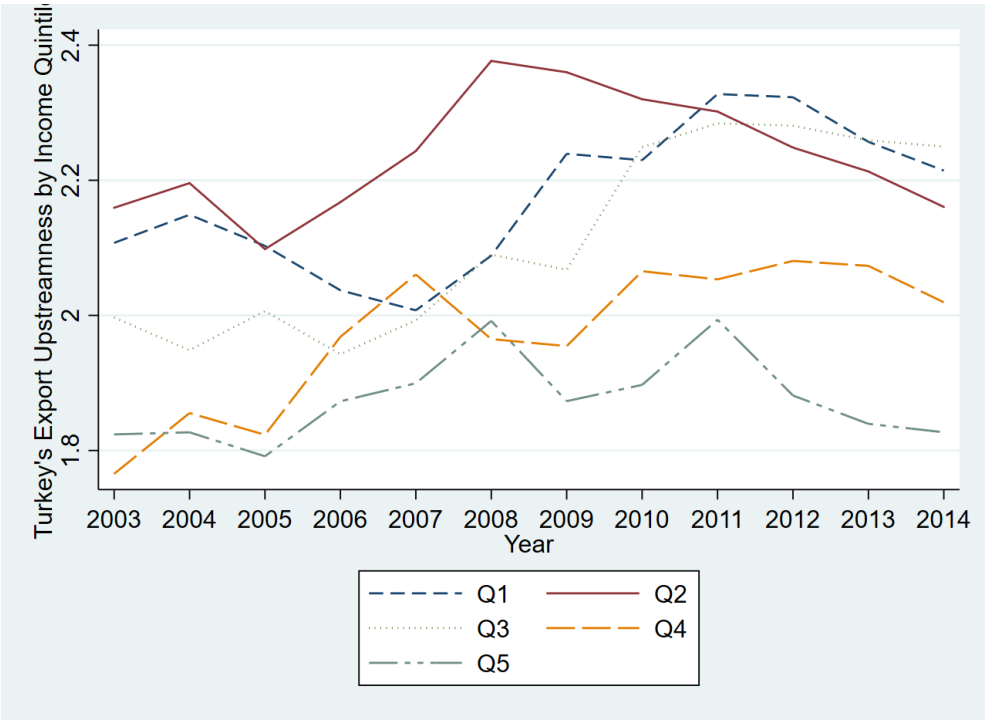


Figure 7: Turkey's Export Upstreamness by Income Quntiles

Using the bilateral upstreamness between Turkey and its trade partners, we can keep track of how Turkey's export and import upstreamness changes over time across different income groups. Here we divide the income level of Turkey's trade partners into 5 different group, each of which yields one quintile for a given year. While Q1 includes the poorest trade partners of Turkey, Q5 consists of the richest group of countries. Figure 7 captures the evolution of Turkey's export upstreamness against

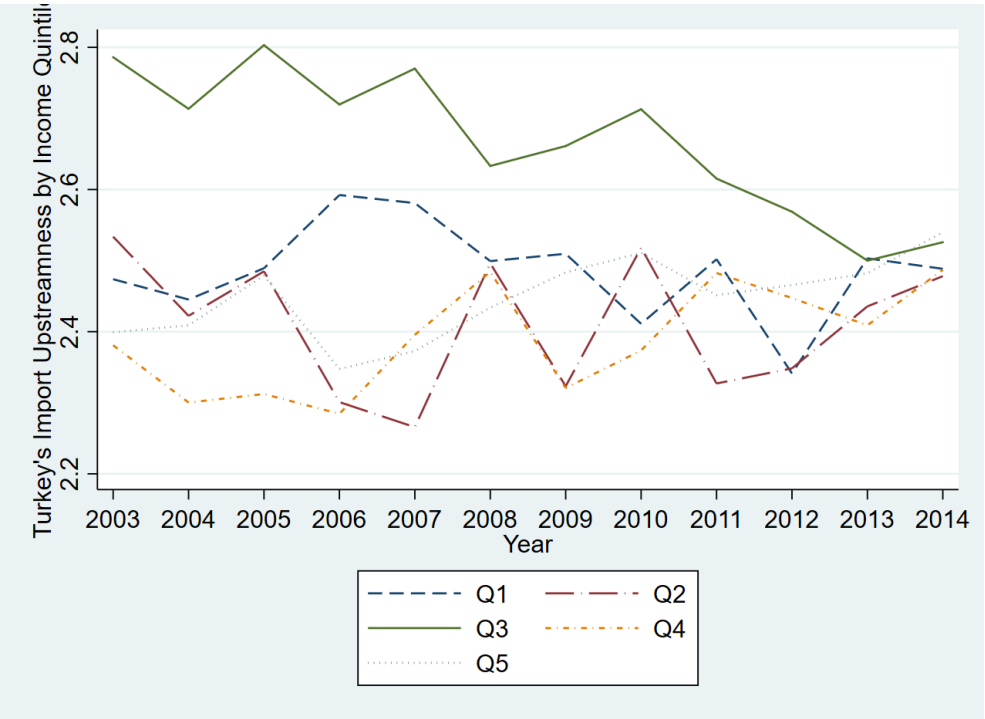


Figure 8: Turkey's Import Upstreamness by Income Quintiles

these different income groups over time. It is immediate to observe that Turkey's export composition shows the most downstream pattern against the richest country groups on average. Hence, Turkish exporters mainly target the final customers when they export to high income countries.

Figure 8 displays the picture for the import upstreamness. Even if Turkish production line position cannot be easily disentangled in the way we analyze its export upstreamness, the import upstreamness of all income quintiles converge to the same value when we move to the end of our data period. Based on this convergence, we can infer that the upstreamness of Turkey's import composition does not differ significantly across the income level of its trading partners towards 2014. When we combine this result with our previous finding that Turkey mostly sells final goods to high income countries, we can observe that Turkey succeeds in deepening the span of production stages for the product types supplied to richer countries. In other words, consistent with the key findings outlined in OECD-WTO (2015) reporting a significant improvement in the content of Turkey's value added exports embodied in exports of

final products between 1995 and 2011, Turkey's integration to GVCs might be more oriented towards downstream activities. Hence, recalling the results of second model tested in Table 8, we find another empirical support to the hypothesis that if one of the trade partners attains a higher income group, the composition of its imports from the other partner will show a much more downstream characteristic.

CHAPTER 4

CONCLUSION

Employing the notion of *upstreamness* together with UN Comtrade data and industry specific upstreamness measures from Antrás et al. (2012), we develop country level export and import upstreamness for the period 2003-2014. Using a bilateral framework, the computation of export and import upstreamness can help us locate the position a certain country occupies in global value chains.

The empirical results of section 3 give us the implications for export and import upstreamness on a global scale. We find that the countries differ particularly in terms of the export upstreamness, meaning that while some specialize in the production of final goods, the others are more inclined to stay at intermediate stages of production. Moreover, we show how the export and import upstreamness are related to strength of institutions, changes in per capita real GDP and years of schooling. Even if we do not see a clear pattern for import upstreamness, the figures imply that as the countries get richer, adopt new institutions making the rule of law a predominant factor in administration and invest in policies increasing the years of schooling, they have a propensity to be exporting in more downstream sectors.

In addition to the basic correlation plots, we embrace a more formal assessment to investigate the impact of country specific characteristics on upstreamness measures, consisting of mainly two approaches. The first approach includes an OLS estimation of average values of variables and a fixed effect panel estimation. The results seem

to be explaining the theoretical implications from the production channel. However; we could see insignificant and theoretically inconsistent estimates from the demand channel. To characterize how a country's production line position relative to its trading partner moves over time, we incorporate a bilateral analysis into our estimation procedure. Depending on the idea that a country's position in global value chains could vary across its different trade partners, we analyze how the change in country level factors could be effective in altering the position of both exporter and importer, controlling for the source and destination fixed effects to observe the actual impact of above-mentioned changes. We find that as the income level of exporter country rises, this might allow the importer country to contribute more value added to the imported products. Similarly, better institutions, financial development and investing in human capital in exporter country allow its export products to be more downstream. Likewise, the rise in the income level and quality of institutions in destination country could change the exporting behavior of its partner, making it supply more downstream products. The level of financial development and increasing intensity of capital per worker can induce the importer country to have a higher import upstreamness whereas the productivity gains and an increase in years of schooling lead it to import more downstream products.

Introducing the gravity variables to our bilateral analysis, we can also observe how the geographical factors can have an impact on the bilateral upstreamness between a source and a destination country. We find that as the distance between two trading partners increases, the exporter country is involved in the sale of final goods to the importer country. If the partners share the same language, then this would reduce the export upstreamness of the source country. While having a common border allows the destination to import more upstream products, we observe an alternating sign for the effect of free trade agreement on bilateral upstreamness depending on the fixed effects we use in our estimation. Fixing any effect of destination country across different years, the presence of a free trade agreement leads the exporter country to ex-

port more downstream products. On the other hand, when we fix the impact coming from the source country, having a free trade agreement allows the importer country to embrace a higher level of import upstreamness.

We also open two separate subsections to describe production line position of Turkey. The first one is concerned with how Turkey's export and import upstreamness move over time against developing and developed country blocks. Starting from mid 2000s, Turkey is mostly located in intermediate stages in production line, yet this tendency appears to be losing momentum through 2011 and Turkish exports are composed of more downstream products. Moreover, Turkey's import upstreamness follows a pattern which is more similar to the average of BRICS members than the average of EU15 and OECD members which follow a parallel trend over time. This type of resemblance between Turkey and BRICS countries might suggest that Turkey occupies a closer position to BRICS countries in global value chains. Generally speaking, they have a higher level of import upstreamness than EU15 and OECD average over the whole period. Towards the end of our period, their export upstreamness measures have a propensity to diminish at a larger extent, suggesting that the span of domestic production stages has inevitably amplified. The second subsection approaches to the same question decomposing Turkey's trade partners across five different income groups. As its trade partners get richer, Turkey mostly sells downstream products. In case of import upstreamness, we cannot easily determine its average production line position across different income quintiles. Still, towards 2014, Turkey's import upstreamness values across different groups converge to the same level regardless of the income level of countries with which it shares a trade activity.

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APPENDIX

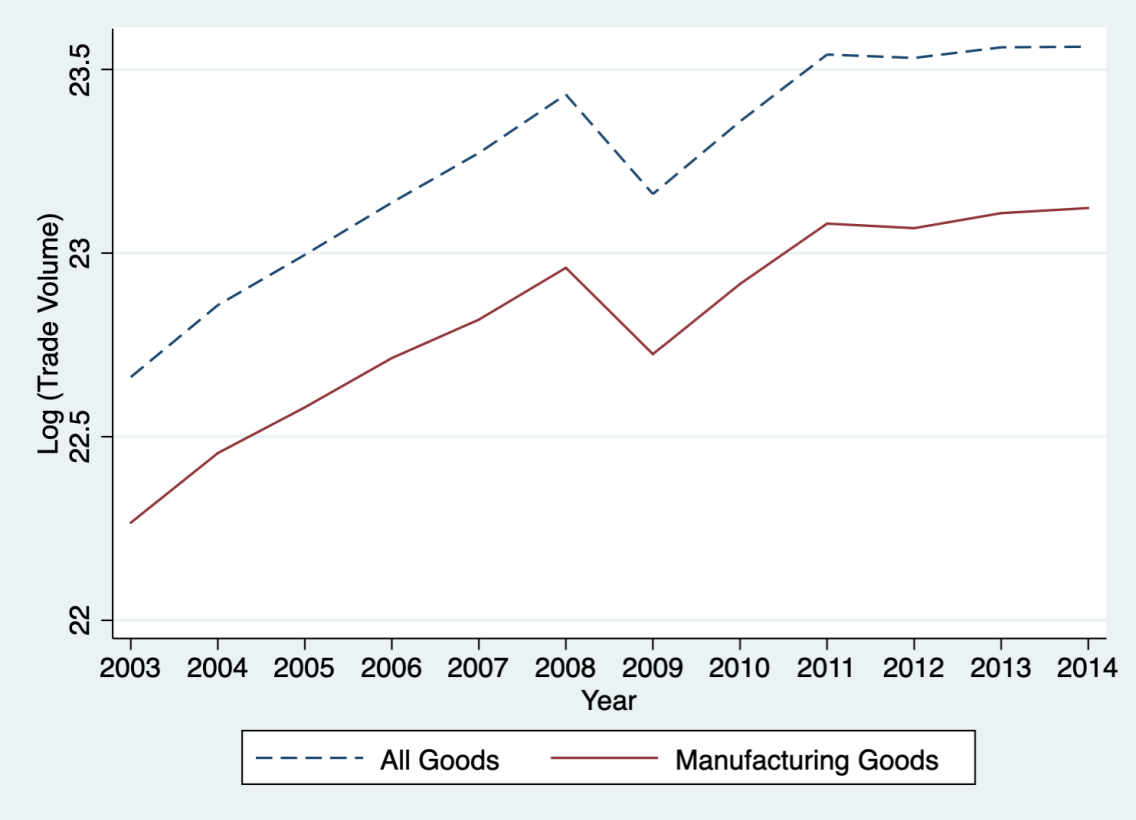

Figure 9: The World Log Trade Volume

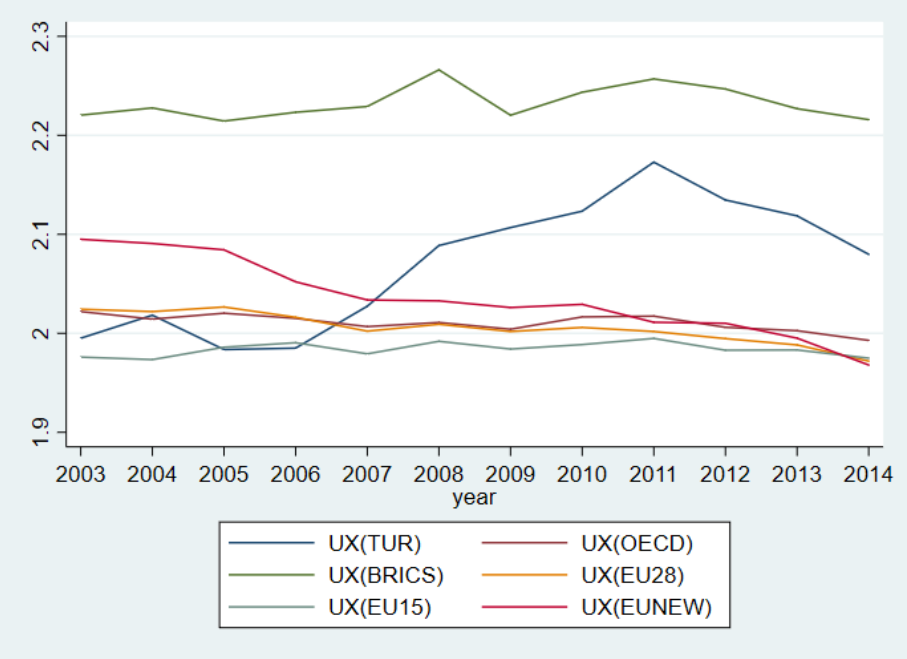

Figure 10: Evolution of Turkish Export Upstreamness

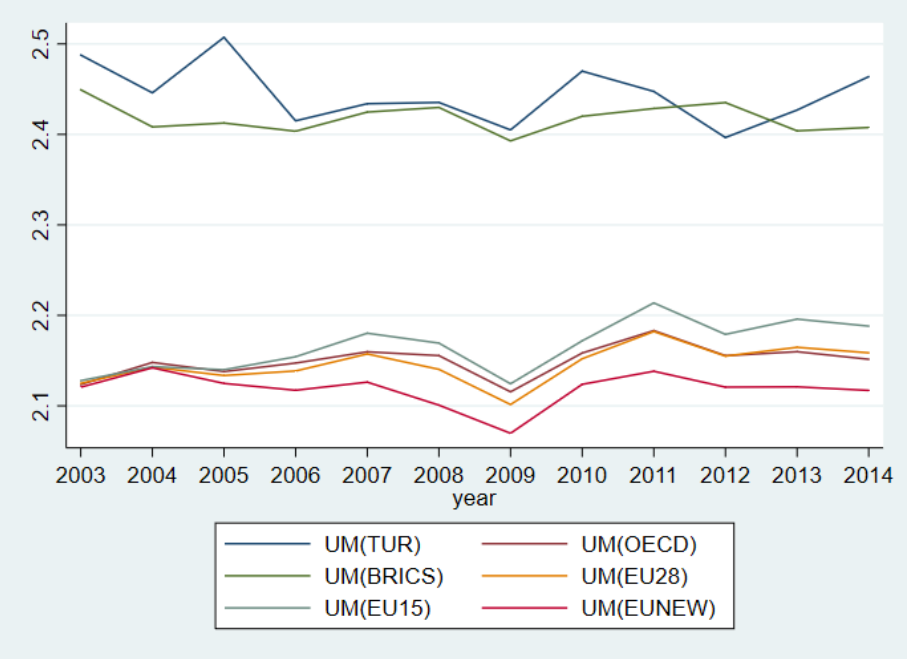

Figure 11: Evolution of Turkish Import Upstreamness

Table 10: Summary Statistics for Country Characteristics

Country Characteristics	Years												
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2003-2014
Log (Real GDP per capita)	8.95	8.99	9.03	9.07	9.11	9.14	9.12	9.15	9.17	9.20	9.22	9.23	9.12
	[1.20]	[1.20]	[1.20]	[1.20]	[1.20]	[1.19]	[1.16]	[1.15]	[1.15]	[1.14]	[1.13]	[1.13]	[1.17]
Rule of Law	3.94e-09	7.62e-09	-1.67e-08	1.62e-08	9.52e-08	1.48e-08	-5.19e-09	-8.49e-09	6.54e-09	9.81e-09	1.54e-08	-1.44e-09	3.64e-09
	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[0.99]
Private Credit / GDP	0.37	0.38	0.40	0.42	0.45	0.50	0.54	0.54	0.48	0.49	0.49	0.51	0.46
	[0.36]	[0.36]	[0.39]	[0.44]	[0.47]	[0.55]	[0.66]	[0.76]	[0.41]	[0.41]	[0.41]	[0.40]	[0.49]
Log (Capital per worker)	-2.72	-2.71	-2.69	2.67	-2.65	-2.62	-2.61	-2.58	-2.56	-2.53	-2.51	-2.48	-2.61
	[1.37]	[1.37]	[1.36]	1.36	[1.35]	[1.35]	[1.35]	[1.34]	[1.33]	[1.33]	[1.32]	[1.31]	1.34
TFP	0.94	0.96	0.97	0.99	1.00	1.00	0.98	0.99	1	1.00	1.00	1.00	0.98
	[0.13]	[0.12]	[0.10]	[0.105]	[0.09]	[0.09]	[0.05]	[0.02]	[0]	[0.03]	[0.06]	[0.07]	[0.08]
Years of Schooling	7.85	7.85	7.85	7.85	7.85	8.34	8.34	8.34	8.34	8.34	8.34	8.34	8.14
	[2.84]	[2.84]	[2.84]	[2.84]	[2.84]	[2.81]	[2.81]	[2.81]	[2.81]	[2.81]	[2.84]	[2.84]	[2.82]

Notes: The unit of measurements are as follow: Log of Real GDP per capita (2010 constant US Dollars), Rule of Law (the estimate from World Governance Indicators), Private Credit / GDP (the ratio of private credits by deposit money banks and other financial institutions to GDP), Log of Capital per worker (Capital stock per employment calculated using Penn World Tables (PWT)), TFP (constant national prices 2011=1 from PWT), Years of Schooling (Barro-Lee's education attainment data). Note also that since 2011 is the base year, all TFP values regarding with this year are taken as 1, naturally having a zero standard deviation.

Table 11: Number of Observations for Country Characteristics

Country Characteristics	Years												
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2003-2014
Log (Real GDP per capita)	237	237	237	237	238	238	238	238	242	239	239	238	2858
Rule of Law	203	210	210	210	210	209	212	212	214	214	214	209	2527
Private Credit / GDP	179	180	181	182	182	183	179	181	179	179	178	175	2158
Log (Capital per worker)	173	173	173	173	173	171	169	169	169	169	169	169	2050
TFP	116	116	116	116	116	116	116	116	116	116	116	116	1392
Years of Schooling	146	146	146	146	146	146	146	146	146	146	146	146	1752

Figure 12: Standard Deviation of Turkey's Export Upstreamness for each Income Quintile

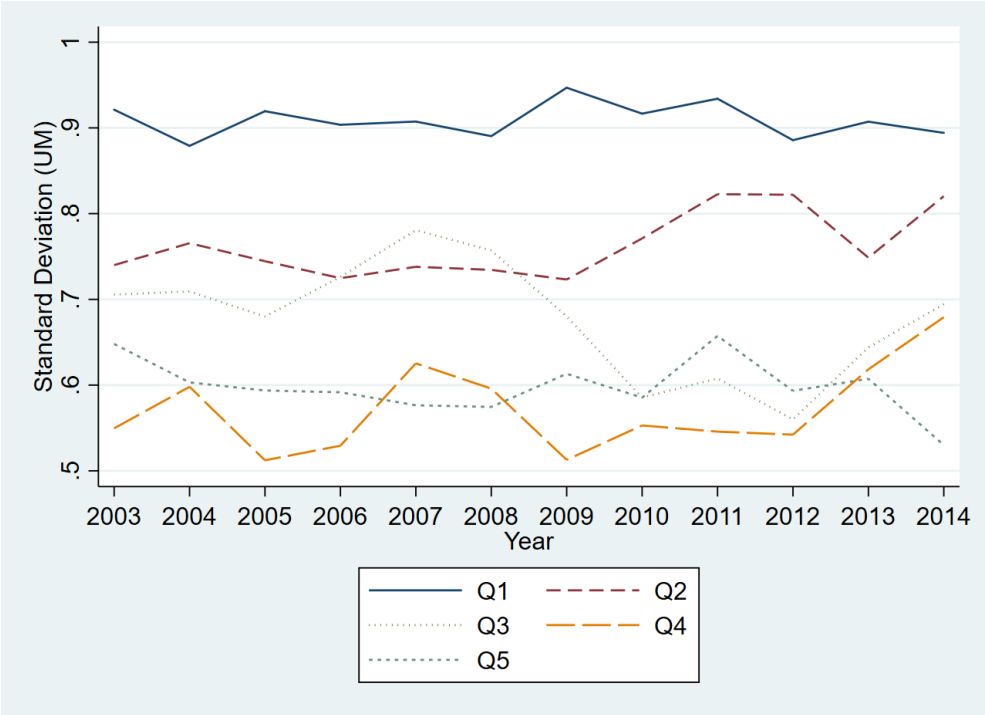

Figure 13: Standard Deviation of Turkey's Export Upstreamness for each Income Quintile

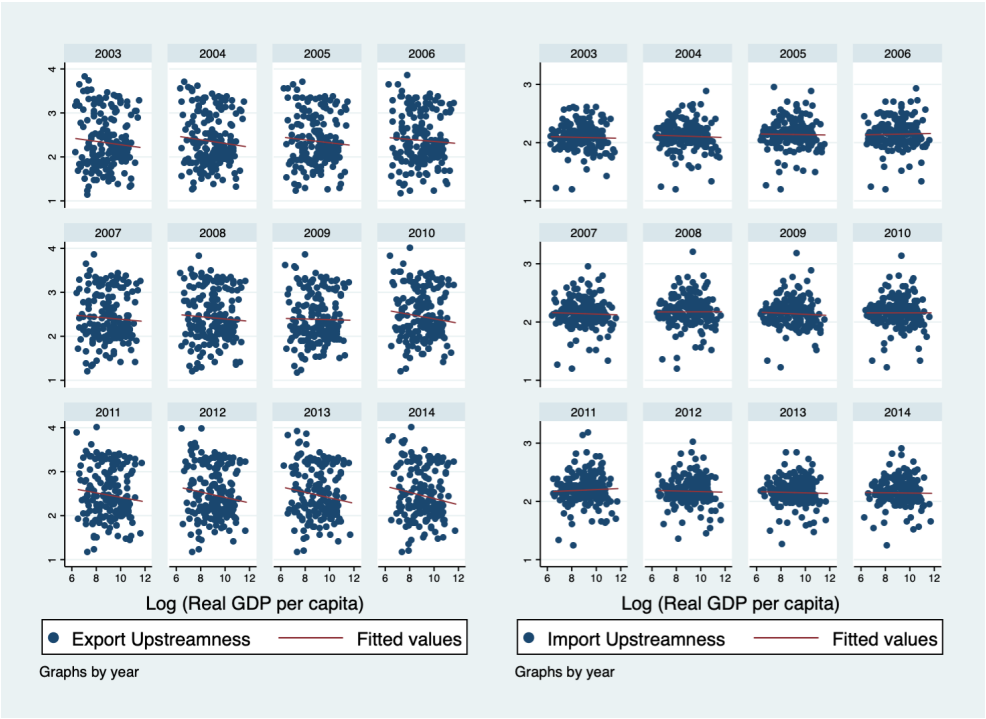

Figure 14: The Correlation between export-import upstreamness and Real GDP per capita varying across different years

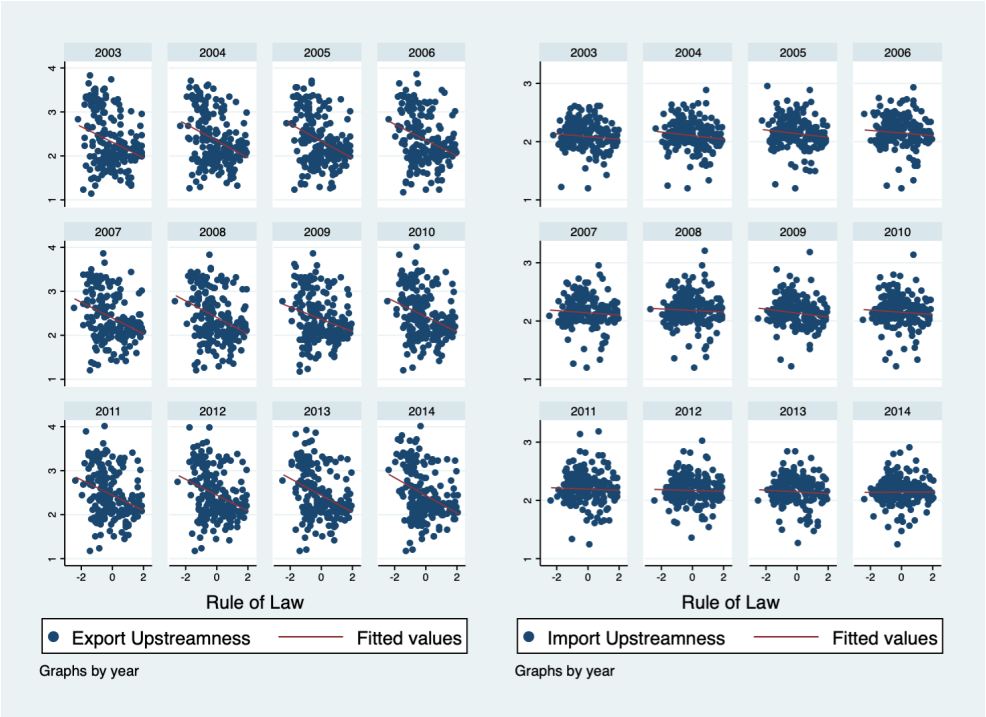

Figure 15: The Correlation between export-import upstreamness and Rule of Law varying across different years

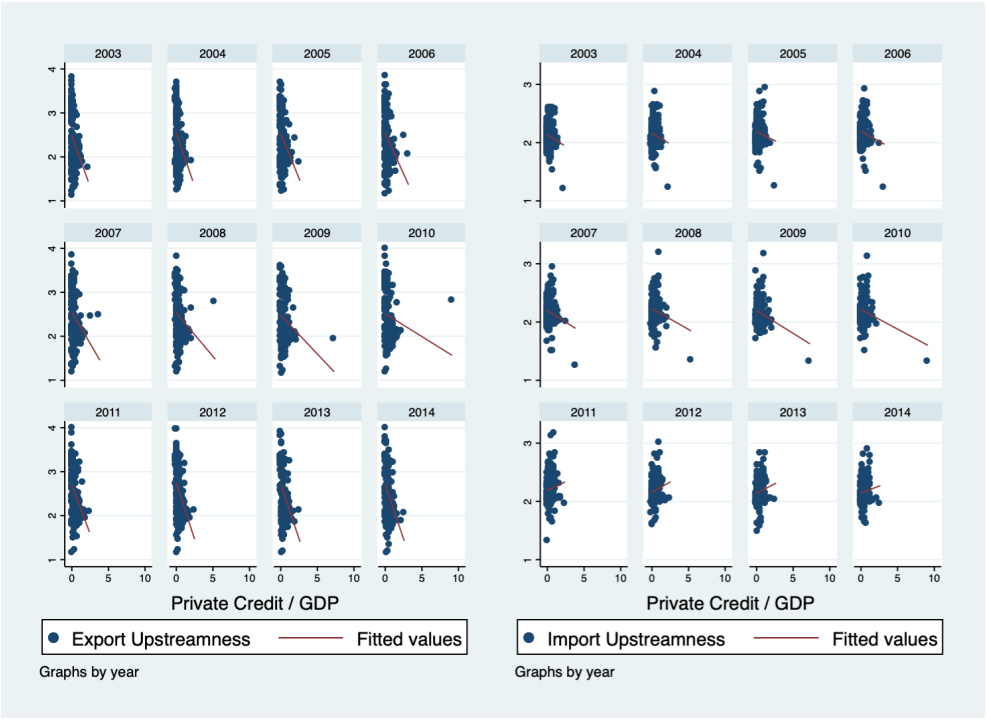

Figure 16: The Correlation between export-import upstreamness and Private Credit / GDP varying across different years

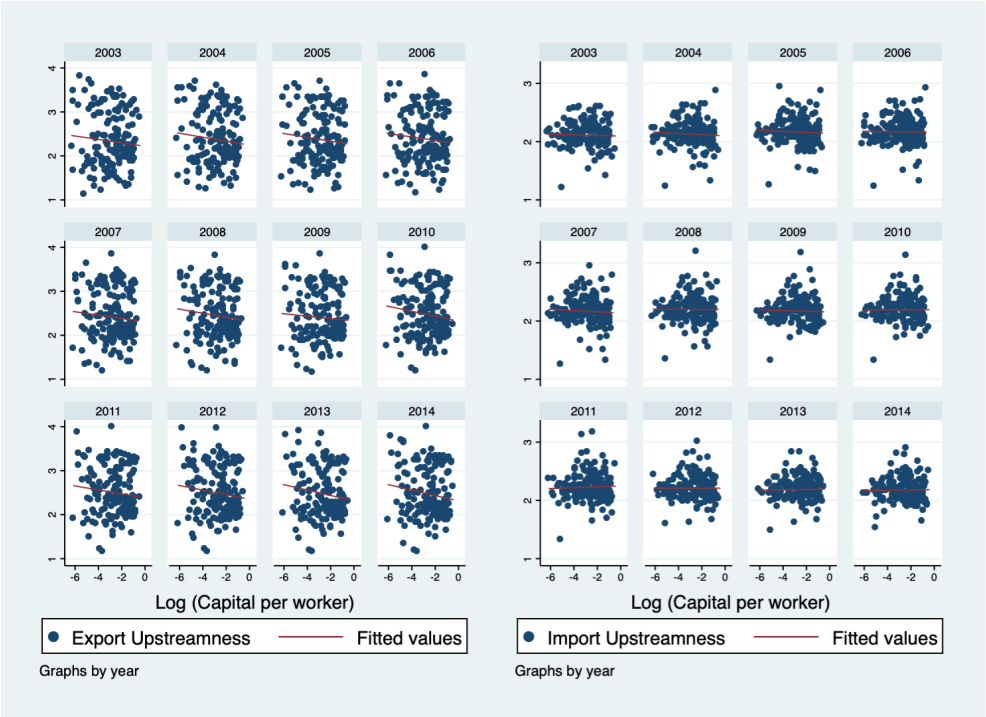

Figure 17: The Correlation between export-import upstreamness and Capital per worker varying across different years

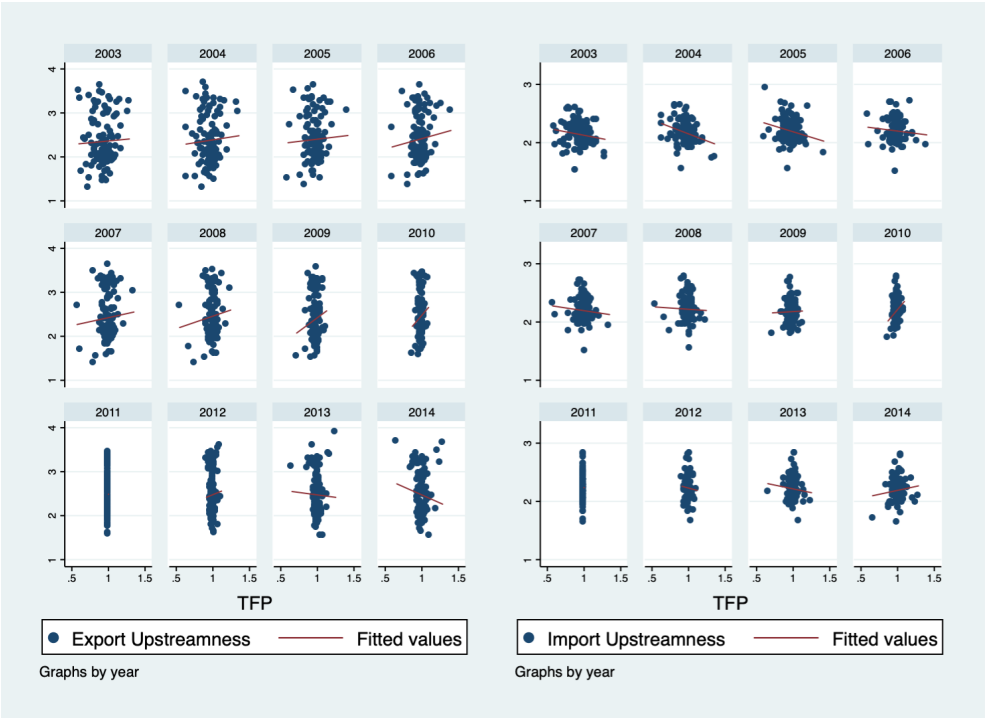

Figure 18: The Correlation between export-import upstreamness and TFP varying across different years

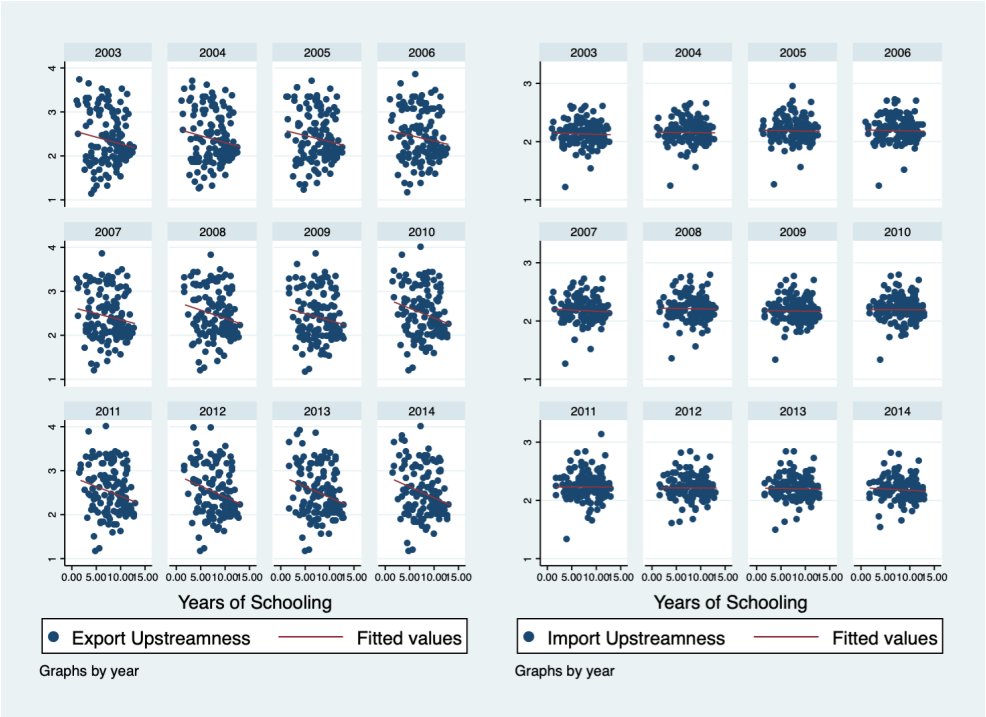

Figure 19: The Correlation between export-import upstreamness and Years of Schooling varying across different years

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Economics.

Assist. Prof. Dr. Fitnat Banu Pakel
Supervisor

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Economics.

Assist. Prof. Dr. Şaziye Pelin Akyol
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Assist. Prof. Dr. Seda Köymen Özer
Examining Committee Member

Approval of the Graduate School of Economics and Social Sciences

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Prof. Dr. Halime Demirkan
Director