

Productivity and Profitability Gains of the Top Turkish Industrial Enterprises from Global Value Chains Participation

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Abstract

We first calculate the global value chains (GVCs) participation indices from the Full Eora data of the Eora Global Supply Chain Database by employing advanced calculations methodologies. Then, we examine the productivity and profitability effects of various GVC participation measures by using the dataset on top 1000 Turkish industrial enterprises. We use OLS and fixed effects estimates in our analysis. Our estimations indicate that while backward GVC participation lowers both labor productivity and profitability growth, forward GVC participation promotes both. Moreover, simple and complex backward participation have similarly negative effects on productivity and profitability growth, simple and complex forward participation have the completely opposite effects though.

1 Introduction

We think that global value chains potentially offer a lot to Turkish firms as an emerging market economy with a favorable geographic location, industrial base, and demographic structure. It is a well-established fact that global value chains have strong regional characteristics. Turkey, a bridge between the Europe and Asia, is a part of European factory or hub. Additionally, Turkey has a relatively younger population and competitive labor costs. Therefore, Turkey has a great potential to benefit from global value chains. However, GVC participation in Turkey seems to be lower when compared to similar emerging market countries such as Poland (De Backer and Miroudot, 2013; Ziemann and Guerard, 2016). When firms join GVCs, which naturally raises up inquiries about the relationship between firm performance and GVC participation of firms. Surprisingly, this essential issue remains largely unexplored up to date.

Using data on top 1000-Turkish industrial firms for the period of 1993-2015 (ICI, 2020), our study evaluates the effects of GVC participation measures on firm productivity and profitability and contributes to the existing literature in some important dimensions. First, we investigate both the firm productivity and profitability effects of GVC participation. To the best of our knowledge, no previous study has yet examined the profitability effects of GVC for firms. Second, in addition to overall backward and forward GVC participation rates, we also calculate and utilize simple and complex GVC measures in our estimations.

Our estimations reveal that there is a clear difference between the productivity and profitability effects of backward and forward participation measures for Turkish firms. It seems that backward GVC participation depresses productivity and profitability growth, forward participation fails to raise productivity but boosts the profitability growth. Simple and complex backward participations have uniform effects on productivity and profitability, simple and complex forward participations have differing effects though.

The remaining parts of this study are structured as follows. We review the literature in the section 2, explain our methodology, specification, and data in the section 3, present and discuss empirical results in the section 4, finally conclude in the section 5.

2 Literature Review

There is no doubt that advancements in technology, communication and transportation have played a critical role in the surge in GVCs (Amador and Cabral, 2016). Unlike in the past, firms would produce or carry out tasks in which they are the most productive. Instead of producing everything on their own or from inception to final stage, they just specialize in certain activities or tasks while offshoring or outsourcing the others.

Joining a value chain would affect the productivity and profitability through several channels, such as a finer division of labor and hyper specialization, higher quality, and greater variety of more competitively priced foreign inputs, learning by exporting, knowledge spillovers and technology transfers (Baldwin and Yan, 2016; Criscuolo and Timmis, 2017; Constantinescu et al, 2019; Ignatenko et al., 2019). First and arguably most importantly, GVCs enable firms to specialize in the core tasks, components, and parts in which they are more productive while offshoring/outsourcing the others (Grossman and Rossi-Hansberg, 2008; Jangam, 2020), implying a dynamic resource reallocation. Second, accessing to higher quality and greater variety of foreign inputs with lower prices than domestically available ones would lead to positive externalities and lower cost. Third, GVC firms would benefit from learning by exporting (Baldwin and Yan, 2016; Benkovskis et al., 2020). Fourth, compared to traditional international trade, GVCs considerably facilitate and encourage the knowledge and technology transfer

among participant firms along the value chain (Criscuolo and Timmis, 2017; Benkovskis et al., 2020; Banh et al. 2020).

However, benefitting from these positive effects probably depend on some key conditions, including firm capabilities, types of governance, export and import destinations, the characteristics of products, and even the position in the value chain (Agostino et al., 2015; Baldwin and Yan, 2016; Criscuolo and Timmis, 2017; Brancati et al., 2017; Banh et al., 2020; Benkovskis et al., 2020).

Having examined the relationship between productivity and participation in GVCs, we now turn to the profitability effects. Despite a close relation between productivity and profitability, we should first note that what matters most for firms is the profitability (Wagner, 2012; Grazi, 2012; Van den Berg et al, 2018). As succinctly put by Kowalski et al. (2015) firms engage in GVCs to make profits. Although international traders are more productive than non-traders, they also incur some extra costs to sell or buy abroad, such as doing market research, re-designing products, finding local partners, adopting different standards and regulations, paying higher wages (Wagner, 2012).

More interestingly, to the best of our knowledge, no previous study has yet examined the possible impacts of GVC participation on firm profits. However, there are some studies investigating the profitability effects of exports and imports. For example, Fryges and Wagner (2010) find a positive, but rather small, relationship between exporting and profitability for German manufacturing firms. In contrast, Lu and Bemish (2006) suggest that exporting activity has a negative effect on profitability for Japanese firms. Along these lines, Wagner (2012) reports the absence of any significant effects of international trade activities, including exports, imports, and two-way trades, on profits for German firms.

3 Data and Methodology

We employ a firm level data from the Turkey's both first and second top 500 industrial enterprises (ICI, 2020). We have actually 2,233 firms considered on the top 1000 list for the period from 1993 to 2015. If we run the regressions for the firms stayed on the list at least five years, we then end up with 1,418 firms. These two sets of regressions produce very similar results. These estimates not reported here but available upon request. Data for the first top 500 is available for the years between 1993 and 2019 and the second top 500 list is available for the years 1997 and 2019. We then combine these two datasets and obtain a firm-level panel data of top 1000 industrial enterprises. While the share of these top 1000 list firms in total industrial value added in 2015 is over 20 percent (ICI (2017a, 2017b)), their share in the total Turkish exports is over 40 percent. Thus, working with a comprehensive sample has specific significance to understand the dynamics of Turkish firms participating in value chains.

We employ the following estimation model to evaluate, based on the review of the literature such as the following.

$$y_{it} = \alpha_0 + \alpha_1 L.y_{it} + \alpha_2 Capital_Adequacy_{it} + \alpha_3 Export_{it} + \alpha_4 Foreign\ share_{it} + \alpha_5 Firm_size_{it} + \alpha_6 Public\ share_{it} + \alpha_7 GVC\ Participation_{st} + \varepsilon_{it}$$

where i refers to a firm, s sector, and t year. The dependent variable is the logarithm of labor productivity or returns on total assets. The former measure is calculated as a ratio of real gross value added to the number of employees and the latter is the ratio of before tax profits to total assets. By following the empirical literature reviewed above, we also utilize capital adequacy, firm size, export share, origin of firm ownership, and public share as explanatory variables. Capital adequacy is the ratio of total equities to total assets. Firm size is proxied by the natural logarithm of real assets. Export is measured as the share of exports in net firm sales and since data on exports are in US dollars, we employ exchange rates from the Turkish Central Bank. Foreign share represents the share of foreign ownership. Public share shows the percentage of a firm owned by the government. Otherwise indicated, all measures are taken from the first and second Top 500 data of Istanbul Chamber of Industry (ICI) (This data is well-known as ISO500 and ISO1000 data).

We calculate GVC participation indices from the Full Eora data of the Eora Global Supply Chain Database (Lenzen et al. (2012, 2013)). The University of International Business and Economics Global Value Chain Indicators (UIBE GVC Indicators) Database (UIBE, 2021) already have the required codes for the calculation of GVC participation indices according to Wang et al. (2017) for various input-output databases. We adopt and modify these codes for the calculation of GVC participation indices from the Full Eora input-output tables. Full Eora is a distinguished database including input-output table for each year. Each table consists of large matrices of transaction (14838 x 14838), final demand (14838 x 1134) and value added (6 x 14838). To calculate indices for a country is not possible without calculation of indices for all countries. Thus, we first calculate sectoral GVC participation indices for 189 countries, then just employ indices of Turkey in our empirical analysis. We then calculate country-sector level both backward and forward GVC participation indices with their simple and complex sub-indices for each year from 1990 to 2015. Although our firm level data range from 1993 to 2019, participation indices can only be calculated from 1990 to 2015 due to the available IO tables.

Variables	# of obs	Mean
Labor productivity (in thousands)	14.935	70,081
Capital adequacy, %	14.884	0,413
Firm (assets) size (in logs)	14.935	18,064
Export share, %	14.935	0,323
Foreign share, %	14.935	0,118
Public share, %	14.935	0,027
Backward participation, %	14.935	0,256
Simple backward participation, %	14.935	0,140
Complex backward participation, %	14.935	0,116
Forward participation, %	14.935	0,197
Simple forward participation, %	14.935	0,106
Complex forward participation, %	14.935	0,092

Table 1. Summary Statistics

NACERev2	ISICRev2	Full EORA Industry
5	210	Mining of coal and lignite
6	210	Extraction of crude petroleum and natural gas
7	210	Mining of metal ores
8	210	Other mining and quarrying
10	311	Manufacture of food products and beverages
10	312	
11	313	
12	314	Manufacture of tobacco products
13	321	Manufacture of textiles
14	322	Manufacture of wearing apparel
15	323	Tanning and dressing of leather
15	324	
16	331	Manufacture of wood and of products of wood and cork, except furniture
17	341	Manufacture of pulp, paper and paper products
18	342	Publishing, printing and reproduction of recorded media
19	353	Manufacture of coke, refined petroleum products and nuclear fuels
-	354	
20	351	Manufacture of chemicals and chemical products
20	352	
21	352	
22	355	Manufacture of rubber and plastic products
22	356	
23	361	Manufacture of other non-metallic mineral products
23	362	
23	369	
24	371	Manufacture of basic metals
24	372	
25	381	Manufacture of fabricated metal products, except machinery and equipment
32	390	
32.1	390	
32.9	390	
28	382	
33	382	Manufacture of machinery and equipment n.e.c.
26	382	Manufacture of office machinery and computers
26	383	
26	385	
27	383	Manufacture of electrical machinery and apparatus n.e.c.
29	332	Manufacture of motor vehicles, trailers and semi-trailers
29	384	
30	384	Manufacture of other transport equipment
31	332	Manufacture of furniture
35	400	Electricity, gas, steam and hot water supply

Notes: This sector concordance table is prepared by authors according to Full Eora sectors for Turkey (Lenzen et al (2012 and 2013)) and ISO first and second Top 500 data (ICI 2020b).

Table 2. Industry Matching Strategy for ISO1000 and Full EORA

These two indices show the allocation of the factor contents among pure domestic activities without international trade, traditional trade just involving the trade of final goods, simple GVC activities and complex GVC activities. The main difference between simple and complex GVC activities is that intermediate goods just cross the borders once in simple GVC activities and more than once for complex GVC activities. Note that as shown in the Appendix I, through Industry Matching Strategy for the ISO1000 and Full EORA, we are able to match 25 sectors for each and every firm in our sample. Note that since we don't have firm level participation indices, indices employed for 25 sectors here are sectoral averages. Actually, without global scale firm level input-output tables (not available yet) it is not possible to calculate firm level versions of such advanced GVC participation indices. Given that almost half of the total country exports are undertaken by these firms, we thus expect that our sectoral indices can be a good approximation of firm level indices.

In Table 1, we provide the summary statistics for the variables used in empirical part of the study. Turkish firms have relatively higher backward participation compared to forward participation.

We estimate the equation above with OLS and fixed effects estimates for the full sample. We actually utilize the weighted OLS and fixed effects estimations to cope with the variation in the firm size as explained below. Moreover, Table 2 gives our industry concordance strategy.

4 Empirical Results and Discussion

4.1 Labor Productivity

Our baseline estimations on the labor productivity effects of GVC participations are reported in Table 3. The first two columns report the unweighted OLS estimates and the columns 3 and 4 show the unweighted fixed effects estimates. As expected, the estimates at the first four columns indicate that firms with more capital and larger asset size enjoy higher productivity growth. Surprisingly, exports seem to have a negative effect on productivity. While public share doesn't exert any significant effect, foreign share is significant only for the OLS estimates. For participation indices we obtain similar results for both OLS and fixed effects estimates.

Since we have an estimation sample consisting of very large firms alongside with relatively small firms, we then estimate our regressions where firms are weighted by their share in total sectoral value added. Our weighted regressions are also shown in the last six columns of Table 3. While our estimates for GVC participation substantially differ for backward and forward participation, weighted estimates are qualitatively the same for unweighted regressions for other explanatory variables. Although backward participation seems to have positive coefficients for the unweighted regressions, the weighted regressions show that backward participation reduces the firm productivity growth. The estimated coefficient at the 7th column implies that a one percent increase in backward GVC participation leads to over 3 percent decline in labor productivity growth. The negative effect from the weighted OLS estimates for forward participation disappears with the fixed effects with weighed firms though. Note that from now on we rely on the fixed effects estimates with weighted firms.

	OLS		Fixed Effects		OLS		Fixed Effects			
	Unweighted estimates				Weighted estimates					
	1	2	3	4	5	6	7	8	9	10
Capital adequacy	0.783*** (29.56)	0.783*** (29.57)	0.767*** (14.30)	0.764*** (14.23)	0.382*** (15.35)	0.405*** (15.88)	0.511*** (7.324)	0.538*** (7.664)	0.506*** (7.241)	0.523*** (7.516)
Firm size	0.196*** (31.24)	0.196*** (31.24)	0.297*** (17.80)	0.298*** (17.84)	0.161*** (29.05)	0.147*** (26.05)	0.330*** (10.80)	0.342*** (10.55)	0.327*** (10.95)	0.304*** (10.09)
Exports	-0.270*** (-10.52)	-0.270*** (-10.55)	-0.129*** (-2.622)	-0.118** (-2.414)	-0.400*** (-14.98)	-0.373*** (-13.65)	-0.464*** (-5.327)	-0.493*** (-5.669)	-0.486*** (-5.611)	-0.452*** (-5.503)
Foreign share	0.302*** (12.69)	0.302*** (12.68)	-0.0143 (-0.318)	-0.0137 (-0.306)	0.492*** (24.02)	0.462*** (22.04)	-0.0330 (-0.653)	-0.0479 (-0.976)	-0.0265 (-0.506)	-0.0538 (-1.048)
Public share	-0.172 (-0.983)	-0.170 (-0.972)	-0.241 (-1.188)	-0.247 (-1.216)	-0.101 (-1.434)	0.478*** (6.891)	-0.0312 (-0.157)	-0.0237 (-0.117)	-0.0131 (-0.0679)	0.0122 (0.0671)
Backward participation	0.0922 (0.212)		1.128** (2.396)		-7.009*** (-27.97)		-3.606*** (-5.682)			
Forward participation		0.294 (0.563)		0.482 (0.981)		-3.001*** (-8.287)		0.806 (0.960)		
Simple backward participation									-4.636*** (-5.081)	
Complex backward participation									-2.618*** (-3.298)	
Simple forward participation										2.699*** (3.334)
Complex forward participation										-1.614** (-1.974)
Observations	14,539	14,539	14,539	14,539	14,539	14,539	14,539	14,539	14,539	14,539
R-squared	0.415	0.415	0.714	0.714	0.781	0.771	0.932	0.931	0.933	0.933

Notes: Year, sector, and location(provincial) dummies are included in all specifications but not reported here. Constant terms are not reported. t statistics in parentheses. ***, **, * Significant at the 1, 5, 10 percent-level, respectively. t-statistics are based on robust standard errors.

Table 3. Impact of GVC Participation on Labor Productivity Growth

The last two columns of Table 3 report the estimates for the disaggregated participation indices. Both simple and complex backward participation indices have very strong negative effect on labor productivity with the former having a larger effect. However, while simple forward participation promotes productivity growth, complex forward GVC participation reduces it. These results clearly demonstrate the importance of making a distinction between the simple and complex participation measures. Our results considerably differ from that of some previous studies such as Formai and Caffaraelli (2015), Constantinescu et al. (2019), Pahl and Timmer (2020), reporting a positive effect of backward GVC participation on the labor productivity.

High backward, but a low forward GVC participation index for Turkey indicates (see Table 1 and Figure 1) that Turkey has a relatively downstream position in GVCs. During the period considered in the study, although backward participation increases significantly, forward participation remains more stable in Turkey. Additionally, the forward/backward GVC participation ratio can be used as a measure of the position of country-sector in GVCs (WTO, 2019). One of the main characteristics of the downstream countries are the assembly of the intermediate goods for exporting as final goods to third countries (De Backer and Mirodout, 2013) and they cannot benefit more from the value added along the chains as upstream ones can. Forward GVC participation can be a good indicator for the gains from GVCs (see, Banga, 2013). However, this is not an automatic result and highly depend on how a country or a sector participate in GVCs. Although we find significant the positive impact of forward participation, this positive effects mainly come from the simple forward participation. Complex forward participation has significantly negative impacts. Simple GVC activities don't require complex networks of firms, since intermediate goods cross borders once. However, complex GVC activities mainly coordinated by lead firms include larger networks of firms. Benefiting from GVCs depends on whether a firm is lead firm or not, since leads firms may constrain other firms in terms of upgrading in the GVCs for sustaining their own competitiveness (Humphrey et al (2018), Yoruk (2019)).

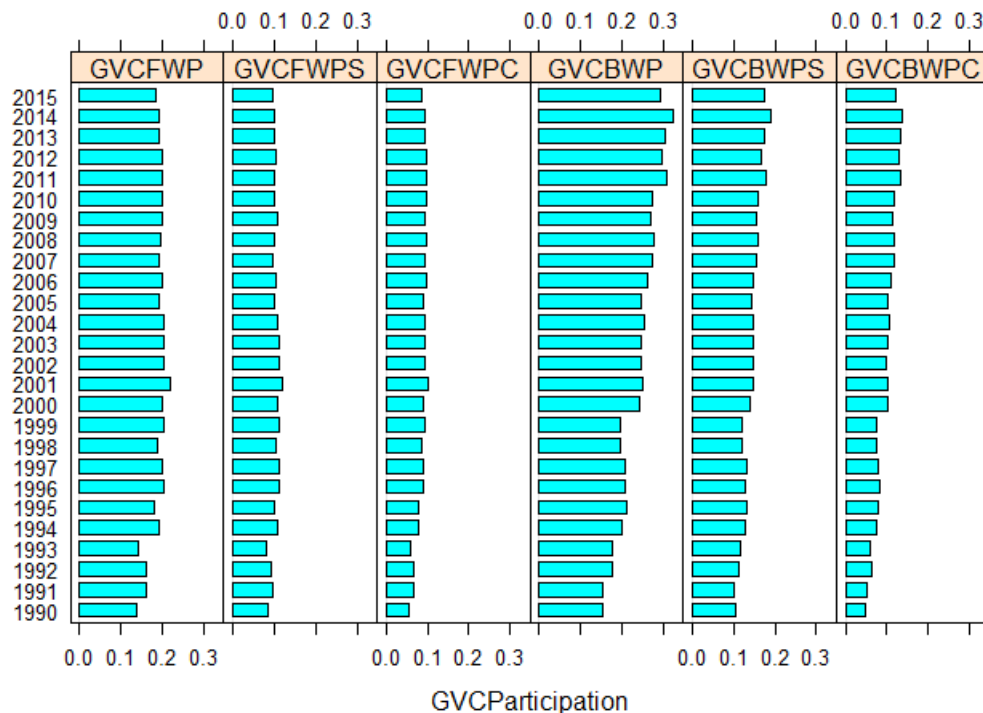


Figure 1. Annual GVC Participation Indices for Turkey

Moreover, simple backward participation is relatively higher compared to complex participation for Turkey (see, Figure 1). Therefore, our finding can be interpreted in the context of argument put forward by Pahl and Timmer (2020). They argue that if countries are buyers of sophisticated intermediate goods, then they can benefit more from backward GVC participation. However, if countries participate in GVCs as upstream suppliers they would enjoy less from backward participation but possibly more from forward participation. We think that this argument would be helpful in explaining our negative productivity growth effects of backward GVC participation for Turkey. For example, based on the normalized scores, hi-tech import of Turkey is well below that of some Asian countries such as China, Thailand, or Vietnam (WDI, 2020), important participants of GVC trade. This roughly implies that Turkey's engagement as buyers of sophisticated intermediates goods is rather limited. Similarly, hi-tech export of Turkey is just around 3 percent of total manufactured exports for a long time. Moreover, it is a well-known argument that the effects of GVC participation depend on some other conditions, such as absorptive and firm capabilities (Agostino et al., 2015; Criscuolo and Timmis, 2017; Banh et al., 2020; Benkovskis et al., 2020). Our

results also imply the presence of some obstacles or structural problems which prevent Turkish firms gaining from positive productivity effects of backward GVC participation.

4.2 Firm Profitability

Having presented and discussed the results regarding labor productivity effects of GVC participation, we can now turn to the profitability growth. Table 4 presents our OLS and fixed estimations for both unweighted and weighted firms. Similar to the productivity estimates, employing weighted fixed effects estimations produces very interesting results especially for backward participations. Our estimates at the 7th column imply that backward GVC participation substantially reduces profitability growth for all firms. This particular result confirms the close relationship between productivity and profitability growth. However, neither simple nor complex GVC participation exert a significant impact (the 9th column). In contrast, forward GVC participation significantly raises firm profitability, driven mainly by the simple forward participation. Considering the 10th columns of both Table 3 and Table 4, our estimates clearly show that simple forward participation promotes both productivity and profitability. These results are consistent with the literature as reviewed above. Once again, our results obviously underline the importance of distinguishing between backward and forward GVC participations.

These results are not surprising when considering the ambiguity on the empirical relationship between international trade and firm profitability (Wagner, 2012; Van den Berg et al., 2018). This adverse profitability effect of backward participation is critical because backward participation in Turkey almost doubles in percentage terms from 1990 to 2015. An increase in forward participation is relatively limited (almost 30 percent) though (see, Figure 1). Note that capital adequacy and asset size positively while exports negatively affect the firm profitability in most specifications. Negative effect of export on profitability is consistent with that of Aksoy and Kandil Göker (2020).

	OLS		Fixed Effects		OLS		Fixed Effects			
	Unweighted estimates				Weighted estimates					
	1	2	3	4	5	6	7	8	9	10
Capital adequacy	0.300*** (67.18)	0.300*** (67.23)	0.339*** (16.38)	0.339*** (16.40)	0.294*** (63.60)	0.294*** (63.80)	0.317*** (16.35)	0.320*** (16.41)	0.317*** (16.42)	0.319*** (16.39)
Firm size	-0.0099*** (-9.254)	-0.0099*** (-9.248)	0.0123*** (3.145)	0.0121*** (3.095)	-0.00121 (-1.407)	-0.00129 (-1.504)	*	*	*	*
Exports	0.0203*** (4.619)	0.0206*** (4.697)	-0.00351 (-0.376)	-0.00541 (-0.585)	-0.0111*** (-2.661)	-0.0113*** (-2.726)	*	*	*	*
Foreign share	0.0122*** (2.960)	0.0123*** (2.965)	-0.0178** (-2.007)	-0.0178** (-2.008)	0.0216*** (6.730)	0.0205*** (6.429)	-0.00602 (-0.498)	-0.00886 (-0.762)	-0.00577 (-0.480)	-0.00908 (-0.778)
Public share	-0.0551* (-1.858)	-0.0573* (-1.932)	-0.00749 (-0.217)	-0.00574 (-0.166)	-0.0610*** (-5.591)	-0.0490*** (-4.677)	-0.0483 (-0.757)	-0.0396 (-0.675)	-0.0476 (-0.762)	-0.0384 (-0.666)
Backward participation	-0.00195 (-0.0260)		-0.152* (-1.790)		0.0881** (2.272)		-0.334** (-2.185)			
Forward participation		-0.217** (-2.380)		0.0410 (0.339)		0.452*** (8.252)		0.418** (1.961)		
Simple backward participation									-0.372 (-1.633)	
Complex backward participation									-0.297 (-1.409)	
Simple forward participation										0.490** (2.149)
Complex forward participation										0.325 (1.579)
Observations	14,924	14,924	14,924	14,924	14,525	14,525	14,525	14,525	14,525	14,525
R-squared	0.319	0.319	0.604	0.604	0.403	0.406	0.685	0.686	0.685	0.686

See notes to Table 3.

Table 4. Impact of GVC Participation on Profitability Growth

5 Conclusion

Using the data for the top 1000 Turkish industrial firms with sectoral GVC measures, we examine the firm productivity and profitability effects of various GVC participation indices. Our weighted fixed effects estimates suggest that backward GVC participation reduces productivity growth of Turkish firms. This is also valid when we consider the two subcategories of backward participation. However, while forward GVC participation is not significantly associated with productivity growth, simple (complex) forward participation leads to a higher (lower) productivity growth.

As for the profitability growth impacts, there is a significant difference between backward and forward GVC participations. More precisely, while backward participation depresses the profitability growth, forward participation raises it, which is largely driven by the simple forward participation.

What do our main empirical findings suggest and imply? First, making a distinction between backward and forward GVC participation matters for productivity and profitability effects. Therefore, focusing on a single or total GVC measure and ignoring the distinction between backward and forward GVC participation would lead to crucially misleading results. Additionally, it is important to distinguish between simple and complex GVC participation measures as well. Second, similar to productivity effects, backward GVC participation is associated with lower profitability growth, suggesting a close link between profitability and productivity effects. Contrary to the first impression, this result is not inconsistent with the stylized effects of international trade and the empirical literature reviewed above. Which factors prevent Turkish firms benefitting from especially backward GVC participation? What do we expect from the latest COVID crisis regarding GVC and non-GVC trade? Doubtlessly, these questions deserve further empirical attention.

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