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Global Value Chains Participation and Productivity Gains for North African Firms

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Abstract

This paper analyzes the participation of North African countries and firms into Global Value Chains (GVCs) and its implications for competitiveness. First it shows that North African countries are not (yet) fully integrated into international production networks, although large part of their (low) trade is due to value added related upstream activities, and the importance of global linkages has been increasing over time. Then, it empirically investigates if and how the performance of North African firms is affected by GVC participation. We find that firms that have had access to international supply chains perform better, showing further productivity gains over time. The ability to get such improvements however relies on specific characteristics, such as an adequate level of quality and compliance with international standards, along with specialized skills. Policies designed to support the latter represent then an important tool for linking developing countries to global production and trade, with possible positive consequences on their economic development.

Keywords: global value chains, firm heterogeneity, North Africa, productivity.

JEL codes: F14, F15, L23, L25, 055.

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1 Introduction

In the last two decades technological progress, a sharp decrease in trade barriers, transportation and information costs has changed the way goods and services are produced and exchanged. The emergence of the international fragmentation of production is rooted in the "unbundling" of different stages of production, previously performed in close proximity, to a global level (Johnson and Noguera, 2012). The analysis of international trade is increasingly paying attention to Global Value Chains (GVCs), a concept that encompasses the full range of activities required to bring a good or service to the final consumer, from the product design to the distribution (Cattaneo et al., 2010). GVCs entail a vertical fragmentation of production process: parts and components are produced in different countries by different firms, integrated or not within a company's corporate boundary, and then assembled either sequentially along the chain or in a final location (Del Prete and Rungi, 2015). The resulting production networks are highly complex, spanning from manufacturing activities to logistics and transportation, as well as customs agents and other services (Baldwin and Venables, 2013). Given the complexity of these relations in the exchange of customized inputs, especially in developing countries the compliance with international standards has become a *sine qua non* for entry into globalized production networks (Nadvi, 2008).

Against this background, countries are no longer the single frame of analysis. In order to assess a country's degree of competitiveness and the impact of economic policies, it is crucial to take into account also the firm-level cross-border dimension of production processes. Firms do not necessarily need to develop the domestic capacity to perform all major production steps nor possess the expertise to export, as can focus on specific tasks and support the value chain as suppliers of intermediate inputs or subcontractors, even several levels down from the ultimate buyer (Humphrey and Schmitz, 2002). Participation in a supply chain and cooperation within a network of upstream and downstream partners can enhance a firm's information flows and learning possibilities, introduce new business practices and more advanced technology, in turn enhancing growth. Hence, the reallocation of resources from less productive activities to new and more connected ones is now crucial to the success of a country.

Since the '90s, several countries, especially in Asia, have been able to exploit these opportunities and enter global production networks. China, for instance, has integrated into GVCs by firstly specializing in the activities of final good assembly and was then capable of upgrading its position by enhancing the competitiveness and quality of its intermediate goods (Marvasi, 2013). Contrary to Asia, and China in particular, North Africa (NA) has not been able so far to intercept the main changes in trade patterns nor enter massively into global markets. Despite a relatively good geographic and logistic positioning, most North African firms have mainly remained "local", producing at home and for the domestic market. Their involvement in GVCs is still limited and mostly on low value added phases. But as China and other Asian countries move up the value chain, there is room for other countries to integrate, especially in labor intensive productions.

As far as we know, there are (few) successful examples of NA firms that have become key value chain suppliers. For instance, Morocco is "a rear base for the French aerospace industry". All Airbus aircraft machineries delivered worldwide fly with parts manufactured by the Moroccan aeronautics industry, which employs 10,000 people and plans to double the number of companies in the sector by 2020 with 20,000 jobs into the bargain.[1] With 100% of its production aimed at exports, the Moroccan aeronautics sector includes nearly 100 companies of international scope mainly involved in the production of cables and wires, electronics components, and technical plastic parts (UNECA, 2016). EADS, Boeing, Safran, Ratier Figeac and, more recently, Eaton and Hexcel, are all present in Morocco. Given the high skills required in the aeronautic industry, the development of a value chain in the sector can have very interesting long run consequences and bring substantial benefits to the country.

The Moroccan garment industry is also a key supplier for fast fashion supply chains, such as Zara, thanks mainly to its proximity to the European market. The latter is a crucial driver of fast supply chains because of the speed and responsiveness of suppliers to meet changes in demand effectively.

[1] These numbers appeared in the news in 2015. See, for instance, the article "Morocco's fledgling aeronautics sector spreads its wings" published on the Financial Times, November 23.

The Moroccan textile industry association has also been able to create over time a sector-led code of conduct and social label called Fibre Citoyenne, which the fashion retailers find attractive, leading to a successful upgrade into global fashion value chains. Their workers shared in the gains from economic upgrading, improving skills and benefiting from measurably improved standards (AfDB et al., 2014).

Three other Moroccan industries are involved in international production networks. The automotive sector, which has been able to join the Renault-Nissan value chain in 2012, provides an annual production capacity of 340,000 vehicles, 90% of which are intended for export, in particular to Europe. Thanks to savings achieved through lower logistics costs it then resulted in a policy of local integration. Second, the phosphate industry, that has positioned itself in all parts of the value chain from the production of fertilizer to that of phosphoric acid as well as derivative products. And finally, the food sector, where the wheat value chain is key to the country's food security.

If Morocco is at the forefront, also Egypt is an interesting case to single out. Thanks to its important logistical position in the region due the Suez Canal, Egypt's textiles sector is engaged in the full range of GVC related activities – from cotton cultivation to production of fabrics and ready-made wear – thus creating about 30% of manufacturing job opportunities (UNECA, 2016). Also, in the information and communication technology (ICT) sector, Vodafone, Orange, Microsoft, Intel and Oracle have set up operations in the country that serve their global clients (AfDB et al., 2014). Traditional IT Services (ITS), such as software installation and testing and IT Enabled Services (ITES), such as call centers, are among the most common activities of local SMEs. The call centers industry in particular, covers from very simple to complex operations, such as marketing, sales, and business and information technology (IT) consulting.

This anecdotal evidence suggests that North Africa integration into the global economy can in principle lead to positive developments for firms, countries and the whole area, as outlined also by Smith (2015). However, building on few case studies may be misleading, as GVC participation may advantage only few specific firms and industries, while others may risk marginalization or even exclusion.

Against this background, this paper investigates empirically if and to what extent GVC participation is boosting the local competitiveness. To the best of our knowledge, we are the first to provide an empirical micro-level assessment of North Africa GVC involvement and its role in driving firms' productivity. To this aim, we make use of the World Bank Enterprise panel surveys to perform an impact evaluation analysis. Our findings point to a productivity premium for firms that have been able to access international supply chains. Nevertheless, the ability to get such gains relies on specific characteristics, such as an adequate level of quality and reliability, typically guaranteed by internationally recognized certifications, along with specialized skills.

The paper first looks at some stylized facts and describes North African countries' GVC participation (Section 2). Using Eora multi-regional Input-Output tables, we show that NA countries are not (yet) fully integrated into international production networks, although large part of their (low) trade is due to value added related upstream activities, and the importance of global linkages has been increasing over time. This is also the first attempt to directly focus on NA at a macro-level, due to lack of data from multi-region Input-Output tables used so far (e.g. WIOD and TiVA among others).[2]

Then, Sections 3 and 4 investigate empirically the relationship between international activities and firm-level productivity, employing a pooled OLS regression analysis and a propensity score Diff-in-Diff approach respectively. Finally, Conclusions provide a joint reading of the micro and macro evidences and discuss possible policies to enhance competitiveness.

[2] The analysis is performed on the years before the beginning of both the Great Recession and Arab Spring. The macro analysis refers to the period 1995-2007, while the firm-level analysis is applied to a 2004-2007 panel of North African firms. Two main reasons motivate the choice of the period beside data availability. The first concerns macroeconomic conditions: studying the pre-2007 period keeps the possible shocks of the Great Recession out of the analysis. The second reason is idiosyncratic to North Africa, as the more recent years have been characterized by political instability and turmoil following the Arab Spring. While investigating the economic effects of those extreme events is of primary interest, this goes beyond the scope of this paper and is left for future research.

2 Stylized facts on GVCs in North Africa

As different stages of the same production process are now likely to be allocated to different countries, intermediate inputs cross borders multiple times and are then counted each time by gross trade flows. As a result, conventional trade statistics become increasingly misleading as a measure of value produced by any particular country. However, recent improvements in Input-Output (I-O) metrics allow us to measure the sources and destinations of value-added trade (Koopman et al., 2010).

In this section, we analyze the GVC participation and position of NA countries. We derive value added trade data from the Eora global multi-region I-O (MRIO) table, that brings together a variety of primary data sources including national I-O tables and main aggregates data from national statistical offices and combines these primary data sources into a balanced global MRIO, using interpolation and estimation in some places. It provides a contiguous, continuous dataset for the period 1990-2013 on 49 African countries and 25 harmonized ISIC-type sectors (Lenzen et al., 2012, 2013).[3]

In order to identify the different value added components of which gross export flows are composed and the resulting GVC participation and position metrics, we rely on the Koopman et al. (2010) decomposition. The foreign value added share (FVA) indicates the share of a country's exports that consist of inputs produced in other countries, the so-called backward integration, and thus does not add to the GDP of the country of interest. It is therefore likely to be higher if a country is involved in downstream production processes. The 'indirect value added exports' share (DVX), is the share of a country's value added exports embodied as intermediate inputs in other countries' exports (i.e. forward integration), and it represents the contribution of the domestic sector to the exports of other countries, thus indicating the extent of GVC participation for relatively upstream sectors. The analysis of backward (FVA) and forward integration (DVX) provides a comprehensive description of GVC participation and position of a particular country/area.[4] While in developed countries upstream stages are usually associated with the production of knowledge assets at the beginning of the value chain and most of the value added is in fact created in those stages, in developing countries, where rates of innovation tend to be lower, the upstream stages are more likely associated with the production of raw materials and other basic inputs, which may have little scope for upgrading (Foster-McGregor et al., 2015).

Figure 1[5] presents the GVC participation, i.e. the sum of FVA and DVX components, and its evolution over time (1995 and 2007), for some main countries/areas (Figure 1a), and North African countries (Figure 1b). The fact that advanced[6] and ASEAN countries are heavily integrated in GVCs is hardly surprising. What is more interesting, and in line with the results of Foster-McGregor et al. (2015) and Del Prete et al. (2016), is that North Africa has some of the highest rates of GVC partici-

[3] To validate our database, we can rely on few references since, to the best of our knowledge, there is no similar database covering input-output data for 187 countries around the world. Hence, we employ the above methodology to compute the FVA component from the World Input Output Database (WIOD) and we retrieve the same figure directly from the OECD-WTO Trade in Value Added (TiVA) database (Timmer et al., 2015; OECD and WTO, 2012). The correlations between the 1995 foreign value added share, as computed from the EORA and matched against the same country figures provided by WIOD and TiVA are respectively .88 and .76.

[4] For more details on this procedure applied to North African countries see Del Prete et al. (2016).

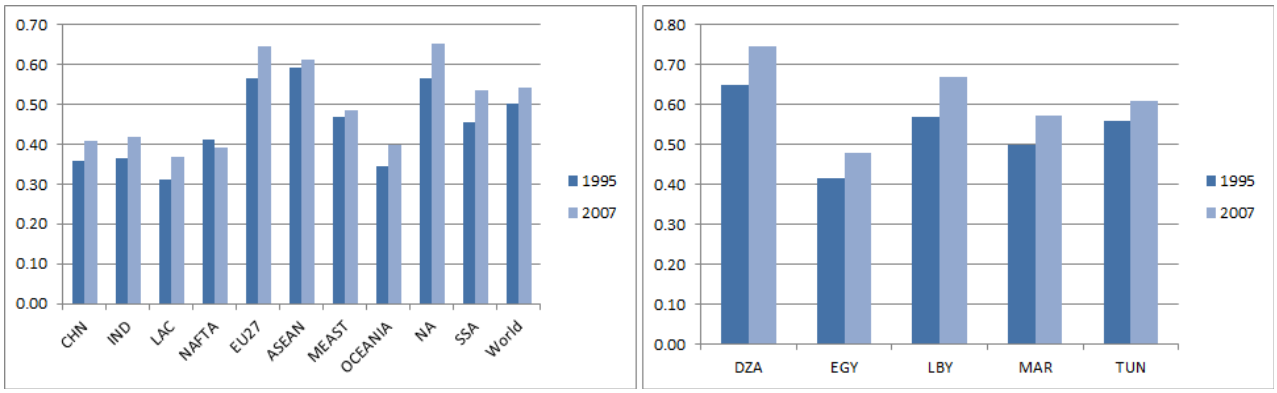
[5] In the following figures, CHN stands for China; IND: India; LAC encompasses Argentina, Guyana, Chile, Suriname, Bolivia, Ecuador, Colombia, Brazil, Uruguay, Paraguay, Peru and Venezuela; NAFTA: Mexico, USA and Canada; EU27: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Sierra Leone, Slovakia, Spain, Sweden and UK; ASEAN: Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand and Viet Nam; MEAST: Bahrain, Cyprus, Egypt, Gaza Strip, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syria, Turkey, UAE and Yemen; OCEANIA: Australia, Fiji, New Zealand, Papua New Guinea, Samoa and Vanuatu; NA: Algeria (DZA), Egypt (EGY), Libya (LBY), Morocco (MAR) and Tunisia (TUN); SSA: Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Congo, Cote d'Ivoire, DR Congo, Djibouti, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, Swaziland, Tanzania, Togo, Uganda, Zambia and Zimbabwe.

[6] Note that considering the individual countries separately, we are likely to inflate the extent of GVC participation of the EU27 relative to other large single countries, such as the China and India.

pation, matching the levels found in Europe (65% in 2007). In particular, Algeria presents the highest GVC participation rate, followed by Libya and Tunisia, respectively with 74%, 67% and 61% rates.

Further, the same Figure indicates that the fragmentation of production activities has been increasing in most regions, from around 50% to 54% worldwide. In NA the growth rate of GVC participation increased almost twice (14% vs 8% over the period 1995-2007) (Figure 1a). Figure 1b details the differences between NA countries and shows that, in the same period, Libya GVC participation grew by 17%, while that of Algeria and Morocco by 14%.

Figure 1: GVC participation

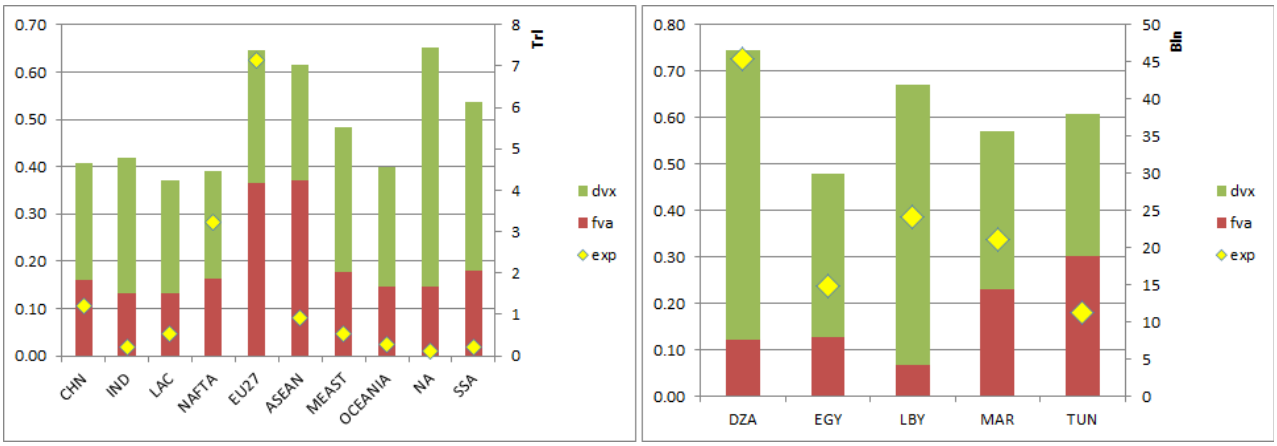


Source: Authors' elaboration based on Eora.

In order to better understand the relative involvement into global production networks, Figure 2 plots the 2007 GVC participation into its two components (FVA and DVX), together with export volumes.

Not surprisingly, the exports are mainly concentrated in developed countries (in 2007, EU exports about 7 trillion USD which corresponds to a 42% world export share and NAFTA 19%) and China 7%. With a share of less than 1% of world export, NA plays a very marginal role in world trade. Turning to the individual NA countries figure, Algeria and Libya, given the composition of their production, biased towards energy, present the highest exports values, with about 45 bln and 25 bln of USD in 2007.

Figure 2: FVA, DVX and Exports in 2007



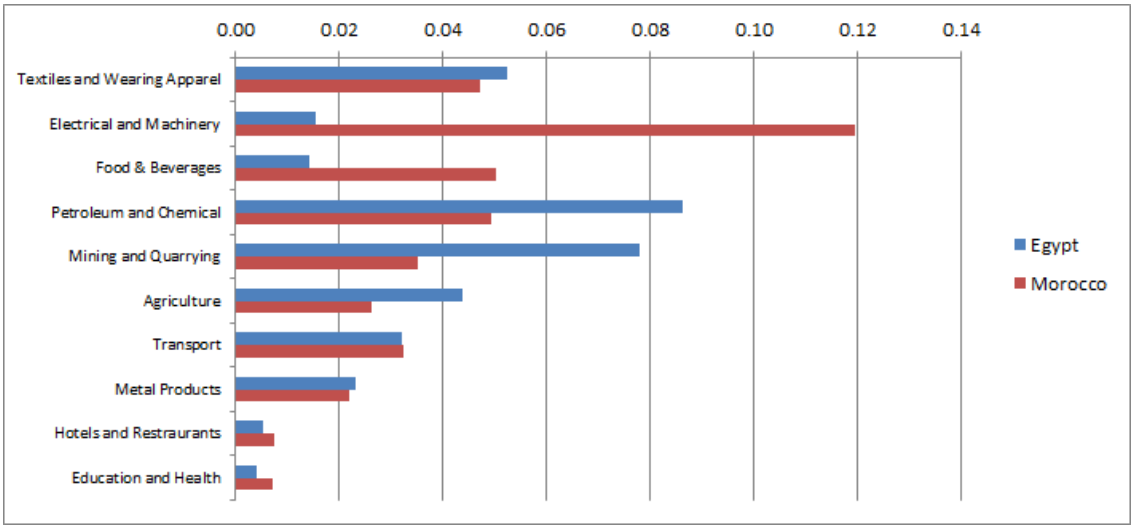
Source: Authors' elaboration based on Eora.

Then, looking at the different components of the total GVC participation, we can identify the position of each country/area along the chains. Advanced countries present higher level of backward participation (FVA) suggesting a relative downstream position (Figure 2a). In NA foreign value added was only 15% in 2007 (left axes). In the region, Tunisia (30%) and Morocco (23%) present the highest FVA (Figure 2b). These results suggest that along with other developing regions, North Africa has struggled to become increasingly engaged in downstream production within GVCs (Figure 2a). Developing countries tend to be relatively more involved in upstream production processes, e.g. natural resource and simple manufacturing. Indeed, in 2007 North Africa has the highest DVX share (50%).

The large values for the DVX variable combined with the relatively small values for the FVA variable in the case of NA further reinforces the view that much of its involvement in GVCs is in production stages further from final consumers.[7] However there is evidence of some country heterogeneity. As pointed out above, while Algeria and Libya follow this pattern, Morocco and Tunisia present a greater share of FVA in total GVC participation, 40% and 49% respectively, suggesting a slightly more downstream position (Figure 2a,b) where some potential to better integrate in higher value-added phases exists.

We finally compute the sectoral contributions to the measures of GVC participation described above for Morocco and Egypt. The sum across the sectors therefore equals the value of total GVC participation reported in Figure 1. Figure 3 shows the contribution of the first ten sectors according to their export volumes in 2007, to the involvement in GVCs as measured by the sum of FVA and DVX. In line with the anecdotal evidence reported above, the figure shows that the sectors of Petroleum and Chemicals, and Textiles and Apparel are among the most involved sectors in both countries. However, while Morocco presents high level of participation also in the Food & Beverages and Electrical and Machinery sectors, Egypt is relatively more involved into the Mining and Quarrying, and Agriculture sectors.

Figure 3: Morocco and Egypt sectoral GVC participation in 2007



Source: Authors' elaboration based on Eora.

To sum up, NA is still a very marginal player of global trade and has not yet been able to exploit the opportunities coming from the emergence of global production networks. But, while NA plays a secondary role for the actual volumes of exports at the world level, GVCs are found to be of primary importance for NA trade: participation in the international fragmentation of production has been

[7] The share of total GVC participation due to the DVX measure (50%), accounts for 77% of the involvement in 2007. This suggests the importance of forward integration in the region.

steadily increasing in the last decades and the share of NA exports due to value added trade is now in line with that of other major areas. The overall figure, however, hides an important fact: NA takes part in GVCs by contributing mainly to the upstream phases, being confined to low value added stages of production, with few exceptions. The exceptions, such as the aeronautic and automotive industry or the fashion value chains, are however worth being further investigated. The anecdotal evidence suggests that firms that managed to enter are doing relatively better than others.

3 Firms' involvement in GVCs

The recent literature on international trade and global value chains has shed light on the increasing importance of micro level analyses (among the others, Melitz (2003), Giuliani et al. (2005) and Waldkirch and Ofosu (2010)). In this section, exploiting the World Bank Enterprise Survey database we provide a firm level perspective on GVC participation and its effects on productivity. To this aim, we analyze a panel of 930 manufacturing firms in Egypt and Morocco active in the years 2004 and 2007.[8] The available surveys provide information on the characteristics of firms across various dimensions, including size, ownership, trading status and performance (World-Bank, 2016). Table 6, in the Table Appendix, reports the descriptive statistics.

The links between domestic and foreign firms, have different degrees of complexity. Importing, which can be considered as a 'simple' mode of internationalization, is among the most frequent activity in our sample, as 18% of firms buy products from abroad, i.e. about 87% of international traders. Interestingly, the share of two-way traders (21%) is larger than that of pure exporters (only 6%), suggesting that firms may be indeed involved in complex fragmented activities.[9] Since production processes can be sliced into single tasks, firms can easily specialize in a particular stage of the production and internationalize despite, for instance, being small. Agostino et al. (2015) and Giovannetti et al. (2015) argue that the productivity and competitiveness of small and medium firms may be fostered by joining international supply chains. Participation in supply chains, in turn, provides incentives and opportunities to upgrade their technical capabilities. There is a growing debate on the role and the upgrading processes of the intermediate firms (Gereffi, 1994; Alcacer and Oxley, 2014). Applied studies and anecdotal evidence agree that certifications play an important role as they guarantee and signal the ability of the firm to meet the international standards typically required by the leading firms of developed countries and often necessary for the coordination of vertically fragmented production processes (Beghin et al., 2015). Given the complexity of the buyer-supplier relations in the exchange of customized inputs, firms operating on a global scale need a high level of coordination along the chain. Nadvi (2008) suggests that compliance with international standards has become a *sine qua non* for entry into globalized production networks and this is even more stringent for firms active in developing countries. In the Moroccan Aeronautics industrial cluster, for instance, most of the producers possess one or more certifications.[10] Based on these considerations, we identify participation into GVCs as a positive feature of quality certified traders.[11]

Figure 4 shows that, not surprisingly, the share of traders tends to increase with size. This confirms a typical finding of the international trade literature, according to which larger firms are more prone to cover the sunk costs of the internationalization activities and have a higher propensity to reach farther and more productive markets as they perform relatively better (Antràs and Helpman, 2004). The figure also shows that greater size is also associated with foreign ownership and international quality certifications.

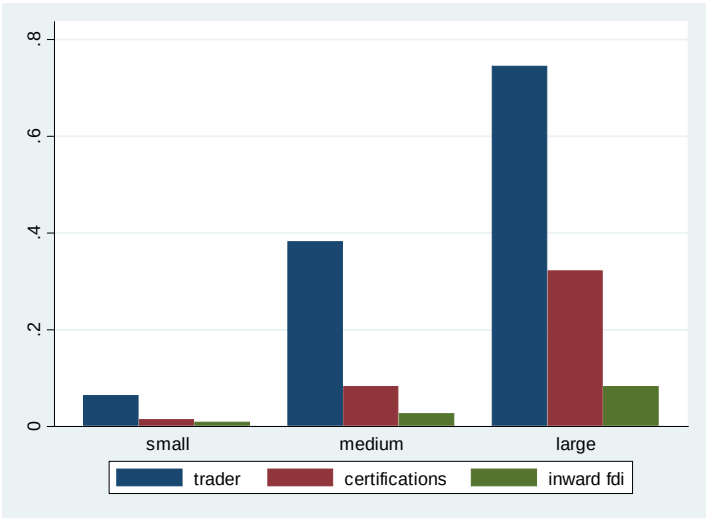
[8] As a robustness check, we performed the analysis on the 2007 cross-section including 1885 from Egypt, Morocco and Algeria. Results are in line with the baseline pooled OLS model.

[9] We define internationalization modes as mutually exclusive: exporters are defined as firms that make more than 10% of their total sales abroad; exporters and importers refer to firms performing only one-way trade, while firms both importing and exporting are captured by the two-way dummy.

[10] For example, the company Aircelle has the MRP2 Class A certification of industrial excellence; while the SMES has many certifications including DAC, EASA, FAA, ISO 9001-EN 9110, ISO 14001 (Source: International Civil Aviation Organization of the UN, 2014).

[11] Note that given the high costs of certifications, especially in developing countries, firms are prone to bear them only if they need to meet particular reliability requirements, such as those satisfying standards in developed countries.

Figure 4: Shares of traders, certified firms and foreign owned firms by size class.



Note: small 5-19, medium 20-99, large from 100 employees

As expected, summary statistics show that the share of internationalized firms is always higher among certified firms (Table 1). On the one hand, quality certifications tend to be strongly associated with internationalization, as 84% of certified firms are also traders. On the other, certified firms are only 22% among international traders (Table 2). Overall, almost all certified firms are also internationalized, though certifications seem to capture a specific feature characterizing only some of the traders.

Table 1: Shares of firms by certification and internationalization mode.

	Exporter	Importer	Twoway	FDI	Domestic
Not certified	0.05	0.15	0.19	0.06	0.61
Certified	0.16	0.34	0.34	0.20	0.16
Total	0.06	0.17	0.21	0.07	0.56

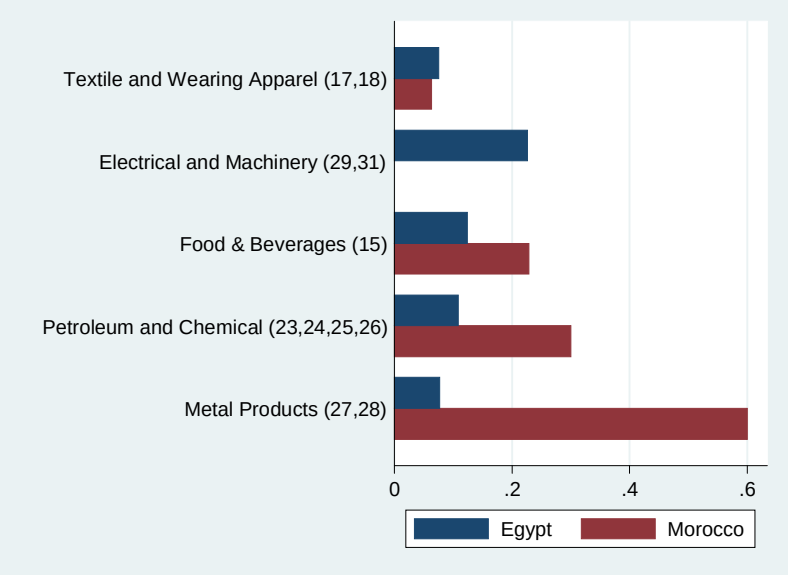
Table 2: Shares of traders and certified firms.

	Domestic	Trader	Total
Not certified	61.0	39.0	100
Certified	16.1	83.9	100
Total	55.8	44.2	100
Not certified	96.7	78.2	88.5
Certified	3.3	21.8	11.5
Total	100	100	100

Figure 5 shows the 2007 sectoral shares of GVC firms in our sample, distinguished by countries and ISIC rev.3 sectors.[12] In line with the numbers reported in Figure 3, the bulk of NA firms involved in global supply chains is in the chemicals (ISIC 24; 13 firms for Egypt and 12 firms for Morocco), food products (ISIC 15; 12 and 11 firms respectively), textiles and wearing apparel (ISIC 17 and 18;

[12] To improve comparability with the aggregate IO indicators reported in the previous section, different ISIC rev.3 sectors have been aggregated. We do not report both manufacturing sectors without any GVC firm and those with a negligible number of firms.

Figure 5: Firms in GVCs, Egypt and Morocco, 2007 as shares.



Source: Authors' elaboration based on WB-ES Database.

15 and 10 firms), and metal products manufacturing sector (ISIC 27 and 28; 6 and 6 firms)[13].

3.1 Empirical analysis

In what follows, we gauge the relation between internationalization, GVC participation and firm's performance in terms of productivity.[14] Our baseline equation is:

$$Y_{ist} = \beta_0 + \beta_1 X_{ist} + \beta_2 GVC_{ist} + \beta_3 Z_{ist} + \gamma_c + \gamma_s + \gamma_t + \varepsilon_{ist} \quad (1)$$

where Y_{it} is productivity (alternatively sales per worker, value added per worker or TFP) of firm i in year t (i.e. 2004 or 2007) active in core industry s in country c; X_{ist} is the firm's internationalization mode (either importer, exporter and twoway trader), GVC_{ist} (1 if the firm is a trader and has an internationally-recognized quality certification) is our proxy for global value chain involvement and Z_{ist} represents firm-level control measures, namely employment, capital intensity, human capital, age and a foreign ownership dummy variable (1 if i is foreign owned)[15]. In addition, the γ terms represent a full set of (country, industry and year) fixed effects, in order to take into account all possible differences in institutional and industrial[16] environments related to the year of the analysis.

Estimation results from a pooled standard ordinary least squares (P-OLS) regression are reported in Table 3.[17]

[13] As GVC production processes involve many industries, firms can be active in one on more activities even different from the final good sector. This clearly applies to the above cited case studies as well. For instance, the Maroccan Matis Aerospace assembles metal products, such as complex wire bundles, whose final use is in the aircarft industry.

[14] We use data on sales, value added and employment to compute sales per employee and value added per employee, and we estimate total factor productivity (TFP). The latter assumes a Cobb-Douglas production function in which value added is the output variable. The estimation is performed at the country level as in Levinsohn and Petrin (2003). In particular, the number of observations is not sufficient to perform separate country-sector estimations. Moreover, no deflators were available. Alternative estimations based on pooled OLS and panel fixed effect regressions produce very similar results. Estimated TFP is highly positively correlated with the two other productivity measures as showed in Figure 8 (Table Appendix).

[15] Inward FDI is a dummy for firms with a share of foreign ownership above 10%. Size is measured as the number of employees. Human capital is the ratio of skilled workers to total number of workers. Capital intensity is capital (machinery and land) over total number of workers.

[16] Industries are classified as two-digit ISIC rev 3.1 activities.

[17] Correlation matrices show no multicollinearity. The model is robust to the inclusion of each of the regressors

Table 3: Productivity and GVC (pooled OLS).

	(1) Sales/empl.	(2) VA/empl.	(3) TFP	(4) Sales/empl.	(5) VA/empl.	(6) TFP
Exporter	0.348**	0.308*	0.511***	0.221	0.190	0.116
	(2.120)	(1.753)	(3.153)	(1.487)	(1.224)	(0.734)
Importer	0.870***	0.855***	1.242***	0.710***	0.710***	0.718***
	(8.881)	(8.054)	(11.184)	(6.633)	(6.086)	(6.028)
Twoway trader	0.271***	0.319***	1.056***	0.186	0.255*	0.156
	(2.807)	(3.005)	(9.119)	(1.545)	(1.894)	(1.131)
GVC	0.524***	0.577***	1.002***	0.398***	0.444***	0.539***
	(4.231)	(4.380)	(7.468)	(3.172)	(3.389)	(4.066)
FDI				0.021	0.087	0.133
				(0.237)	(0.744)	(1.111)
Employment (ln)				0.014	0.011	0.491***
				(0.405)	(0.291)	(12.309)
Age				0.000	0.000	0.001
				(0.060)	(0.066)	(0.564)
Human capital				-0.019	-0.025	-0.026
				(-0.190)	(-0.223)	(-0.224)
Capital intensity (ln)				0.272***	0.294***	0.007
				(10.754)	(10.976)	(0.240)
Constant	5.230**	5.208**	7.326***	5.523***	5.520***	5.438***
	(2.258)	(2.242)	(4.246)	(3.069)	(3.115)	(3.243)
Country f.e.	Yes	Yes	Yes	Yes	Yes	Yes
Sector f.e.	Yes	Yes	Yes	Yes	Yes	Yes
Year f.e.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1802	1741	1708	1750	1694	1694
R-squared	0.308	0.205	0.274	0.402	0.314	0.365

t statistics in parentheses

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

Not surprisingly, there is a positive relation between internationalization and firm's performance, as all types of traders have positive and significant coefficients for the whole set of performance indicators. These findings are in line with the theoretical predictions that only the most productive firms are able to sustain the higher sunk costs of internationalization (Antràs and Helpman, 2004). Further, there is evidence of a "pecking order", as firms active in multiple globalization modes and importers tend to have a better performance than exporters only which, however, tend to be more productive than domestic firms (Tomiura, 2007; Kohler and Smolka, 2012; Bas and Strauss-Kahn, 2014).

In line with our expectations, firms involved in GVCs (i.e. traders with an internationally recognized quality certification) present a productivity premium, as the coefficient on GVC is always positive and significant at 1% level. Since quality certifications are a crucial requirement to enter international supply chains, this result corroborates our hypothesis that firms involved in GVC are more efficient and perform relatively better than domestic firms.

The foreign ownership coefficient is positively related to productivity (Blomström and Sjöholm, 1999) but not significant, suggesting that the main difference with domestically owned firms lies primarily in the scale of the operation.

To check for the robustness of our main results, we explicitly consider the time dimension of our data by including lags for the main control variables as follows:

$$Y_{ist} = \beta_0 + \beta_1 X_{ist} + \beta_2 GVC_{ist} + \beta_3 Z_{ist-1} + \beta_4 Y_{ist-1} + \gamma_c + \gamma_s + \gamma_t + \varepsilon_{ist} \quad (2)$$

In Table 4 we firstly introduce the lagged dependent variables (Table 4, columns 1, 2 and 3). Then, we also control for the lagged values of employment, human capital and capital intensity (Table 4, columns 4, 5 and 6). The main results hold and, in particular, the involvement into international production networks is associated to better performance of firms, as the GVC coefficient is always positive and significant.

separately.

Table 4: Productivity and GVC (OLS with lags).

	(1) Sales/empl.	(2) VA/empl.	(3) TFP	(4) Sales/empl.	(5) VA/empl.	(6) TFP
Exporter	0.373	0.351	0.369	0.450	0.448	0.318
	(1.390)	(1.256)	(1.397)	(1.582)	(1.524)	(1.189)
Importer	0.454***	0.415**	0.571***	0.384**	0.347*	0.346*
	(3.083)	(2.511)	(3.263)	(2.360)	(1.836)	(1.864)
Twoway trader	0.076	0.059	0.515***	0.038	0.028	0.058
	(0.538)	(0.357)	(2.829)	(0.204)	(0.123)	(0.254)
GVC	0.490***	0.552***	0.881***	0.405**	0.470**	0.534***
	(3.020)	(3.199)	(4.781)	(2.251)	(2.435)	(2.830)
L.Sales per empl. (ln)	0.246***			0.225***		
	(5.463)			(4.501)		
L.VA per empl. (ln)		0.242***			0.212***	
		(5.263)			(4.219)	
L.TFP (ln)			0.308***			0.208***
			(6.437)			(4.683)
FDI				0.203	0.071	0.054
				(1.478)	(0.350)	(0.276)
L.Employment (ln)				0.027	0.019	0.348***
				(0.456)	(0.256)	(4.731)
L.Human capital				0.092	0.184	0.342**
				(0.646)	(1.099)	(2.076)
L.Capital intensity (ln)				0.056*	0.069**	0.103***
				(1.772)	(2.095)	(3.301)
Age				-0.001	0.000	0.001
				(-0.320)	(0.064)	(0.248)
Constant	-0.489	-0.494	1.513***	-0.583	-0.551	0.700
	(-1.073)	(-1.071)	(2.994)	(-1.087)	(-0.939)	(1.329)
Country f.e.	Yes	Yes	Yes	Yes	Yes	Yes
Sector f.e.	Yes	Yes	Yes	Yes	Yes	Yes
Year f.e.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	878	825	794	847	798	789
R-squared	0.372	0.247	0.343	0.380	0.261	0.387

t statistics in parentheses

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

3.2 Is GVC participation driving productivity?

The above analysis shows that GVC participation is positively associated with the performance of firms. The result is robust to different productivity measures and using several contemporaneous and lagged controls. However, it only describes a feature of the data: certified traders are more productive both *ex ante* and *ex post*, other things equal. The direction of causality is still unknown and there may be issues of endogeneity and reverse causality. Thanks to the panel dimension of our data, we then investigate the possible endogeneity with a Diff-in-Diff approach, where we compare GVC firms to the others over time (Card and Krueger, 1994; Heckman et al., 1997).

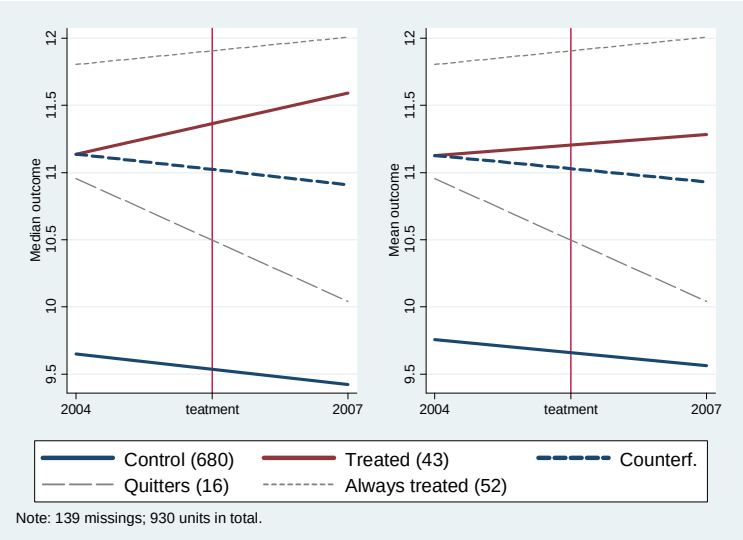
We first identify two specific groups of firms: i) the switchers, i.e. firms becoming involved into global production networks during the period of analysis (treated group); ii) firms that are excluded from GVC (control group). Two other categories of firms exists, but they are not the focus of our analysis: the quitters, that is firms that cease to be involved into GVC; and firms that always participate in GVC during the period.

In Figure 6, we report descriptive statistics for the four groups: means and medians of total factor productivity.[18] In 2004, firms involved in GVCs (treated group) were already more productive than those never participating (control group). Between 2004 and 2007, 43 firms entered into GVCs according to our definition. The treated and the control groups follow opposite trends, as more clearly shown by the counterfactual line (i.e. treated group firms had they not entered GVC and thus followed the control group trend, given the initial level of productivity). Additionally, firms that are always involved in GVC perform even better, while quitters display a fast drop in productivity. Overall, this

[18] Similar figures are obtained with the other productivity measures and are available upon request.

descriptive evidence points to different time trends for our GVC groups and may be due to a causal effect: although firms that enter into GVC perform relatively better *ex ante*, they also benefit from *ex post* additional increases in productivity.

Figure 6: TFP means and medians by group of firms.



Source: Authors' elaboration based on WB-ES Database.

It is important to note that among treated firms, 77% were already traders in 2004, but acquired an international certification only at a later stage. This comes as an additional evidence of the fact that, even among internationalized firms, the compliance with international standards is an additional requirement for entry into global production networks. Moreover, the fact that in the treated group the share of traders is higher than in the control group (about 35%) partly explains why the former are more productive *ex ante*. While informative, this is of one of the reasons why the above descriptive evidence is certainly not sufficient to draw any conclusion.

In an ideal scenario, we would like to compare each treated firm with its counterfactual, that is a control firm identical in any other characteristic. Based on this, we first match each treated firm with similar firms from the control group, so to obtain a synthetic empirical counterfactual. Then, we employ a Diff-in-Diff estimator to compare the two groups before and after GVC participation.[19] This will eventually return us an estimate of the average GVC participation effect on productivity (i.e. average treatment effect on the treated, ATT). This estimate can be reasonably interpreted as a causal effect, as it is obtained by comparing each firm entering a GVC with an estimated counterfactual. One possible issue is that with only two years available, we can not control for the firms' trends in the previous years. Concerns regarding this point are mitigated by considering that entering GVC could be the final step of a preparation period, but if the effect on productivity was anticipated, then we are probably underestimating it.

The results for the coefficient of interest are reported in the first part of Table 5, where the treatment variable is the GVC participation dummy defined as in the previous regression analyses (certified traders). Note that by employing too many control variables in a Propensity Score Matching setting, while providing more accurate matching, may make the balancing procedure more difficult to achieve.[20] In order to check how the matching algorithm performs with different sets of covariates, we estimated five different models sorted by 'complexity', from simple country and sector fixed effects to the full set of covariates. Note also that the matching is fully achieved (i.e. the matched treated and control groups are not statistically different), except when we include the trade dummies among the

[19] Specifically, we perform a Kernel Propensity Score Matching Diff-in-Diff (PSM-DD) estimation.

[20] Detailed tables reporting the balancing t-tests are available upon request

covariates (models 4 and 5).

Along the different models, we find that the effect of GVC participation is positive and significant, i.e. the involvement into global productions networks fosters productivity enhancement.

However, a possible concern may arise when we include traders both in the definition of our GVC dummy and in the covariates. While this could be problematic in general, it is not an issue in our case since, as shown above, almost all GVC firms become traders before acquiring an international certification. In other words, in our specification, the GVC dummy captures traders that become certified between 2004 and 2007. To check for this, we run our five models using only the certification dummy as the treatment variable. Results are reported in the second part of Table 5. Albeit lower in magnitude, the estimated effects are again positive and significant. This is expected as the treated group includes basically the same firms.

We also use a subset of the GVC firms, focusing on certified twoway traders only (GVC-strong dummy). This is an even narrower definition of GVC participation, as firms so identified are more likely to have a stronger GVC involvement. Hence, we expect the effect on productivity to be stronger for this group of firms. Note that since twoway traders are included in the new GVC proxy variable, we must exclude from the covariates the respective dummy. As a consequence, we redefine importer and exporter dummies so to be non-mutually exclusive. Our expectations are fully confirmed in the last part of Table 5, which shows high and statistically significant effects.

Table 5: Propensity Score Matching Diff-in-Diff estimations on TFP.

Model	Diff-in-Diff	S. Err.	t	p-val	R2	balancing	N control	N treated
				Treatment: GVC (certified traders)				
(1)	0.236	0.162	1.45	0.146	0.18	yes	614	42
(2)	0.646***	0.184	3.51	0.000	0.07	yes	550	42
(3)	0.372**	0.186	2.00	0.046	0.04	yes	497	41
(4)	0.435**	0.206	2.11	0.035	0.05	no	355	41
(5)	0.491**	0.218	2.25	0.025	0.03	no	358	41
				Treatment: Certifications				
(1)	0.280	0.173	1.62	0.106	0.08	yes	610	46
(2)	0.549***	0.179	3.08	0.002	0.03	yes	518	44
(3)	0.533***	0.192	2.77	0.006	0.02	yes	471	45
(4)	0.398**	0.180	2.22	0.027	0.01	no	558	44
(5)	0.341*	0.195	1.75	0.080	0.00	yes	487	46
				Treatment: GVC-strong (certified twoway traders)				
(1)	0.429***	0.151	2.83	0.005	0.28	no	604	17
(2)	0.846***	0.239	3.54	0.000	0.07	yes	232	18
(3)	0.966***	0.280	3.45	0.001	0.06	yes	182	18
(4)	0.534**	0.251	2.12	0.034	0.04	yes	200	17
(5)	0.661**	0.280	2.36	0.019	0.04	no	162	18

*** p<0.01; ** p<0.05; * p<0.1

Means and Standard Errors are estimated by linear regression.

Estimation performed on the common support of the propensity score.

Model (1) includes country and sector f.e.

Model (2) includes country and sector f.e.; employment; FDI dummy.

Model (3) includes country and sector f.e.; employment; FDI dummy; human capital; capital intensity; age.

Model (4) includes country and sector f.e.; employment; FDI, export, import and twoway dummies.

Model (5) includes country and sector f.e.; employment; FDI, export, import and twoway dummies; human capital; capital intensity; age.

GVC-strong models use non-mutually exclusive export and import dummies and no twoway dummy.

Balancing t-test of the difference in the means between control and treated groups in the base year; yes = no statistical difference in the covariates.

Overall, our Propensity Score Matching-Diff in Diff (PSM-DD) estimations support the existence of a causal effect of GVC participation on productivity, as measured by the acquisition of international certifications by traders. The estimated causal effects are slightly lower than the regression coefficients found above. For instance, the most conservative estimations from the models with a successful balancing are 0.37 when the treatment is the GVC dummy, 0.34 for certification dummy and 0.53 when the treatment is the GVC-strong dummy. This suggests that the above regressions results, while being qualitatively correct, tend to overestimate the causal effect, possibly due to endogeneity and reverse causality issues.[21]

4 Conclusions

In this paper we describe the participation of North African countries and firms into global value chains and highlight the possible benefits of a more active involvement. We show that the region has not been able so far to fully enter into global production networks, being a very marginal player at the world level. Despite this, NA increasingly relies on GVC-related trade. Further, in many sectors NA mostly participates in the upstream phases, which typically involve low value added activities. However, the area is quite heterogeneous, since countries are integrated in different ways and in different industries, also according to their level of human capital and the availability of skills.

Firms in these countries have only recently started to actively participate in international production networks. They are no longer just importing intermediates for a mere assembling process, or serving their domestic markets; they are exporting parts and components used in some of the most sophisticated products in industrialized countries.

A crucial issue is then to understand whether only the most productive firms can join GVC and improve country's competitiveness or whether joining GVC can itself make firms more productive. Our findings show that the most productive North African firms tend to become involved into GVC. Moreover, after entering global supply chains, these firms tend to further increase their productivity. In particular, using a regressions analysis and Propensity Score Matching Diff-in-Diff approach, we show that there is a positive, causal impact of GVC participation on firms' performance.

Two main policy implications can be drawn from this analysis. Regardless of a firm's position in the value chain, quality and reliability requirements must be met. The buyers' sourcing strategies are constantly revised to improve their ability to join supply chains. The complexity and heterogeneity of quality standards and certifications, often requested by developed countries, has become a large barrier, in particular for developing countries and SMEs, adding a significant cost to trade. Upstream firms supplying intermediate inputs to several destinations may have to duplicate production processes to comply with conflicting standards, or to incur burdensome certification procedures multiple times for the same product (Miroudot et al., 2013). On this, international regulatory cooperation (convergence of standards, certification requirements and mutual recognition agreements) can alleviate the burden of compliance and enhance firms' participation in international trade by specializing in specific tasks along a supply chain.

For GVCs to have a positive impact on firms' productivity and country's competitiveness, an adequate framework is required. Human capital development can be tailored to the needs of particular segments of the value chain; specialized skills are a prerequisite for involvement in high value added stages of the chains associated with industries such as information technology, electronics, chemicals, aeronautics and automotive. Policies designed to support education and technical training represent an important tool to increase the gains of global production.

When such conditions are met, then GVC can become an important mean for linking developing countries to global production and trade, potentially supporting export propensity for SMEs, with possible positive consequences on economic development.

[21] For robustness, we also performed the analysis (5 models for each of the 3 GVC proxy variants) on the other 2 productivity measures, i.e. sales per employee and value added per employee. Results are similar (see the Table Appendix for details).

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A Table Appendix

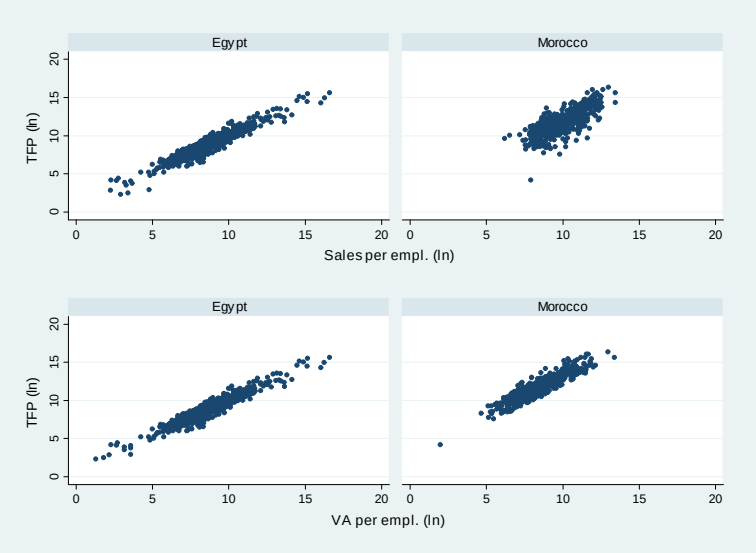
Figure 7: Common 25 ISIC-type classification.

Sector name	ISIC Rev.3 correspondence
Agriculture	1,2
Fishing	5
Mining and quarrying	10,11,12,13,14
Food and beverages	15,16
Textiles and wearing apparel	17,18,19
Wood and paper	20,21,22
Petroleum, chemical and non-metallic mineral products	23,24,25,26
Metal products	27,28
Electrical and machinery	29,30,31,32,33
Transport equipment	34,35
Other manufacturing	36
Recycling	37
Electricity, gas and water	40,41
Construction	45
Maintenance and repair	50
Wholesale trade	51
Retail trade	52
Hotels and restaurants	55
Transport	60,61,62,63
Post and telecommunications	64
Financial intermediation and business activities	65,66,67,70,71,72,73,74
Public administration	75
Education, health and other services	80.85,90,91,92,93
Private households	95
Others	99

Table 6: Summary Statistics (pooled).

Variable	Obs	Mean	Std. Dev.	Min	Max
Sales per empl. (ln)	1825	8.98	1.58	2.27	16.64
VA per empl. (ln)	1764	8.57	1.55	1.33	16.64
TFP (ln)	1731	9.92	1.64	3.02	16.95
Exporter	1860	0.06	0.24	0.00	1.00
Importer	1860	0.18	0.38	0.00	1.00
Twoway trader	1860	0.21	0.41	0.00	1.00
GVC	1836	0.10	0.30	0.00	1.00
FDI	1860	0.08	0.26	0.00	1.00
Employment (ln)	1858	3.79	1.36	1.79	9.48
Human capital	1848	0.57	0.29	0.00	1.00
Capital intensity (ln)	1808	3.67	3.53	-4.56	13.65
Age	1854	21.57	15.46	0.00	111.00

Figure 8: Total factor productivity and other productivity measures.



Source: Authors' elaboration based on WB-ES Database.

Table 7: Propensity Score Matching Diff-in-Diff estimations on Sales per employee.

Model	Diff-in-Diff	S. Err.	t	p-val	R2	balancing	N control	N treated
			Treatment: GVC (certified traders)					
(1)	0.246	0.163	1.52	0.128	0.09	no	613	41
(2)	0.163	0.168	0.97	0.333	0.04	no	582	44
(3)	0.407**	0.182	2.24	0.026	0.03	yes	529	42
(4)	0.247	0.210	1.18	0.240	0.02	no	339	45
(5)	0.535**	0.221	2.43	0.015	0.03	yes	369	41
			Treatment: Certifications					
(1)	0.253	0.166	1.53	0.126	0.03	yes	680	48
(2)	0.401**	0.168	2.40	0.017	0.02	yes	608	47
(3)	0.526***	0.184	2.85	0.004	0.02	yes	513	45
(4)	0.350**	0.170	2.06	0.040	0.01	yes	610	48
(5)	0.360*	0.187	1.93	0.054	0.00	yes	506	47
			Treatment: GVC-strong (certified twoway traders)					
(1)	0.419***	0.142	2.95	0.003	0.08	no	674	19
(2)	0.695***	0.238	2.92	0.004	0.05	yes	249	20
(3)	0.949***	0.280	3.39	0.001	0.04	yes	191	19
(4)	0.535**	0.247	2.16	0.031	0.02	yes	219	19
(5)	0.671**	0.278	2.41	0.016	0.03	no	180	19

*** p<0.01; ** p<0.05; * p<0.1

Means and Standard Errors are estimated by linear regression.

Estimation performed on the common support of the propensity score.

Model (1) includes country and sector f.e.

Model (2) includes country and sector f.e.; employment; FDI dummy.

Model (3) includes country and sector f.e.; employment; FDI dummy; human capital; capital intensity; age.

Model (4) includes country and sector f.e.; employment; FDI, export, import and twoway dummies.

Model (5) includes country and sector f.e.; employment; FDI, export, import and twoway dummies; human capital; capital intensity; age.

GVC-strong models use non-mutually exclusive export and import dummies and no twoway dummy.

Balancing t-test of the difference in the means between control and treated groups in the base year; yes = no statistical difference in the covariates.

Table 8: Propensity Score Matching Diff-in-Diff estimations on Value added per employee.

Model	Diff-in-Diff	S. Err.	t	p-val	R2	balancing	N control	N treated
			Treatment: GVC (certified traders)					
(1)	0.183	0.161	1.14	0.254	0.07	yes	639	42
(2)	0.519***	0.190	2.72	0.007	0.06	yes	560	42
(3)	0.403**	0.190	2.12	0.034	0.03	yes	504	41
(4)	0.328	0.211	1.55	0.121	0.04	no	384	43
(5)	0.479**	0.232	2.07	0.039	0.02	no	631	40
			Treatment: Certifications					
(1)	0.309*	0.176	1.76	0.079	0.02	yes	635	46
(2)	0.471**	0.185	2055	0.011	0.02	no	506	44
(3)	0.575***	0.193	2.98	0.003	0.02	yes	475	45
(4)	0.390**	0.184	2.12	0.034	0.01	no	579	46
(5)	0.410**	0.206	1.99	0.047	0.00	yes	488	46
			Treatment: GVC-strong (certified twoway traders)					
(1)	0.437***	0.144	3.04	0.002	0.07	no	697	18
(2)	0.841***	0.271	3.11	0.002	0.05	yes	231	19
(3)	0.959***	0.310	3.09	0.002	0.04	yes	182	18
(4)	0.464*	0.272	1.171	0.089	0.03	yes	204	19
(5)	0.549*	0.298	1.84	0.066	0.03	no	163	17

*** p<0.01; ** p<0.05; * p<0.1

Means and Standard Errors are estimated by linear regression.

Estimation performed on the common support of the propensity score.

Model (1) includes country and sector f.e.

Model (2) includes country and sector f.e.; employment; FDI dummy.

Model (3) includes country and sector f.e.; employment; FDI dummy; human capital; capital intensity; age.

Model (4) includes country and sector f.e.; employment; FDI, export, import and twoway dummies.

Model (5) includes country and sector f.e.; employment; FDI, export, import and twoway dummies; human capital; capital intensity; age.

GVC-strong models use non-mutually exclusive export and import dummies and no twoway dummy.

Balancing t-test of the difference in the means between control and treated groups in the base year; yes = no statistical difference in the covariates.