Participation in Global Value Chains: macro and micro evidence for North Africa

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Abstract

This paper analyzes North African countries' participation into international production networks and estimates if/to what extent being part of a global value chain affects the perfromance of firms. Using new Input-Output data from UNCTAD-Eora, we describe regional and country GVC involvement. Results show that North African countries have not been able so far to integrate into international production networks. However, large part of their (low) trade is due to global value chains related activities, mainly in the upstream phases, and the importance of global linkages has been increasing over time. To better understand the impact of international fragmentation of production on competitiveness, we perform a micro, firm-level analysis. We show that firms' performance, measured by several indicators, is positively associated with internationalization modes as well as GVC participation. These results confirm those of our sectoral analyses and are in line with existing anecdotal evidence. Enhancing GVC participation of North African countries is likely to substantially benefit the area. However, the ability to retain such benefits relies on specific characteristics, such as the level of human capital, the logistics, the presence of trade barriers, thus leaving room for policy intervention.

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

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

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1 Introduction

In the last two decades technological progress and a sharp decrease in trade barriers and costs have changed the way goods and services are produced. The increase of trade in intermediates is rooted in the "unbundling" over several countries of different stages of production that previously were performed in close proximity (Johnson and Noguera, 2012). The analysis of international trade is now indeed taking place in the context of 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 and then are assembled either sequentially along the chain or in a final location (Del Prete and Rungi, 2015). The networks of involved firms are highly complex, spanning from manufacturing activities to logistics and transportation, as well as customs agents and other services (Baldwin and Venables, 2013).

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 not necessarily need to have the domestic capacity to perform all major steps and the expertise to export, they can simply support the value chain as suppliers of intermediate inputs and act as 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. The reallocation of resources from less productive activities to new and more connected ones is crucial.

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 production networks. For instance, China has integrated into GVCs by firstly specializing in the activities of final good assembly and was then capable of upgrading its participation by building a competitive supply base of intermediate goods and by enhancing the quality of its exports (Marvasi, 2013). But as it moves up the value chain, NA can become the next hub of labor intensive productions and expand its technological sectors. Despite a relatively good geographic and logistic positioning, most North African firms, especially the smaller ones, 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.

The paper describes to what extent North African countries have been able to enter GVC and possible benefits from a greater integration, providing both a macro and micro perspective. Firstly, it directly addresses the issue of participation in GVCs for North African countries, employing a new database from UNCTAD-Eora. To the best of our knowledge, this is the first attempt to directly focusing on NA at a macro-level. This is mainly due to lack of data from Input-Output tables.

Second, the paper investigates GVCs participation of firms. At the micro-level, the literature about GVCs is scant and mainly based on case studies. The paper fills this gap by providing an econometric firm-level assessment of GVC involvement and its role in driving productivity.

A third contribution of the paper is to narrow the divide between macro and micro evidence on GVC, by looking at both and trying to connect them in order to better understand the aggregate implications of a greater GVCs integration at the firm-level.

The empirical analysis is performed on the years before the beginning of both the Great Recession and Arab Spring. The macro analyisis refers to the period 1995-2007, while the firm-level analysis is applied to a 2007 cross-section of North African firms. There are two main reasons which lead us to make this time choice. The first regards macroeconomic conditions: analyzing the pre-2007 period keeps the possible shocks of the 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.

The rest of the paper is organized as follows. Section 2 describes participation of North African countries and positioning along the value chain, using Input-Output tables and trade data. Section 3

investigates econometrically the relationship between global value chains participation and firm-level productivity. The Conclusions provide a joint reading of the micro and macro evidence and assesses the scope for participation of North African countries in global value chains, discussing possible policies and their implications for competitiveness.

2 Macro perspective - value added trade patterns

As different stages of the same production process are now 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 (Koopman et al., 2014). However, recent improvements in Input-Output (I-O) metrics allow to measure trade in value-added terms, also separating foreign and domestic value added content of exports.

In this section, exploiting the UNCTAD-Eora GVC Database, we analyze the GVC participation and position of NA countries. We derive North Africa 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 to provide a contiguous, continuous dataset for the period 1970-2010 (Lenzen et al., 2012, 2013).

We rely on the Koopman et al. (2011) decomposition for which the foreign value added share (FVA) indicates the share of a country's exports that consist of inputs produced in other countries and thus do not add to the GDP of the country of interest. It captures the extent of GVC participation for downstream firms and industries. Their approach also allows one to calculate the 'indirect value added exports' (DVX), i.e. the share of a country's value added exports embodied as intermediate inputs in other countries' exports, which captures the contribution of the domestic sector to the exports of other countries, thus indicating the extent of GVC participation for relatively upstream sectors. Summing the FVA and the DVX of a single country/area, we can get a comprehensive description of GVC participation.

Thanks to this information, we can translate the MRIO table for multiple countries and industries into a standard I–O matrix form:

$$
\begin{aligned}
\mathbf{x} &= \mathbf{z} + \mathbf{y} & (1) \\
\mathbf{x} &= \mathbf{A}\mathbf{x} + \mathbf{y} & (2) \\
\mathbf{x} &= (\mathbf{I} - \mathbf{A})^{-1}\mathbf{y} = \mathbf{L}\mathbf{y} & (3)
\end{aligned}
$$

where $\mathbf{x}$ represents the gross output $n \times 1$ vector of n countries, $\mathbf{z}$ the total intermediate demand vector ($\mathbf{z} = \mathbf{Z}\mathbf{j}$, with $\mathbf{Z}$ being the intermediate demand matrix and, $\mathbf{j}$ an all-one vector), $\mathbf{y}$ the total final demand vector ($\mathbf{y} = \mathbf{Y}\mathbf{j}$, with $\mathbf{Y}$ being the final demand matrix), $\mathbf{I}$ the identity matrix, $\mathbf{A}$ is the technical coefficient matrix and $\mathbf{L}$ is the Leontief inverse matrix. Total value added is obtained from the vector $\mathbf{w} = \mathbf{x} - \mathbf{Z}'\mathbf{j}$ as the difference between gross output and intermediates use. To calculate value added trade, we start with the share of value added per unit of output by country (e.g. $v_1 = w_1/x_1$ being the first element of the vector $\mathbf{v}$), combined with the Leontief inverse matrix $\mathbf{L}$ and aggregate exports by country as retrieved by the sum of the intermediates and final goods sold abroad (e.g. $e_1 = (z_1 - Z_{11}) + (y_1 - Y_{11})$ being the first element of the vector $\mathbf{e}$). The value added trade matrix can then be written as $\mathbf{T^v} = \mathbf{VLE}$, that is:

$$
\begin{pmatrix}
T^{\mathbf{v}}_{11} & \cdots & T^{\mathbf{v}}_{1n} \\
\vdots & \ddots & \vdots \\
T^{\mathbf{v}}_{n1} & \cdots & T^{\mathbf{v}}_{nn}
\end{pmatrix}
=
\begin{pmatrix}
v_1 & \cdots & 0 \\
\vdots & \ddots & \vdots \\
0 & \cdots & v_n
\end{pmatrix}
\begin{pmatrix}
L_{11} & \cdots & L_{1n} \\
\vdots & \ddots & \vdots \\
L_{n1} & \cdots & L_{nn}
\end{pmatrix}
\begin{pmatrix}
e_1 & \cdots & 0 \\
\vdots & \ddots & \vdots \\
0 & \cdots & e_n
\end{pmatrix}
\tag{4}
$$

where the left hand side matrix $\mathbf{T^v}$ describes how the value added contained in the exports of each country (and industry) is generated (by column) and distributed (by row) across countries.

In fact, the columns of the matrix **VL** indicate the amount of value added required from the different row-countries for the column-country to produce 1 unit of gross output and all the columns sum up to 1 by construction.

Similarly, under the assumption of homogeneity between output and export, the columns of the matrix **T^v** represents the value added content of exports of the column-country, which is then composed of two parts: on the main diagonal, the term $T_{ii}^{\mathbf{v}}$ denotes the Domestic Value Added (DVA) of country i; outside the main diagonal, the term $T_{ki}^{\mathbf{v}} = v_k L_{ki} e_i$ with $k \neq j$ denotes, instead, the Foreign Value Added (FVA) generated by row-country k and incorporated in the exports of column-country i. The (column) sums of Domestic and Foreign Value Added, by construction, will yield the total exports of countries (i.e. $\mathbf{e} = \mathbf{T^{v\prime}j}$).

The trade in value added **T^v** matrix also provides information on how much of each country's domestic value added enters as an intermediate input in the value added exported by other countries. For row-country i, the term $T_{ik}^{\mathbf{v}} = v_i L_{ik} e_k$ represents exported domestic value added that is further incorporated into the exports of column-country k. Hence, by reading the matrix along the row (and excluding the diagonal term), it is possible to measure the "indirect value added exports" (DVX).

Eventually, to capture the overall participation of countries and industries in GVCs we combine the FVA and DVX measures, by summing up the foreign value-added used in a country's own exports and the value added supplied to other countries' exports, and taking the sum as a ratio to gross exports, i.e. GVC = FVA + DVX.

2.1 GVCs analysis

The analysis of GVCs stemming from the above I-O manipulations can be performed by looking at both value added trade in absolute values and as a shares of total export. The former allows us to understand where most of the value is generated in a cross-country (and cross-sector) perspective. Shares are instead meant to provide information on the importance of GVCs to the creation of value added for each country's exports.

Hence, our starting point is the comparison of NA with other major exporters as GVCs players. Then, we further investigate the role of GVCs for NA exports.

The methodology described in the previous section leads to the Figure 1, where we plot the overall GVC participation for some main countries/areas (Figure 1a) and North African countries (Figure 1b) together with export volumes in 2007. Not surprisingly, the bulk of trade is concentrated among developed countries (EU 42%, NAFTA 19% and China 7%). With a share of less than 1% of world export, North Africa plays a very marginal role in world trade. Turning to the individual NA countries figures, 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.

Figure 1: FVA, DVX and Exports in 2007

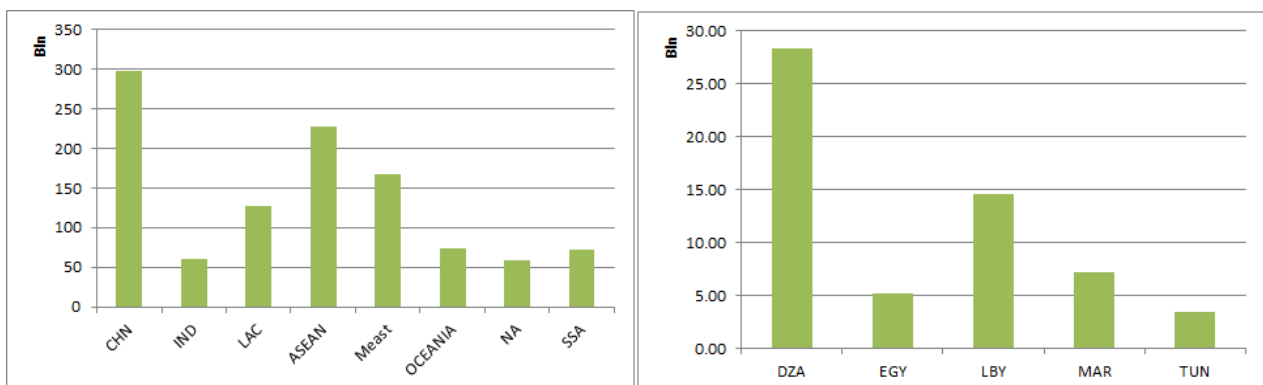Source: Authors' elaboration based on UNCTAD/EORA GVC Database.

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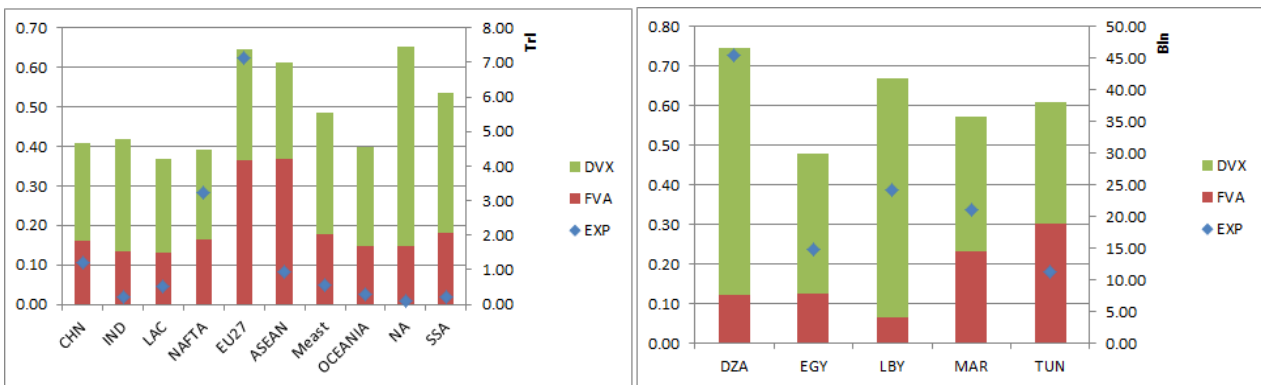
These evidence is also confirmed by considering foreign value added and the value of exports of intermediates in value added exports of other countries respectively for each region as well as for North African individual countries. For clarity purposes, in Figures 2 and 3 we consider only developing areas, while EU27 and NAFTA are not included since they operate at a higher scale (the graph would not allow to see heterogeneity among other countries/areas). Both figures confirm that North Africa has not yet being able to enter GVCs and play a significant role at the world level, making up about 1% of foreign value added and exports of other countries' value added exports. Despite this, a good deal for heterogeneity emerges when we look at individual countries; for instance, Algeria and Morocco present the highest foreign value added values (Figure 2b) while Algeria and Libya the highest values of exports of other countries' value added exports (Figure 3b).

Figure 2: Foreign Value Added volume (excluding EU27 and NAFTA)
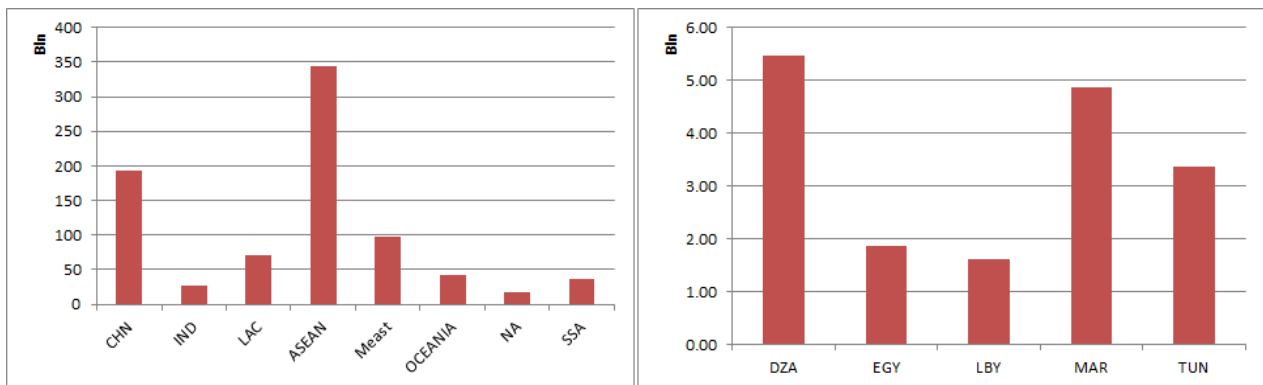
Source: Authors' elaboration based on UNCTAD/EORA GVC Database.

Figure 3: Indirect Value Added volume (excluding EU27 and NAFTA)

Source: Authors' elaboration based on UNCTAD/EORA GVC Database.

We can now look back at Figure 1, to appreciate the total levels of GVC participation, i.e. the total sum of FVA in exports and DVX in exports. The fact that advanced countries[1] are heavily integrated in GVCs is hardly surprising as well as the intensive GVC participation of ASEAN countries. What is

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[1]Note that we consider the individual countries separately, meaning that the measures reported include intermediate flows between countries of the same region. This is likely to inflate the extent of GVC participation of the EU27 relative to other large single countries, such as the China and India.

more interesting, and in line with the results of Foster-McGregor et al. (2015), is that North Africa has some of the highest rates of GVC participation, 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% rate.

To shed more light on this, we report in Figure 4 the latter metrics for the years 1995 and 2007. The left figure indicates that GVC participation has been increasing in most regions, from around 50% in 1995 to 54% 2007 worldwide. The growth rate of GVC participation in NA has also been almost the double to that of all countries, with GVC participation increasing by 14% for North Africa and 8% for all countries over the period 1995-2007 (Figure 4a). Again Figure 4b, reveals that between 1995 and 2007, Libya GVC participation grew by 17%, while that of Algeria and Morocco by 14%.

Figure 4: GVC participation
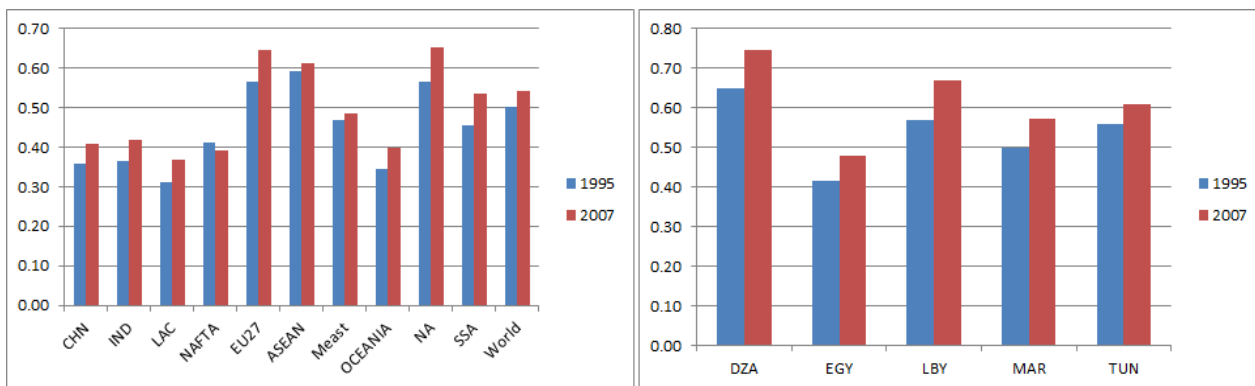
Source: Authors' elaboration based on UNCTAD/EORA GVC Database.

Following Koopman et al. (2011) approach, in Figure 5 and 6 we split up total GVC participation into the FVA and DVX components. As above stated, the former measure indicates the extent to which a country's exports are dependent on imported content (i.e. backward integration) and accordingly is likely to be higher if a country or sector is involved in downstream production. Conversely, the DVX measure is likely to be higher for countries and sectors involved in upstream production, with output and exports of that country feeding into the production and exports of downstream producers (i.e. forward integration). The analysis of these two metrics can provide hints on where within a GVC a particular country is. While upstream stages are associated with the production of knowledge assets at the beginning of the value chain, in a developing country context where rates of innovation are low it is 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).

At the global level, the average FVA is approximately 30% in 2007. That means, roughly, that around 5 trillion of the 17 trillion in 2007 world exports of goods and services has been contributed by foreign countries for further exports and is thus "double counted" in global trade. The remaining 12 trillion is the actual value added contribution of trade to the global economy. FVA has tended to rise over time for all countries, though the increase has been largely driven by the advanced countries. Overall, foreign value added increased by around 10% between 1995 and 2007 with large increases occurring in EU27 19% and China 33%. For other developing regions a decline in FVA was observed between 1995 and 2007 with the largest declines occurred for the ASEAN (by 10%) and Middle East (5%) regions.

In 1995 foreign value added in NA was 13% while 15% in 2007, resulting in a 15% growth rate (Figure 5a). At a more detail, Tunisia (30%) and Morocco (23%) present the highest FVA in the region (Figure 5b). However these results suggest that along with other developing regions, North Africa have struggled to become increasingly engaged in downstream production within GVCs.

Figure 6 reports similar figures for the DVX metrics. This suggests that all regions observed an increase in the indirect value added exports between those two years. In terms of the 2007, we observe

Figure 5: Foreign Value Added component (FVA)

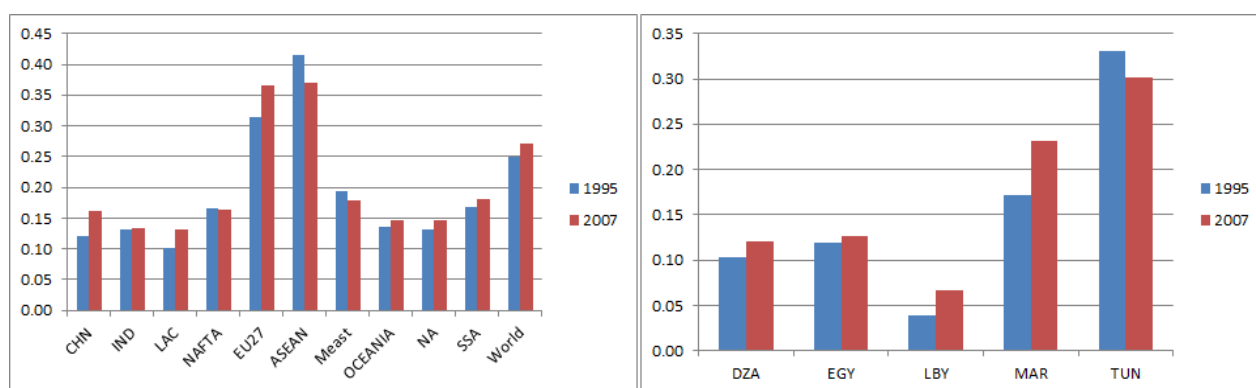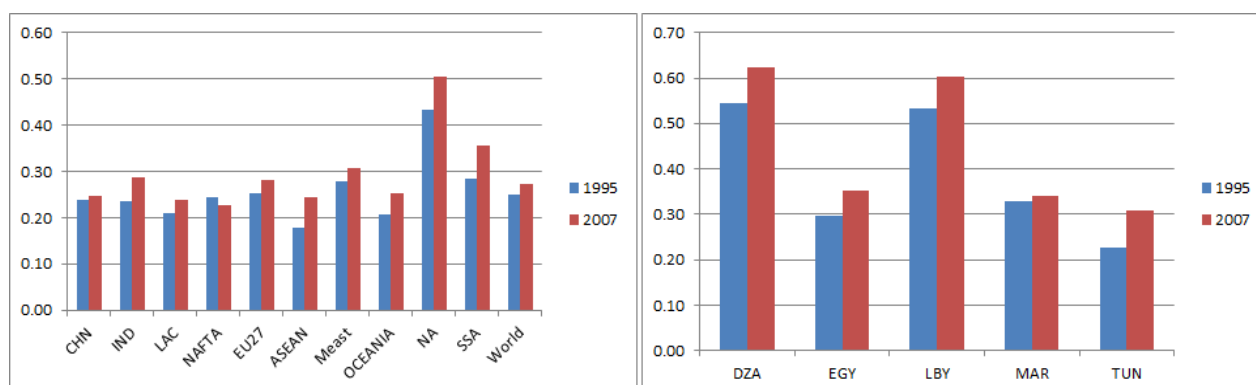Source: Authors' elaboration based on UNCTAD/EORA GVC Database.

that North Africa has the highest DVX share (50%). The region also shows the largest increase in the DVX measure between 1995 and 2007, with an increasing by 16%. Large growth rates also occurred in SSA countries (21%) and ASEAN (33%) countries. Not surprisingly, increases were much larger for developing countries than for advanced countries.

Figure 6: Indirect Value Added component (DVX)

Source: Authors' elaboration based on UNCTAD/EORA GVC Database.

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 it has struggled in breaking into downstream production and that much of its involvement in GVCs is in upstream production. Indeed if we consider the share of total GVC participation that is due to the DVX measure we find that it accounts for 77% in 2007, which highlights the importance of upstream production (natural resource and simple manufacturing) in the region. However there is evidence of some country heterogeneity. While Algeria and Libya follow this pattern, Morocco and Tunisia show a greater share of FVA in total GVC participation (40% and 49% share respectively), suggesting a relatively downstream position (Figure 6a,b).

To sum up, NA is a very marginal player of GVC-related 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 GVCs at the world level , GVCs are found to be of primary importance for NA trade: participation in GVC has been 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 countries. The overall figure, however, hides an important fact: NA participates in GVCs by contributing mainly to the upstream

phases, being confined to low value added stages of production, with some exceptions.

2.2 North Africa and GVCs: some examples

GVC participation can be approximately described by trade in intermediates. As of today about 60% of global trade consists of intermediates and services, incorporated at different stages of production (UNCTAD, 2013). NA trade in intermediates was about 50% in 2012, with Egypt showing the highest intermediates export share (57%) followed by Morocco (53%). Tunisia, on the other hand, shows the highest intermediate share for imports (59%) (Figure 7a). The heterogeneity of North African countries in their involvement in GVCs depends on the productive structure of the different economies, their endowments as well as some characteristics such as education level of the population, presence of tax benefits, technological parks etc.

In this section we introduce some practical examples of GVC participation in North Africa, and link them with the data of the above figures. The Moroccan garment industry is a key supplier for fast fashion supply chains, such as Zara, thanks to its proximity to the EU 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. Furthermore, the Moroccan textile industry association has been able to create over time a sector-led code of conduct and social label called Fibre Citoyenne, which the fashion retailers found 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). This anecdotic evidence is supported by our data. As Figure 7b shows, in the textile sector, Morocco mainly imports intermediate goods and once processed exports final goods.

Further, the country is also "a rear base for of the French aerospace industry". All Airbus aircrafts 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. Then, in this sector Morocco imports intermediates and exports components of the aircraft (Figure 7b). The development of the aeronautics sector is a very promising global value chain, which relies on a pool of skilled human resources. With 100% of its production aimed at exports, the Moroccan aeronautics sector comprises nearly 100 companies of international scope involved in activities covering production, services and engineering, which are the main components of the global value chain for aeronautics. EADS, Boeing, Safran, Ratier Figeac and, more recently, Eaton and Hexcel, are all present in Morocco.

Figure 7: Trade in intermediates in NA countries and Morocco
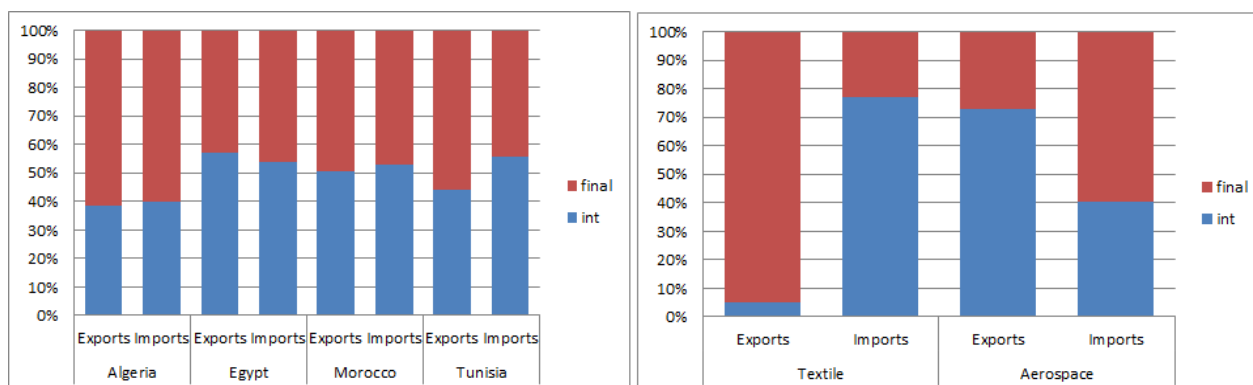
Source: Authors' elaboration based on STAN Bilateral Trade in Goods by Industry and End-use (BTDIxE), ISIC Rev.4.

Two other industries are involved in global supply chains. The automotive sector has been able to enter the Renault-Nissan value chain in Tangiers in 2012, with an annual production capacity of 340

000 vehicles, 90% of which are intended for export, in particular to Europe. The automotive chain is interesting since it started with a large investment of the Renault group which then resulted in a policy of local integration aimed at increasing the number of components that are locally sourced, thanks to savings achieved through lower logistics costs. The phosphate industry in Morocco has finally positioned itself in all parts of the value chain from the production of fertilizer to that of phosphoric acid as well as derivative products.

If Morocco is at the forefront, also Egypt has interesting situations. The country is the destination of outsourcing from Microsoft, which gets some services that complement its products but there are some small firms that serve Microsoft directly. Traditional IT Services (ITS), such as software installation and testing and IT Enabled Services (ITES), such as call centers, are by far the largest contribution of SMEs and not just packaged software and hardware. The call centers development in Egypt covers from very simple to complex operations, such as marketing and sales, and business and information technology (IT) consulting.

3   Micro perspective - firms in GVCs

GVCs have contributed to shift the attention of the economic analyses from countries to firms. Thanks to the international fragmentation of production into single tasks, firms can now specialize in a particular stage of the chain and also internationalize despite, for instance, a small size. There is a growing debate on the role and the upgrading processes of the intermediate firms (Gereffi, 1994; Alcacer and Oxley, 2014). In this respect, both Agostino et al. (2014) and Giovannetti et al. (2015) argue that joining the supply chain may be decisive even for small and less productive firms, by providing incentives and opportunities to upgrade their technical capabilities or just provide the specific task required in a value chain.

In this section, we provide a micro-level evidence about GVCs participation and its possible effects on the performance of firms. For the firm level analysis, we exploit a subset of the original World Bank Enterprise Survey database specifically focusing on NA countries' firms. The available surveys provide information on the characteristics of firms across various dimensions, including size, ownership, trading status, and performance, and collects data for 1,885 firms and three NA countries for which data are available in 2007, namely Algeria, Egypt and Morocco[2].

The main descriptive statistics for the variables employed in the empirical analysis are reported in Table 1[3] .The analysis is focused on manufacturing firms only.

In our sample firms are characterized by different modes of internationalization, depending on the complexity of their links with other domestic or foreign firms. As summarized in Figure 8, we observe direct and indirect trade (i.e. through intermediaries). About 48% of firms in the area, and with differences between the different countries considered, are direct traders, while indirect traders are 11%. In both cases, the most frequent internationalization mode regards import, either direct (26%) or indirect (8%). Interestingly and possibly related to GVCs, the share of twoway traders (17%) is larger than that of pure exporters (only 5%), suggesting that firms may be indeed involved in value added trade.

As expected, the share of traders tends to increase with firm's size, as shown in Figure 9. This confirms typical findings of the heterogeneous firms literature, i.e. internationalized firms perform better and size matters. Larger firms indeed can reach farther markets.

Figure 9 also shows that, not surprisingly, larger firms also have a higher probability of being foreign owned and of having international quality certifications.

International quality certifications attest the ability of the firm to meet the international standards typically required in vertically fragmented production processes (Beghin et al., 2015). Firms operating

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[2]Unofrtunately, due to data unavailability, Tunisia could not be included into the analysis.

[3]Internationalization modes are 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. The same applies to indirect traders. Inward FDI is a dummy for firms with a share of foreing 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.

Table 1: Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
sales/employment	1762	9.21	1.71	0.63	16.64
value added/employment	1631	8.69	1.66	-2.17	16.64
tfp	1492	7.03	1.77	-1.40	14.43
exporter	1885	0.05	0.22	0.00	1.00
importer	1885	0.26	0.44	0.00	1.00
twoway	1885	0.17	0.37	0.00	1.00
indirect trader	1885	0.11	0.31	0.00	1.00
GVC	1818	0.13	0.34	0.00	1.00
size	1883	3.96	1.50	1.10	9.68
inward fdi	1885	0.08	0.27	0.00	1.00
human capital	1866	0.59	0.28	0.00	1.00
age	1881	22.35	16.57	1.00	115.00
capital intensity	1614	4.40	3.91	-7.14	14.37

Figure 8: Shares of traders and domestic firms.
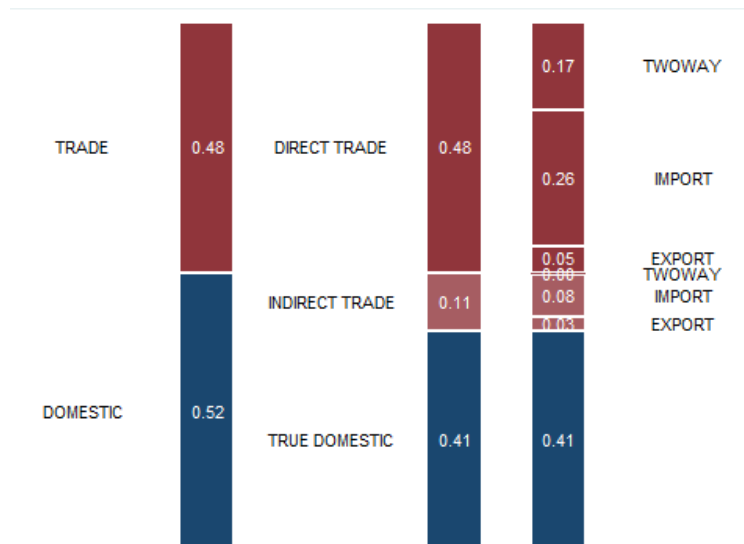
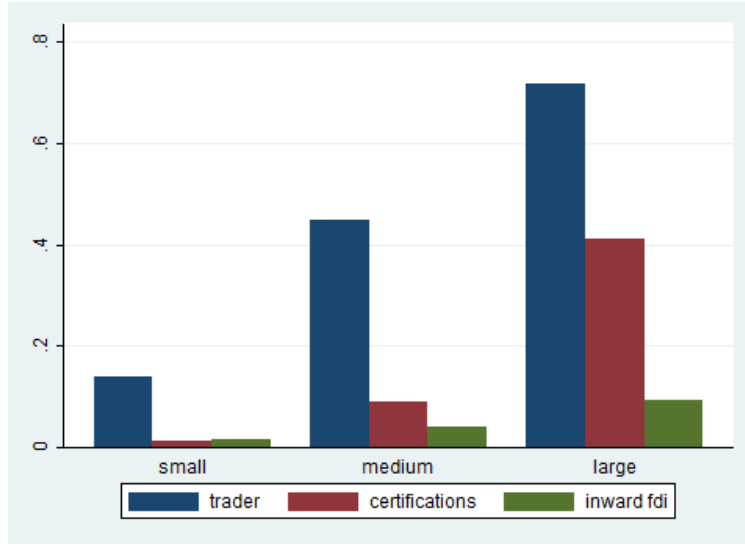Source: Authors' elaboration based on WB Enterprise Surveys.

in GVC require a higher level of coordination along the chain, given the complexity of buyer-supplier relations which implies the exchange of customized products that typically need to satisfy specific requirements. Against this background, international standards and quality certifications can play a key role in identify involvement in international supply chains. Building on this idea, we indeed use the presence of certifications among traders as a proxy for GVC participation.

As expected, summary statistics show that the share of internationalized firms is always higher among certified firms (Table 2). On the one hand, quality certifications tend to be strongly associated with internationalization, as 79% of certified firms are also an international traders. On the other hand, certified firms are only 28% among traders (Table 3). Overall almost all certified firms are also somehow internationalized and certifications seem to capture a specific feature characterizing only some of the traders..

In what follows, we employ the above indicators to gauge the relation between internationalization, GVC participation and firm's performance in terms of productivity. We use sales, value added and employment from the data to compute sales per employee and value added per employee, while total factor productivity (TFP) is estimated. Specifically, our TFP estimation assumes a Cobb-Douglas production function in which value added is the output variable. Due to data constraints, the esti-

Figure 9: Shares of traders, certified firms and foreign owned firm by size class.

Source: Authors' elaboration based on WB Enterprise Surveys.

Table 2: Share of firms by internationalization mode and certifications

	exp	imp	twoway	indtrader	inwfdi	truedomestic
Not certified	0.04	0.22	0.13	0.12	0.06	0.49
Certified	0.11	0.35	0.34	0.06	0.19	0.14
Total	0.05	0.24	0.17	0.11	0.08	0.43

Table 3: Shares of traders and certified firms

	Domestic	Trader	Total		Domestic	Trader	Total
Not certified	60%	40%	100%	Not certified	94%	72%	83%
Certified	21%	79%	100%	Certified	6%	28%	17%
Total	54%	46%	100%	Total	100%	100%	100%

mation is performed at the country level with 2-digit sector fixed effects[4]. Estimated TFP is highly positively correlated with the two other productivity measures as showed in Figure 10.

3.1 Empirical analysis

In our baseline equation we regress the three different productivity measures on the measures of internationalization and on GVCs involvement controlling for several other firm's characteristics:

$$Y_{iac} = \beta_0 + \beta_1 X_i + \beta_2 GVC_i + \beta_3 Z_{iac} + fe_{ac} + \varepsilon_{iac} \qquad (5)$$

where Y is productivity (alternatively sales per worker, value added per worker or TFP) of firm i active in core industry a in country c; X_i is the firm's internationalization mode (either direct or indirect importer, exporter and two-way trader), GVC_i (1 if the firm is a trader and has an internationally-recognized quality certification) is our proxy for global value chain involvement and Z_{iac} represents firm-level control measures, namely capital intensity, human capital, size, age and a foreign ownership dummy variable (1 if i is foreign owned). In addition we make use of fe_{ac} a full set of (country and

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[4]In particular, the number of observations is not sufficient to perform separate country-sector estimations. The estimation is based on OLS regression.

Figure 10: Total factor productivity and other productivity measures.
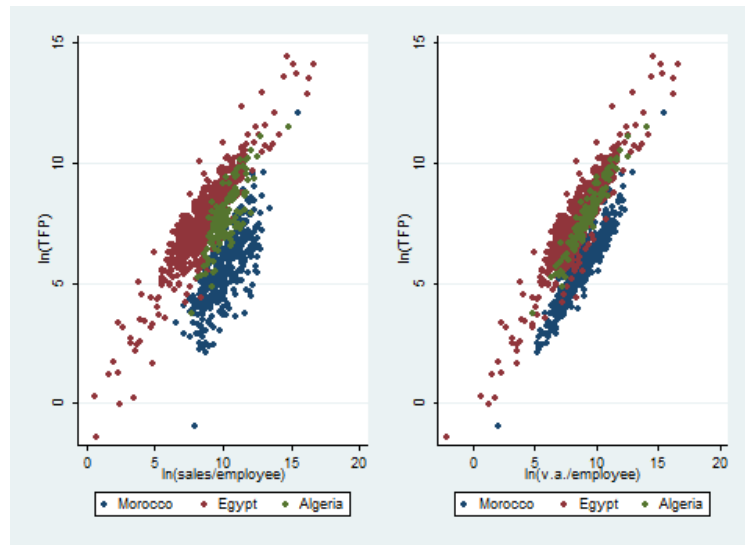
Source: Authors' elaboration based on WB Enterprise Surveys.

industry) fixed effects, in order to take into account all possible differences in institutional environments combined with industrial composition recorded at the 2-digit level of disaggregation.

Estimation results from a standard OLS regression are reported in Table 4[5].

Not surprisingly, there is a positive relation between international linkages and firm performance, as both direct and indirect 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 direct importers tend to have a higher performance than direct exporters, indirect traders and domestic firms (Tomiura, 2007; Kohler and Smolka, 2012).

Regarding GVCs, results are in line with our expectations. Traders in GVCs (i.e. those with an internationally recognized quality certification) present a productivity premium, performing relatively better than other traders. Since quality certifications are a crucial requirement to enter GVCs, this result corroborates our hypothesis that firm in GVC are more efficient, a particularly important result for developing and emerging countries.

Interestingly, foreign ownership is positively related to our dependent variables, which reveals that firms in a multinational group have a higher performance respect their domestic owned counterparts (Blomström and Sjöholm, 1999), while size follows a quadratic approximation, for which productivity rises with firm size, but at a diminishing rate (Foster-McGregor et al., 2014).

Eventually, the model also includes indicators of human capital and capital intensity. The former presents some non-linearities, as both firms endowed with relatively unskilled and skilled employment tend to have a lower performance. Overall, capital intensive firms are more productive.

All the main results are also robust to sample composition effects. In Table 5, we test our specifications firstly by excluding Algeria, whose productive structure, largely based on natural resources, is very different from that of Egypt and Morocco (Table 5, columns 1,2 and 3). Then, to verify that the above results are not driven by the possible presence of outliers, we employ a trimming procedure. Accordingly, we exclude the 1st and 99th percentiles for the distributions of size, sales and value added (Table 5, columns 4,5 and 6). We still find confirmation of our main predictions, according to which the involvement in GVCs is associated to higher performance of firms.

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

Table 4: Productivity, internationalization mode and GVC.

	SALES/EMP	VA/EMP	TFP	SALES/EMP	VA/EMP	TFP
	(1)	(2)	(3)	(4)	(5)	(6)
exp	0.224	0.210	-0.055	0.091	0.089	0.075
	(0.192)	(0.201)	(0.187)	(0.182)	(0.192)	(0.191)
imp	0.650***	0.713***	0.460***	0.540***	0.610***	0.617***
	(0.110)	(0.125)	(0.124)	(0.123)	(0.139)	(0.139)
twoway	0.327***	0.411***	0.150	0.332**	0.451***	0.425**
	(0.125)	(0.134)	(0.129)	(0.150)	(0.166)	(0.166)
indirect trader	0.284**	0.305**	0.259*	0.411***	0.365**	0.367**
	(0.123)	(0.152)	(0.152)	(0.129)	(0.156)	(0.154)
GVC	0.404***	0.441***	0.311**	0.427***	0.435***	0.431***
	(0.130)	(0.138)	(0.131)	(0.130)	(0.136)	(0.135)
inward fdi				0.246*	0.306**	0.302**
				(0.127)	(0.148)	(0.148)
size				0.283**	0.316**	0.237
				(0.133)	(0.150)	(0.150)
size^2				-0.035**	-0.040**	-0.041**
				(0.015)	(0.017)	(0.017)
age				-0.001	-0.002	-0.002
				(0.002)	(0.002)	(0.002)
hc				0.794	1.317*	1.372*
				(0.606)	(0.708)	(0.707)
hc^2				-0.612	-0.991*	-1.057*
				(0.519)	(0.599)	(0.598)
capital intensity				0.278***	0.303***	-0.019
				(0.028)	(0.031)	(0.031)
Constant	3.242***	2.408***	2.740***	1.539***	0.427	2.133***
	(0.225)	(0.243)	(0.242)	(0.388)	(0.435)	(0.435)
R-squared	0.274	0.139	0.315	0.366	0.259	0.331
N	1703	1575	1442	1508	1426	1426
Country FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

The above regressions are estimated using standard ordinary least squares (OLS) techniques, which seek to estimate the performance premia at the conditional mean of the performance distribution. Recently, trade literature is accounting for the heterogeneity of firms in the relation between productivity and both imports and exports (Melitz, 2003; Antràs and Helpman, 2004). Then, there are reasons to believe that the impact of international linkages is likely to differ across firms. In order to consider this we also employ a quantile regression (QR)[6], which estimates the parameters of the model at different points on the (conditional) productivity distribution. In this we rely on Foster-McGregor et al. (2014), estimating different parameters on the GVC and trade dummies for under-achievers (i.e. those at the lower end of the conditional productivity distribution) and over-achievers (i.e. those at the upper end).

QR results are reported in Table 6 for the 25, 50 (i.e. median) and 75th and percentiles of

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[6]In addition to allowing for non-linearities in the relationship between a firm's trading status and its performance, QR has a number of other advantages over OLS. A further benefit relates to the fact that median regression methods can be more efficient than mean regression estimators in the presence of heteroscedasticity. QR is also robust with regard to outlying observations in the dependent variable. The QR objective function is a weighted sum of absolute deviations, which gives a robust measure of location, so that the estimated coefficient vector is not sensitive to outlier observations on the dependent variable. Finally, when the error term is nonnormal, QR estimators may be more efficient than least squares estimators.

Table 5: OLS. No Algeria and trimming procedure.

	SALES/EMP	VA/EMP	TFP	SALES/EMP	VA/EMP	TFP
	(1)	(2)	(3)	(4)	(5)	(6)
exp	0.099	0.073	0.078	0.093	0.069	0.054
	(0.186)	(0.195)	(0.195)	(0.144)	(0.151)	(0.150)
imp	0.565***	0.646***	0.653***	0.520***	0.573***	0.567***
	(0.139)	(0.152)	(0.152)	(0.100)	(0.111)	(0.110)
twoway	0.366**	0.454***	0.443***	0.375***	0.447***	0.446***
	(0.157)	(0.171)	(0.172)	(0.117)	(0.131)	(0.131)
indirect trader	0.622***	0.418**	0.421**	0.385***	0.278*	0.280*
	(0.151)	(0.175)	(0.174)	(0.119)	(0.144)	(0.143)
GVC	0.424***	0.406***	0.414***	0.391***	0.428***	0.411***
	(0.134)	(0.139)	(0.139)	(0.102)	(0.108)	(0.108)
inward fdi	0.270**	0.310**	0.306**	0.149	0.172	0.167
	(0.134)	(0.155)	(0.155)	(0.103)	(0.123)	(0.123)
size	0.340**	0.417***	0.292*	0.407***	0.361**	0.272*
	(0.140)	(0.157)	(0.157)	(0.135)	(0.143)	(0.143)
size^2	-0.041***	-0.049***	-0.047***	-0.046***	-0.043***	-0.047***
	(0.015)	(0.017)	(0.017)	(0.015)	(0.016)	(0.016)
age	-0.001	-0.001	-0.001	-0.002	-0.002	-0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
hc	0.976	1.441*	1.460*	0.100	0.397	0.425
	(0.662)	(0.762)	(0.760)	(0.459)	(0.520)	(0.521)
hc^2	-0.784	-1.146*	-1.167*	0.027	-0.150	-0.176
	(0.567)	(0.644)	(0.643)	(0.400)	(0.451)	(0.451)
capital intensity	0.289***	0.313***	-0.022	0.204***	0.213***	-0.020
	(0.031)	(0.034)	(0.034)	(0.020)	(0.022)	(0.022)
Constant	2.159***	-0.206	-0.011	7.291***	6.377***	7.878***
	(0.404)	(0.455)	(0.455)	(0.357)	(0.394)	(0.395)
R-squared	0.356	0.264	0.338	0.446	0.289	0.434
N	1364	1310	1310	1437	1359	1359
Country FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses *** $p<0.01$, ** $p<0.05$, * $p<0.1$

the conditional productivity distribution. Results on the control variables are largely similar to those obtained by means of OLS regression both in terms of sign and significance, though firm size tends not to be a significant determinant of productivity at lower quantiles. Coefficients on the trade dummies are largely consistent with those from the OLS results as is the ranking in terms of the size of the coefficients. GVC coefficient is found to be larger at lower quantiles of performance, but it is largely positive and significant.

We also report visual evidence of estimates for marginal effects in Figure 11 (Azevedo, 2011). Note that for parsimony we only draw visual estimates for coefficients on GVC metrics, ceteris paribus, i.e. given the other control variables. A reference line is also reported for comparison for simple least squares estimates. Narrow bands of 95% pointwise confidence intervals are reported for both quantiles and least squares specifications.

A similar pattern emerges for our productivity measures. For all of them, firms in the bottom part of the productivity distribution tend to have a higher premium from GVC participation, while more productive firms tend to gain relatively less. This result suggests that the marginal benefits from GVC participation may be higher for less productive firms, other things equal. This seems to be particularly relevant for small and medium enterprises, which tipycally present lower productivity levels. It is worth noting, however, that this evidence, although interesting, is purely qualitative and

Table 6: Quantile regressions.

	SALES/SEMP (1) 25th	SALES/EMP (4) 50th	SALES/EMP (7) 75th	VA/EMP (2) 25th	VA/EMP (5) 50th	VA/EMP (8) 75th	TFP (3) 25th	TFP (6) 50th	TFP (9) 75th
exp	-0.083	0.100	0.343	0.080	-0.043	0.356*	0.029	-0.021	0.343*
	(0.188)	(0.147)	(0.277)	(0.221)	(0.141)	(0.210)	(0.193)	(0.141)	(0.182)
imp	0.537***	0.615***	0.513***	0.628***	0.720***	0.617***	0.549***	0.746***	0.691***
	(0.099)	(0.095)	(0.102)	(0.122)	(0.115)	(0.122)	(0.120)	(0.118)	(0.114)
twoway	0.245*	0.368***	0.287***	0.545***	0.559***	0.343***	0.328**	0.542***	0.356***
	(0.145)	(0.119)	(0.106)	(0.131)	(0.125)	(0.126)	(0.142)	(0.128)	(0.125)
indirect trader	0.345***	0.350***	0.361***	0.387**	0.282**	0.350***	0.348**	0.336**	0.404***
	(0.094)	(0.103)	(0.134)	(0.170)	(0.124)	(0.093)	(0.166)	(0.162)	(0.121)
GVC	0.588***	0.386***	0.350***	0.532***	0.443***	0.291**	0.577***	0.436***	0.270***
	(0.147)	(0.095)	(0.108)	(0.150)	(0.104)	(0.116)	(0.156)	(0.109)	(0.104)
inward fdi	0.130	0.050	0.137	0.292**	0.210*	0.293**	0.310***	0.230	0.326**
	(0.157)	(0.118)	(0.122)	(0.145)	(0.126)	(0.131)	(0.108)	(0.150)	(0.140)
size	0.314**	0.122	0.504***	0.268	0.172	0.536***	0.222	0.089	0.414***
	(0.148)	(0.100)	(0.094)	(0.193)	(0.122)	(0.127)	(0.204)	(0.124)	(0.116)
size^2	-0.036**	-0.010	-0.046***	-0.034	-0.018	-0.051***	-0.037	-0.021	-0.048***
	(0.018)	(0.011)	(0.009)	(0.022)	(0.013)	(0.013)	(0.025)	(0.013)	(0.012)
age	-0.003	-0.002	-0.002	-0.006**	-0.003*	-0.002	-0.007**	-0.002	-0.003*
	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)
hc	0.257	0.495	0.826*	1.018	0.321	0.838*	1.025	0.546	1.017*
	(0.500)	(0.460)	(0.468)	(0.742)	(0.501)	(0.502)	(0.660)	(0.533)	(0.522)
hc^2	-0.095	-0.434	-0.507	-0.623	-0.255	-0.491	-0.643	-0.432	-0.664
	(0.417)	(0.396)	(0.406)	(0.615)	(0.442)	(0.413)	(0.554)	(0.454)	(0.422)
capital intensity	0.220***	0.240***	0.255***	0.227***	0.256***	0.254***	-0.079***	-0.065***	-0.057***
	(0.019)	(0.016)	(0.016)	(0.022)	(0.018)	(0.019)	(0.021)	(0.017)	(0.017)
Constant	1.852	1.858	0.402	0.659	1.008	-0.217	2.259	2.677*	1.395
	(13.043)	(16.800)	(14.392)	(12.544)	(16.277)	(8.227)	(4.075)	(1.560)	(6.764)
N	1508	1508	1508	1426	1426	1426	1426	1426	1426
Country FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

requires further investigation, since the estimates from the QR and OLS are not statistically different, as showed by their overlapping confidence intervals.

Figure 11: Quantile regressions.
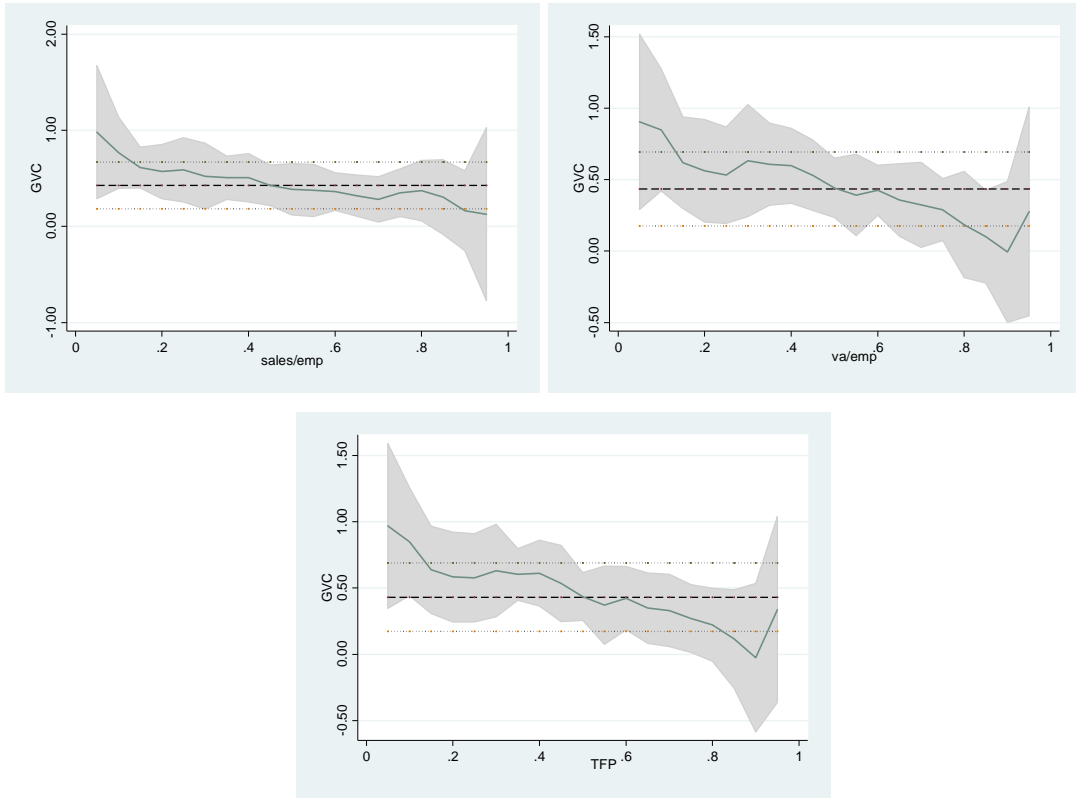
4 Conclusions

In this paper we investigate to what extent North African countries enter into GVCs, from both a macro and micro perspective, exploiting different datasets. Our results show that North Africa has not been able so far to enter into global production networks, being a very marginal player at the world level. Despite this, NA exports, although quantitatively low, largely and increasingly rely on GVC-related trade, being relatively highly involved in production networks. Considering positioning along the GVC, NA mostly participates in the upstream phases, which typically involve low value added activities. However, the area is rather heterogeneous. Different countries are integrated in different ways, with very few successful examples of beneficial participation in a value chain.

Regardless of a firm's position in the value chain, minimum quality and reliability requirements must be met. The buyers' sourcing strategies are constantly revised to improve these elements of their supply chains. The complexity and heterogeneity of quality standards and certifications has become a large barrier, in particular for SMEs, adding a significant cost. 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. On this, international regulatory cooperation (convergence of standards, certification requirements and mutual recognition agreements) can alleviate the burden of compliance and enhance competitiveness.

Above all, for GVCs to have a positive impact, an adequate preparation 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 and pharmaceuticals. Hence policies designed to support education and technical training represent an important tool to increase the gains of global production.

The capacity to take advantages of GVCs relies on the ability to enhance the possible spillovers, specialization and upgrading. 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 employment and eventually growth.

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