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ECONOMIC DEVELOPMENT IN A GLOBALIZED WORLD: THE ROLE OF GLOBAL VALUE CHAINS

Three essays on implications and opportunities for North Africa

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Contents

Introduction

Global Value Chains (GVCs) emerged in the last decades and changed the landscape of the international organisation of production. A value chain comprises *"the full range of activities that firms and workers do to bring a product/good or service from its conception to its end use and beyond [,including] activities such as design, production, marketing, distribution and support to the final consumer"* (Duke University 2020). In the aftermath of two major unbundlings such as the industrial revolution in the XIXth century, and especially the ICT revolution in the '80s (Baldwin 2012), the reduction of transport costs and the development of new technologies increased the possibility of and the profitability from the fragmentation of the production process into single phases carried out by different firms, also located in different countries. Value chains fragmented across countries' borders and the production process has increasingly taken the form of a dense international network. An escalation of commercial and financial linkages has been both the cause and the consequence of this phenomenon: trade flows, especially of intermediate goods, as well as FDI to affiliate key partners, have increased dramatically. Such a complex architecture offers remarkable advantages, such as reduced procurement costs and high degrees of local/regional specialization, but also exposes to relevant risks and sources of instability, especially in the presence of unexpected shocks.

For their relevance in shaping firms' and countries' performances, the international production network and GVCs emerged as an important topic in the international economic literature.

This literature, thanks also to the development of new methodologies and data, covered both the macro- and micro-dimension: the study of international Input-Output (IO) tables to address structural and country level issues, and the analysis of firm level data to empirically and theoretically investigate the drivers of firm participation, are major examples. Moreover, the adaption of new approaches, such as network representation, has enriched the toolkit for these studies.

As far as the macro perspective is concerned, scholars have described the structure of the international production network as well as its evolution over time. Seminal studies have been conducted in this regard by, among the others, Fally (2011), De Benedictis and Tajoli (2011), De Benedictis et al. (2014), Timmer et al. (2014), Los et al. (2015), Baldwin and Lopez-Gonzalez (2015), Amador and Cabral (2017) and Criscuolo and Timmis (2018). In this regard, the flourishing of new methodologies to measure countries engagement in GVCs has been fundamental (Fally 2011;

Antràs et al. 2012; Johnson and Noguera 2012; Koopman et al. 2014; Wang et al. 2017a,b; Borin and Mancini 2019).

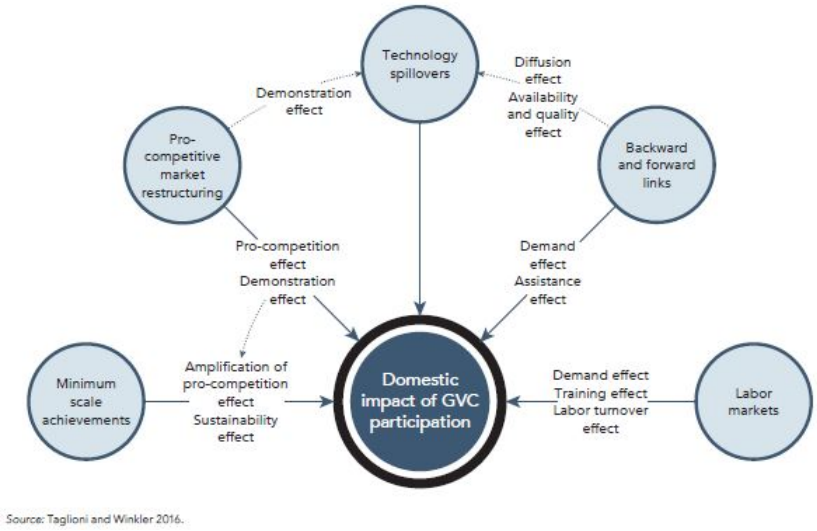
Micro level investigation has instead provided both a theoretical and empirical characterization of firm international behaviour. Krugman (1979, 1980), recognising the increasing role of intra-industry trade of final goods, develops a general equilibrium model where, for the first time, the firms are the actors of trade dynamics. Melitz (2003), Helpman et al. (2004) and others build on this contribution introducing firm heterogeneity as the decisive factor for international performances. Along this line Feenstra and Hanson (1996) and Grossman and Rossi-Hansberg (2008), focusing on trade of tasks and intermediate goods, describe the functioning of GVCs highlighting their impact on labour market composition. Building upon these theoretical contributions and on the growing availability of new micro-level data, the empirical literature flourished: in this regard Clerides et al. (1998) and Bernard and Jensen (1999) provided seminal contributions.

In this globalization process, developed countries have so far had a central role: they have the highest shares of GVCs participation, extract the largest part of value added, and are positioned in the most profitable segments of the chains.

However, GVCs may offer remarkable opportunities also for developing countries (Taglioni and Winkler 2016; World Bank 2019, 2020). A first advantage coming from this organisation of the production is an easier access to international markets, given that firms may produce single intermediate goods or fulfil easier tasks rather than complete final products. Moreover, by increasing participation and improving position in GVCs, developing countries may benefit through several channels (Figure 1) (Taglioni and Winkler 2016): first, firms and countries may activate backward and forward linkages with the domestic economy; second, technological spillovers from foreign relationships may arise; third, facing more intense competition may spur minimum scale achievements. Overall, these phenomena may promote a pro-competitive restructuring of the domestic market, which in turn affects the local labour market, stimulating training and skill upgrading.

Furthermore, GVCs trigger servicification (Lodefalk 2013, 2017). Indeed, firms increasingly buy, produce, sell and export services as integrated or accompanying parts of their primary products. Services are both enablers and phases in the chain: for example communications, insurance and logistics sustain the chain, while R&D, design and after-sales activities are actual stages. Servicification may be incredibly beneficial for many developing countries. Indeed, the development of the service sector may contribute to diversifying their economy as well as to sustaining the traditional sectors that still constitute the backbone of the economy.

Figure 1: GVCs transmission channels



In light of the role that GVCs may play in the development process of many developing countries, I decided to focus my analysis on North Africa (NA). This area is trying to emerge from the group of middle income countries and enter a stable development path. However, the financial crisis of 2008 and the series of Arab Spring revolutions have undermined the progresses achieved over the past decades. In this scenario, the COVID-19 pandemic poses further serious concerns.

Addressing economic development for the whole area is complex. Indeed, despite having suffered common shocks as well as sharing many demographic, cultural and social characteristics, the economic structure of these countries is different. Algeria and Libya are highly dependent on revenues from raw materials such as oil and natural gas; Morocco and Tunisia have developed over the years an advanced manufacturing fabric thanks also to the entry of foreign multinationals into domestic economy; finally, Egypt has an economic structure where traditional sectors, such as shipbuilding and agriculture, coexist along with advanced ones such as ICT. Preliminary analyses on GVCs performances give an approximation of this heterogeneity.

Table 1 provides evidence of countries' exports decomposition. The analysis has been performed using EORA 2016 multi-region input-output (MRIO) Tables at 26 sectors following Borin and Mancini (2019) decomposition methodology. Algeria is found to be by far the largest exporter, followed by Morocco, Egypt, Tunisia and Libya. All countries exports are mainly composed by *Domestic content*: it is not surprising to find highest values for Algeria and Libya, given their specialization in primary resources; figures decline for Egypt, Morocco and Tunisia as the economic structure moves toward a manufacturing specialization. Figures on *DAVAX*, domestic VA directly absorbed by the importer, supports such an explanation: Algeria

and Libya have the lowest values as primary resources are mainly used for further processing – and exports – rather than for final consumption of foreign countries. The decomposition by Borin and Mancini (2019) allows also to estimate the extent of GVCs-related trade in exports. *GVCs-related trade* is defined as the share of exports which crosses at least two borders: according to which is the second border crossed with respect to the one considered, *GVCs-related trade* can be split into *GVC-backward*, if the crossing of the second border took place before the one considered, and *GVC-forward* if further crossings take place after the one considered. Looking at GVCs participation for NA countries, Algeria and Libya lead the group, but, as said, this result comes from primary resources exports: their share of *GVC-backward* is indeed significantly lower than other countries, especially than Morocco and Tunisia. The latter is the only country in the sample with higher *GVC-backward* than *GVC-forward* witnessing its integration into GVCs. Morocco exhibits a similar pattern, while Egypt lies in the middle between the latter and Algeria and Libya.

Table 1: NA Exports Decomposition

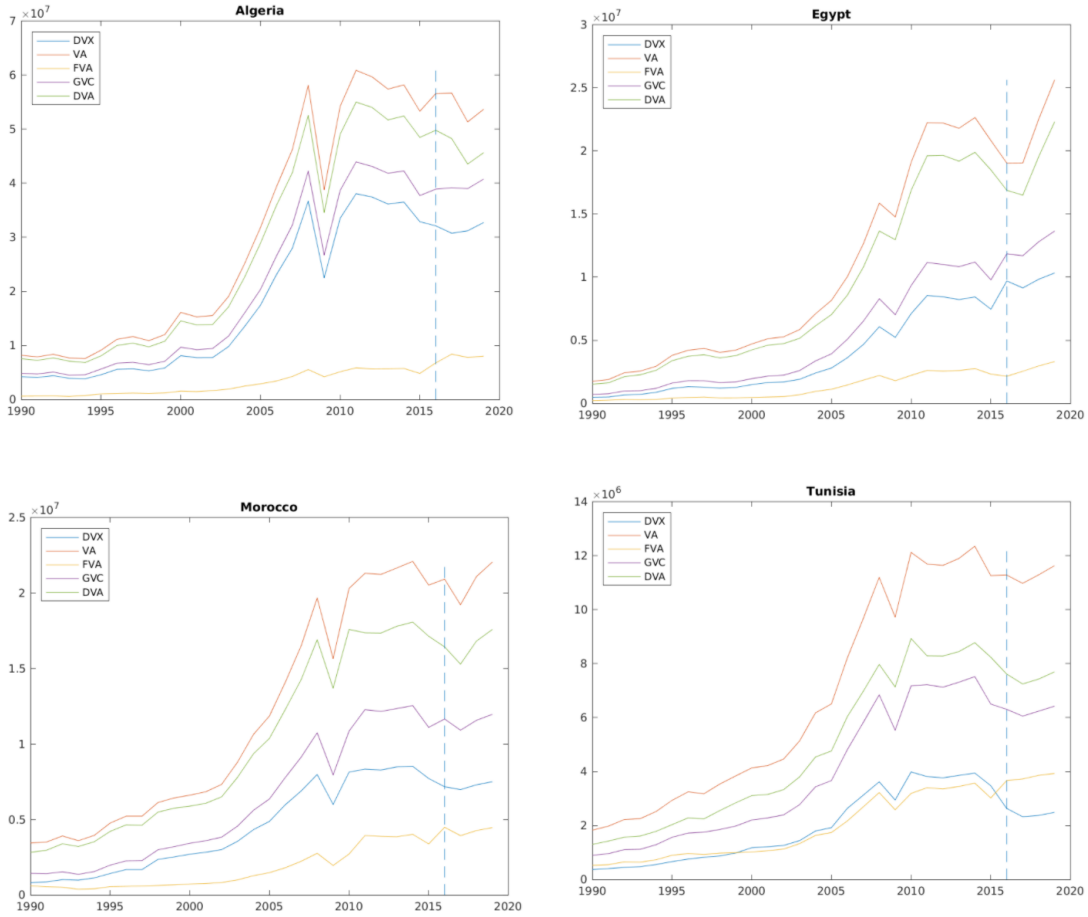
	Algeria %	Egypt %	Libya %	Morocco %	Tunisia %
Gross exports (Million $)	62122.57	22119.99	12052.50	22716.57	12947.23
Domestic content (DC)	91.58	88.81	92.46	83.86	74.49
DAVAX	47.54	63.18	45.46	58.16	51.33
Foreign content (FC)	8.42	11.19	7.54	16.14	25.51
GVC-related trade (GVC)	52.46	36.82	54.54	41.84	48.67
GVC-backward (GVCB)	8.49	11.20	7.55	16.15	25.52
GVC-forward (GVCF)	43.97	25.62	46.99	25.68	23.15

Notes: Elaboration on EORA 2016 MRIO Tables at 26 sectors. The methodology of export decomposition follows Borin and Mancini (2019): *Domestic content* and *Foreign content* are the share of respectively domestic and foreign VA in country exports; *DAVAX* reflects the share of domestic VA that is directly absorbed by the importer; *GVC-related trade* accounts for all trade flows crossing at least two borders and can be decomposed between *GVC-backward*, if further crossings take place before the one considered, and *GVC-forward* if further crossings take place after the one considered. By definition *DAVAX* and *GVC-related trade* are complement.

Figure 2 depicts NA exports decomposition over time. At a first glance, NA countries exhibit a common trend: a significant growth in the international activity of these countries has taken place since the 1990s, with a sharp increase from 2000 and a sudden halt following the 2008 financial crisis. However, responses to the shock have been quite diversified: Algeria, that has suffered most from the shock, entered a declined path; on the contrary, Egypt, probably the least impacted country, after a flat path and a further decline around 2016, has embarked on a trend of clear growth; halfway between these two patterns, Morocco and Tunisia have had ups and downs and only a slight semblance of growth appears in recent years. Interestingly, for

these two countries, the relative share of FVA has been growing steadily, especially for Tunisia, thus suggesting an increasing integration into GVCs.

Figure 2: Exports decomposition over time



Notes: Elaboration by EORA. *VA* is gross exports, *FVA* is Foreign Value Added, *DVA* is Domestic Value Added, *DVX* is Domestic Value Added used as inputs in other countries exports, *GVC* is GVC-related trade.

In light also of the diversity of NA countries, my research has focused, rather than on an organic approach to the whole area, on the analysis of specific issues addressed by the literature concerning the role of GVCs on development. The structure of this work is therefore more similar to a series of self-contained papers rather than to an organic thesis.

In particular, in the first chapter I address the impact of GVCs participation on firm productivity. The issue has been widely discussed in the literature: while first studies pointed out the existence of just a self-selection mechanism into international markets according to productivity, evidence came out about a learning by participating effect. The chapter enriches this literature by investigating Egyptian firms performances in the aftermath of the Arab Spring revolution. I find a positive

and significant impact of GVCs participation on firm productivity, especially for domestic firms.

In the second chapter, I investigate the relationship between firm GVCs participation and FDI activity. Relying on a very recent strand of literature, I hypothesise and prove that the direction of FDI follows and is caused by firm pattern of trade. Introducing governance indicators, I find changes in the general relationship according to countries' development. Moreover, a focus on NA reveals the peculiarity of this area. The analysis, for whom I enjoyed the supervision of also Dr. Gianluca Santoni, has been conducted on French administrative data during my visiting period at *CEPII*[1].

Finally, in the last chapter, I link the literature on GVCs with the Economic Complexity (EC) approach (Hidalgo, Klinger, et al. 2007; Hidalgo and Hausmann 2009). The latter provides new tools and metrics to measure countries economic performances and offers interesting insights to study economic development. I link these strands of literature by applying the Product Space and other EC metrics to the study of GVCs. I also provide a new index to measure countries GVCs participation coherent with the EC approach. These contributions are then applied to the case study of NA countries.

All in all, the research proves the importance of internationalisation for economic development. Integrating into GVCs, firms may increase their performances, and therefore countries improve their position and widen their linkages into the international production network.

If one imagines a climber along a rock face, the success in climbing higher and higher will of course depend on preparation but also on the ability to take advantage of new and unexpected handholds. Following this analogy, GVCs cannot but constitute handholds in the development process: not recognising or exploiting their role can slow down the ascent and increase the distance from other "climbers". Given their position, developing countries cannot fail to exploit GVCs.

[1] *Centre d'Études Prospectives et d'Informations Internationales*, Paris.

References

Amador, João and Sónia Cabral (2017). "Networks of value-added trade". In: *The World Economy* 40.7, pp. 1291–1313.

Antràs, Pol, Davin Chor, Thibault Fally, and Russell Hillberry (2012). "Measuring the upstreamness of production and trade flows". In: *American Economic Review* 102.3, pp. 412–16.

Baldwin, Richard (2012). *Global supply chains: Why they emerged, why they matter, and where they are going*. Tech. rep. CEPR Discussion Papers.

Baldwin, Richard and Javier Lopez-Gonzalez (2015). "Supply-chain trade: A portrait of global patterns and several testable hypotheses". In: *The World Economy* 38.11, pp. 1682–1721.

Bernard, Andrew B and J Bradford Jensen (1999). "Exceptional exporter performance: cause, effect, or both?" In: *Journal of International Economics* 47.1, pp. 1–25.

Borin, Alessandro and Michele Mancini (2019). *Measuring what matters in global value chains and value-added trade*. Policy Research Working Paper 8804. The World Bank.

Clerides, Sofronis K, Saul Lach, and James R Tybout (1998). "Is learning by exporting important? Micro-dynamic evidence from Colombia, Mexico, and Morocco". In: *The Quarterly Journal of Economics* 113.3, pp. 903–947.

Criscuolo, Chiara and Jonathan Timmis (2018). "The Changing Structure of Global Value Chains: Are Central Hubs Key for Productivity?" In: *International Productivity Monitor* 34, pp. 64–80.

De Benedictis, Luca, Silvia Nenci, Gianluca Santoni, Lucia Tajoli, and Claudio Vicarelli (2014). "Network analysis of world trade using the BACI-CEPII dataset". In: *Global Economy Journal* 14.3-4, pp. 287–343.

De Benedictis, Luca and Lucia Tajoli (2011). "The world trade network". In: *The World Economy* 34.8, pp. 1417–1454.

Duke University (Oct. 2020). *GLOBAL VALUE CHAINS Iniative - CONCEPTS & TOOLS*. URL: https://globalvaluechains.org/concept-tools.

Fally, Thibault (2011). "On the Fragmentation of Production in the US". In: *University of Colorado mimeo*.

Feenstra, Robert C and Gordon H Hanson (1996). *Globalization, outsourcing, and wage inequality*. Tech. rep. National Bureau of Economic Research.

Grossman, Gene M and Esteban Rossi-Hansberg (2008). "Trading tasks: A simple theory of offshoring". In: *American Economic Review* 98.5, pp. 1978–97.

Helpman, Elhanan, Marc J Melitz, and Stephen R Yeaple (2004). "Export versus FDI with heterogeneous firms". In: *American Economic Review* 94.1, pp. 300–316.

Hidalgo, César and Ricardo Hausmann (2009). "The building blocks of economic complexity". In: *Proceedings of the National Academy of Sciences* 106.26, pp. 10570–10575.

Hidalgo, César, Bailey Klinger, A-L Barabási, and Ricardo Hausmann (2007). "The product space conditions the development of nations". In: *Science* 317, pp. 482–487.

Johnson, Robert C and Guillermo Noguera (2012). "Accounting for intermediates: Production sharing and trade in value added". In: *Journal of International Economics* 86.2, pp. 224–236.

Koopman, Robert, Zhi Wang, and Shang-Jin Wei (2014). "Tracing value-added and double counting in gross exports". In: *American Economic Review* 104.2, pp. 459–94.

Krugman, Paul (1979). "Increasing returns, monopolistic competition, and international trade". In: *Journal of International Economics* 9.4, pp. 469–479.

— (1980). "Scale economies, product differentiation, and the pattern of trade". In: *American Economic Review* 70.5, pp. 950–959.

Lodefalk, Magnus (2013). "Servicification of manufacturing–evidence from Sweden". In: *International Journal of Economics and Business Research* 6.1, pp. 87–113.

— (2017). "Servicification of Firms and Trade Policy Implications". In: *World Trade Review* 16.1, pp. 59–83. DOI: 10.1017/S147474561600029X.

Los, Bart, Marcel P Timmer, and Gaaitzen J de Vries (2015). "How global are global value chains? A new approach to measure international fragmentation". In: *Journal of Regional Science* 55.1, pp. 66–92.

Melitz, Marc J (2003). "The impact of trade on intra-industry reallocations and aggregate industry productivity". In: *Econometrica* 71.6, pp. 1695–1725.

Taglioni, Daria and Deborah Winkler (2016). *Making global value chains work for development*. The World Bank.

Timmer, Marcel P, Abdul Azeez Erumban, Bart Los, Robert Stehrer, and Gaaitzen J De Vries (2014). "Slicing up global value chains". In: *Journal of Economic Perspectives* 28.2, pp. 99–118.

Wang, Zhi, Shang-Jin Wei, Xinding Yu, and Kunfu Zhu (2017a). *Characterizing global value chains: Production length and upstreamness*. Tech. rep. National Bureau of Economic Research.

— (2017b). *Measures of participation in global value chains and global business cycles*. Tech. rep. National Bureau of Economic Research.

World Bank (2019). *GLOBAL VALUE CHAIN DEVELOPMENT REPORT 2019 - TECHNOLOGICAL INNOVATION, SUPPLY CHAIN TRADE, AND WORKERS IN A GLOBALIZED WORLD*. The World Bank.

— (2020). *WORLD DEVELOPMENT REPORT 2020 - TRADING FOR DEVELOPMENT IN THE AGE OF GLOBAL VALUE CHAINS*. The World Bank.

Chapter 1

Global Value Chains participation and firm productivity: evidence from Egypt

Abstract

Global Value Chains (GVCs) have become the predominant structure in world trade flows. They allow firms to specialise in very specific tasks, thus offering an easier access to international markets. Developing countries may benefit from this framework through many channels. I focus on Egypt, a country that faced remarkable challenges in recent years. The analysis is based on the World Bank Enterprise Survey (WBES). After descriptive statistics that evidence the superior performances of traders with respect to domestic firms, I investigate the specific relationship between GVCs participation and firm productivity. I am interested in inquiring whether a learning mechanism for Egyptian GVCs participants in the aftermath of the revolution exists. I use the definition by Taglioni and Winkler (2016), that allows participants to be broken down into different groups and, hence, to investigate differential effects for these categories. By using a DiD-PSM procedure, I find that entering GVCs causes an increase in firms' productivity; moreover, the effect is heterogeneous among the different groups. In the empirical analysis I confront the results with those obtained using the Multiple Imputation procedure, in order to partially solve the problem of missing data.

Keywords: Global Value Chains, Firm Productivity, Egypt
JEL codes: F61, O10, O12, O55

1.1 Introduction

The Arab Republic of Egypt is the third richest African country, and, with almost 100 hundred million people, also the third by population. The role and the prestige of this country are linked to its geographical position and conformation: the Nile river regular and abundant floods paved the way for the flourishing of one of the greatest history civilization; being the corner point between the Mediterranean and the Red sea has made the country a world commercial hub since the opening of the Suez Canal in 1869; finally, in the last century the country has often served as a buffer state between the West and the Middle East in balancing international tensions as during the Israeli state birth or, more recently, throughout the ISIS crisis.

Today Egypt is slowly recovering from turbulent years characterized by severe social unrest and political instability, which caused a significant slowdown to the development of the country. Although the economy is gradually finding its feet, many social issues that led to the revolution have not yet been addressed (Santos and Ceccacci 2015; IEMed 2015, 2016, 2017, 2018; Arezki et al. 2018). In such a fragile situation it is thus even more complex putting into practice sound and far-reaching development policies.

Far from offering a panacea, I empirically investigate possible economic benefits emanating from the engagement of Egyptian firms in international trade. In particular, my focus is on analysing opportunities deriving from the international fragmentation of production and through the underlining structures of Global Value Chains (GVCs). Acknowledging the large potential of GVCs for economic development, I focus on the effect of GVCs participation on the productivity of Egyptian firms.

The relationship between firm internationalisation and productivity has a central role in the international economic literature. A growing availability of firm-level data has indeed fostered the study of firms' international performances. Exporters are found to outperform domestic firms (Bernard and Jensen 1999; Aw, Chen, et al. 2001; Aw and Hwang 1995): they are larger, pay higher wages, are more capital intensive and more productive. This emerging evidence of firm heterogeneity gives many scholars the opportunity to expand the Krugman (1979, 1980) model and thus to offer new interesting insights on firm performances.

Extensive research has indeed investigated whether differences in firm performances, especially productivity, are either a cause, a consequence or both the two of firm international status (Wagner 2007, 2012).

Melitz (2003), building on Krugman (1979), theoretically models firm hetero-

geneity by allowing productivity to be firm specific. Opening up to trade causes a sectoral reallocation of revenues and profits such that least productive firms are forced to exit the market, while the most productive ones survive, export and gain revenues and profits. Therefore, Melitz (2003) concludes that exporters are ex-ante more productive than domestic firms, thus underlining the existence of a self-selection mechanisms that lead to internationalisation.

If on one side the self-selection mechanisms is consistent with empirical data, participating to international trade may also increases firm productivity, and thus constituting a learning process, by allowing for an easier access to more productive foreign inputs, such as advanced technology, or by stimulating product and process upgrading to face fiercer competition.

The empirical literature have evidenced the existence of both self-selection and learning mechanisms in explaining productivity differentials.

The first studies on the issue are mainly confined to exporting as internationalisation mode. On one hand, Clerides et al. (1998) for Colombia, Mexico and Morocco, and Bernard and Jensen (1999) for USA find no evidence of the existence of learning by exporting, suggesting that productivity differentials are determined by ex-ante differences; Delgado et al. (2002) confirm this hypothesis for Spain, evidencing that a learning mechanism exists, though weak, only for "younger" exporters. On the other hand, several studies highlight the existence of a learning by exporting effect: among these, Baldwin and Gu (2003) document it for Canadian manufacturing firms; Van Biesebroeck (2005) reports an increasing gap during time between exporters and domestic firms on a panel of firms from nine Sub-Saharan countries, identifying scale achievement as the main contributor to the productivity increase; De Loecker (2007) finds similar effects in his study on Slovenia; Lileeva and Trefler (2010), analysing the effect of US tariffs cuts on Canadian firms, find an overall but heterogeneous learning by exporting impact.

The literature has also investigated the role played by other modes of internationalisation in shaping productivity dynamics. As far as importing is concerned, Amiti and Konings (2007) document for Indonesia that a reduction of import tariffs induces productivity gains deriving from easier access to foreign intermediate inputs through which learning, variety and quality effects spread; similar results are found for India by Topalova and Khandelwal (2011); productivity is found to increase with internationalisation also for Chilean firms: Kasahara and Rodrigue (2008) report a learning by importing effect, while Kasahara and Lapham (2013) single out the complementarities between imports and exports as the main driver for this growth. Halpern et al. (2015) find for Hungarian firms that importing in-

puts contributed to the 22 percent increase of firm's revenue productivity, and to one-quarter of Hungarian productivity growth during the 1993-2002.

In addition, also the effect on productivity of the interaction of different internationalisation modes has been investigated (Altomonte and Békés 2009; Vogel and Wagner 2010).

In this context, Criscuolo and Timmis (2017) assess the relationship between productivity and GVCs participation. GVCs, as said, are complex structures in which firms may perform different roles and functions according to their position and involvement. A first consequence of this complexity, is the difficulty in finding a definition of GVCs participant that could encompass this heterogeneity. A unique definition does not exist, with different attempts focused only on specific aspects. As a consequence, the literature investigating the relationship between productivity and GVCs participation is today experiencing its primal development. Nevertheless, the first studies seem to confirm gains in productivity from participating. Giovannetti et al. (2015) investigate the positive impact of GVCs participation on the performances of Italian small enterprises. Baldwin and Yan (2016), considering two-way traders as GVCs participant, find a learning effect for Canadian entrants in GVCs; Del Prete et al. (2017), by defining traders with an internationally recognized quality certifications as participant, single out a learning by participating effect for Morocco and Egypt in the time span 2004-2007. Ayadi et al. (2020), testing several definitions of GVCs participation, show a positive and significant association between TFP gains and GVCs in the North African region.

This work aims to contribute to this recent literature on the relationship between GVCs participation and productivity. It has a threefold objective: first, enlarging this narrow and specific strand of the literature; second, addressing the issue by testing a new definition of GVCs participant proposed by Taglioni and Winkler (2016) which offers an original perspective, that, to my knowledge, has never been empirically assessed previously; third, updating the analysis on Egypt by Del Prete et al. (2017) in the aftermath of the Arab Spring revolution, thus providing interesting insights for policy implementation. Furthermore, I apply a statistical solution to avoid some of the problems arising from missing data.

Using a balanced panel dataset for the time span 2013-2016, I find that entering GVCs increases firm productivity. However, this effect is not homogeneous among different types of participants. The results are in line with previous estimates for Egypt (ibid.), as well as robust to change in the empirical strategy and to multiple imputation of missing data.

The chapter is organised as follows: Section 1.2 presents the data and the empirical methodology; Section 1.3 provides descriptive statistics on Egyptian firms and internationalisation; Section 1.4 reports results; Section 1.5 concludes.

1.2 Data and empirical strategy

The analysis is conducted on World Bank Enterprise Survey (WBES) data. This project provides standardised firm-level data and it has so far interviewed 164,000 enterprises in 144 countries, with new surveys currently under implementation. Each dataset is nationally representative and is based on a questionnaire characterised by a common structure, containing information on firm characteristics, firm outcomes (such as sales, supplies, employment and capital), and business environment (both factual and perceived), and by a regional and country specific part.

As far as Egypt is concerned, several waves of WBES are available. This analysis is based on the 2013 and 2016 waves. This choice allows to study the post-Arab spring economic environment, which is supposed to have been profoundly shaken by the social conflicts that hit the country between 2011 and 2013. The 2013 wave comprises 2897 enterprises, with 1827 in the 2016 wave[1]. On this sample I calculated the descriptives statistics. The empirical analysis is instead implemented on the balanced panel that comprises all the 659 firms that have been interviewed in both the waves, for a total of 1318 observations.

Firms are considered GVCs participants according to the definition given by Taglioni and Winkler (2016, p. 112). Such definition considers 4 types of firms as GVCs participants: multinationals, domestic suppliers of country's multinationals, domestic suppliers that export, and domestic producers that import[2]. The relevance of this definition relies on the fact that it recognizes the existence of different types of firms, and thus of their different roles, in GVCs. Hence, it defines GVCs participants as an heterogeneous group of firms, thus conveying the complexity of the chain structure and of its internal relationships. Given this peculiarity, this definition allows, on one hand, the inclusion into GVCs of a heterogeneous set of actors which other definitions may have overlooked and, on the other hand, the exclusion of firms that are not actually involved in GVCs but are instead (well-recognised)

[1]For details about dataset structure see Appendix *A5. Dataset structure.*

[2]Data constraints prevent for the precise identification of the 4 groups: domestic suppliers of country's multinational cannot be identified; moreover, it is not possible to unambiguously distinguish between producers and suppliers. A detailed description about the way different status are assigned is given in the Appendix *A1. Assignment of GVCs participant status.*

traders who, with certain other criteria, may have been included. Two examples of this selection mechanism are briefly given: defining GVCs participants as two-way traders may constitute a too strict criterion, since, for example, domestic suppliers that only export but source domestically will be excluded, while having a role in the world production process and possibly being integrated in GVCs; conversely, defining GVCs participants as certified traders may constitute a too large criterion since some one-way certified traders, as simple certified exporters or importers, that possibly may not be integrated into GVCs, can be included. In this work, according to data availability, the following groups have been identified: multinationals, as foreign owned (>10%) firms which source domestically; domestic suppliers, as domestic (>90%) firms which export at least the 10% of their production; and domestic (>90%) producers, as domestic importers of at least the 25% of their inputs[3]. Therefore, any firm belonging to one of these group is considered a GVCs participant.

Despite the discussed advantages, also the limitations of this definition must be recognised. The most important of them is the high extent of arbitrariness. This concerns, on the one side, the taxonomy of participants, which are fixed in Multinationals, Domestic Producer and Domestic Supplier, and on the other side, the criteria for the inclusion in each of the specific group, which is built on fixed exogenous thresholds. Given these considerations, I find that investigating the heterogeneity of GVCs participants may offer interesting insights for the empirical literature and offer precious hints for developing countries policy agenda. For this purpose, keeping in mind the limitations afore mentioned, I exploit in Section 1.4.4 the nature of this definition to identify heterogeneous effects between groups, as well as to propose possible improvements of the classification.

As far as productivity is concerned, I compute different measures: Labour productivity, and Total Factor Productivity (TFP) based on Levinsohn and Petrin (2003) and on Olley and Pakes (1992) procedures[4].

As regards identification assumption, a causality issue is to be addressed. As a consequence, the empirical strategy is based on the combination of two widely used impact evaluation techniques: Difference-in-Difference (DiD) and Propensity Score

[3]Different thresholds for domestic suppliers' exports and domestic producers' imports have been tested: the selected ones are average values. A detailed description about the way different status are assigned is given in the Appendix, *A1. Assignment of GVCs participant status.*

[4]For details about the computation of productivity measures see Appendix *A2. Productivity Measurement*

Matching (PSM) (Caliendo and Kopeinig 2008). This procedure makes allowance for both unobservable (DiD) and observable (PSM) factors that could have affected firms decisions and performances (Del Prete et al. 2017; De Loecker 2007; Baldwin and Yan 2016).

Treatment and control groups are thus defined: treated firms are the firms that entered GVCs – hence they were outside in 2013 and inside in 2016; control firms are the ones always outside (Table 1.1).

Table 1.1: Change in GVCs status

	# of firms	%
Exiters	58	8.80
Always outside (Control Group)	392	59.48
Enters (Treatment Group)	130	19.73
Always inside	79	11.99
Total	659	100.00

The comparability between the treatment and the control group is ensured by the establishment of a common support through PSM. This procedure is fundamental to ensure that productivity differentials emerging from DiD analysis can be attributed only to the treatment.

Explicitly, with PSM, firm probability in 2013 of getting the treatment is calculated by using a Probit Model where the treatment variable is regressed against firm productivity, either Labour or L&P or O&P productivity, firm age in 2013, and a categorical variable defining firms as small, medium or large. The choice of these variables is in line with the international economics literature (Del Prete et al. 2017; De Loecker 2007). The balancing between treatment and control for each observable is assessed along 8 different blocks; propensity scores have been then used in the DiD analysis as probability weights. According to the specific productivity estimate used, several matching procedure have been implemented, and hence different common supports and probability weights obtained[5].

Once the matching is performed, the effect of the treatment is measured on the subset of firms inside common support using a standard DiD procedure, Equation 1.1:

$$PROD_{it} = \beta_0 + \beta_1 t + \beta_2 TREATMENT + \beta_3 POST + \gamma_s + \varepsilon_i \qquad (1.1)$$

where $PROD_{it}$ may be either labour productivity or TFP, t is a dummy equal to 0 in 2013 and 1 in 2016, $TREATMENT$ is a dummy equal to 1 if the firm entered

[5]For more details about the PSM procedure see Appendix *A3. PSM.*

GVCs in the 2013-2016 time span, $POST$ is the interaction dummy between t and TREATMENT, and γ_s are industry controls[6].

To control for some other factors that could have led to a productivity increase, I performed an estimation through Equation 1.2:

$$PROD_{it} = \beta_0 + \beta_1 t + \beta_2 TREATMENT + \beta_3 POST + \beta_4 preR\&D + \beta_5 preTr + \beta_6 C + \gamma_s + \varepsilon_i \tag{1.2}$$

where $preR\&D$ is a dummy equal to 1 if the firm had R&D expenditure in 2012, $preTr$ is a dummy equal to 1 if the firm implemented a training program for its workers in 2012, and C is a dummy equal to 1 if the firm has an internationally recognized quality certification.

1.3 Descriptive statistics

The first set of statistics reports the firms' status, i.e. if firms operate domestically or also internationally. In the time span considered, Egyptian firms have increased their participation in foreign markets[7] (Table 1.2). The percentage of traders increased 10pp in the time span, from 26% to 36%. In particular, the percentages of both exporters and importers rose, respectively by 2 and 13pp[8]. As a consequence, also the percentage of two-way traders increased from 8.7 to 13.8%.

In addition to the increase in participation, Egyptian firms have also improved their "quality" on foreign markets. Indeed, the share of international enterprises with recognized quality certification have drastically increased in the time span 2013-2016 (Table 1.3). In particular, the share of internationally-recognized certified firms has increased by 8pp if traders are taken into account. The change is found to be smaller (2pp) for importers, while much larger for exporters (19pp). The large increase in the share of certified exporters is an important result for the country: indeed, the adoption of certifications and the meeting of product and process

[6]Robust standard errors and weights reflecting firm probability to be treated, derived from the PSM, have been used.

[7]Modes of internationalisation taken into account are the following: traders refers to firms that either import, or export, or both; importers are the firm that use directly bought foreign inputs (variables 9 and 10, Dataset Structure Table, Appendix A5); exporters are firms that directly sell their output foreignly (variable 8, Dataset Structure Table, Appendix A5); two-way traders are firms that both import and export. As a consequence these classes are not mutually exclusive, e.g traders comprise also two-way traders, importers comprise also some exporters and vice-versa.

[8]The large increase in importers' rate is affected by a large degree of missing data in the 2013 variables used to define the importer status. However, some controls suggest that missing data are not correlated with specific firm characteristics. Hence, given the aggregate results for traders, an increase in the percentage of importers is expected to have been detected even with completed data

Table 1.2: Exporters, Importers, and Two-way traders in 2013 and in 2016

		Exporters					
		2013			2016		
		No	Yes	Total	No	Yes	Total
Importers	No	1487	152	1639	1160	83	1243
	(%)	(74.05%)	(7.57%)	(81.62%)	(64.05%)	(4.58%)	(68.64%)
	Yes	194	175	369	318	250	568
	(%)	(9.66%)	(8.72%)	(18.38%)	(17.56%)	(13.80%)	(31.36%)
	Total	1681	327	2008	1478	333	1811
	(%)	(83.72%)	(16.28%)	(100%)	(81.61%)	(18.39%)	(100%)

Notes: Importers are the firm that use directly bought foreign inputs (variables 9 and 10, Dataset Structure Table, Appendix A5); exporters are firms that directly sell their output foreignly (variable 8, Dataset Structure Table, Appendix A5).

standards have become, especially for firms in developing countries, a *sine qua non* condition to implement sound international relationships (Nadvi 2008). Hence, given that developing countries' firms often operate in the international production process as assemblers or recipients of de-localised tasks (Grossman and Rossi-Hansberg 2008), to have an international quality certification is fundamental to increasing or just triggering GVCs integration.

Table 1.3: Traders and International Quality Certifications

	Traders		Importers		Exporters		Two-way traders	
	2013	2016	2013	2016	2013	2016	2013	2016
Non Certified	49.74%	41.69%	44.44%	42.65%	42.08%	23.28%	20.83%	19.20%
Certified	50.26%	58.31%	55.56%	57.35%	57.92%	76.72%	79.17%	80.80%
Total Obs.	577	650	360	565	385	335	168	250

Notes: Traders refers to firms that either import, or export, or both; importers are the firm that use directly bought foreign inputs (variables 9 and 10, Dataset Structure Table, Appendix A5); exporters are firms that directly sell their output foreignly (variable 8, Dataset Structure Table, Appendix A5); two-way traders are firms that both import and export. Internationalisation modes are not mutually exclusive.

These considerations are reinforced by the figures regarding two-way traders. Indeed, the firms that both imports and exports and are, therefore, highly integrated in international markets, even in 2013 exhibit a very high share of certifications (79%). This share slightly increases (1,5 pp) in 2016.

Let us now investigate some characteristics of international firms. Are firms involved in international trade different from domestic ones (Bernard and Jensen 1999)? To address this question, I investigate, in line with the existing literature, the existence of premia for traders (Table 1.4).

Table 1.4: Traders' premia

	Traders		Importers		Exporters		Two-way traders	
	No	Yes	No	Yes	No	Yes	No	Yes
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Small Firms (5-19) (%)	45.90	21.42	43.98	18.79	44.93	18.54	43.66	10.59
Medium Firms (20-99)(%)	36.34	29.06	36.26	27.81	34.54	26.25	34.60	21.41
Large Firms (100+) (%)	17.76	49.52	19.75	53.40	20.82	55.21	21.74	68.00
Total (%)	100	100	100	100	100	100	100	100
Mean of employment (#)	61.68	361.58	81.09	384.13	81.06	485.06	93.36	625.72
Mean of VA (ln)	13.70	16.35	13.92	16.38	13.98	16.79	14.15	17.09
Mean of Labour Productivity (ln)	11.25	12.14	11.30	12.22	11.41	12.11	11.43	12.26

Notes: Traders refers to firms that either import, or export, or both; importers are the firm that use directly bought foreign inputs (variables 9 and 10, Dataset Structure Table, Appendix A5); exporters are firms that directly sell their output foreignly (variable 8, Dataset Structure Table, Appendix A5); two-way traders are firms that both import and export. Internationalisation modes are not mutually exclusive. *Labour Productivity* is calculated as *Total Sales* over *Total Employment*

As expected, traders are bigger. The share of large firms is indeed higher (50%) than for domestic firms (18%) (Column 1-2), and the opposite is true for small and medium enterprises. Almost no differences can be found when decomposing between importers and exporters (Columns 3-6). Instead, a difference exists when dealing with two-way traders (columns 7-8): the share of large firms is much higher (68%) for this type of internationalisation, with only 10% represented by small firms.

By analysing the differences in size taking into account total employment, I obtain similar results. Traders outperform domestic enterprises, with, on average, 300 workers more. Again, two-way traders have a larger premium in terms of size, with an average of 626 workers, almost 6 times the non-two-way (93). Finally, in this case, importers and exporters exhibit differences: exporters employ, on average, 100 workers more than importers.

The last two rows of Table 1.4 show other two types of traders' premia. Traders obtain larger VA from their activities and have higher labour productivity than domestic firms. For these two measures no particular variation appears between the different modes of internationalisation.

The tables directly above highlight the existence of premia for traders. In particular, a status-size-productivity nexus has been detected. Figures 1.1 and 1.2 provide further support for this evidence. Figure 1.1 shows the dominance of traders' distribution with respect to domestic firms. Indeed, all the three modes of internationalisation considered here – only importers, only exporters and two-way traders – have an average productivity that is higher than domestic firms. Moreover, importers are

found, on average, to be more productive than exporters, whilst two-way traders outperform both of them, with a skewed distribution characterized by a larger density about 13-15 productivity level.

Figure 1.1: Labour productivity distribution by firm status

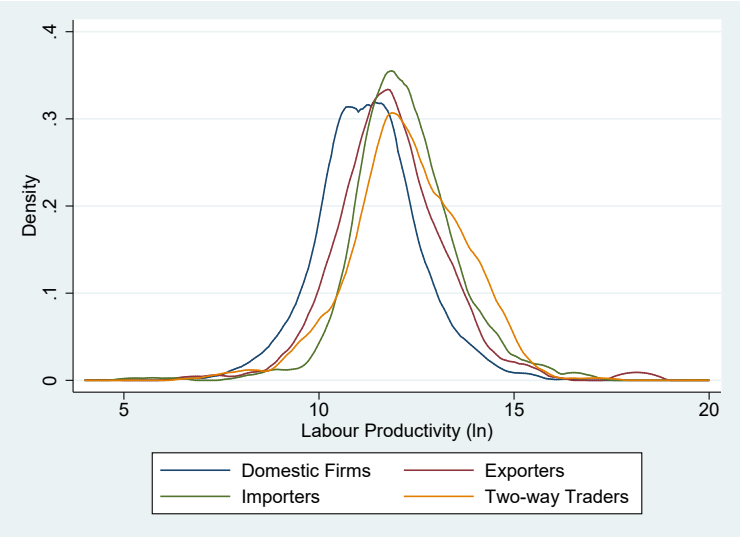
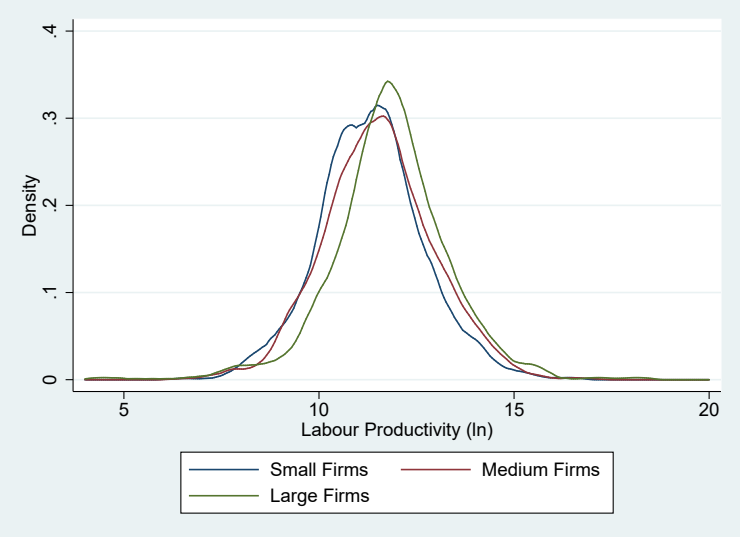


Figure 1.2, on the other hand, shows the relationship between productivity and size, closing the circle of the nexus above mentioned. Large firms, that are more likely to integrate into international markets, are found, on average, to be more productive than small and medium firms. The productivity distributions of the latter do not appear that different.

Figure 1.2: Labour productivity distribution by firm size



1.4 Results

1.4.1 Baseline estimation

Section 1.3 evidences how traders outperform domestic firms in many characteristics including productivity. Table 1.5 provides such evidence on the estimation sample showing how GVCs participants outperform non-GVCs firms in all the measures of productivity.

Table 1.5: GVCs participation and Productivity

	Labour Prod.	$TFP^{L\&P}$	$TFP^{O\&P}$
Non GVCs	11.36	8.25	9.17
# of obs.	786	521	528
GVCs	12.06	8.72	9.65
# of obs.	289	193	199

Notes: GVCs participants are defined according to Taglioni and Winkler (2016).

Table 1.6 reports results estimated by using Equation 1.1, in order to infer causation from GVCs participation to productivity. The coefficient of interest is the one of *POST*. I find that entering in GVCs produces a net increase in labour productivity (Columns 1-2). The coefficient is significant at 5%, and no relevant changes occur when adding controls (Column 2). Considering TFPs as dependent variable does not change results. The magnitude of the coefficient (floating around 0.50) is almost unaffected with the two different techniques (Columns 3-6). However, these coefficients are found to be significant only at the 10% significance level, with the exception being the one for $TFP^{O\&P}$ (Column 6), just above the 10% threshold. I consider the cause for this reduction in significance to be the lower number of observations and in turn the increase in the standard errors. The issue is addressed more in depth in the section 1.4.2, where I apply a multiple imputation procedure to fill missing data.

These results corroborate the large empirical evidence regarding learning by internationalising, and, also, the specific outcomes for MENA countries found by Del Prete et al. (2017) and Ayadi et al. (2020). In particular, an increase in productivity due to GVCs participation is found to exist in Egypt the day after the Arab Spring revolution, and this effect has manifested in just three years (maximum). Moreover, the estimated coefficients are in line with Del Prete et al. (2017).

The heterogeneity that characterises the set of GVCs participants prevents from detecting some specific causes of the productivity increase that is valid for all the

three categories. In any case, as domestic suppliers and domestic producers are the largest groups amongst treated firms, access to foreign high-technology inputs and the increase in competition in foreign markets appear to provide the strongest arguments. This issue is addressed in more depth in Section 1.4.4.

Table 1.6: Learning by participating to GVCs effect

VARIABLES	(1) Labour Prod	(2) Labour Prod	(3) $TFP^{L\&P}$	(4) $TFP^{L\&P}$	(5) $TFP^{O\&P}$	(6) $TFP^{O\&P}$
t	0.13	0.14	-0.21	-0.20	-0.11	-0.12
	(0.12)	(0.12)	(0.19)	(0.19)	(0.18)	(0.18)
TREATMENT	0.04	0.05	-0.03	-0.04	-0.06	-0.0710
	(0.17)	(0.18)	(0.17)	(0.18)	(0.18)	(0.18)
POST	0.57***	0.52**	0.52*	0.51*	0.49*	0.47
	(0.22)	(0.23)	(0.28)	(0.29)	(0.28)	(0.29)
Constant	11.43***	11.40***	8.41***	8.35***	9.29***	9.21***
	(0.21)	(0.22)	(0.21)	(0.22)	(0.23)	(0.24)
Sectors	√	√	√	√	√	√
Controls		√		√		√
Obs.	753	738	482	473	493	484
R-squared	0.10	0.10	0.09	0.09	0.06	0.07

Notes: Robust standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01. Productivity is in logarithm. *TREATMENT* refers to entering GVCs in the 2013-2016 time span. GVCs participants are defined according to Taglioni and Winkler (2016). *POST* identifies the interaction between time and the treatment, thus identifying the DiD parameter. Weights reflecting firm probability to be treated, derived from the PSM, have been used.

1.4.2 Multiple imputed data

The estimates reported in Table 1.6 show a positive effect on productivity measures from participating in GVCs. However, the significance is weaker when TFP is the dependent variable with respect to labour productivity. As said, this is probably due to the lower number of observations for TFP: indeed, several variables used for its estimation have large shares of missing data. To control for the possibility that this may have altered the results, a multiple imputation (MI) analysis has been performed (Rubin 2004).

This procedure allows to fill missing data with imputations. In particular, it provides a set of imputed values for each missing data in the variables of interest such that the variability of original data is conserved. Although I implement MI to reduce the missingness of TFPs estimations, I do not actually impute TFPs,

but rather the variables used to construct TFP: *Total sales, Total employment, Assets, Total electricity costs, Total fuel costs, Total raw material costs, Total labour costs, Total investments.* The imputation has been performed using predictive mean matching chained equations, taking into account the longitudinal structure of the dataset. 10 imputations per variables have been produced. Once imputation has been implemented, single estimations are performed on the 10 datasets and then combined into a single MI result according to the so called Rubin rules[9].

Table 1.7 reports the estimation of Equations 1.1 and 1.2 on the imputed measures of TFPs. The coefficient of interest, β_3, is positive, but slightly lower than

Table 1.7: Learning by participating to GVCs effect on MI data

VARIABLES	(1) TFP	(2) $^{L\&P}$	(3) TFP	(4) $^{O\&P}$
t	-0.25	-0.24	-0.01	-0.00
	(0.24)	(0.25)	(0.18)	(0.19)
TREATMENT	0.06	0.06	0.02	0.03
	(0.18)	(0.18)	(0.19)	(0.19)
POST	0.47**	0.47**	0.44*	0.44*
	(0.23)	(0.23)	(0.24)	(0.25)
Constant	8.59***	8.60***	9.63***	9.62***
	(0.31)	(0.30)	(0.31)	(0.30)
Sectors	√	√	√	√
Controls		√		√
Obs.	1014	990	1010	986

Notes: Robust standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01. Productivity is in logarithm. *TREATMENT* refers to entering GVCs in the 2013-2016 time span. GVCs participants are defined according to Taglioni and Winkler (2016). *POST* identifies the interaction between time and the treatment, thus identifying the DiD parameter. Weights reflecting firm probability to be treated, derived from the PSM, have been used.

before (Table 1.6, Columns 3-6). However, participation in GVCs still increases productivity. Moreover, the significance is higher: all the effects are indeed significant at the 10% level, with the ones for $TFP^{L\&P}$ as dependent variable (Column 1-2) reaching the 5% level. It is important to note that the combination of the m estimates follows the so called Rubin rules (Rubin 2004), an averaging formula that takes into account also the variability that exists between the different imputations. Such procedure may result in an enlargement of the variability of the single MI result. Thus, the significance of the coefficients can be considered a sort of lower

[9]For a more detailed description of MI procedure see Appendix *A4. Multiple Imputation Procedure.*

bound since it comprises a variability inflation due to the difference between the imputations. Hence, it is possible that, had the data been complete, the estimates would have had a significance level more similar to those for Labour Productivity (Table 1.6, Columns 1-2).

1.4.3 Bernard and Jensen (1999) procedure

As a robustness check of results, I implement an alternative identification strategy, developed by Bernard and Jensen (ibid.), and widely used in the literature (Wagner 2007), to detect the relationship between productivity and GVCs participation.

This procedure works on first differences and regresses changes in productivity against dummies that identify the behaviour of firms with respect to participation in GVCs (Equation 1.3):

$$PROD_{it} - PROD_{it-1} = \beta_0 + \beta_1 ENTER + \beta_2 ALWAYS + \beta_3 EXIT + \gamma_s + \varepsilon_i \tag{1.3}$$

where $PROD_{it}$ may be either labour productivity or TFP; $ENTER$, $ALWAYS$ and $EXIT$ are dummy variables equal to 1 if the firm respectively entered, has been inside in both times, or exited GVCs, and 0 otherwise; γ_s are industry controls[10].

This strategy allows me to compare the performances of GVCs entrants with the group of always inside and exiting firms as well. The benchmark are firms that are always outside GVCs. Results are reported in Table 1.8.

As far as labour productivity is concerned (Column 1), GVCs entrants exhibit a positive and highly significant increase in productivity. For always inside firms and for firms that exited GVCs the effect is positive but it is not significant.

Analysing TFPs (with MI data), the coefficients for entrants is again found to be positive (Columns 2 and 3), even if its magnitude decreases with respect to Column 1. For TFP $^{L\&P}$ productivity, the coefficient is significant at 10% level, whilst for TFP $^{O\&P}$ it is just above the threshold, reaching only the 11%. Also for these productivity measures, no effect is found for always inside firms and for firms which exited.

In a nutshell, and with caution due to the short period considered, GVCs participation seems to mostly benefit firm productivity at the entry: the coefficient for enters is indeed much larger and significant with respect to the other groups. In particular, since the reference category is composed by always outside GVCs firms, it is possible to state that the productivity dynamics of always inside firms are not

[10]Robust standard errors have been used.

Table 1.8: B&J Procedure

VARIABLES	(1) Δ Labour Prod.	(2) Δ TFP $^{L\&P}$	(3) Δ TFP $^{O\&P}$
ENTER	0.62***	0.43*	0.40
	(0.22)	(0.25)	(0.25)
ALWAYS	0.34	0.052	0.10
	(0.30)	(0.34)	(0.36)
EXIT	0.16	0.013	0.040
	(0.26)	(0.35)	(0.35)
Constant	0.57*	0.24	0.43
	(0.32)	(0.49)	(0.44)
Sectors	√	√	√
Obs.	441	598	604

Notes: Robust standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01. Dependent variable is the difference in ln(PROD) between 2016 and 2013. *START*, *ALWAYS*, *EXIT* are dummies defining firm behaviour in terms of GVCs participation in time span 2013-2016.

different from those of always outside. The existence of a beneficial effect of GVCs participation only at the entry could suggest that the gains from internationalisation mainly derive from opportunities coming from outside the country rather than from their interactions with national policies: in other words, it looks like, once access to foreign market is achieved, participating firms are not able to further increase their performances in terms of productivity as if they lack proper national policies to provide further incentives and opportunities. The latter have to be considered suggestions that explain the perverse effect that hits always inside firms.

1.4.4 GVCs participants' heterogeneity

In this analysis, I investigate the existence of learning effects by identifying GVCs participants following Taglioni and Winkler (2016). As said, this definition is characterized by heterogeneity in terms of firm types that are considered as GVCs participants. For this reason, possible differential effects for these groups of firms are now investigated.

First, it can be very useful to provide productivity estimations of the different types of participants. It is worth recalling the composition of GVCs participants, whose identification is based both on their ownership and on their international performances: multinationals are foreign owned (>10%) firms which source domestically; domestic suppliers are domestic firms (>90%) which export at least the 10% of their production; and domestic producers are domestic (>90%) importers of at

least the 25% of their inputs.

GVCs participants, as already shown, exhibit large productivity premia with respect to non participants. Especially domestic producers outperform the other two groups in term of labour productivity, while multinationals are characterized by the largest values of TFPs (Table 1.9).

Table 1.9: GVCs participants decomposition and productivity

	Labour Prod.	TFP $^{L\&P}$	TFP $^{O\&P}$
Non GVCs	11.36	8.25	9.17
# of obs.	786	521	528
GVCs:			
Multinationals	11.95	8.80	9.80
# of obs.	64	43	44
Domestic Suppliers	11.94	8.74	9.63
# of obs.	130	98	102
Domestic Producers	12.27	8.65	9.62
# of obs.	142	87	91
Superstars	12.18	8.69	9.66
# of obs.	47	35	38
Superstars&Multinationals	12.05	8.75	9.74
# of obs.	111	78	82

Notes: Productivity is in logarithm. GVCs participants are identified according to Taglioni and Winkler (2016) definition. *Multinationals* are foreign owned firms which source domestically; *Domestic Suppliers* are domestic firms which export at least the 10% of their production; *Domestic Producers* are domestic importers of at least the 25% of their inputs. *Superstars* are firms which are identified both as *Domestic Producers* and *Domestic Suppliers*. *Superstars&Multinationals* is a group containing the two category above mentioned.

From the definition of the classes of participants, two additional categories may be analysed. This offers the opportunity to enlarge the classification by Taglioni and Winkler (2016), thus providing possible suggestions for future developments of this approach.

The first of these is composed by what may be called *Superstars*. Since domestic suppliers and domestic producers are not mutually exclusive groups, their intersection may be seen as an additional category composed by domestic firms characterized by a strong integration in international markets both as buyers and sellers. Surprisingly, *Superstars*' productivity, although widely higher than non GVCs firms, is not characterized by supplementary premia with respect to single groups of domestic suppliers and producers: only TFP $^{O\&P}$ is found to be higher, whilst the other two productivity measures lie in the middle.

The second additional category considers together *Superstars* and Multinationals

so as to reflect firms that exhibit the most complex internationalisation mode. This group is characterized by firm experiencing deep integration in international markets, the *Superstars*, but also international financing and expertises through FDI, the multinationals. By construction, productivity estimates lie in the middle between values of the two groups, thus outperforming non GVCs firms' performances.

To further investigate differences amongst the groups in terms of productivity dynamics, I assess the existence of learning mechanisms appertaining to the different categories.

To address this issue, I implement the same identification analysis of the baseline estimation, Equation 1.1, where the TREATMENT corresponds to becoming each of the specific GVCs participants[11].

Table 1.10: Differential learning mechanisms for GVCs participants

	(1)	(2)	(3)	(4)	(5)
VARIABLES	Labour Prod.				
$POST_{NewMultinationals}$	0.13				
	(0.54)				
$POST_{NewDomProd}$		0.49**			
		(0.22)			
$POST_{NewDomSup}$			0.55*		
			(0.32)		
$POST_{NewSuperstar}$				0.19	
				(0.36)	
$POST_{NewMulti\&Superstar}$					0.17
					(0.38)
Constant	11.44***	11.45***	11.47***	11.47***	11.45***
	(0.21)	(0.20)	(0.20)	(0.21)	(0.20)
Sectors	√	√	√	√	√
Observations	753	753	753	753	753
R-squared	0.09	0.09	0.09	0.08	0.08

Notes: Robust standard errors in parentheses. * p<0.10, **p<0.05, *** p<0.01. *NewMultinationals*, *NewDomSup*, *NewDomProd*, *NewSuperstar*, *NewMulti&Superstar* are the treatments taken into account in each column. They refer respectively to becoming a multinational, a domestic supplier that export, a domestic producer that import, a superstar, a multinational or a superstar. *POST* for each treatment identifies the DiD parameter. The common support used is the same of Table 2.5. Weights reflecting firm probability to be treated, derived from the PSM, have been used.

[11] As above, robust standard errors and weights reflecting firm probability to be treated, derived from the PSM, have been used.

Amongst the different types of treatment investigated, only becoming domestic suppliers or domestic producers appears to significantly increase productivity (Table 1.10, Columns 2 and 3). Surprisingly, the other treatments analysed – becoming a multinational, a *Superstar*, or one of the two – do not cause any increase in productivity. These results confirm the hypotheses from the baseline estimation: the learning effect passes mainly through the increment of domestic producer and supplier productivity. The higher coefficient for domestic suppliers seems to suggest that meeting the standards and, in general, facing stronger foreign competition, are the main engines for this growth. Access to foreign technology and know-how may be considered the main causes for domestic producers' increase in productivity.

As far as the lack of learning mechanism for the other groups, I believe it may be linked to a reduced number of observations in these categories. Anyway, DiD coefficient, β_3, is found to be much lower than the one estimated for domestic suppliers and domestic producers. This constitutes an interesting starting point for future analyses focused on shedding light on this puzzling result.

1.5 Conclusions

Egypt development has come to a dramatic halt in recent years. Serious social issues, that led to the revolution, have not yet been addressed and economic growth has stalled, with government mainly concerned in restoring stability and control over the country. Despite this unfavourable framework, development opportunities may still arise, especially from beyond the national borders.

This study proves it by assessing the impact of internationalisation on firm performances. After highlighting the characteristics of firms that are engaged in international trade, it addresses the impact of GVCs participation on a specific index that conveys country's performances and competitiveness, that is firm productivity. Using a DiD-PSM procedure as identification strategy, I show that productivity differentials between GVCs participants and domestic firms are also a consequence of participation. This work enlarges the evidence supporting the hypothesis of the existence of learning mechanisms for internationalising firms. Results are also robust to changes in the identification strategy.

Moreover, this analysis, thanks to the use of a novel definition of GVCs participant by Taglioni and Winkler (2016), characterized by the inclusion of different types of firms as participants, allows to detect differential impacts on these categories.

In summary, entering GVCs is found to be extremely beneficial for the productivity of firms. This effect is supposed to be driven, on one hand, by access to

foreign technology and know-how, and, on the other hand, by meeting process and product standards and by the fierce competition that characterise international markets. Opening to international trade is not a panacea, nevertheless it constitutes an important opportunity to foster development.

References

Altomonte, Carlo and Gábor Békés (2009). *Trade complexity and productivity*. Tech. rep. IEHAS Discussion Papers.

Amiti, Mary and Jozef Konings (2007). "Trade liberalization, intermediate inputs, and productivity: Evidence from Indonesia". In: *American Economic Review* 97.5, pp. 1611–1638.

Arezki, Rabah, Lili Mottaghi, Andrea Barone, Rachel Yuting Fan, Youssouf Kiendrebeogo, and Daniel Lederman (2018). *Economic Transformation – Middle East and North Africa Economic Monitor, April*. DOI: 10.1596/978-1-4648-1288-0.

Aw, Bee Yan, Xiaomin Chen, and Mark J Roberts (2001). "Firm-level evidence on productivity differentials and turnover in Taiwanese manufacturing". In: *Journal of Development Economics* 66.1, pp. 51–86.

Aw, Bee Yan and Amy Ruey-meng Hwang (1995). "Productivity and the export market: A firm-level analysis". In: *Journal of Development Economics* 47.2, pp. 313–332.

Ayadi, Rym, Giorgia Giovannetti, Enrico Marvasi, and Chahir Zaki (2020). *Global Value Chains and the Productivity of Firms in MENA countries: Does Connectivity Matter?* Tech. rep. Universita'degli Studi di Firenze, Dipartimento di Scienze per l'Economia e l'Impresa.

Baldwin, John R and Wulong Gu (2003). "Export-market participation and productivity performance in Canadian manufacturing". In: *Canadian Journal of Economics/Revue Canadienne d'Économique* 36.3, pp. 634–657.

Baldwin, John R and Beiling Yan (2016). *Global value chain participation and the productivity of Canadian manufacturing firms*. Institute for Research on Public Policy.

Bernard, Andrew B and J Bradford Jensen (1999). "Exceptional exporter performance: cause, effect, or both?" In: *Journal of International Economics* 47.1, pp. 1–25.

Caliendo, Marco and Sabine Kopeinig (2008). "Some practical guidance for the implementation of propensity score matching". In: *Journal of Economic Surveys* 22.1, pp. 31–72.

Clerides, Sofronis K, Saul Lach, and James R Tybout (1998). "Is learning by exporting important? Micro-dynamic evidence from Colombia, Mexico, and Morocco". In: *The Quarterly Journal of Economics* 113.3, pp. 903–947.

Criscuolo, Chiara and Jonathan Timmis (2017). "The Relationship Between Global Value Chains and Productivity". In: *International Productivity Monitor* 32, pp. 61–83.

De Loecker, Jan (2007). "Do exports generate higher productivity? Evidence from Slovenia". In: *Journal of International Economics* 73.1, pp. 69–98.

— (2011). "Product differentiation, multiproduct firms, and estimating the impact of trade liberalization on productivity". In: *Econometrica* 79.5, pp. 1407–1451.

De Loecker, Jan and Frederic Warzynski (2012). "Markups and firm-level export status". In: *American Economic Review* 102.6, pp. 2437–71.

Del Prete, Davide, Giorgia Giovannetti, and Enrico Marvasi (2017). "Global value chains participation and productivity gains for North African firms". In: *Review of World Economics* 153.4, pp. 675–701.

Delgado, Miguel A, Jose C Farinas, and Sonia Ruano (2002). "Firm productivity and export markets: a non-parametric approach". In: *Journal of International Economics* 57.2, pp. 397–422.

Fontagné, Lionel and Gianluca Santoni (2019). "Agglomeration economies and firm-level labor misallocation". In: *Journal of Economic Geography* 19.1, pp. 251–272.

Foster, Lucia, John Haltiwanger, and Chad Syverson (2008). "Reallocation, firm turnover, and efficiency: Selection on productivity or profitability?" In: *American Economic Review* 98.1, pp. 394–425.

Giovannetti, Giorgia, Enrico Marvasi, and Marco Sanfilippo (2015). "Supply chains and the internationalization of small firms". In: *Small Business Economics* 44.4, pp. 845–865.

Grossman, Gene M and Esteban Rossi-Hansberg (2008). "Trading tasks: A simple theory of offshoring". In: *American Economic Review* 98.5, pp. 1978–97.

Halpern, László, Miklós Koren, and Adam Szeidl (2015). "Imported inputs and productivity". In: *American Economic Review* 105.12, pp. 3660–3703.

IEMed (2015). *IEMed Mediterranean Yearbook 2015*.

— (2016). *IEMed Mediterranean Yearbook 2016*.

— (2017). *IEMed Mediterranean Yearbook 2017*.

— (2018). *IEMed Mediterranean Yearbook 2018*.

Kasahara, Hiroyuki and Beverly Lapham (2013). "Productivity and the decision to import and export: Theory and evidence". In: *Journal of International Economics* 89.2, pp. 297–316.

Kasahara, Hiroyuki and Joel Rodrigue (2008). "Does the use of imported intermediates increase productivity? Plant-level evidence". In: *Journal of Development Economics* 87.1, pp. 106–118.

Krugman, Paul (1979). "Increasing returns, monopolistic competition, and international trade". In: *Journal of International Economics* 9.4, pp. 469–479.

— (1980). "Scale economies, product differentiation, and the pattern of trade". In: *American Economic Review* 70.5, pp. 950–959.

Levinsohn, James and Amil Petrin (2003). "Estimating production functions using inputs to control for unobservables". In: *The Review of Economic Studies* 70.2, pp. 317–341.

Lileeva, Alla and Daniel Trefler (2010). "Improved access to foreign markets raises plant-level productivity... for some plants". In: *The Quarterly Journal of Economics* 125.3, pp. 1051–1099.

Melitz, Marc J (2003). "The impact of trade on intra-industry reallocations and aggregate industry productivity". In: *Econometrica* 71.6, pp. 1695–1725.

Nadvi, Khalid (2008). "Global standards, global governance and the organization of global value chains". In: *Journal of Economic Geography* 8.3, pp. 323–343.

Olley, G Steven and Ariel Pakes (1992). *The dynamics of productivity in the telecommunications equipment industry*. Tech. rep. National Bureau of Economic Research.

Rovigatti, Gabriele and Vincenzo Mollisi (2018). "Theory and practice of total-factor productivity estimation: The control function approach using Stata". In: *STATA JOURNAL* 18.3, pp. 618–662.

Rubin, Donald B (2004). *Multiple imputation for nonresponse in surveys*. Vol. 81. John Wiley & Sons.

Santos, Nuno and Iride Ceccacci (2015). *Key trends in the agrifood sector*. FAO.

Taglioni, Daria and Deborah Winkler (2016). *Making global value chains work for development*. The World Bank.

Topalova, Petia and Amit Khandelwal (2011). "Trade liberalization and firm productivity: The case of India". In: *Review of Economics and Statistics* 93.3, pp. 995–1009.

Van Biesebroeck, Johannes (2005). "Exporting raises productivity in sub-Saharan African manufacturing firms". In: *Journal of International Economics* 67.2, pp. 373–391.

— (2008). "The sensitivity of productivity estimates: Revisiting three important debates". In: *Journal of Business & Economic Statistics* 26.3, pp. 311–328.

Vogel, Alexander and Joachim Wagner (2010). "Higher productivity in importing German manufacturing firms: self-selection, learning from importing, or both?" In: *Review of World Economics* 145.4, pp. 641–665.

Wagner, Joachim (2007). "Exports and productivity: A survey of the evidence from firm-level data". In: *World Economy* 30.1, pp. 60–82.

— (2012). "International trade and firm performance: a survey of empirical studies since 2006". In: *Review of World Economics* 148.2, pp. 235–267.

Appendix

A1. Assignment of GVCs participant status

According to Taglioni and Winkler (2016) GVCs participants can be divided into four specific groups: multinationals, domestic suppliers of country's multinationals, domestic suppliers that export, and domestic producers that import. Not being able to detect domestic suppliers of country's multinationals, only the other three groups are here taken into account, and defined as follows:

- Multinationals: firms with a share of foreign ownership $\geq 10\%$ and with a share of domestic sourcing > 0;
- Domestic Suppliers: firms with a share of private domestic ownership $> 90\%$ and with a percentage of sales that are exported (directly + indirectly) $\geq 10\%$
- Domestic Producers: firms with a share of private domestic ownership $> 90\%$ and with a percentage of material inputs of foreign origin (directly imported) $> 25\%$

The thresholds of imports and exports for domestic suppliers and producers have been introduced to address the lack of a specific variable in the questionnaire defining firms' main products as final or intermediate. Such threshold have been chosen as average values among the many attempts performed.

A2. Productivity Measurement

Productivity essentially measures the ability of a firm to transform inputs into outputs. Despite the concept appearing so simple, its estimation is affected by several issues (Van Biesebroeck 2008), and as a consequences, many different approaches and techniques for its measurement have been proposed. In this paper, three calculations of productivity have been implemented: Labour Productivity and two estimates of Total Factor Productivity (TFP).

Labour productivity takes into account only labour as a production factor. In particular, it measures the units of output produced per worker. Hence, it has been calculated as the simple ratio between firm "Total sales" and "Total employment", and expressed in logarithmic terms.

Differently from labour productivity, TFP takes into account all production factors used by firms. In its simplest version it can be measured as the residual, u_{it}, from the regression of production against capital, k_{it}, and labour, l_{it}:

$$y_{it} = \beta_0 + \beta_1 l_{it} + \beta_2 k_{it} + u_{it} \tag{1.4}$$

As a matter of fact, this procedure considers productivity completely exogenous to both labour and capital. However, this is very unlikely to occur. To address this issue, several techniques have been proposed. According to them, u_{it} may be decomposed as:

$$u_{it} = \varepsilon_{it} + \omega_{it} \tag{1.5}$$

where ε_{it} is an un-anticipated error term, while ω_{it} an anticipated productivity shock, on which firms base their choices regarding labour and capital. As a consequence of Equation 5, productivity can be measured as a residual, and the only issue is to find a proxy for the anticipated productivity shock, ω_{it}.

The first technique used to estimate TFP is based on Levinsohn and Petrin (2003), a two stage procedure that uses raw materials as a proxy for ω_{it}. In particular, the variables used for the estimation are: "Total sales" for production, "Total employment" for labour, "Assets" for capital, and "Total electricity costs" as proxy. All variables are expressed in logarithmic terms, and their values have been inflated – for monetary variables – to 2015 values, through WB GDP deflator.

The other measure of TFP, developed by Olley and Pakes (1992), differs from the Levinsohn and Petrin (2003) technique only for the proxy used. Indeed, O&P link firm choices about production factors with the amount of expenditure for investments. Hence, "Total investments" has been chosen as a proxy for ω_{it}. All other variables stay the same, and still are expressed as inflated log-values.

Both the TFP estimations have been conducted using the Stata program `Prodest` developed by Rovigatti and Mollisi (2018). Table 1.11 reports correlation matrix of the productivity measures developed. Despite the differences of the approaches, the correlations are found to be very high. This is true also for Labour Productivity and TFPs (Column 1).

I recognise the limitations concerning the procedure of productivity estimation. First, the inclusion of variables defining firm international status may be meaningful for productivity estimation: importing intermediate inputs may indeed affect the output to employment ratio and thus the measurement of TFP (Halpern et al. 2015). For instance, importing foreign high technology machinery may change firm

Table 1.11: Correlation matrix of productivity estimates

	Labour Productivity	L&P (TFP)	O&P (TFP)
Labour Productivity	1.0000		
L&P (TFP)	0.9201	1.0000	
O&P (TFP)	0.9404	0.9805	1.0000

labour demand both with respect to capital and with respect to the composition itself of labour (skill-biased technological change). Second, this impact may address differently productivity if the numerator of the afore mentioned ratio is VA or total sales. In this regard also ownership linkages may play a fundamental role with domestic affiliate of foreign multinationals that, thanks to parents' investments, may experience a tremendous increase in the ratio VA over employment. In the latter case also the choice on the different proxy for the anticipated productivity shock ω_{it}, and thus of the different methodology chosen – L&P vs O&P – comes to be meaningful. Moreover, another widely discussed issue in productivity estimation is the role played by output prices in shaping both firms turnover and productivity itself (De Loecker 2011; De Loecker and Warzynski 2012). Taking into account prices allows to decoupling productivity from profitability and thus taking into account demand shifters and market power in the estimation. Unfortunately, I do not observe firm level prices for the time span included in the analysis (2013-2016). The inclusion of industry deflators would even worsen estimation since, as pointed out by Foster et al. (2008), prices exhibit substantial and persistent dispersion even within narrowly defined product classes. I address the issue including year dummies in the estimation to take into account economy wide prices dynamics.

Finally, another interesting issue investigated by new developments of the literature, and here overlooked, is the extent of firm misallocation of resources rather than simple firm productivity (Fontagné and Santoni 2019).

With these considerations in mind, estimation here conducted constitutes a starting point for future developments. Possible improvements and enlargements of the procedure may indeed constitute valuable assets for increasing the quality of the paper to higher publication standards.

A3. PSM

The use of PSM is fundamental for the identification strategy. It allows to ensure the comparability between Treatment and Control group by controlling for differences

in some observable factors that could lead to productivity differentials that depart from the exposure to the treatment.

In other words, PSM excludes from the DiD analysis all firms that do not have a proper comparison, i.e. that lay outside the common support, with respect to some specific variables. This procedure is then fundamental to ensure that productivity differentials emerging from DiD analysis can be attributed only to the Treatment.

Explicitly, with PSM firm probability in 2013 of getting the treatment is calculated according to the following Probit Model:

$$TREATMENT_i = \beta_0 + \beta_1 PROD_i + \beta_2 AGE_i + \beta_3 SIZE_i + \varepsilon_i \tag{1.6}$$

where $PROD$ is either Labour or L&P or O&P productivity, AGE is firm age in 2013, and $SIZE$ a categorical variable defining firms as small, medium or large. The choice of these variables relies on a deep analysis of international economics literature (Del Prete et al. 2017; De Loecker 2007), and on several attempts on the dataset to achieve the highest level of balancing.

The propensity scores from the Probit model have been divided in 8 different blocks, where the balancing between Treatment and Control average values for each observable is assessed. Propensity scores have been then used in the DiD analysis as probability weights.

Given the fact that more than one productivity estimates have been performed, different matching, and hence different common supports and probability weights for the DiD analysis, have been implemented. Moreover, to calculate the common support for the DiD analysis on imputed data for TFPs, an average of the m imputations per firm has been calculated and then used as $PROD_i$ in the Probit Model.

A4. Multiple Imputation Procedure

Multiple imputation (MI) is a statistical procedure that allows to fill missing data with imputations (Rubin 2004). In particular, this technique provides a set of m imputed values for each missing data of the variables of interest such that the variability of original data is conserved. Then, estimations are computed in each m imputed dataset and then combined according to the so called Rubin rules.

MI has been used in this study to reduce the missingness of TFPs estimations. However, TFPs have not been actually imputed, rather the variables used to construct such indicators have been. To better control for correlation between variables identifying firm performances, 8 variables have been imputed: *Total sales, Total employment, Assets, Total electricity costs, Total fuel costs, Total raw material costs,*

Total labour costs, Total investments.

Before imputing missing data, the dataset have been reshaped from long to wide: this essentially dropped the time variable and duplicated all the other variables, with one identifying values in 2013 and one in 2016 per each firm. This step allows to take into account the correlations between the observations of the same firm, and thus the longitudinal structure of the dataset.

The imputation step has been performed using predictive mean matching chained equations. Each of the 16 imputed variables[12] has been regressed on the other 15 in a chained system of equations. The missing values are replaced with imputations that corresponds to the nearest real observation to the fitted value obtained by the regression. Chaining the equations allows to account for the correlation between the variables, such that imputed values solve simultaneously the system. 10 imputations per variables have been produced.

After the imputation step, the dataset has been again reshaped to its original structure.

At this point, TFPs have been estimated. Following the same procedure described in Section *A.2 Productivity Measurement*, one L&P and one O&P TFP per each imputed dataset have been calculated.

[12]Each of the variable above mentioned is indeed split in 2013 and 2016 variable.

A5. Dataset Structure

	Variable	Description
1	idstd	Observation's identification code
2	panelid	ID that is the same across the waves for panel firms
3	year	Year of survey
4	panel	Panel: Firm interviewed in these years
5	Trader	Importer and/or exporter
6	Exporter	Direct exporter in that year
7	Importer	Direct importer in that year
8	Exported sales	% of sales directly exported
9	Use of imported inputs	% of inputs of foreign origin
10	Foreign inputs directly imported	Are foreign inputs used directly imported?
11	Two-way trader	Is the firm a two-way trader?
12	Certification	Does Establishment Have An Internationally-Recognized Quality Certification?
13	Multinational	Multinational which sources domestically (TW definition)
14	Domestic supplier	Domestic supplier that exports (exp. threshold 10%) (TW definition)
15	Domestic producer	Domestic producer that imports (imp threshold 25%) (TW definition)
16	Superstar	Domestic supplier and domestic producer
17	TWgvc	GVCs participant (TW definition)
18	TWgvc change	Change in TWgvc status
19	Treatment	Does the firm enter GVCs in the 2013-2016 time span?

Continued on next page

Table 1.12 – *Continued from previous page*

	Variable	Description
20	New Multinationals	Does the firm became a multinational in the 2013-2016 time span?
21	New domestic supplier	Does the firm became a domestic supplier in the 2013-2016 time span?
22	New domestic producer	Does the firm became a domestic producer in the 2013-2016 time span?
23	New Superstar	Does the firm became both a dom. supplier and dom. producer in the 2013-2016 time span?
24	Female owner	Amongst The Owners Of The Firm, Are There Any Females?
25	Female top manager	Is The Top Manager Female?
26	Female production workers	Num. Full-Time Employees At End Of Last Fiscal Yr: Female Production Workers
27	Female non priduction workers	Num. Full-Time Employees At End Of Last Fiscal Yr: Female Non-Production Workers
28	Female workers	Num. Full-Time Employees At End Of Last Fiscal Yr: Female
29	Total production workers	Num. Full-Time Employees At End Of Last Fiscal Yr: Production Workers
30	Total non production workers	Num. Full-Time Employees At End Of Last Fiscal Yr: Non-Production Workers
31	Average years of education	Average Years Of Education For Typical Production Worker
32	Young production workers	Number of production workers under 30 years old
33	Young non production workers	Number of non-production workers under 30 years old
34	Total skilled workers	Num. Full-time Employees At End Of Last Fiscal Yr: Skilled Production Workers
35	Firm type	Manufacturing or Services
36	Total sales	In Last Fiscal Year, What Were This Establishment's Total Annual Sales?
37	Total employment	Num. Permanent, Full-Time Employees At End Of Last Fiscal Year
38	Total electricity costs	Total Annual Costs Of Electricity In Last Fiscal Year
39	Total fuel costs	Total Annual Cost of fuel in last fiscal year
40	Total raw material costs	Cost Of Raw Materials And Intermediate Goods Used In Prod. In Last Fiscal Year

Continued on next page

Table 1.12 – *Continued from previous page*

	Variable	Description
41	Total labour costs	Total Labor Cost (Incl. Wages, Salaries, Bonuses, Etc) In Last Fiscal Year
42	Capital	Cost For Establishment To Re-Purchase All Of Its Machinery
43	Assets	Value of total assets
44	VA	Value Added (Total sales - Total raw material costs)
45	Total investments	Total Annual Expenditure For Purchases Of Equipment In Last Fiscal Year
46	R&D	During Last Fiscal Year, Establishment Spent On R&D (Excl Market Research)?
47	Training_prog	During last fiscal year, Establishment implemented a formal training program for employees?
48	Labour Productivity	Tot sales/total employment (ln)
49	L&P TFP	TFP with L&P procedure
50	O&P TFP	TFP with O&P procedure

Chapter 2

Global Value Chains participation and firm boundaries: evidence from French FDI

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Abstract

The tremendous development of new technologies during the last decades allowed for an increasing interconnection between countries' economies and firms' activities: both commercial and financial linkages along value chains intensified, and also overlapped. As a consequence, Global Value Chains (GVCs) and Foreign Direct Investments (FDI) have dominated the international economics literature as two sides of the same coin. Using French administrative data, this paper studies the relationship between these two topics at the firm level. Trade and investments are found to be complement, with the first increasing the future likelihood of the latter. Using trade in intermediates as a proxy for GVCs participation, I prove that GVCs-related trade drives the effect. Moreover, the level of governance of destination country affects this relationship, with a different impact for backward and forward GVCs participation. A focus on North Africa reveals the peculiarity of this destination for French investors.

Keywords: Global Value Chains, Trade, FDI, Economic Development
JEL codes: F61, F10, F63

2.1 Introduction

In the last decades, the development of logistic infrastructures and information and communication technology (ICT) has triggered a tremendous growth in the circulation of people, ideas and goods. Globalization has changed the world we live in, and particularly economics has been affected.

Two major phenomena characterised this change in the economic structure. On one hand, the production process was fragmented: most of the products we use daily have been produced and assembled in subsequent phases carried out by different firms all around the world; in other words, value chains became global. These structures account for the majority of traded value, with trade flows mainly composed by intermediate inputs waiting for further processing or assembling. On the other hand, in opposite direction with respect to this fragmentation, firms enlarged their boundaries through Foreign Direct Investments (FDI) as a way to acquire market access or to control key suppliers or buyers. In this context, Multinational Enterprises (MNEs), that are the main actors of both phenomena, gained a leading role in world economy.

In light of these facts, the literature has extensively investigated the reasons of, as well as the consequences from, the increasing cross-country connection between firms. This research, initially focusing on FDI and GVCs separately, has recently started to combine these two phenomena, thus offering a more comprehensive framework to analyse the complexity that characterises international economic relationships (Antràs 2020).

A strand of this literature focuses on organisational issues along value chains. Antràs and Chor (2013) develop a property rights model to investigate under which conditions final good producers internalise suppliers along the value chain. Supplier relative position and buyer final good demand elasticity determine the pattern of integration such that when elasticity is high relative to input substitutability, buyers find more profitable to integrate downstream and viceversa. Alfaro et al. (2019) generalise this model and highlight the role of input specificity and inter-firm contractibility (Rauch 1999; Nunn 2007) in shaping the existent pattern. Del Prete and Rungi (2017), building upon these contributions, shed light on i) the dynamics of midstream parents, underlining that final good demand elasticity is not the decisive factor in the make or buy dilemma, and on ii) the concept of relative positioning between parent and affiliate along the chain, showing that integration increases with proximity along segments. Along this line, Berlingieri et al. (2019) point out that firm decision on input integration is affected by input cost share.

Another strand of literature has discussed the role of trade, and of GVCs participation, as FDI determinants. In their seminal contribution, Helpman et al. (2004) consider FDI and exports as substitutes, with firms that self-select in the two internationalisation modes according to productivity: they argue that, enlarging Melitz (2003), among exporters, the most productive engage in FDI. However, the literature has also proven the complementarity between trade and FDI. Mayer, Méjean, et al. (2010) analyse the role of supply access in FDI location choice. Studying the pattern of French investments, they highlights that firms' probability of investment in a specific country increases with country's supply of intermediate goods to the investor's sector. Conconi et al. (2016), in a firm-level analysis on Belgian firms, point out that the probability of horizontal investments in a country increases in presence of previous exports to that market. More recently, Amendolagine et al. (2019), for 19 Sub-Saharan countries and Vietnam, show that sectoral level GVCs participation and upstream specialization positively affect inward FDI. A sound institutional environment, measured through governance indicators, enlarges this effect. A similar positive association between country-level GVCs participation and inward FDI is found by Martìnez-Galàn and Fontoura (2019) for OECD countries.

Building upon these contributions, I combine these two different strands of literature. First, I investigate whether and to what extent firm-level GVCs participation in a specific country affects the likelihood of FDI in that country. Therefore, I add the geographical dimension to the make or buy dilemma that characterises the literature on value chains organisation, as well as, adopting a micro-level focus, I enlarge the literature on the effect of GVCs participation on FDI location choice from the perspective of investors. The approach is thus close to Conconi et al. (2016) with the difference that intermediates' trade is taken into account, to proxy for GVCs participation, and both exports and imports are considered. Therefore, I do not impose any restriction on the type of FDI – horizontal vs vertical. This choice is supported by Baldwin and Okubo (2014), according to which such differentiation could lead to an inaccurate and inappropriate categorisation.

To deal with the literature studying FDI location determinants, standard gravity variables are included in the empirical model. Moreover, the role of agglomeration forces, that proved to be determinants of French foreign investors choice (Mayer, Méjean, et al. 2010; Procher 2011), is also investigated[1].

As expected from previous findings in the literature, I find a positive association between trading with a country and the future likelihood of FDI in that country, with

[1]More details about variables' construction and the empirical strategy are given in the methodological part.

GVCs participation pushing the firm to enlarge its boundaries in the same direction of its commercial flows. In particular, this effect holds for both imports and exports, with a significant stronger effect of GVCs-related trade. Quantile decomposition of intermediates' imports and exports provides evidence that the effect of both backward and forward participation is increasing in intensity. Moreover, I confirm the role of relational specificity in shaping organisational issues along the value chains (Nunn 2007; Del Prete and Rungi 2017; Alfaro et al. 2019). This evidence enlarges the results by Conconi et al. (2016), highlighting complementarity and sequencing between trade and FDI. These results may also be reconciled with Helpman et al. (2004): my analysis is indeed performed on the subsample of foreign investors and thus it could explain the dynamic of how the effect the authors predict takes place. The sequencing observed may be explained with firms evaluation of the profitability and trustworthiness of FDI engagement in light of the high sunk costs required.

The results are robust to endogeneity issues: an Instrumental Variable (IV) analysis confirms the baseline OLS estimation. Furthermore, as an enlargement, I highlight a mechanism of complementarity between backward and forward GVCs participation, such that the effect of the first disappear in the case of two-way GVCs participation.

As a second contribution, I investigate the role of governance indicators, as well as of their interaction with GVCs integration, in FDI location choice. Shedding light on this issue is crucial since FDI may benefit domestic economies, especially in developing countries, through many channels. Figuring out the governance indicators firms mostly care about is thus fundamental for investments' attracting policies and promotions agencies. I also examine the existence of possible differential effect for North African (NA) countries. The area is struggling to recover after the wave of Arab Spring revolutions and to make the final leap towards a stable development path. NA countries are still far to be largely involved in the international trade panorama, and are a minor recipient of FDI with respect to other developing regions, such as Asia or Latin America (UNCTAD 2019). Foreign investments may trigger growth and development, with French contribution, given the cultural and historical linkages with the area, being even more beneficial.

Recent studies have analysed FDI determinants for African countries, many of them paying attention to governance indicators as well as focusing on NA. Mina (2012) points out that improving investors' protection and increasing country stability are the best solutions to enhance FDI attraction: these are pre-requisites for the effectiveness of bilateral investments treaties. Abbas and Mosallamy (2016), using a panel dataset covering the years of the Arab Spring revolution, indicate

infrastructures, market openness and human capital as the main drivers of FDI inflows; interestingly, natural resource availability and political stability do not affect the FDI pattern. The limited role of natural resource in FDI attraction is similarly underlined by Okafor et al. (2017), and by Chen et al. (2016). The latter, in their analysis on Chinese FDI, also highlight a prevalence of investments in politically unstable environments.

I enlarge this set of studies in two main directions: first, by using the six dimensions of governance developed by the Worldwide Governance Indicators (WGI) project (Kaufmann et al. 2010), I provide evidence that French investors are attracted by low levels of governance for 4 out of 6 indicators; second, by interacting governance with GVCs participation, I find that, in the presence of low levels of governance, forward GVCs participation serves as a substitute of FDI, while backward participation role remains unaffected. On the contrary, for NA the interaction between low governance and both forward and backward GVCs participation has a positive and significant impact on FDI.

The paper is organised as follows: Section 2.2 outlines the data used and the empirical strategy. Section 2.3 provides some descriptive statistics on French FDI and investors. Section 2.4 reports the results. Section 2.5 concludes.

2.2 Data and empirical strategy

The analysis is conducted on French administrative data.

Dataset observations are identified by the triple i, j, t that respectively indicate firm, FDI destination country and year. The set I comprises all the manufacturing French firms that, in the time span T= 2012-2016, have at least a foreign affiliate. The set J comprises all countries that in the time span T receive at least an investment by any firm i. For each existing couple it, I take into account all possible j destinations, thus ending up with a squared structure in the final sample (with a maximum length equal to I x T x J). I exclude from the analysis domestic investments ties, and thus merely domestic investors.

Data on investments come from the *LiFi* dataset, an administrative source that comprises all the existing ownership ties involving French firms. I construct the variable FDI_{ijt} as a dummy equal to 1 if firm i has at least an affiliate in destination country j at time t, or 0 otherwise. Exploiting the fact that *LiFi* also contains information on the share of ownership detained by parent firms, I create an alternative variable identifying control investments, $FDI_{Control}$, as a dummy equal to 1 if *FDI* equals 1 and ownership share is higher than 50%. This is done to exclude portfolio or

financial investments that are eventually uncorrelated with the productive activity of the firm, and thus unrelated to its commercial linkages. Finally, from the *LiFi* dataset, I calculate a measure of country agglomeration, counting the number of French investments in each country in each year.

Trade variables derive from the *Douanes* dataset, a French customs administrative dataset provided by the *INSEE*[2], that collect all imports and exports, with respectively origin and destination country, for all French firms disaggregated at the 6 digits level of the Harmonised System (HS). This allows to estimate firm total inward and outward trade flows with all possible partners, and, by using the Broad Economic Category (BEC) classification, also to decompose between final and intermediate goods. I use trade in intermediates to proxy for GVCs participation. Quantiles of intermediates' imports and exports are also calculated. As a first attempt to tackle reverse causality issues, I use 3-years lagged trade variables.

For the relevance that the issue has in the make or buy dilemma literature (Nunn 2007; Nunn and Trefler 2013; Del Prete and Rungi 2017; Alfaro et al. 2019), I consider inputs' specificity. Goods are classified as relational specific using the Rauch (1999) classification. The variable *Specificity* is constructed as a dummy equal to 1 if firm i amount of trade in relational specific goods at time t with country j is higher than the median, and 0 otherwise.

Gravity variables, such as countries' macroeconomic indicators, as well as geographical, cultural, trade facilitation and institutional factors are sourced from the *Dynamic Gravity Dataset* (Gurevich and Herman 2018). Due to limited coverage on GDP per capita, World Bank estimates are used for this variable.

Baseline equation is the following:

$$FDI_{ijt} = \beta_0 + \beta_1 Trade_{ijt-3} + \beta_2 Trade_{ijt-3} * Specificity_{ijt-3} + GRAVITY + \gamma_{it} + \epsilon_{ijt} \tag{2.1}$$

where FDI may be either FDI or $FDI_{Control}$; $Trade$ is disentangled in many forms from total trade up to intermediates' imports' and exports' quantiles decomposition; $Specificity$ is the above defined dummy; $GRAVITY$ comprises the set of gravity controls; and γ_{it} are firm-year fixed effects.

Finally, I use data on institutional quality and governance provided by the Worldwide Governance Indicators (WGI) project (Kaufmann et al. 2010), that, by combining and harmonising a wide array of data sources, provides six different dimensions of governance: Voice and Accountability, Political Stability and Absence of Violence, Government Effectiveness, Regulatory Quality, Rule of Law, Control of Corruption.

[2] *Institut national de la statistique et des études économiques*

Per each WGI, I create a dummy equal to 1 if a country has an index under the median, denoting low governance level. Including WGIs, the baseline equation is enlarged:

$$FDI_{ijt} = \beta_0 + \beta_1 Trade_{ijt-3} + \beta_2 Trade_{ijt-3} * Specificity_{ijt-3} + GRAVITY + \beta_3 WGI_{jt-1} + \beta_4 WGI_{jt-1} * NA + \beta_5 WGI_{jt-1} * Trade^{GVC}_{ijt-3} + \beta_6 WGI_{jt-1} * Trade^{GVC}_{ijt-3} * NA + \gamma_{it} + \epsilon_{ijt} \quad (2.2)$$

Estimation is conducted per each WGI to detect the effect of the specific indicator. The interaction between WGI and the different measures of $Trade^{GVC}$ allows to detect possible differential impacts on investors' behaviour. Further interaction with NA, a dummy variable indicating if the partner country is in North Africa, provides estimates of the effect on the specific area.

2.3 Descriptive statistics

A total of 3289 French manufacturing firms have foreign investments in the time span 2012-2016. FDI projects increase after 2012, with a total of more than 9500 FDI over 2013-2015, reducing back by 1000 ties in 2016, Table 2.1. The vast majority of these ties is characterized by direct control on the affiliate (85%), thus suggesting productive rather than financial reasons as the main driver for the willingness of the parent to enlarge its boundaries. This appear to be a first hint about the interconnection between FDI and GVCs.

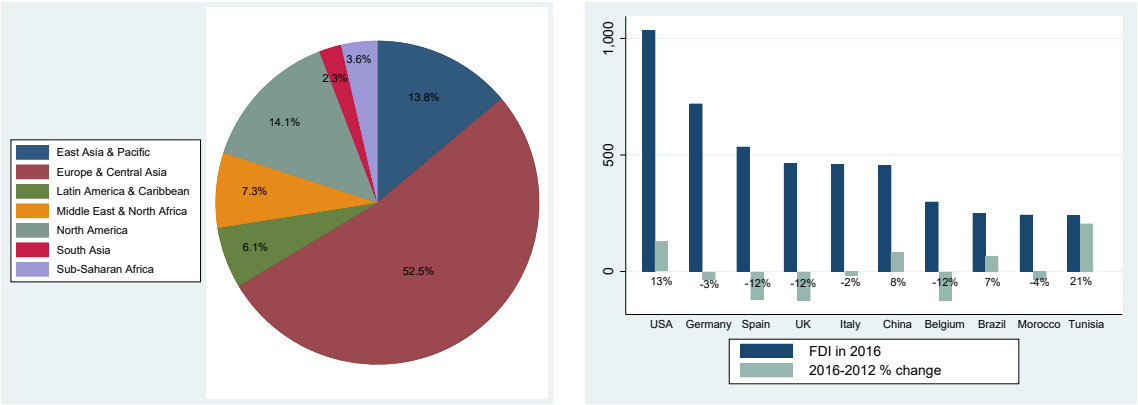
Looking at per firm FDI, French investors have about 1.5 affiliates per country, for a total of almost 4 affiliates per year. The average number of destination countries per firm is more than the double, 8.41. Therefore, there exists high variability in term of firms' types within the investors' group: a small group of huge multinationals reaching dozens of countries seems to counterbalance a multitude of investors with just one affiliate in one country. These data might suggest the existence of an elite club of "Happ*ier* few" (Mayer and Ottaviano 2008) inside the already high performance class of investors.

As far as FDI destinations are concerned (Figure 2.1), one on two FDI is directed to Europe, Panel (a); North America and East Asia & Pacific combine for almost the 30%; other regions do not reach the 10%. Panel (b) shows top 2016 receivers countries: USA are by far the country in which French multinationals invest more, attracting one tenth of investments and almost one fourth of investors (Table 2.12, Appendix). Behind USA, as expected from Panel (a), there are mostly European countries: Germany leads the group, followed by Spain, UK, Italy and Belgium.

Table 2.1: French FDI, 2012-2016

	2012	2013	2014	2015	2016	Average
FDI	8752	9653	9517	9625	8656	9240.60
% of Control FDI	84%	87%	84%	85%	85%	85%
Investors	2340	2412	2515	2435	2387	2417.80
Av. # of FDI per firm	3.74	4.00	3.78	3.95	3.63	3.82
Av. # of FDI per firm per country	1.40	1.47	1.42	1.48	1.37	1.43
Av. # of country per firm	8.38	8.85	8.27	8.32	8.23	8.41

Figure 2.1: FDI destinations



(a) *FDI by Region* (b) *FDI Top Receivers*

However, in the time span considered, almost all of these countries experienced a reduction of inward FDI that have been redirected mainly out of Europe, towards USA, but also China, Brazil and Tunisia.

Table 2.2 reports some specific descriptives on NA. The area is a minor recipient of French FDI: at maximum, only the 8% of French firms choose to invest in a NA country – this occurs for Morocco in 2016. Besides, there is large variability between countries: Morocco and Tunisia exhibit the best performances, with increasing trends between 2012 and 2016 in both absolute and relative terms; on the contrary, Algeria, Egypt and Libya are much less attractive and with declining trends. Despite the role that historical linkages as well as national trade and investments policies certainly have in shaping the depicted pattern, the analysis of governance indicators could offer interesting instruments to comprehend the FDI allocation mechanisms in NA.

Table 2.2: French investors in NA, 2012-2016

	2012	**2013**	**2014**	**2015**	**2016**	**2016-2012 %Δ**
Morocco	181	191	191	194	194	7%
(% on total investors)	7.74%	7.92%	7.59%	7.97%	8.13%	5%
Tunisia	158	160	162	164	167	6%
(% on total investors)	6.75%	6.63%	6.44%	6.74%	7.00%	4%
Algeria	57	63	57	55	54	-5%
(% on total investors)	2.44%	2.61%	2.27%	2.26%	2.26%	-7%
Egypt	13	11	11	8	10	-23%
(% on total investors)	0.56%	0.46%	0.44%	0.33%	0.42%	-25%
Libya	2	2	1	1	1	-50%
(% on total investors)	0.09%	0.08%	0.04%	0.04%	0.04%	-51%

Notes: The figures report the number of firms investing in each country and the share on total investors.

To conclude, I provide some statistics on investors, Table 2.3. Many predictions and stylized facts in the literature (Bernard and Jensen 1999; Melitz 2003; Helpman et al. 2004; Mayer and Ottaviano 2008) about investors and internationalising firms are respected. Foreign investors (Column 1) are an absolute minority: they are just the 1% of total manufacturing firms, one fifth of two-way traders (Column 3) and one tenth of traders[3] (Column 4), outperforming all of them in key relevant variables. Foreign investors have more than three times the total production of two-way traders, and almost 6 times that of traders; on average they hire more than 300 workers, 2.8 times two-way traders and 4.7 times traders; also labour productivity is significantly higher; the same is true for the level of imports and exports. Comparing foreign investors with the rest of manufacturing firms (Column 2), figures are even more astonishing, with differences of even two orders of magnitude for total production, exports and imports.

[3]Two-way traders are defined as firms that both imports and exports; traders are firms that imports and/or exports.

Table 2.3: Foreign investors' performances

	Foreign investors			
	Yes	No	Two-way traders	Traders
	(1)	(2)	(3)	(4)
% over manufacturing	1.09%	98.91%	5.91%	11.65%
Total Production	113,980	1,996	36,021	20,002
Total Employment	332.4	10.5	117.9	69.4
Labour Productivity (ln)	5.9	4.9	5.6	5.4
Exports	41,523	384	13,917	7,138
Imports	25,225	383	10,820	5,608

Notes: Total Production, Exports and Imports are in thousands of €. Labour productivity is calculated as Total Production over Total Employment.

2.4 Results

2.4.1 Baseline estimation

Before going into the empirical analysis as described in Section 2.2, some introductory regressions on the relationships between FDI and trade at firm level open this section, Table 2.4. As a first empirical exercise for a preliminary evidence, I regress *FDI* against a series of 3-year-lag dummies describing firm trade behaviour[4]. Being a trader with a country is positively correlated with the likelihood of having an affiliate in that country three years later (Column 1), and this appears to be strictly connected to productive activities, since the interaction with $Heaven_{t-3}$, a dummy equal to one if the country is considered a tax heaven, reduces that likelihood by one fourth (Column 2). Moreover, GVCs-related activities drive the correlation of Column 1: the coefficient of $Trade^{Int}_{t-3}$, a dummy indicating if a firm has trade in intermediate with the specific country, has an 8 times higher impact than that of trade in non intermediates (Column 3). The effect in Column 1 holds for both imports and exports (Column 4): being either an importer or an exporter increases the likelihood of FDI, with an higher effect for the first. Again, GVCs-related imports and exports drive this effect (Column 5 and 6), with imports of intermediate that again provide an higher impact on *FDI*. The higher impact of imports seems thus to suggest the preference of parents for investing in suppliers' countries rather than

[4]These regressions are not based on Equation 2.1: I use here dummies instead of continuous regressors and destination-year fixed effects (jt) instead of Gravity variables to evidence the underlining mechanisms in a more condensed way.

Table 2.4: Investments and trade relationship

	Dependent Variable: FDI					
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Trade_{t-3}	0.038***	0.039***				
	(0.002)	(0.002)				
$\text{Trade}^{Heaven}_{t-3}$		-0.011*				
		(0.006)				
Trade^{Int}_{t-3}			0.049***			
			(0.003)			
$\text{Trade}^{Nint}_{t-3}$			0.006***			
			(0.001)			
Exports_{t-3}				0.036***	0.036***	
				(0.002)	(0.002)	
Imports_{t-3}				0.069***		0.066***
				(0.004)		(0.004)
$\text{Imports}^{Nint}_{t-3}$					0.044***	
					(0.004)	
$\text{Imports}^{Int}_{t-3}$					0.076***	
					(0.005)	
$\text{Exports}^{Nint}_{t-3}$						0.009***
						(0.002)
$\text{Exports}^{Int}_{t-3}$						0.048***
						(0.003)
Observations	1,835,096	1,835,096	1,835,096	1,835,096	1,835,096	1,835,096
R-squared	0.137	0.137	0.140	0.153	0.153	0.155
FEs	it & jt	it & jt	it & jt	it & jt	it & jt	it & jt
Cluster	Firm & jt	Firm & jt	Firm & jt	Firm & jt	Firm & jt	Firm & jt

Notes: Linear Probability Model (LPM) estimation. Constant is included. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All regressors are dummies.

in buyers'. Such evidence is discussed more in depth below, where trade variables are expressed in continuous terms.

Going more in depth into the empirical analysis, Tables 2.5 and 2.6 report the estimation of the effect of firm GVCs participation on FDI location choice, conducted using Equation 2.1.

Estimates are conducted using a Linear Probability Model (LPM). Despite the risk of estimation bias, this model allows to quantitatively interpret and compare the coefficients of different variables and specifications, something not achievable by conducting the estimation using a non linear model, such as the Logit one. In any case, Logit estimates, confirming the direction and significance of the results, are reported in Appendix, Table 2.14.

Increasing trade relationships with a country positively affects the likelihood to invest in that country. This effect is heterogeneous in magnitude for different types of trade. Doubling the amount of trade with any country j produces a really small impact, 0.4 pp, on the likelihood of investing there three years later (Column 1) and no particular differences are found by decomposing between intermediates' and non intermediates' trade (Column 2).

Table 2.5: FDI and GVCs

	Dep. Variable $FDI_{Control}$				
VARIABLES	(1)	(2)	(3)	(4)	(5)
$Trade_{t-3}$	0.006***				
	(0.000)				
$Trade^{Int}_{t-3}$		0.005***			
		(0.000)			
$Trade^{Nint}_{t-3}$		0.005***			
		(0.000)			
$Exports_{t-3}$			0.005***	0.005***	
			(0.000)	(0.000)	
$Imports_{t-3}$			0.008***		0.008***
			(0.000)		(0.000)
$Imports^{Int}_{t-3}$				0.022***	
				(0.001)	
$Imports^{Nint}_{t-3}$				0.008***	
				(0.000)	
$Exports^{Int}_{t-3}$					0.013***
					(0.001)
$Exports^{Nint}_{t-3}$					0.005***
					(0.000)
GDP	0.000	-0.000	-0.000***	-0.001***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GDP per capita	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Distance	-0.015***	-0.012***	-0.007***	-0.006***	-0.007***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Polity Index	0.000	0.000	-0.000	-0.000*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Common Language	-0.009***	-0.0090***	-0.009***	-0.009***	-0.009***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Trade Agreement	-0.005***	-0.006***	-0.005***	-0.005***	-0.006***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
French Colony	-0.003***	-0.001**	0.001	0.002**	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Country Agglomeration	0.009***	0.007***	0.007***	0.006***	0.006***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	1,456,656	1,456,632	1,456,656	1,456,617	1,456,601
R-squared	0.124	0.139	0.149	0.154	0.154
Region Controls	√	√	√	√	√
FEs	it	it	it	it	it
Cluster	Firm	Firm	Firm	Firm	Firm

Notes: LPM estimation. Constant is included. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All trade variables are in logs of thousands €. Int- and Nint- refer to intermediate and non intermediate types of goods. An extended version of the table in Appendix, Table 2.13.

The latter results change completely when investigating imports and exports separately. First, imports have a stronger impact, however limited to a 1 pp increase (Column 3); second, the impact of intermediates' imports and exports shows up

(Columns 4 and 5). Doubling the amount of intermediate imports and exports increases indeed the likelihood of control FDI by respectively 1.5 and 0.9 pp.

Table 2.6 reports the results with quantiles decomposition of intermediate imports and exports, and investigates the role of input specificity. The impact of GVCs-related trade increase in intensity along quantiles with a fundamental contribution that is given by input specificity.

These results evidence that trade, especially of intermediate goods, and FDI are complement, with the former increasing the future likelihood of the latter. In line with Conconi et al. (2016), results seem to suggest that firms, before acquiring a commercial partner, need time to evaluate the profitability of the investment, and thus trade constitutes as an exploratory phase before investments. Results also show the crucial role of inputs specificity in the make or buy dilemma (Del Prete and Rungi 2017; Alfaro et al. 2019).

The impact of gravity controls in the bottom panel of Tables 2.5 and 2.6 may provide further hints on the mechanisms that lead firms to invest. GDP is found to have a negative effect: considering it as a proxy for market access could suggest that French investors are more likely to invest for cheaper sourcing rather than for demand oriented reasons; supporting this hypothesis, GDP per capita coefficient is negative, probably indicating a negative effect of labour costs on FDI location choice. Interestingly, the governance synthetic indicator comprised in the Dynamic Gravity Dataset, the Polity Index, has a really small impact, and almost not significant: this seems to contrast with the existing literature, thus claiming out the importance of further investigating such relationship.

Looking at relational variables between France and FDI destination country, sharing a common language has a negative effect on FDI likelihood, and the same occurs for the existence of a trade agreement. More puzzling appears the effect of being a past French colony: it has a negative impact when aggregated trade is taken into account (Table 2.5, Col. 1 and 2), while positive when imports are decomposed between intermediates and final goods (Table 2.5, Col. 4, Table 2.6, Col. 1); no impact is found in the case of exports decomposition (Table 2.5, Col. 5, Table 2.6, Col. 2). A deeper analysis could shed more light on this relationship, enlarging also the existing literature (Head et al. 2010). Finally, I find a positive effect on FDI of Country Agglomeration, suggesting that French investors choose to locate in countries already experiencing French presence to exploit agglomeration economies (Mayer, Méjean, et al. 2010; Procher 2011).

Table 2.6: FDI and GVCs - Quantile decomposition and specificity

VARIABLES	Dep. Variable FDI	$FDI_{Control}$
	(1)	(2)
2^{nd}Q Imports$^{Int,Spec=1}_{t-3}$	0.005	
	(0.006)	
3^{rd}Q Imports$^{Int,Spec=1}_{t-3}$	0.023***	
	(0.006)	
4^{th}Q Imports$^{Int,Spec=1}_{t-3}$	0.043***	
	(0.008)	
5^{th}Q Imports$^{Int,Spec=1}_{t-3}$	0.057***	
	(0.009)	
2^{nd}Q Exports$^{Int,Spec=1}_{t-3}$		0.003
		(0.004)
3^{rd}Q Exports$^{Int,Spec=1}_{t-3}$		0.018***
		(0.004)
4^{th}Q Exports$^{Int,Spec=1}_{t-3}$		0.029***
		(0.005)
5^{th}Q Exports$^{Int,Spec=1}_{t-3}$		0.054***
		(0.009)
GDP	-0.001***	-0.001***
	(0.000)	(0.000)
GDP per capita	-0.003***	-0.003***
	(0.000)	(0.000)
Distance	-0.006***	-0.007***
	(0.000)	(0.000)
Polity Index	-0.000*	-0.000
	(0.000)	(0.000)
Common Language	-0.009***	-0.008***
	(0.000)	(0.000)
Trade Agreement	-0.005***	-0.005***
	(0.000)	(0.000)
French Colony	0.002***	0.001
	(0.001)	(0.001)
Country Agglomeration	0.007***	0.006***
	(0.000)	(0.000)
Observations	1,456,617	1,456,601
R-squared	0.156	0.163
Controls	A	B
Region Controls	√	√
FEs	it	it
Cluster	Firm	Firm

Notes: LPM estimation. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. *Spec* is a dummy equal to 1 if firm i amount of intermediate imports (exports) in relational specific goods at time t-3 with country j is higher than the median. Controls A refers to X_{t-3}, M^{Nint}_{t-3}, and 2-5Q $M^{Int,Spec=0}_{t-3}$, and Controls B to M_{t-3}, X^{Nint}_{t-3}, 2-5Q $X^{Int,Spec=0}_{t-3}$. An extended version of the table in Appendix, Table 2.13.

Table 2.7 enlarges the evidence till now proposed. Given that both exports and imports increase the likelihood of FDI, I investigate the existence of a possible mechanism of complementarity between the two. The variable GVC is a dummy equal to 1 if firm i both imports and exports intermediates from and to country j at t-3. For this set of estimations, the sample has been reduced to all firms i that have at least one two-way intermediates' trade relationship with a country j.

Column 1 shows that, despite the reduction in the coefficients with respect to Column 3 of Table 2.5, an impact of aggregate imports and exports on FDI still exists. Columns 2 and 3 focus on GVCs-related trade: by inserting intermediates' imports (Col. 2) and exports (Col. 3) along with GVC_{t-3}, I investigate whether imports and exports of intermediates affect FDI by themselves or whether a combination of the two is required. I find a high degree of interdependence between intermediates' imports and exports: if two-way trade of intermediates takes place the impact of $Imports^{Int}_{t-3}$ is no more significant, while that of $Exports^{Int}_{t-3}$ halves. Importing intermediates looks thus important for FDI location if firms re-export intermediates to imports' origin; on the contrary, exports of intermediates appears to have a role for FDI location even if export destination is different from sourcing origin. In general, I highlight the impact of GVC_{t-3}: it increases by about 8 pp the likelihood of FDI, comparable to the effect of top quantiles intermediates' importers and exporters.

Table 2.7: Import-Export Complementarity

	Dep. Variable: $FDI_{Control}$		
VARIABLES	(1)	(2)	(3)
$Export_{t-3}$	0.004***	0.003***	
	(0.000)	(0.000)	
$Import_{t-3}$	0.004***		0.004***
	(0.000)		(0.000)
$Imports^{Int}_{t-3}$		0.001	
		(0.001)	
$Imports^{Nint}_{t-3}$		0.007***	
		(0.000)	
$Exports^{Int}_{t-3}$			0.007***
			(0.001)
$Exports^{Nint}_{t-3}$			0.005***
			(0.000)
GVC_{t-3}	0.083***	0.088***	0.080***
	(0.004)	(0.004)	(0.004)
Observations	1,129,078	1,129,040	1,129,023
R-squared	0.167	0.172	0.172
Gravity Controls	√	√	√
FEs	it	it	it
Cluster	Firm	Firm	Firm

Notes: LPM estimation. Constant is included. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All trade variables are in logs of thousands €. GVC is a dummy equal to 1 if firm i both imports and exports intermediates from and to country j.

2.4.2 Identification issues

Baseline estimation provides evidence of the magnitude and of the significance of the relationship between trade and future investments. Using a three year lag for trade variables, I also hypothesise a causality from the first to the latter. The underlining idea is that the willingness to internalise suppliers or buyers is not the cause of a three year before increase in commercial linkages with a specific destination, while, on the contrary, it is the consequence. The lag I use is indeed much larger than the average time to set an affiliate (De la Medina Soto and Ghossein 2013). However, there still may be identification issue. Firms may indeed target in advance a sector or a specific firm to internalise, and start intensifying exchange with that to assess the profitability and the trustworthiness of the intended investment. Moreover, baseline estimation is not conducted only on new investors. Therefore, reverse causality may affect the estimation.

A second issue that may affect the results is omitted variable bias: some key

Table 2.8: Fixed Effects regressions

	Dep. Variable: $FDI_{Control}$				
VARIABLES	(1)	(2)	(3)	(4)	(5)
$Trade_{t-3}$	0.0001***				
	(0.0000)				
$Trade^{Int}_{t-3}$		0.0001**			
		(0.0000)			
$Trade^{Nint}_{t-3}$		0.0001**			
		(0.0000)			
$Exports_{t-3}$			0.0001***	0.0001***	
			(0.0000)	(0.0000)	
$Imports_{t-3}$			0.0001		0.0001
			(0.0001)		(0.0001)
$Imports^{Int}_{t-3}$				0.0002	
				(0.0004)	
$Imports^{Nint}_{t-3}$				0.0001	
				(0.0001)	
$Exports^{Int}_{t-3}$					0.0006***
					(0.0002)
$Exports^{Nint}_{t-3}$					0.0001**
					(0.0000)
Observations	1,558,000	1,557,977	1,558,000	1,557,961	1,557,944
R-squared	0.9041	0.9041	0.9041	0.9041	0.9041
FEs	it jt ij	it jt ij	it jt ij	it jt ij	it jt ij
Cluster	Firm	Firm	Firm	Firm	Firm

Notes: LPM estimation. Constant is included. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. AAll trade variables are in logs of thousands €.

variables correlated with both trade and FDI and absent from estimation equation may change the results. Among them may be very specific firm-destination country or year-destination country related variables.

To address these identification issues I conduct a set of regressions saturated with fixed effects and an Instrumental Variable (IV) analysis.

Table 2.8 reports the estimates conducted using all possible couples of fixed effects – firm-year, country-year, firm-country. Despite their introduction, the relationship between trade and FDI is still positive and significant. This occurs for Trade (Column 1) and for its decomposition between GVCs-related and non trade (Column 2). Column 3-5 reports the decomposition between exports and imports: exports are found to have the same positive and highly significant impact (Col. 3 and 5), with a stronger effect of GVCs-related exports; unfortunately the same does not occur for imports, neither aggregate (Col. 3) nor decomposed (Col. 4), with positive but not significant coefficients.

These results exclude the possibility that omitted variables may confound the estimation, and ensure, thanks to firm-country (ij) fixed effects, that trade spurs new investments.

Nevertheless, to address reverse causality more in depth, as well as making clarity on the role of imports, IV analysis comes to be fundamental.

For this purpose, the first key issue is the individuation of a valid set of in-

struments. Following Mayer, Melitz, et al. (2016) and Aghion et al. (2018), I use as instruments for firm imports and exports respectively countries' outward and inward trade with all destinations except France weighted for firm basket of traded products. To check robustness, I also tested an alternative set of instruments, constructed as weighted country multilateral resistance terms (Autor et al. 2013): results are in line with used instruments.

Data are sourced from the CEPII BACI dataset (Gaulier and Zignago 2010), that reports trade flows at 6 digits HS level for all countries: the disaggregation at the product level allows also to distinguish between intermediates and final goods. Given the exclusion of trade flows with France, the instruments are by construction uncorrelated with the dependent variable, thus satisfying the exclusion restriction. Essentially, the instruments measure countries' supply and demand capability for all FDI destinations. In particular, Equation 2.3, French firm imports (exports) from (to) country j are instrumented through $Supply_{ijt}$ ($Demand_{ijt}$), constructed as time t country j aggregate exports (imports) weighted for the share of 2007 firm i imports (exports) from (to) country j. The weights fixed at time t=2007 prevent from trade basket restructuring that could be correlated with FDI choice. Trade is instrumented through $Openness_{ijt}$, that equals the sum of $Supply_{ijt}$ and $Demand_{ijt}$; the instruments for intermediates' and non trade are constructed accordingly.

$$Supply_{ijt} = w^{m}_{ij2007} * ln \sum_{d=1}^{D-Fr} X_{jdt} \tag{2.3a}$$

$$Demand_{ijt} = w^{x}_{ij2007} * ln \sum_{o=1}^{O-Fr} M_{jot} \tag{2.3b}$$

$$Opennes_{ijt} = Supply_{ijt} + Demand_{ijt} \tag{2.3c}$$

Table 2.9 reports the estimates of IV, Table 2.15 in Appendix, the first stage. When trade variables are decomposed between intermediates and non all variables are instrumented.

IV estimation confirms the results so far presented, allowing also to detect the direction of the causality from GVCs to FDI. Estimated coefficients are in line with LPM estimation (Table 2.5): both imports and exports are found to increase the likelihood of FDI (Column 3), and their effect is driven by GVCs-related trade (Columns 4 and 5). The latter evidence, as in Table 2.5, Column 2, is not found if *Trade* is taken into account, while it needs the decomposition between imports and

exports to be discovered (Column 2).

The results of the baseline estimation are thus robust to omitted variable bias and reverse causality, and a causal impact of trade, especially GVCs-related trade, on FDI location choice is confirmed.

Table 2.9: IV

	Dep. Variable: $FDI_{Control}$				
VARIABLES	(1)	(2)	(3)	(4)	(5)
$Trade_{t-3}$	0.001***				
	(0.000)				
$Trade^{Int}_{t-3}$		0.006***			
		(0.000)			
$Trade^{Nint}_{t-3}$		0.009***			
		(0.000)			
$Exports_{t-3}$			0.005***	0.005***	
			(0.000)	(0.000)	
$Imports_{t-3}$			0.010***		0.008***
			(0.000)		(0.000)
$Imports^{Int}_{t-3}$				0.020***	
				(0.003)	
$Imports^{Nint}_{t-3}$				0.011***	
				(0.001)	
$Exports^{Int}_{t-3}$					0.018***
					(0.002)
$Exports^{Nint}_{t-3}$					0.006***
					(0.000)
Observations	1,611,352	1,611,328	1,611,352	1,611,313	1,611,296
FEs	it jt	it jt	it jt	it jt	it jt
Cluster	Firm	Firm	Firm	Firm	Firm
F-test	17500	2654	7452	1173	1779

Notes: 2SLS estimation. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All trade variables are in logs of thousands €.

2.4.3 The role of governance

A critical factor for FDI location choice is the level of governance of the destination country. However, the literature has provided contrasting results when assessing the impact of different governance indicators. A first attempt to measure the role of governance with the synthetic Polity Index indicator, Tables 2.5 and 2.6, does not provide evidence of any impact. For the relevance of the topic, especially for developing countries, I perform a more comprehensive analysis on this issue.

For a deeper understanding of governance indicators used, Table 2.10 provides the definition of the single WGIs (Kaufmann et al. 2010).

Table 2.10: WGI Definition

Area of Governance	WGI	Definition
Citizens and state respect of the institutions	**Control of Corruption (CoC)**	Capturing perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.
	Rule of Law (RL)	Capturing perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.
Effectiveness of policies formulation and implementation	**Government Effectiveness (GE)**	Capturing perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.
	Regulatory Quality (RQ)	Capturing perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.
Selection, monitoring and replacement of governments	**Political Stability and Absence of Violence/Terrorism (PS&AV)**	Capturing perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism.
	Voice and Accountability (V&A)	Capturing perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.

Source: Kaufmann et al. (2010)

I investigate the role of governance in FDI location choice by using Equation 2.2. In particular I perform the estimation for each of the 6 WGIs, thus providing evidence of the differences between the effects of single governance aspects. For each indicator, also the impact of the interaction with intermediate imports and exports, as well as the specific impact in NA, is assessed. As said, *WGI* is a dummy equal to 1 if the country has an under the median WGI, and 0 otherwise. Results are reported in Table 2.11.

First, not always a low level of governance discourages FDI: only scarce CoC and PS&AV decrease the likelihood of FDI (Columns 1-2, 5-6), with an attenuated effect of the latter in NA. Surprisingly, French investors appear attracted by countries with low level of GE, RQ, RoL and V&A (Columns 3-4, 7-12). Generally, given the correlation between low governance and low costs of labour, the average effect may be explained by the willingness to invest in low governance countries for cost-saving reasons. As regards the differences between single WGIs, I suggest that low levels of CoC and PS&AV may be perceived as the biggest threats to FDI profitability, while low level in the other indicators, V&A and GE overall, as a manageable risk or even a source of opportunity, especially for the biggest multinationals, to achieve more favourable investments conditions when dealing with governments and social institutions.

Even more interesting are the interactions between WGIs and GVCs-related trade. There is a net difference between the interactions of WGIs with intermediates' imports and exports: low levels of governance, except for V&A, do not alter the impact of intermediates' imports on FDI, while they do for intermediates' exports. Backward GVCs participation continues indeed to increase the likelihood of FDI also in low WGIs countries, whereas forward participation is found to be a substitute of FDI, with negative and significant coefficients for the interactions with all the WGIs. The underlining mechanism of this pattern may be linked to the concept of trust and to the knowledge of chain dynamics: firms may find less risky to invest in their suppliers' countries rather than in buyers' ones since relationships with suppliers may reveal much more than those with buyers about the ability and the capacity of the trade partner as well as about the environment in which it works. Therefore, direct experience and trust may serve as complements of formal indicators.

Looking at the interaction between WGI and GVCs, NA exhibits net differences with respect to the rest of the world. As far as forward GVCs participation is concerned, the effect is completely counterbalanced: the coefficient for the interaction between WGI, NA and $Exports^{Int}_{t-3}$ are positive and significant for all the WGIs; the same occurs for the interactions with $Imports^{Int}_{t-3}$. Therefore, despite the low levels of WGIs of the area, the relationship between GVCs and FDI is much stronger in NA than in the rest of the world, especially as regards backward GVCs participation: in particular, the likelihood of investing in NA increases by between 3 and 5 pp if a firm doubles its intermediates' imports, and by between 1 and 2.5 pp if it doubles its intermediates' exports. These figures more than double the average estimates obtained in Table 2.5 (Columns 4 and 5). The larger impact of intermediates' imports is in line with the specialization of the area as an input supplier and with its GVCs average upstreamness (Del Prete, Giovannetti, et al. 2018).

To conclude, the analysis just performed provides new evidence on the role of governance on FDI location choice, enlarging the existence literature and also breaking some common feelings. Besides, through the interaction with GVCs related trade, it offers new insights about the dynamics between GVCs and FDI.

Table 2.11: FDI, GVCs and WGI

DEPENDENT VARIABLE: $FDI_{Control}$

WGI:	CoC		GE		PS&AV		RQ		RoL		V&A	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$Imports^{Int}_{t-3}$	0.021***		0.020***		0.020***		0.019***		0.021***		0.021***	
	(0.001)		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)	
$Exports^{Int}_{t-3}$		0.015***		0.015***		0.015***		0.014***		0.015***		0.016***
		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)
WGI_{low}	-0.001**	0.001**	0.003***	0.005***	-0.002***	-0.001***	0.003***	0.004***	0.001	0.003***	0.003***	0.006***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
NA * WGI_{low}	0.001	0.000	-0.003***	-0.004***	-0.000	-0.002*	-0.002	-0.003***	0.000	-0.001	-0.001	-0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
WGI_{low} * $Imports^{Int}_{t-3}$	-0.002		-0.001		-0.003		0.004		0.000		-0.006***	
	(0.002)		(0.003)		(0.002)		(0.002)		(0.003)		(0.002)	
NA * WGI_{low} * $Imports^{Int}_{t-3}$	0.021**		0.046***		0.058***		0.052***		0.021**		0.055***	
	(0.008)		(0.007)		(0.007)		(0.007)		(0.008)		(0.007)	
WGI_{low} * $Exports^{Int}_{t-3}$		-0.007***		-0.012***		-0.008***		-0.006***		-0.009***		-0.013***
		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)
NA * WGI_{low} * $Exports^{Int}_{t-3}$		0.006**		0.016***		0.016***		0.015***		0.007***		0.017***
		(0.002)		(0.002)		(0.002)		(0.002)		(0.002)		(0.002)
Observations	1,509,622	1,509,606	1,509,622	1,509,606	1,509,622	1,509,606	1,509,622	1,509,606	1,509,622	1,509,606	1,509,622	1,509,606
R-squared	0.153	0.153	0.153	0.154	0.154	0.153	0.154	0.153	0.153	0.153	0.154	0.154
Gravity Controls	√	√	√	√	√	√	√	√	√	√	√	√
Controls	A	B	A	B	A	B	A	B	A	B	A	B
FEs	it	it	it	it	it	it	it	it	it	it	it	it
Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm

Notes: LPM estimation. Constant is included. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Dependent variable is $FDI_{Control}$. Controls "A" refers to $Exports_{t-3}$ and $Imports^{Nint}_{t-3}$; Controls "B" refers to $Imports_{t-3}$ and $Exports^{Nint}_{t-3}$.

2.5 Conclusions

FDI and GVCs are among the most studied topics in the international economics literature in the last decades. The increasing relevance of multinational enterprises has led scholars to study these two topics combined, showing how they can be considered two sides of the same coin.

Introducing the geographical dimension into the make or buy dilemma studies, and a firm level approach in the strand of literature investigating GVCs participation as a determinant of FDI location choice, this paper contributes to both of these literatures. In particular, it provides evidence of a positive impact of trade on firm future investment decision. GVCs-related trade, measured as trade in intermediates, drives this effect. Backward GVCs participation appears to have a stronger effect, with the impact largely connected to re-exporting toward sourcing direction.

Moreover, I shed light on the role of governance, breaking some common feelings and enlarging the existing literature. The interaction with GVCs-related trade provides also evidence of a different effect for backward and forward GVCs participation. Finally, the focus on NA, a minor recipient of FDI, shows a different pattern from the rest of the world: in the area the relationship between GVCs and FDI is stronger, and this holds for both backward and forward GVCs participation.

References

Abbas, Sherif and D Mosallamy (2016). "Determinants of FDI flows to developing countries: an empirical study on the MENA region". In: *Journal of Finance and Economics* 4.1, pp. 30–38.

Aghion, Philippe, Antonin Bergeaud, Matthieu Lequien, and Marc J Melitz (2018). *The heterogeneous impact of market size on innovation: Evidence from French firm-level exports*. Tech. rep. National Bureau of Economic Research.

Alfaro, Laura, Davin Chor, Pol Antràs, and Paola Conconi (2019). "Internalizing global value chains: A firm-level analysis". In: *Journal of Political Economy* 127.2, pp. 508–559.

Amendolagine, Vito, Andrea F Presbitero, Roberta Rabellotti, and Marco Sanfilippo (2019). "Local sourcing in developing countries: The role of foreign direct investments and global value chains". In: *World Development* 113, pp. 73–88.

Antràs, Pol (2020). *Conceptual aspects of global value chains*. Tech. rep. Policy Research Working Paper No. 9114. The World Bank.

Antràs, Pol and Davin Chor (2013). "Organizing the global value chain". In: *Econometrica* 81.6, pp. 2127–2204.

Autor, David H, David Dorn, and Gordon H Hanson (2013). "The China syndrome: Local labor market effects of import competition in the United States". In: *American Economic Review* 103.6, pp. 2121–68.

Baldwin, Richard and Toshihiro Okubo (2014). "Networked FDI: Sales and sourcing patterns of Japanese foreign affiliates". In: *The World Economy* 37.8, pp. 1051–1080.

Berlingieri, Giuseppe, Frank Pisch, and Claudia Steinwender (2019). "Organizing Global Supply Chains: Input-Output Linkages and Vertical Integration". In: *CEP Discussion Paper No 1583 Revised April 2019*.

Bernard, Andrew B and J Bradford Jensen (1999). "Exceptional exporter performance: cause, effect, or both?" In: *Journal of International Economics* 47.1, pp. 1–25.

Chen, Wenjie, David Dollar, and Heiwai Tang (2016). "Why is China investing in Africa? Evidence from the firm level". In: *The World Bank Economic Review* 32.3, pp. 610–632.

Conconi, Paola, André Sapir, and Maurizio Zanardi (2016). "The internationalization process of firms: From exports to FDI". In: *Journal of International Economics* 99, pp. 16–30.

De la Medina Soto, Christian and Tania Ghossein (2013). *Starting a foreign investment across sectors*. The World Bank.

Del Prete, Davide, Giorgia Giovannetti, and Enrico Marvasi (2018). "Global value chains: New evidence for North Africa". In: *International Economics* 153, pp. 42–54.

Del Prete, Davide and Armando Rungi (2017). "Organizing the Global Value Chain: a firm-level test". In: *Journal of International Economics* 109, pp. 16–30.

Gaulier, Guillaume and Soledad Zignago (2010). *BACI: International Trade Database at the Product-Level. The 1994-2007 Version*. Working Papers 2010-23. CEPII. URL: http://www.cepii.fr/CEPII/fr/publications/wp/abstract.asp?NoDoc=2726.

Gurevich, Tamara and Peter Herman (2018). "The dynamic gravity dataset: 1948–2016". In: *US International Trade Commission Office of Economics Working Paper*.

Head, Keith, Thierry Mayer, and John Ries (2010). "The erosion of colonial trade linkages after independence". In: *Journal of International Economics* 81.1, pp. 1–14.

Helpman, Elhanan, Marc J Melitz, and Stephen R Yeaple (2004). "Export versus FDI with heterogeneous firms". In: *American Economic Review* 94.1, pp. 300–316.

Kaufmann, Daniel, Aart Kraay, and Massimo Mastruzzi (2010). *The worldwide governance indicators: methodology and analytical issues*. World Bank Policy Research Working Paper No. 5430. The World Bank.

Martìnez-Galàn, Enrique and Maria Paula Fontoura (2019). "Global value chains and inward foreign direct investment in the 2000s". In: *The World Economy* 42.1, pp. 175–196.

Mayer, Thierry, Isabelle Méjean, and Benjamin Nefussi (2010). "The location of domestic and foreign production affiliates by French multinational firms". In: *Journal of Urban Economics* 68.2, pp. 115–128.

Mayer, Thierry, Marc J Melitz, and Gianmarco IP Ottaviano (2016). *Product mix and firm productivity responses to trade competition*. Tech. rep. National Bureau of Economic Research.

Mayer, Thierry and Gianmarco IP Ottaviano (2008). "The happy few: The internationalisation of european firms". In: *Intereconomics* 43.3, pp. 135–148.

Melitz, Marc J (2003). "The impact of trade on intra-industry reallocations and aggregate industry productivity". In: *Econometrica* 71.6, pp. 1695–1725.

Mina, Wasseem Michel (2012). "The institutional reforms debate and FDI flows to the MENA region: the "best" ensemble". In: *World Development* 40.9, pp. 1798–1809.

Nunn, Nathan (2007). "Relationship-specificity, incomplete contracts, and the pattern of trade". In: *The Quarterly Journal of Economics* 122.2, pp. 569–600.

Nunn, Nathan and Daniel Trefler (2013). "Incomplete contracts and the boundaries of the multinational firm". In: *Journal of Economic Behavior & Organization* 94, pp. 330–344.

Okafor, Godwin, Jenifer Piesse, and Allan Webster (2017). "FDI Determinants in Least Recipient Regions: The Case of Sub-Saharan Africa and MENA". In: *African Development Review* 29.4, pp. 589–600.

Procher, Vivien (2011). "Agglomeration effects and the location of FDI: evidence from French first-time movers". In: *The Annals of Regional Science* 46.2, pp. 295–312.

Rauch, James E (1999). "Networks versus markets in international trade". In: *Journal of International Economics* 48.1, pp. 7–35.

UNCTAD (2019). *WORLD INVESTMENT REPORT 2019 - Special Economic Zones*. Tech. rep. UNCTAD.

Appendix

Table 2.12: A. Top receiver countries

2012		2013		2014		2015		2016	
Top receivers (% of investors)									
USA	24.2%	USA	24.1%	USA	24.4%	USA	24.1%	USA	24.4%
Germany	22.6%	Germany	23.3%	Germany	23.2%	Germany	22.9%	Germany	21.6%
Spain	21.1%	Spain	20.2%	Spain	19.8%	Spain	19.0%	Spain	17.7%
UK	16.8%	UK	17.9%	UK	16.7%	UK	15.6%	UK	14.8%
Italy	14.8%	Italy	15.7%	Italy	15.1%	Italy	14.8%	Italy	13.9%
Belgium and Luxembourg	11.8%	Belgium and Luxembourg	11.8%	Belgium and Luxembourg	11.8%	China	11.1%	China	11.6%
China	11.2%	China	10.5%	China	10.3%	Belgium and Luxembourg	11.0%	Belgium and Luxembourg	11.2%
Poland	8.6%	Poland	8.9%	Poland	8.3%	Poland	8.2%	Morocco	8.1%
Morocco	7.7%	Morocco	7.9%	Morocco	7.6%	Morocco	8.0%	Poland	8.1%
Tunisia	6.8%	Brazil	6.6%	Switzerland	7.2%	Switzerland	7.4%	Switzerland	7.0%
Top receivers (% of FDI)									
USA	10.5%	USA	10.7%	USA	11.6%	USA	12.1%	USA	12.0%
Germany	8.5%	Germany	9.3%	Germany	8.5%	Germany	8.4%	Germany	8.3%
Spain	6.9%	Spain	7.1%	Spain	6.9%	Italy	6.7%	Spain	6.2%
UK	6.1%	UK	6.8%	UK	6.3%	Spain	6.3%	UK	5.4%
Italy	5.4%	Italy	5.7%	Italy	5.7%	UK	5.1%	Italy	5.3%
China	4.8%	China	4.7%	China	4.7%	China	5.0%	China	5.3%
Belgium and Luxembourg	3.9%	Belgium and Luxembourg	3.7%	Belgium and Luxembourg	3.6%	Belgium and Luxembourg	3.2%	Belgium and Luxembourg	3.5%
Morocco	2.9%	Poland	2.9%	Poland	3.0%	Brazil	3.0%	Brazil	2.9%
Poland	2.8%	Canada	2.5%	Canada	2.8%	Canada	3.0%	Morocco	2.8%
Brazil	2.7%	Morocco	2.5%	Brazil	2.6%	Poland	2.6%	Tunisia	2.8%

Table 2.13: FDI and GVCs

	Dep. Variable $FDI_{Control}$								
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$Trade_{t-3}$	0.006***								
	(0.000)								
$Trade^{Int}_{t-3}$		0.005***							
		(0.000)							
$Trade^{Nint}_{t-3}$		0.005***							
		(0.000)							
$Exports_{t-3}$			0.005***	0.005***		0.005***		0.004***	
			(0.000)	(0.000)		(0.000)		(0.000)	
$Imports_{t-3}$			0.008***		0.008***		0.007***		0.007***
			(0.000)		(0.000)		(0.000)		(0.000)
$Imports^{Int}_{t-3}$				0.022***					
				(0.001)					
$Imports^{Nint}_{t-3}$				0.008***		0.007***		0.007***	
				(0.000)		(0.000)		(0.000)	
$Exports^{Int}_{t-3}$					0.013***				
					(0.001)				
$Exports^{Nint}_{t-3}$					0.005***		0.005***		0.005***
					(0.000)		(0.000)		(0.000)
2^{nd}Q $Imports^{Int}_{t-3}$						0.030***		0.027***	
						(0.003)		(0.005)	
3^{rd}Q $Imports^{Int}_{t-3}$						0.039***		0.023***	
						(0.003)		(0.005)	
4^{th}Q $Imports^{Int}_{t-3}$						0.0549***		0.0223***	
						(0.004)		(0.007)	
5^{th}Q $Imports^{Int}_{t-3}$						0.082***		0.037***	
						(0.005)		(0.008)	
2^{nd}Q $Exports^{Int}_{t-3}$							-0.005**		-0.006*
							(0.002)		(0.004)
3^{rd}Q $Exports^{Int}_{t-3}$							0.007***		-0.007*
							(0.002)		(0.003)
4^{th}Q $Exports^{Int}_{t-3}$							0.033***		0.011***
							(0.003)		(0.004)
5^{th}Q $Exports^{Int}_{t-3}$							0.090***		0.048***
							(0.005)		(0.008)
2^{nd}Q $Imports^{Int}_{t-3}$ * $Spec_{t-3}$								0.005	
								(0.006)	
3^{rd}Q $Imports^{Int}_{t-3}$ * $Spec_{t-3}$								0.023***	
								(0.006)	
4^{th}Q $Imports^{Int}_{t-3}$ * $Spec_{t-3}$								0.043***	
								(0.008)	
5^{th}Q $Imports^{Int}_{t-3}$ * $Spec_{t-3}$								0.057***	
								(0.009)	
2^{nd}Q $Exports^{Int}_{t-3}$ * $Spec_{t-3}$									0.003
									(0.004)
3^{rd}Q $Exports^{Int}_{t-3}$ * $Spec_{t-3}$									0.018***
									(0.004)
4^{th}Q $Exports^{Int}_{t-3}$ * $Spec_{t-3}$									0.029***
									(0.005)
5^{th}Q $Exports^{Int}_{t-3}$ * $Spec_{t-3}$									0.054***
									(0.009)
GDP	0.000	-0.000	-0.000***	-0.001***	-0.000***	-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GDP per capita	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Distance	-0.015***	-0.012***	-0.007***	-0.006***	-0.007***	-0.006***	-0.007***	-0.006***	-0.007***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Polity Index	0.000	0.000	-0.000	-0.000*	-0.000	-0.000*	-0.000	-0.000*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Common Language	-0.009***	-0.0090***	-0.009***	-0.009***	-0.009***	-0.009***	-0.008***	-0.009***	-0.008***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Trade Agreement	-0.005***	-0.006***	-0.005***	-0.005***	-0.006***	-0.005***	-0.005***	-0.005***	-0.005***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
French Colony	-0.003***	-0.001**	0.001	0.002**	0.001	0.002**	0.001	0.002***	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Country Agglomeration	0.009***	0.007***	0.007***	0.006***	0.006***	0.007***	0.006***	0.007***	0.006***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	1,456,656	1,456,632	1,456,656	1,456,617	1,456,601	1,456,617	1,456,601	1,456,617	1,456,601
R-squared	0.124	0.139	0.149	0.154	0.154	0.155	0.162	0.156	0.163
Region Controls	√	√	√	√	√	√	√	√	√
FEs	it	it	it	it	it	it	it	it	it
Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm

Notes: LPM estimation. Constant is included. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All trade variables are in logs of thousands €. Int- and Nint- refer to intermediate and non intermediate types of goods. The first quantile of intermediate imports and exports comprises all values equal equal to 0. *Spec* is a dummy equal to 1 if firm i amount of intermediate imports (exports) in relational specific goods at time t-3 with country j is higher than the median.

Table 2.14: A. FDI and GVCs - Logit Estimation

	Dep. Variable: $FDI_{Control}$								
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$Trade_{t-3}$	1.282***								
	(0.011)								
$Trade^{Int}_{t-3}$		1.161***							
		(0.008)							
$Trade^{Nint}_{t-3}$		1.142***							
		(0.006)							
$Export_{t-3}$			1.244***	1.247***		1.246***		1.246***	
			(0.009)	(0.009)		(0.009)		(0.009)	
$Import_{t-3}$			1.095***		1.090***		1.086***		1.086***
			(0.005)		(0.005)		(0.005)		(0.005)
$Imports^{Int}_{t-3}$				1.282***					
				(0.022)					
$Imports^{Nint}_{t-3}$				1.055***		1.056***		1.056***	
				(0.004)		(0.004)		(0.004)	
$Exports^{Int}_{t-3}$					1.768***				
					(0.052)				
$Exports^{Nint}_{t-3}$					1.153***		1.147***		1.145***
					(0.006)		(0.006)		(0.006)
2^{nd}Q $Imports^{Int}_{t-3}$						1.801***		1.633***	
						(0.072)		(0.121)	
3^{rd}Q $Imports^{Int}_{t-3}$						1.764***		1.556***	
						(0.079)		(0.128)	
4^{th}Q $Imports^{Int}_{t-3}$						1.785***		1.562***	
						(0.094)		(0.155)	
5^{th}Q $Imports^{Int}_{t-3}$						1.914***		2.123***	
						(0.124)		(0.253)	
2^{nd}Q $Exports^{Int}_{t-3}$							2.004***		1.885***
							(0.111)		(0.161)
3^{rd}Q $Exports^{Int}_{t-3}$							2.888***		2.035***
							(0.195)		(0.245)
4^{th}Q $Exports^{Int}_{t-3}$							4.4167***		3.041***
							(0.356)		(0.409)
5^{th}Q $Exports^{Int}_{t-3}$							6.656***		4.951***
							(0.652)		(0.839)
2^{nd}Q $Imports^{Int}_{t-3}$ * $Spec_{t-3}$								1.134*	
								(0.086)	
3^{rd}Q $Imports^{Int}_{t-3}$ * $Spec_{t-3}$								1.167*	
								(0.097)	
4^{th}Q $Imports^{Int}_{t-3}$ * $Spec_{t-3}$								1.167	
								(0.114)	
5^{th}Q $Imports^{Int}_{t-3}$ * $Spec_{t-3}$								0.895	
								(0.106)	
2^{nd}Q $Exports^{Int}_{t-3}$ * $Spec_{t-3}$									1.106
									(0.093)
3^{rd}Q $Exports^{Int}_{t-3}$ * $Spec_{t-3}$									1.536***
									(0.174)
4^{th}Q $Exports^{Int}_{t-3}$ * $Spec_{t-3}$									1.574***
									(0.179)
5^{th}Q $Exports^{Int}_{t-3}$ * $Spec_{t-3}$									1.436***
									(0.195)
GDP	0.877***	0.834***	0.862***	0.850***	0.867***	0.851***	0.863***	0.850***	0.863***
	(0.022)	(0.022)	(0.022)	(0.022)	(0.023)	(0.022)	(0.022)	(0.022)	(0.022)
GDP per capita	1.004	1.012	0.974	0.970	0.982	0.969	0.986	0.968	0.987
	(0.029)	(0.029)	(0.027)	(0.027)	(0.028)	(0.027)	(0.028)	(0.027)	(0.028)
Distance	0.998	1.142*	1.146*	1.167**	1.177**	1.165**	1.167**	1.167**	1.168**
	(0.075)	(0.085)	(0.085)	(0.087)	(0.087)	(0.087)	(0.087)	(0.087)	(0.087)
Polity Index	1.002	1.001	1.000	1.003	1.001	1.003	1.002	1.003	1.002
	(0.010)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Common Language	0.829***	0.793***	0.808***	0.801***	0.798***	0.802***	0.803***	0.802***	0.802***
	(0.034)	(0.033)	(0.034)	(0.034)	(0.034)	(0.034)	(0.035)	(0.034)	(0.035)
Trade Agreement	0.872*	0.877*	0.860**	0.868**	0.874*	0.866**	0.876*	0.866**	0.878*
	(0.063)	(0.062)	(0.061)	(0.061)	(0.061)	(0.061)	(0.062)	(0.061)	(0.061)
French Colony	1.253*	1.271**	1.254**	1.247**	1.267**	1.246**	1.249*	1.245**	1.249*
	(0.145)	(0.145)	(0.140)	(0.138)	(0.143)	(0.138)	(0.142)	(0.138)	(0.142)
Country Agglomeration	2.577***	2.585***	2.484***	2.500***	2.511***	2.500***	2.494***	2.502***	2.492***
	(0.076)	(0.077)	(0.073)	(0.074)	(0.075)	(0.074)	(0.074)	(0.074)	(0.074)
Observations	1,406,644	1,406,621	1,406,644	1,406,470	1,406,187	1,406,470	1,406,187	1,406,470	1,406,187
Region Controls	√	√	√	√	√	√	√	√	√
FEs	it	it	it	it	it	it	it	it	it
Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm

Notes: Odds Ratio are reported. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All trade variables are in thousands of €. The reference category for Quantiles of Imports and Exports comprises all trade relationships equal to 0. *Spec* is a dummy equal to 1 if firm i amount of trade/exports/imports in relational specific goods at time t-3 with country j is higher than the median.

Table 2.15: A. First stage IV

	(1)	(2)		(3)		(4)			(5)		
VARIABLES	$Trade_{t-3}$	$Trade^{Int}_{t-3}$	$Trade^{Nint}_{t-3}$	$Exports_{t-3}$	$Imports_{t-3}$	$Exports_{t-3}$	$Imports^{Int}_{t-3}$	$Imports^{Nint}_{t-3}$	$Imports_{t-3}$	$Exports^{Int}_{t-3}$	$Exports^{Nint}_{t-3}$
$Openness_{t-3}$	1.956***										
	(0.015)										
$Openness^{Int}_{t-3}$		1.818***	0.343***								
		(0.017)	(0.020)								
$Openness^{Nint}_{t-3}$		0.250***	1.715***								
		(0.015)	(0.015)								
$Supply_{t-3}$				0.450***	2.500***				2.469***	0.071***	0.225***
				(0.020)	(0.023)				(0.023)	(0.004)	(0.017)
$Demand_{t-3}$				2.598***	0.189***	2.596***	0.036***	0.081***			
				(0.022)	(0.010)	(0.022)	(0.002)	(0.007)			
$Supply^{Int}_{t-3}$						0.376***	0.499***	0.612***			
						(0.020)	(0.005)	(0.018)			
$Supply^{Nint}_{t-3}$						0.232***	0.133***	1.935***			
						(0.021)	(0.004)	(0.028)			
$Demand^{Int}_{t-3}$									0.229***	0.540***	0.362***
									(0.012)	(0.005)	(0.020)
$Demand^{Nint}_{t-3}$									0.095***	0.087***	2.280***
									(0.012)	(0.005)	(0.027)
Observations	1,611,352	1,611,328	1,611,328	1,611,352	1,611,352	1,611,313	1,611,313	1,611,313	1,611,296	1,611,296	1,611,296
FEs	it jt	it jt	it jt	it jt	it jt	it jt	it jt	it jt	it jt	it jt	it jt
Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. (#) refers to first stage of regression (#) in Table 2.9

Chapter 3

Global Value Chains participation and development opportunities: hints from the Product Space

Abstract

The Economic Complexity (EC) approach (Hidalgo, Klinger, et al. 2007; Hidalgo and Hausmann 2009) offers a path-breaking perspective into the study of economic development, by introducing new tools for economic analysis, such as the product space and sophistication indexes. A different strand of international economics literature has studied Global Value Chains (GVCs), highlighting their impact on the economic performances of countries. This paper links the EC approach with the literature on Global Value Chains. Applying some of the EC tools to describe a set of selected chains, it offers a new perspective to explain the benefits from GVCs integration. I also propose a new GVCs participation index that is coherent with the EC approach. In addition, the paper applies these contributions to analyse North African countries' GVCs performances. Differences between Tunisia, Egypt and Morocco emerge as far as both current participation and future perspectives are concerned. Overall, the paper, by merging the two strands of literature, for the first time to my knowledge, highlights interesting opportunities for further developments in this direction.

Keywords: Global Value Chains, Economic Complexity, Product Space, North Africa

JEL codes: F14, F43, C80, O10, O57, O55

3.1 Introduction

Economic and social factors are both important in shaping the scope of a country' productive capacities. Many theoretical models have studied how the combination of different production factors shapes future growth trajectories: if the first contributions relied on just labour and capital (Heckscher and Ohlin 1991; Solow 1956), the economic literature studying growth and development has introduced more recently new explanatory factors such as technological upgrading, knowledge and institutions (Lucas Jr 1988; Romer 1990; Acemoglu et al. 2005). Alternatives approaches have pointed out that regions and countries develop following a path-dependent trajectory based on the current production structure. In this view geographical, cognitive, social and cultural factors, as well as their interaction in the economic and social fabric, occupy a prominent role (Becattini 1989; Porter 2000; Boschma 2005; Frenken et al. 2007). However, empirical tests have often fallen short of completely capturing economic reality: indeed, most of the findings and predictions are affected by strong prior assumptions or confined to specific case studies.

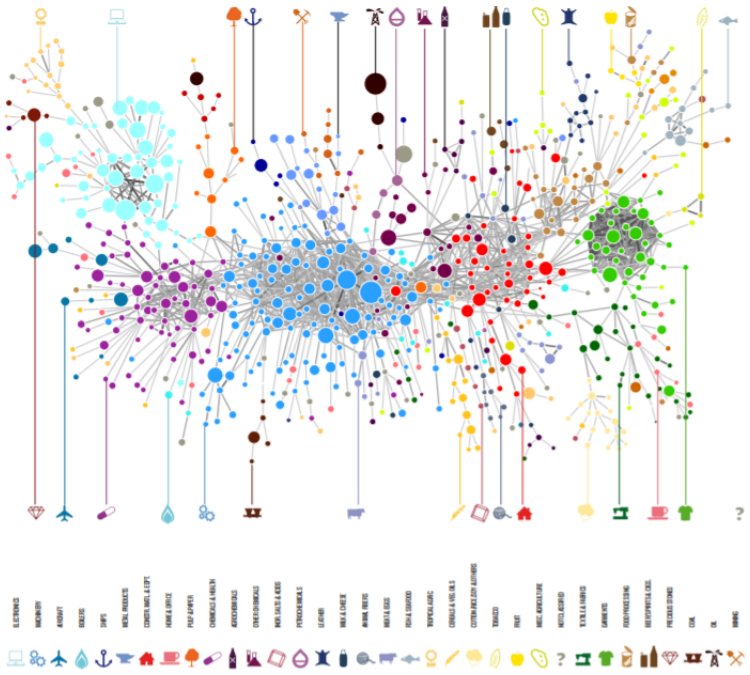
Against this background, an empirically based approach proposed by Hidalgo, Klinger, et al. (2007) and Hidalgo and Hausmann (2009) – the economic complexity (EC) approach – is offering interesting insights into the study of country development trajectories (Hidalgo 2021). According to this view, the economic performances of countries diverge because of the diversity and the interaction of their own capabilities: the greater the availability of capabilities and, hence, the possible set of interactions, the greater the complexity of potential production and, therefore, the development opportunities for countries. Indeed, the production of goods is nothing more than assembling a product's specific components aligned with the available capability within a country.

To study countries' development, the EC approach has introduced innovative and appealing tools as part of its economic analysis.

The product space is probably one of the most known of these tools: it is a network graph whose nodes are products and whose edges represent the degree of proximity between products. Its construction[1] is based on the idea that countries trade performances, used as proxies for productive capacities, may reveal the available capabilities within countries. Defining a measure of products proximity, it is possible to build a network representation of the production process, thus evidencing relatedness between goods and highlighting best strategies for country's differentiation and development. In its simplicity, the product space comprises all the virtues

[1] More details on the Methodological section below.

Figure 3.1: A 4-digits product space representation



Source: Atlas of Economic Complexity, Harvard University

of the EC approach: first, relying on trade data, its construction is completely empirical based, hence there are no prior assumptions about the production process; secondly, according to the type of input data used for network construction, the graph may be tailored to specific areas, or countries, as well as being on global scale and not confined to single specific case studies. As far as global production process is concerned, the first representations of the Product Space (Figure 1) have highlighted a core-periphery structure, with, at the centre, more sophisticated goods, such as machinery or metallurgy, and, on the periphery, less complex products, such as foodstuff or minerals. Consequently, developing countries, whose production basket is characterised by less sophisticated goods, are mainly positioned externally, with best strategies for developing dealing with the individuation of the best routes for moving towards the centre of the network.

Finally, despite the widespread popularity of the product space, other interesting instruments also exist for economic analysis proposed under the EC approach. Among them is a set of indexes measuring product and country sophistication, the PRODY and EXPY indexes respectevely (Hausmann, Hwang, et al. 2007) or the Economic Complexity Index (ECI) and the Product Complexity Index (PCI), which respectively measure the scope of country diversity and product ubiquity (MIT 2019).

Building upon these contributions, the first aim of this paper is to link the EC approach with the literature on Global Value Chains (GVCs). As said, GVCs constitute today the backbone of global production and offer relevant opportunities for developing countries in terms of growth, productivity, employment, labour inclusion and poverty reduction (World Bank 2017, 2019, 2020; Taglioni and Winkler 2016). I provide the position of a set of key GVCs on the product space and analyse their characteristics through the use of EC tools such as the measures of products sophistication. To do so, I construct a new version of the product space with product disaggregation at 6-digits level of the Harmonised System (HS) for the year 2015, and calculate accordingly sophistication indexes. I find that many of the products of the selected GVCs are positioned in the central part of the product space, which means that they share technology and know-how with a larger set of products with respect to peripheral goods. This reveals that integration in GVCs may provide opportunities for diversification and enlargement of the production structure. Moreover selected GVCs, especially Aerospace and Electronics, denote high level of sophistication, which imply that GVCs integration allows also for an improvement of the production structure in terms of value added. These results seem to explain with the use of an EC perspective the afore mentioned benefits of GVCs integration in term of growth, productivity and development. In particular technology and know-how spillovers, originating especially from buyer-supplier relationships, contribute to a large part of GVCs-related benefits. I enrich this conceptual contribution by proposing a new index for GVCs participation based on the EC approach, in order to offer new hints and insights into the study of GVCs.

As a second contribution, I provide a case study on North African (NA) countries. Despite some case studies based on the EC approach on developing countries exist – Ecuador (Hausmann and Klinger 2010), Sub-Saharan Africa (Abdon and Felipe 2011), East Africa (Hidalgo 2012), Brazil and Korea (Romero et al. 2015), and Ethiopia (Fortunato et al. 2015) – none of them is on NA countries. I focus my exercise on GVCs participation and development opportunities, following the approach proposed in the previous section. Specifically, the analysis aims to: i) measure the participation of NA countries in a set of selected GVCs, using the new index provided; ii) discuss the most profitable trajectories to improve integration in the considered GVCs given the current positioning on the product space. This analysis may provide interesting suggestions to these countries for diversifying, and possibly upgrading, their current economic structure.

The paper is organised as follows: Section 3.2 links the EC approach to GVCs;

Section 3.3 provides the case study on NA countries; Section 3.4 concludes.

3.2 GVCs participation and the EC approach

This section links the EC approach to GVCs studies.

As a first step, I present the EC tools used and describe their construction. The first tool I use is the product space. As afore mentioned, the product space is a network in which nodes are products and edges identifies the degree of similarities between them. For the construction I used the CEPII BACI database (Gaulier and Zignago 2010) for the year 2015. This dataset comprises all trade flows with origin and destination disaggregated at the 6-digits level HS classification. The original dataset has a total of more than 7 million observations for 4857 products and 221 countries. To avoid any possible bias in the network construction, due to marginal products or countries with a low share of total trade, I removed all products and countries in the lowest 10th percentile. I end up with a total of 4372 products and 198 countries. On this sample, I compute RCA at the global level for each country in each product; from RCA, I then calculate proximity between products following Hidalgo, Klinger, et al. (2007):

$$\varphi_{i,j} = \min\{P(RCA_i|RCA_j), P(RCA_j|RCA_i)\} \tag{3.1}$$

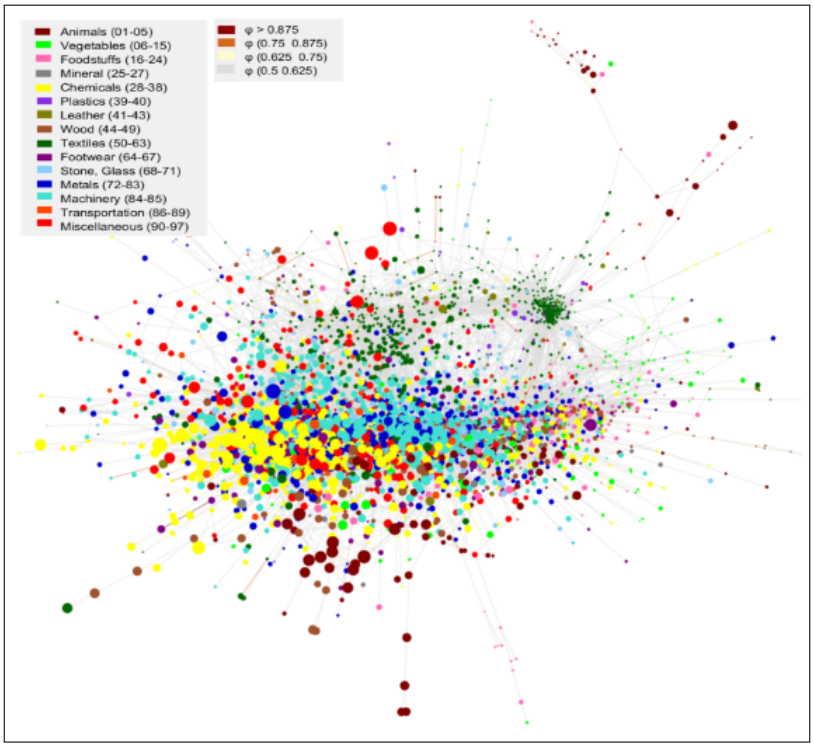
with $\varphi_{i,j}$, the proximity between the couple of goods i and j, being the minimum between the conditional probability of having a RCA in good i given a RCA in good j and viceversa. The symmetric product by product matrix of proximity serves as the adjacency matrix of the network.

Figure 3.2 depicts the product space obtained[2]. As in Figure 3.1, the network shows a clear core-periphery structure. The core is composed of machinery, metals, chemicals, and miscellaneous products. Separately, the periphery includes primary products such as animals, vegetables, and minerals. Interestingly, out of the centre, the network singles out another highly dense part comprising the textile sector. This evidences the high within-sector relatedness of this industry and at same time its connections with other sectors, from machinery to primary activities.

Figure 3.2 provides information also on product sophistication. The size of the nodes represents indeed the PRODY index of each product (Hausmann, Hwang,

[2]For graphical clarity, a threshold at proximity ≤ 0.5 is introduced in the adjacency matrix, thus all the products which exhibit a severely low level of relatedness with any other product are excluded. A complete representation of the network is reported in Appendix, Figure 3.7.

Figure 3.2: The product space



Author's elaboration. Node size: PRODY.

et al. 2007). This is calculated on the BACI dataset as

$$PRODY_k = \sum_{j=1}^{J} \frac{(x_{jk}/X_j)}{\sum_{j=1}^{J}(x_{jk}/X_j)} \times Y_j \tag{3.2}$$

where j identify countries and k products. By construction, the index is a weighted average of countries GDP per capita, where the weights correspond to countries RCA in product k.

The figure highlights how the core of the global production structure is characterised by highly sophisticated products, mainly chemicals and metals. These categories comprise indeed the products with the largest PRODY index. On the contrary, the products in the periphery, overall vegetables and minerals, exhibit lowest levels of sophistication. Table 3.1 reports the HS 6 digits products with highest and lowest PRODY.

Table 3.1: The PRODY index (Hausmann, Hwang, et al. 2007)

	HS code	Description	Sector	PRODY	PCI
Largest	294130	Tetracyclines, derivatives, in bulk, salts	Chemicals	71415.16	0.417
	741021	Foil of refined copper, backed, t < 0.15mm	Metals	69418.44	0.927
	740990	Plate, sheet, strip, copper alloy nes, t > 0.15mm	Metals	63263.82	1.46
	910111	Wrist-watch, precious metal, battery, with hands	Miscellaneous	62898.97	-0.1
	291242	Ethylvanillin(3-ethoxy-4-hydroxybenzaldehyde)	Chemicals	60444.03	1.618
	290369	Halogenated derivatives of aromatic hydrocarbons, nes	Chemicals	60097.21	0.642
	910221	Wrist-watch, base-metal case, automatic wound	Miscellaneous	59790.98	1.381
	910121	Wrist-watch, precious metal, automatic wound	Miscellaneous	59393.07	0.444
	391530	Polyvinyl chloride waste or scrap	Plastics	59197.37	0.431
	252930	Leucite, nepheline and nepheline syenite	Minerals	58504.82	1.132
Smallest	710121	Pearls cultured unworked	Stone and Glass	159.39	-0.845
	90930	Cumin seeds	Vegetables	183.32	-1.305
	90920	Coriander seeds	Vegetables	393.37	-1.632
	260500	Cobalt ores and concentrates	Minerals	556.73	-2.491
	261590	Niobium, tantalum and vanadium ores and concentrates	Minerals	685.40	-2.748
	80130	Cashew nuts, fresh or dried	Vegetables	762.63	-2.992
	270111	Anthracite, not agglomerated	Minerals	893.68	-1.086
	10420	Goats, live	Animals	907.01	-1.929
	90910	Anise or badian seeds	Vegetables	937.97	-1.036
	531010	Woven fabric of jute/bast fibres, unbleached/bleached	Textiles	948.44	-2.157

	Average	Std. Deviation	Minimum	Maximum	$\rho_{PRODY,PCI}$
PRODY	18685.36	10490.85	159.3895	71415.16	0.7307
PCI	0	1	-4.941	2.734	

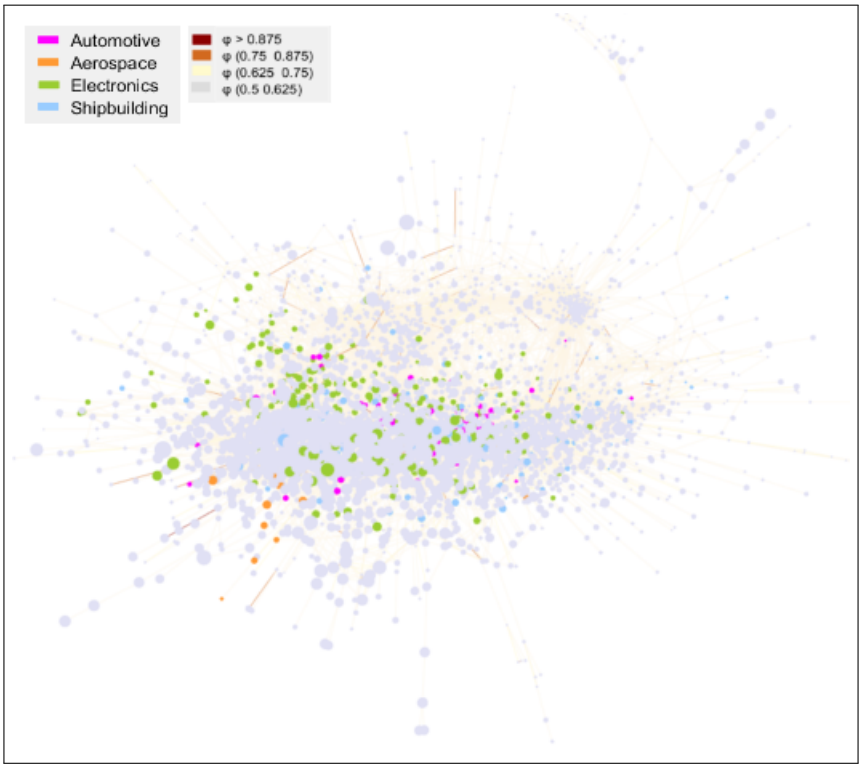
Notes: HS classification follows 1992 nomenclature. PRODY index is calculated using the BACI Dataset (2015) and World Bank GDP per capita in current $. Last column reports the Product Complexity Index (PCI), sourced from MIT (2019).

Once presented the EC tools, I now include GVCs into the analysis. Given the product-level focus of both the product space and the PRODY index, the same dimension is needed for GVCs. I source GVCs product by product decomposition from the *Centre on Globalization, Governance & Competitiveness* at Duke University. I study the automotive, aerospace, shipbuilding, and electronics GVCs (Frederick and Gereffi 2016; Frederick and Brun 2017; Sturgeon et al. 2016; Bamber et al. 2016). Other than being among the most developed GVCs, these chains are particularly relevant for the case study on NA countries: aerospace and automotive leading companies, such as Boeing, Airbus, and Renault, are indeed important investors in the region; shipbuilding has always been a leading sector in NA, especially for Egypt; finally electronics, one of the fastest growing global sectors, may constitute a precious high value added route for diversification.

The first attempt to investigate GVCs using EC approach instruments consists in a graphical representation that depicts the positioning of the selected GVCs on the product space, Figure 3.3[3].

[3]A complete representation is reported in Appendix, Figure 3.8

Figure 3.3: GVCs on the product space



Author's elaboration. Node size: PRODY. Node colour: belonging to one of the selected chain. Grey nodes do not belong to any of the selected chains.

The bulk of the products of these chains is situated in the central part of the network. The chains appear also to be quite related to each other, with products of different chains very closely positioned. This is especially the case for the electronics and automotive chains.

Table 3.2 reports some statistics. Electronics is the largest chain, with 269 products, whilst aerospace is the smallest, with 27. The average sophistication of the four chains is slightly above the mean PRODY, that amounts to about 18,000 $, with electronics and aerospace showing a PRODY about 4,000 $ higher than automotive and shipbuilding. Automotive and electronics are by far the most central chains, whilst aerospace has a more peripheral positioning, due to the presence of a certain share of products on the outer ring.

Table 3.2: GVCs, Sophistication and Network Centrality

GVC	# of products	Average PRODY ($)	Total PRODY ($)	Average Centrality
Automotive	85	18480	1,570,818	5,503.36
Aerospace	27	22195	599,270	965.41
Electronics	269	22023	5,924,150	5,375.52
Shipbuilding	136	17794	2,419,997	3,021.00

Notes: Weighted betweenness centrality has been used. The average PRODY index for all the products is 18,685.36. The average value of centrality for all the products in the network is 4781.70.

The descriptive evidence just proposed offers a new perspective on the study of GVCs. The fact that the products of the considered chains have higher centrality and sophistication may explain, from an EC perspective, the beneficial effects from GVCs integration documented by the literature.

These may come, first, from easier opportunities for diversification, and thus for growth and development. Entering GVCs may indeed constitute for many countries in a movement toward the centre of the product space, where, on average, proximity between products is higher. Technology spillovers and supplier-buyer relationships at the source of this proximity may thus explain the beneficial effect of GVCs integration. Secondly, this movement toward the centre is accompanied by an increase in the sophistication of the economy. The use of new foreign inputs and technology, and the meeting of product and process standard may explain this evidence.

Given the meaningfulness of linking the EC approach and the literature on GVCs, I conclude this section, by proposing a new index to measure country-level GVCs participation. The construction of this Participation Index (PI) is based on RCA and on the PRODY index. For the i_{th} country in the j_{th} GVC, it can be written as:

$$PI_{ij} = \frac{\sum_1^k PRODY_k}{\sum_1^n PRODY_n} \qquad with \quad 0 \leq k \leq n \tag{3.3}$$

where k identifies the 6-digits level products of the j_{th} GVCs in which the country i_{th} has RCA, while n all the 6-digits level products of the j_{th} GVC. By construction, the index, that ranges between 0 and 1, is characterised by the following properties:

- a country participates in a specific GVC if it has RCA in at least one good comprised in that specific GVC
- the higher the number of a country RCAs in products of a specific GVC, the higher the participation of that country in that specific GVC

- for the same number of RCAs in a specific GVC, the higher the sophistication, proxied with PRODY, of the products with RCA, the higher the participation

3.3 NA countries, economic complexity and GVCs

Despite a strategic geographical position in the Mediterranean Sea, closed to Europe, and in between America and East Asia, NA has not been able to fully develop and improve its living conditions. Indeed, political and social unrest and failed development policies have confined the area into middle-income status, with a strong need for a restructuring of domestic economies (Arezki et al. 2018). In this context, NA countries have not been able to fully integrate into international markets. Algeria, thanks to gas, is the region's first exporter, accounting for the 0.23% of world trade, followed by Egypt, 0.18%, Morocco, 0.15%, Tunisia, 0.01%, and Libya, 0.01% (MIT 2019). However, regardless of these very low percentages, as also shown in the Introduction, exports decomposition reveals that GVC participation of NA countries is good (Del Prete et al. 2018): the average for the area in 2013 matches the European level, with all the countries outperforming also China, India and NAFTA countries. Such result is mainly attributed to high shares of domestic value added embodied as intermediate inputs in other countries' exports, revealing a specialisation in the upstream stages of production, often with low value added.

Therefore, NA countries need to improve their gross participation in international markets, as well as improving their position towards higher value added activities. Indeed, their geographical position, historical ties and capabilities offer valuable opportunities to gain international relevance and become important players in international trade transactions.

In trying to shed more light on the area's performance, I first compute the new index for GVCs participation. I do not consider Libya and Algeria because of their reduced number of RCAs, due to their large specialisation in primary activities, as well as their serious social and political challenges in the most recent years. Hence, the sample comprises Tunisia, Morocco and Egypt.

Table 3.3 provides the estimation of the PI for the selected GVCs. Tunisia is by far the most engaged in the four GVCs considered, with a total PI of 15.25%, more than doubling the results of Morocco and Egypt. Taking into account single GVCs, it has the highest PI in electronics, almost 20%, followed by automotive, aerospace and shipbuilding. In particular, with the exception of the latter GVC, Tunisia is the country with the highest PI in all the chains compared to the other two countries.

On the contrary, Morocco, despite the relevant share of FDI inflows especially in the automotive sector, does not lead any chain by PI: its total PI is 7.10% with a peak in automotive of 10.36%. Electronics is the second chain, 7.27%, while shipbuilding and aerospace do not reach the 6%. Country participation in the four chains is fairly uniform, thus allowing for a future development in more than one chain.

Table 3.3: NA GVCs participation

GVC		Morocco	Tunisia	Egypt	PI mean
Automotive	# of RCAs	10	15	3	9.21%
	PI	10.36%	15.09%	2.19%	
Aerospace	# of RCAs	2	3	0	5.18%
	PI	5.71%	9.82%	0.00%	
Shipbuilding	# of RCAs	7	13	26	10.07%
	PI	5.90%	9.57%	14.73%	
Electronics	# of RCAs	24	58	18	9.90%
	PI	7.27%	17.97%	4.45%	
Total	# of RCAs	40	86	46	9.58%
	PI	7.10%	15.25%	6.39%	

Finally Egypt GVCs participation results to be the lowest. The total PI accounts for the 6.39%, resulting from largely heterogeneous figures in the single chains. The country highest PI is in the shipbuilding GVC, which is also the highest for the area, reflecting the country's significant historical tradition in the sector. However, apart from this chain, the results are very disappointing: the second PI is in electronics, with a very small 4.45%, then automotive, 2.19%, and finally aerospace, with no product in the chain in which the country has a RCA. However, despite the low PI, country integration is expected to increase over the next few fears in light of large FDI inflows, especially in the electronics sector.

Figures 3.9, 3.10, 3.11 in the Appendix provide country positioning on the product space along with GVCs participation offering a graphical representation of quantitative results just presented.

As far as average results for the area are concerned, I find a total PI of 9.58%. The variability of the index for the four chains is quite small: the PI for automotive, shipbuilding and electronics, the most developed, is almost equal in the area. As the exception, the aerospace chain despite substantial investments in the area from

multinationals – such as Airbus – is a step behind with a PI of 5.18%.

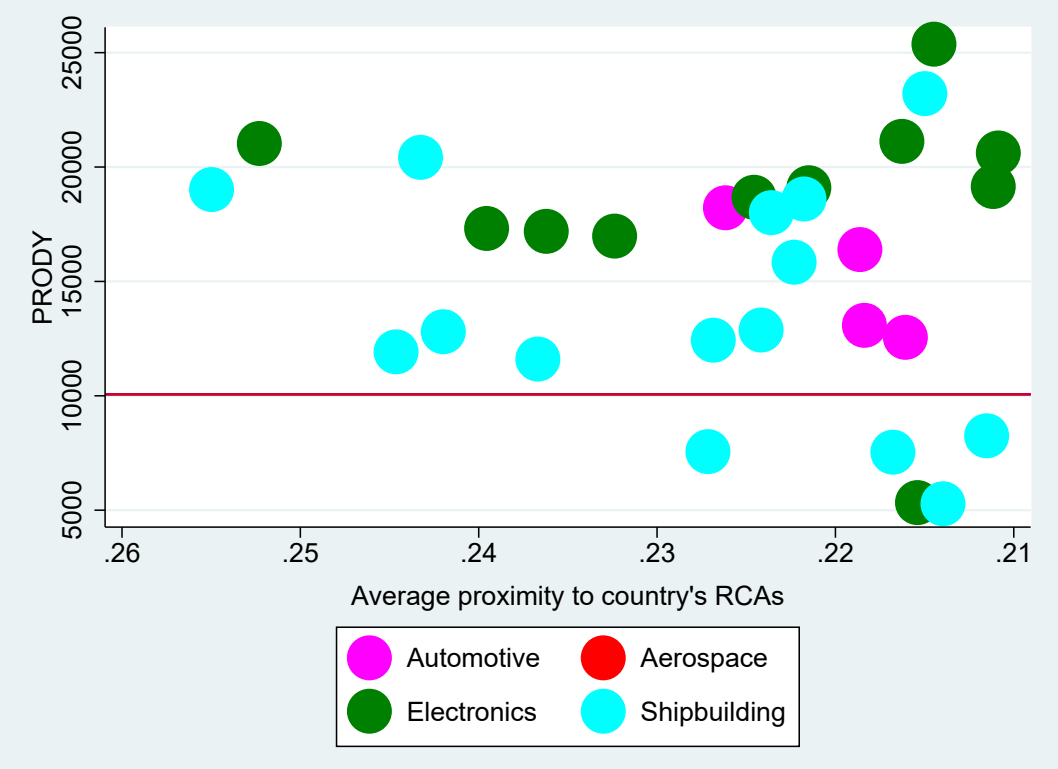
The analysis of the PI index provided in Table 3.3 highlights strengths and weaknesses for each of the countries considered in the different chains. A key message emerging is that clear differences exist between their level of integration into the selected GVCs. These differences require investigation into and discussion about possible future trajectories and related policy interventions, looking at each country one at a time. To provide such a country specific assessment, I present a scatter plot that depicts a sort of "development space" in GVCs. Each dot of the scatter is a GVC product in which the country has not RCA. On the axes I use the concepts of proximity and PRODY, which emerged as meaningful tools to address GVCs analysis. In particular, on x-axis I put the average of the proximity between each of non-RCA products, comprised into the selected GVCs, and the basket of country RCAs. Higher values denotes high relatedness between selected GVCs goods and the country basket of RCAs, thus evidencing the goods sharing similar technology, know-how, or other production factors with current countries capabilities. In a perspective of diversification, these products should be the ones in which each country should find easiest to reach a RCA. On the y-axis is the PRODY index, which allows to assess the profitability of further integration in each specific product or chain.

From a policy perspective, this relationship provides insights and suggestions to understand in which direction to devote interests, investment and industrial policies in order to increase GVCs participation as well as country diversification at a whole.

Figures 3.4, 3.5, 3.6 report the development space for Morocco, Tunisia and Egypt respectively, while Tables 3.4, 3.5, 3.6 in Appendix the list of the top 30 products in term of average proximity.

Morocco's development space highlights that the country's most related goods belong to the electronics and shipbuilding chains. In fact, products from these two chains occupy the first ten positions, in terms of average proximity, Appendix, Table 3.4.

Figure 3.4: Morocco development space into GVCs



Notes: The red horizontal line identifies the country sophistication level, calculated as the EXPY Index.

The most related products are HS 730630 and HS 853810, respectively "*Pipes etc nes, iron/steel welded nes, diameter <406.4m*" and "*Electrical boards, panels, etc, not equipped*" of the shipbuilding and electronics chains. The average proximity of these two goods is higher than 0.25, meaning that the average probability that each of these two goods and the RCA goods of the country are co-exported with RCA is higher than the 25%. With average proximity in the range 0.25-0.23 there are 7 other goods, again all belonging to the shipbuilding or electronics chain. The first good belonging to a different chain, automotive, is HS 940120 "*Seats, motor vehicles*", with an average proximity of 0.226. Further, there are three other goods of the automotive chain in the top 30, with an average proximity close to 0.22. No good in the aerospace GVC appears in top 30 related products.

Looking at the sophistication of the most related products, it is easy to notice that the large majority has a PRODY index larger than the country average, the so called EXPY index[4] (Hausmann, Hwang, et al. 2007) – red horizontal line in the graph. This is true, on average, for all the three chains appearing in Morocco's development space, with exceptionally high values for the electronics chain. Therefore,

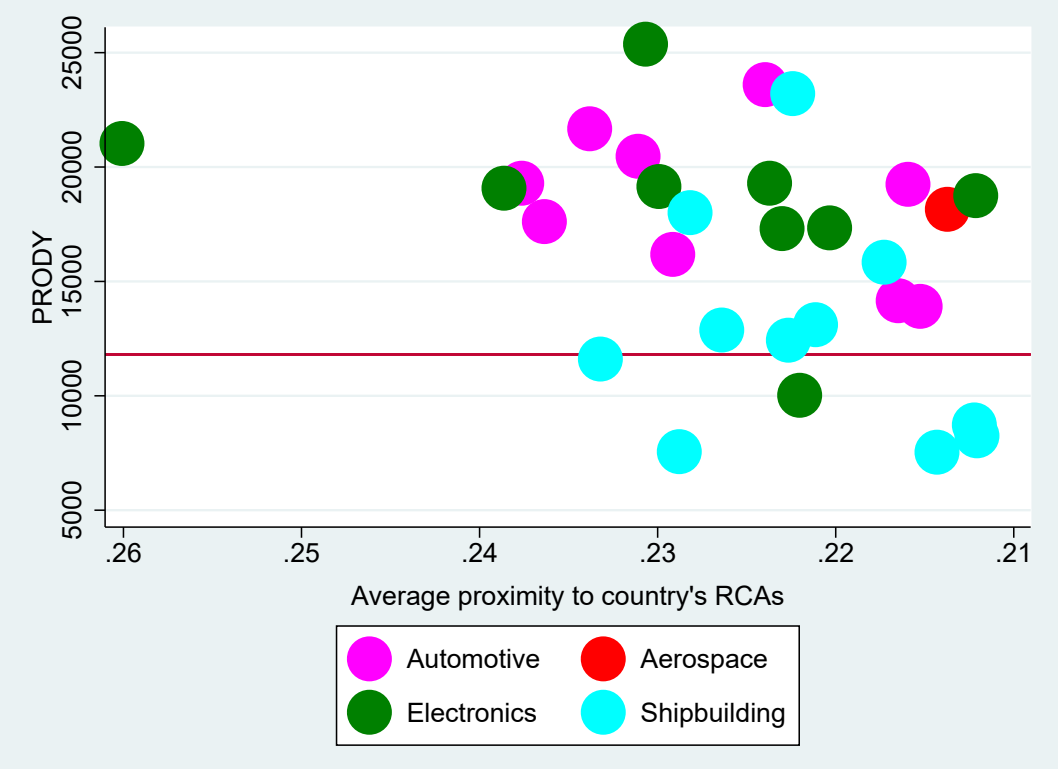
[4] $EXPY_j = \sum_{k=1}^{K}(x_{jk}/X_j) \times PRODY_k$. j identifies country and k product.

increasing integration in the aforementioned chain would considerably increase both the quality and quantity of the country's productive capacity.

In summary, Morocco's development into selected GVCs appears to be directed towards the shipbuilding and electronics GVCs. Indeed. these are the chains comprising the majority of the most related products. However, the possibilities for upgrading into the automotive chains exist and Morocco should pursue such an objective, since this is the chain that has the highest PI amongst those under consideration (Table 3.3). As far as sophistication is concerned, increasing participation in these chains would, in any case, allow the country to increase its EXPY index. If so, Morocco would have different solutions for improving its GVC performance, all of them consisting in a net economic development for the country.

Figure 3.5 reports the development space for Tunisia. The product with the highest average proximity is HS 853810 "*Elictrical boards, panels, etc, not equipped*" of the electronics GVC, with a value of 0.26 and a PRODY, about $21000, almost doubling country's EXPY. Despite the high proximity of this good, next related products exhibit much lower relatedness, with values lower than 0.24. These products, positioning in the 0.24- 0.22 range, belong to different chains: amongst a set of other electronics products, there is a rump of highly sophisticated automotive goods, such as HS 870839 "*Brake system parts except linings for motor vehicles*", HS 700711 "*Safety glass (tempered) for vehicles, aircraft, etc*", and HS 870892 "*Mufflers and exhaust pipes for motor vehicles*", with PRODY index around $20000. Also in the shipbuilding chain, Tunisia has a set of quite closely related goods, which however reveal reduced sophistication with respect to other chains' products. Interestingly, differently from Morocco, in the top 30 related goods, Tunisia also has a good from the aerospace chain, HS 401210 "*Retreaded Tyres*".

Figure 3.5: Tunisia development space into GVCs



Notes: The red horizontal line identifies the country sophistication level, calculated as the EXPY Index.

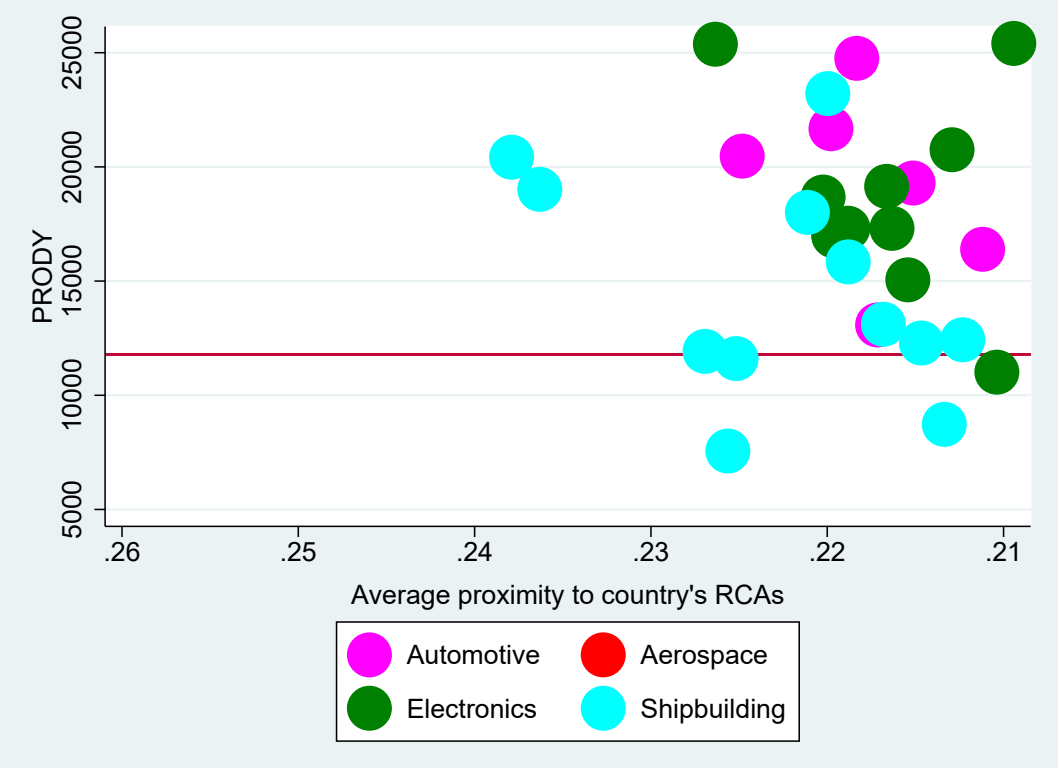
The results allow the expectation of an improvement for Tunisian GVCs. Despite the majority of products being concentrated in the medium distance range (0.24-0.22), with HS 853810 as the only exception, the country has really good possibilities for increasing its participation in all the chains under consideration. Electronics and automotive appear the best solutions, both for reasons of proximity and sophistication which could encourage an increase in the respective PI of up to the 20%. Increasing participation in the shipbuilding chain should also be assessed: on one hand, it would allow the enlargement of its PI which, at the moment, is the lowest for the country; on the other hand, given the low sophistication of the related goods from this chain, devoting investments in other directions could be more productive. Finally, there is different rationale for the aerospace chain: even if only one good is comprised in the top 30, devoting investment in this chain could, initially, increase the already high PI, thus positioning Tunisia as a leading actor in the chain, and, secondly, it could allow the benefits arising from the aerospace chain's high sophistication to spread to the domestic economy.

Table 3.3 clearly reports that Egypt GVCs participation is the lowest for the area. Excepting a remarkable result in the shipbuilding chain, the country has

indeed very low PI in the other chains being considered.

Looking at the country development space, Figure 3.6, Egypt's perspectives appear to be less positive than those for Morocco and Tunisia. Indeed, their whole set of products has a lower average level of proximity, with almost two thirds of the top 30 related products showing an average proximity that is lower than 0.22.

Figure 3.6: Egypt development space into GVCs



Notes: The red horizontal line identifies the country sophistication level, calculated as the EXPY Index.

The products with the highest level of average proximity are positioned in the range 0.24-0.23: HS 840999 "*Parts for diesel and semi-diesel engines*" and HS 730630 "*Pipes etc nes, iron/steel welded nes, diameter <406.4m*", both of them belonging to the shipbuilding chain, which is by far the most represented. Unfortunately, despite the relative high proximity, if one leaves aside these two aforementioned goods, the average sophistication of the goods from this chain is just slightly above the country EXPY index. As far as other chains are concerned, there are also some automotive and electronics chains' products that are attainable by Egypt. Amongst them, those with the highest average proximity are HS 853080 "*Electric signal, safety & traffic controls, nes*" in the electronic chain and HS 700721 "*Safety glass (laminated) for vehicles, aircraft, etc*" in the automotive chain. Mirroring the shipbuilding chain, the lower values of the average proximity of these products is

characterised by high values of PRODY. Finally, as Table 3.3 suggests, no aerospace goods appear in the top 30 related products.

In summary, Egyptian development space identifies challenges facing the country's improvement in GVCs. First, increasing the PI in the shipbuilding chain, the most straightforward objective, would allow the country to position itself as a leader in this sector but, at the same time, it would not encourage great improvement in the country's EXPY index. Second, investing in order to improve participation in the electronics and automotive chains, that would enable a substantial increase in the country's EXPY where the country currently has very low values of PI, seems to be constrained by their higher distance. For these reasons, empowering participation in the shipbuilding chain in the very near future and, meanwhile, trying to approach the other two chains could be the best, if not completely satisfactory, solution for the country. There appear to be very few possibilities for increasing participation in the aerospace chain.

3.4 Conclusions

The economic development of countries consists of a dynamic process, in which both purely economic and social factors have a prominent role. The diversity of available capabilities, as well as the scope of their interactions, together shape country growth and performance. The EC approach, proposed by Hidalgo and Hausmann (2009), is routed along this idea and offers many interesting tools. Recognising the simultaneous role of internationalisation, particularly in the way that integration into GVCs has in shaping a country's development, this paper tries to encompass these two strands of literature by examining GVCs characteristics and country performance, using the approach of EC.

The analysis is conducted by using a broad set of advanced descriptive statistics, both in graphical and quantitative form. In addition, I propose a new EC coherent index to measure GVC participation at the country level.

I find that the EC approach offers a new perspective to study GVCs. Selecting a specific group of GVCs - automotive, aerospace, electronics and shipbuilding - I find that the products they include are on average more sophisticated and positioned in the central part of the products space. This can explain the documented benefits in terms of growth and development coming from GVCs integration.

By focusing on the assessment of NA countries performances – Morocco, Tunisia and Egypt – I measure GVCs participation through the proposed index, and evaluate possible trajectories for increasing GVCs integration. The analysis shows qualitative

and quantitative differences, both as concerns the measurement of GVCs participation, with Tunisia outperforming the other two countries in the selected chains, and as concerns future trajectories.

To conclude, the main contribution consists of an attempt to interact GVCs and EC studies: further research in this direction could offer interesting insights for the enlargement and the development of both strands of literature. I recognise there are limitations regarding the bounded scope of this analysis, both from the geographical and chain selection side, as well as regarding the structure of the proposed GVCs participation index. I believe, however, that it is a starting point for future improvements, which could be extremely beneficial for the development of both these strands of literature.

References

Abdon, Arnelyn and Jesus Felipe (2011). "The product space: What does it say about the opportunities for growth and structural transformation of Sub-Saharan Africa?" In: *The Levy Economics Institute Working Paper Collection*.

Acemoglu, Daron, Simon Johnson, and James A Robinson (2005). "Institutions as a fundamental cause of long-run growth". In: *Handbook of Economic Growth* 1, pp. 385–472.

Arezki, Rabah, Lili Mottaghi, Andrea Barone, Rachel Yuting Fan, Youssouf Kiendrebeogo, and Daniel Lederman (2018). *Economic Transformation – Middle East and North Africa Economic Monitor, April*. DOI: 10.1596/978-1-4648-1288-0.

Bamber, Penny, Stacey Frederick, and Gary Gereffi (2016). *The Philippines in the Aerospace Global Value Chain*. Tech. rep. Center on Globalization, Governance and Competitiveness, Duke University.

Becattini, Giacomo (1989). "Riflessioni sul distretto industriale marshalliano come concetto socio-economico". In: *Stato e Mercato*, pp. 111–128.

Boschma, Ron (2005). "Proximity and innovation: a critical assessment". In: *Regional Studies* 39.1, pp. 61–74.

Del Prete, Davide, Giorgia Giovannetti, and Enrico Marvasi (2018). "Global value chains: New evidence for North Africa". In: *International Economics* 153, pp. 42–54.

Fortunato, Piergiuseppe, Carlos Razo, and Kasper Vrolijk (2015). *Operationalizing the product space: A road map to export diversification*. Tech. rep. United Nations Conference on Trade and Development.

Frederick, Stacey and Lukas Brun (2017). *The Philippines in the shipbuilding global value chain*. Tech. rep. Center on Globalization, Governance and Competitiveness, Duke University.

Frederick, Stacey and Gary Gereffi (2016). *The Philippines in the electronics and electrical global value chain*. Tech. rep. Center on Globalization, Governance and Competitiveness, Duke University.

Frenken, Koen, Frank Van Oort, and Thijs Verburg (2007). "Related variety, unrelated variety and regional economic growth". In: *Regional studies* 41.5, pp. 685–697.

Gaulier, Guillaume and Soledad Zignago (2010). *BACI: International Trade Database at the Product-Level. The 1994-2007 Version*. Working Papers 2010-23. CEPII.

URL: http://www.cepii.fr/CEPII/fr/publications/wp/abstract.asp?NoDoc=2726.

Hausmann, Ricardo, Jason Hwang, and Dani Rodrik (2007). "What you export matters". In: *Journal of Economic Growth* 12.1, pp. 1–25.

Hausmann, Ricardo and Bailey Klinger (2010). "Structural transformation in Ecuador". In: *Inter-American Development Bank*.

Heckscher, Eli Filip and Bertil Gotthard Ohlin (1991). *Heckscher-Ohlin trade theory*. The MIT Press.

Hidalgo, César (2012). "Discovering East Africa's Industrial Opportunities". In: *arXiv preprint arXiv:1203.0163*.

— (2021). "Economic complexity theory and applications". In: *Nature Reviews Physics*, pp. 1–22.

Hidalgo, César and Ricardo Hausmann (2009). "The building blocks of economic complexity". In: *Proceedings of the National Academy of Sciences* 106.26, pp. 10570–10575.

Hidalgo, César, Bailey Klinger, A-L Barabási, and Ricardo Hausmann (2007). "The product space conditions the development of nations". In: *Science* 317, pp. 482–487.

Lucas Jr, Robert E (1988). "On the mechanics of economic development". In: *Journal of Monetary Economics* 22.1, pp. 3–42.

MIT (2019). *The Observatory of Economy Complexity*. URL: https://atlas.media.mit.edu/en/.

Porter, Michael E (2000). "Location, competition, and economic development: Local clusters in a global economy". In: *Economic Development Quarterly* 14.1, pp. 15–34.

Romer, Paul M (1990). "Endogenous technological change". In: *Journal of Political Economy* 98.5, Part 2, S71–S102.

Romero, João Prates, Elton Freitas, Gustavo Britto, and Clara Coelho (2015). *The great divide: the paths of industrial competitiveness in Brazil and South Korea*. Tech. rep. Cedeplar, Universidade Federal de Minas Gerais.

Solow, Robert M (1956). "A contribution to the theory of economic growth". In: *The Quarterly Journal of Economics* 70.1, pp. 65–94.

Sturgeon, Timothy, Jack Daly, Stacey Frederick, Penny Bamber, and Gary Gereffi (2016). *The Philippines in the automotive global value chain*. Tech. rep. Center on Globalization, Governance and Competitiveness, Duke University.

Taglioni, Daria and Deborah Winkler (2016). *Making global value chains work for development*. The World Bank.

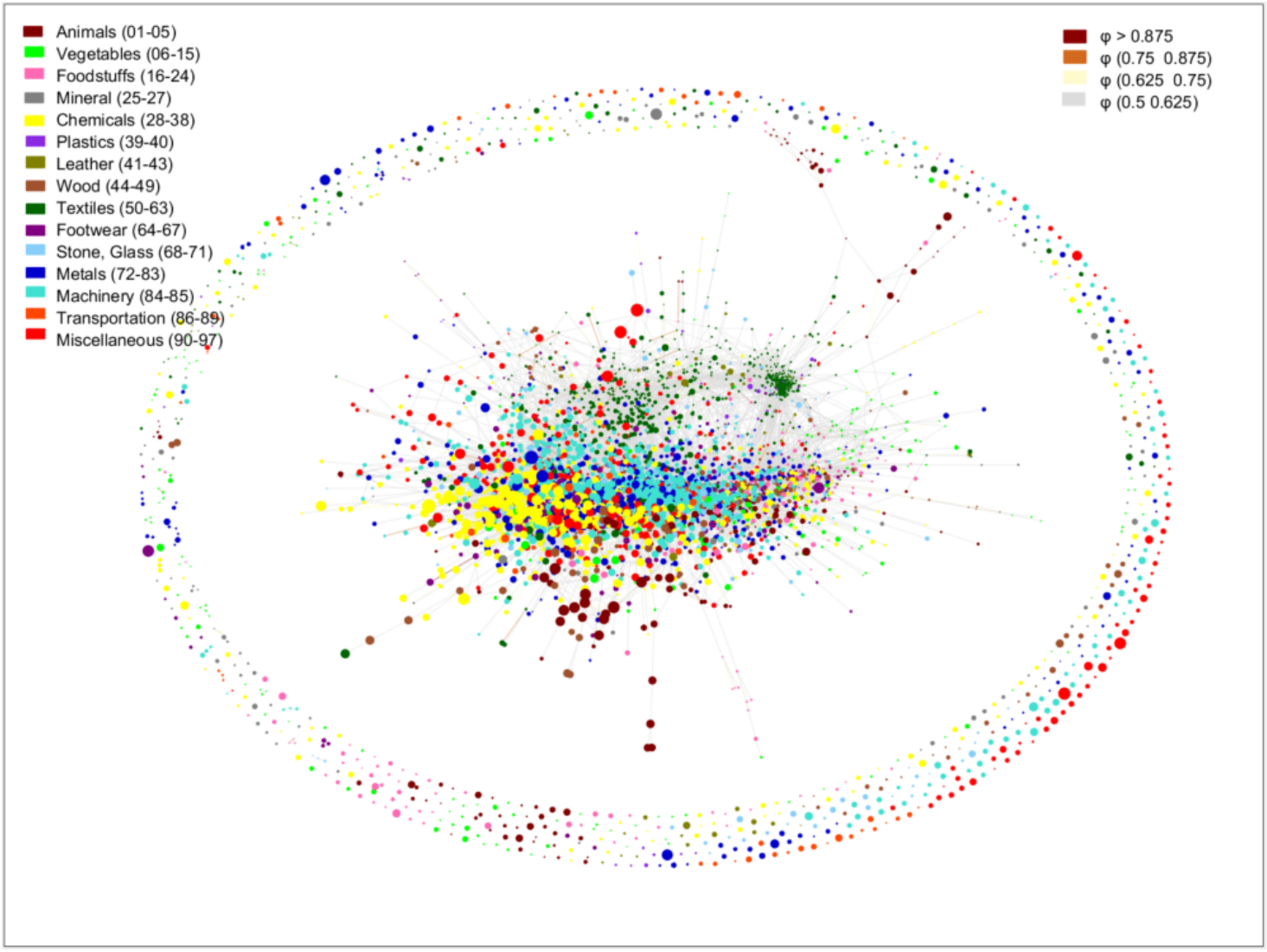
World Bank (2017). *GLOBAL VALUE CHAIN DEVELOPMENT REPORT 2017 - Measuring and analyzing the impact of GVCs on economic development*. The World Bank.

— (2019). *GLOBAL VALUE CHAIN DEVELOPMENT REPORT 2019 - TECHNOLOGICAL INNOVATION, SUPPLY CHAIN TRADE, AND WORKERS IN A GLOBALIZED WORLD*. The World Bank.

— (2020). *WORLD DEVELOPMENT REPORT 2020 - TRADING FOR DEVELOPMENT IN THE AGE OF GLOBAL VALUE CHAINS*. The World Bank.

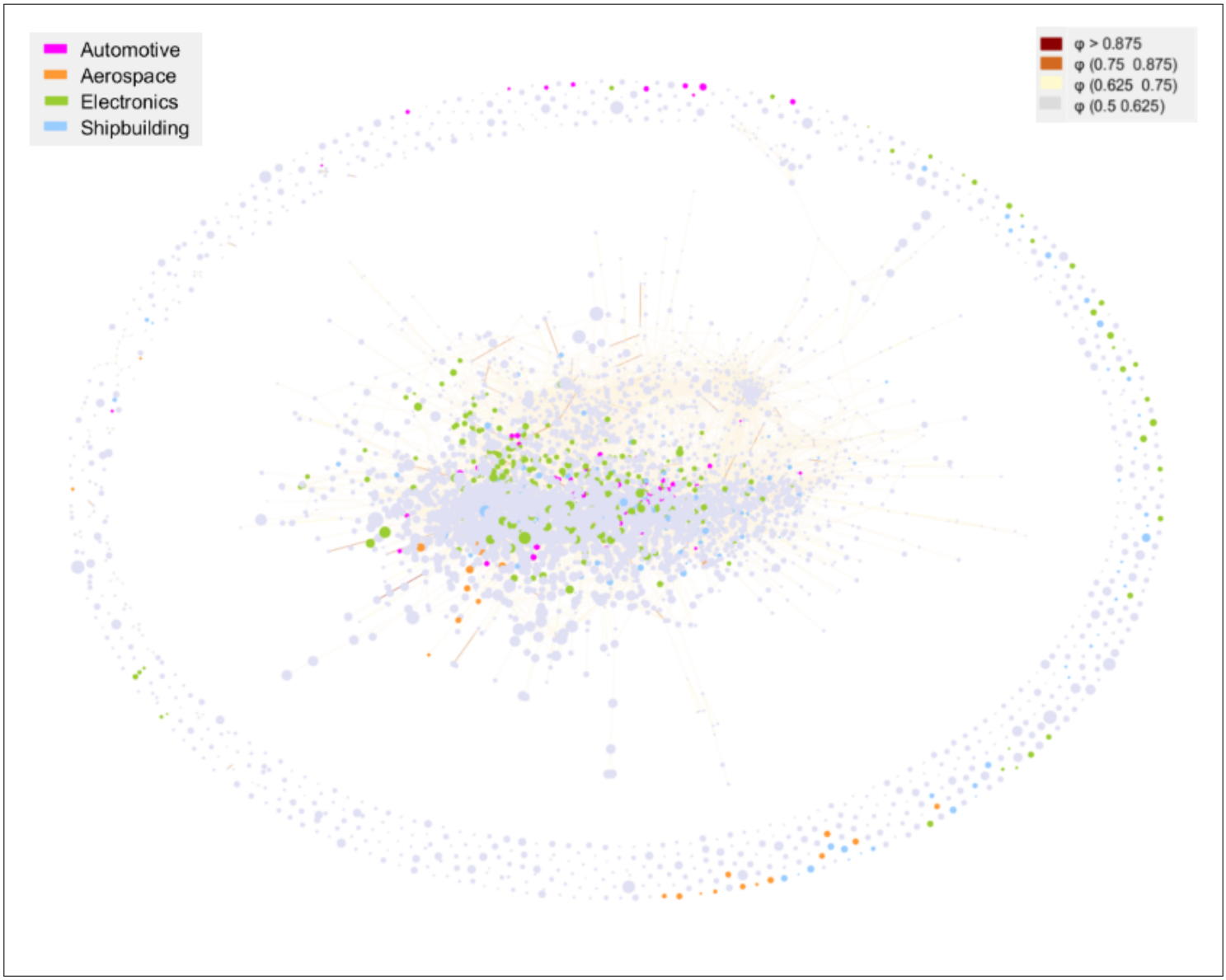
Appendix

Figure 3.7: A new 6-digits product space



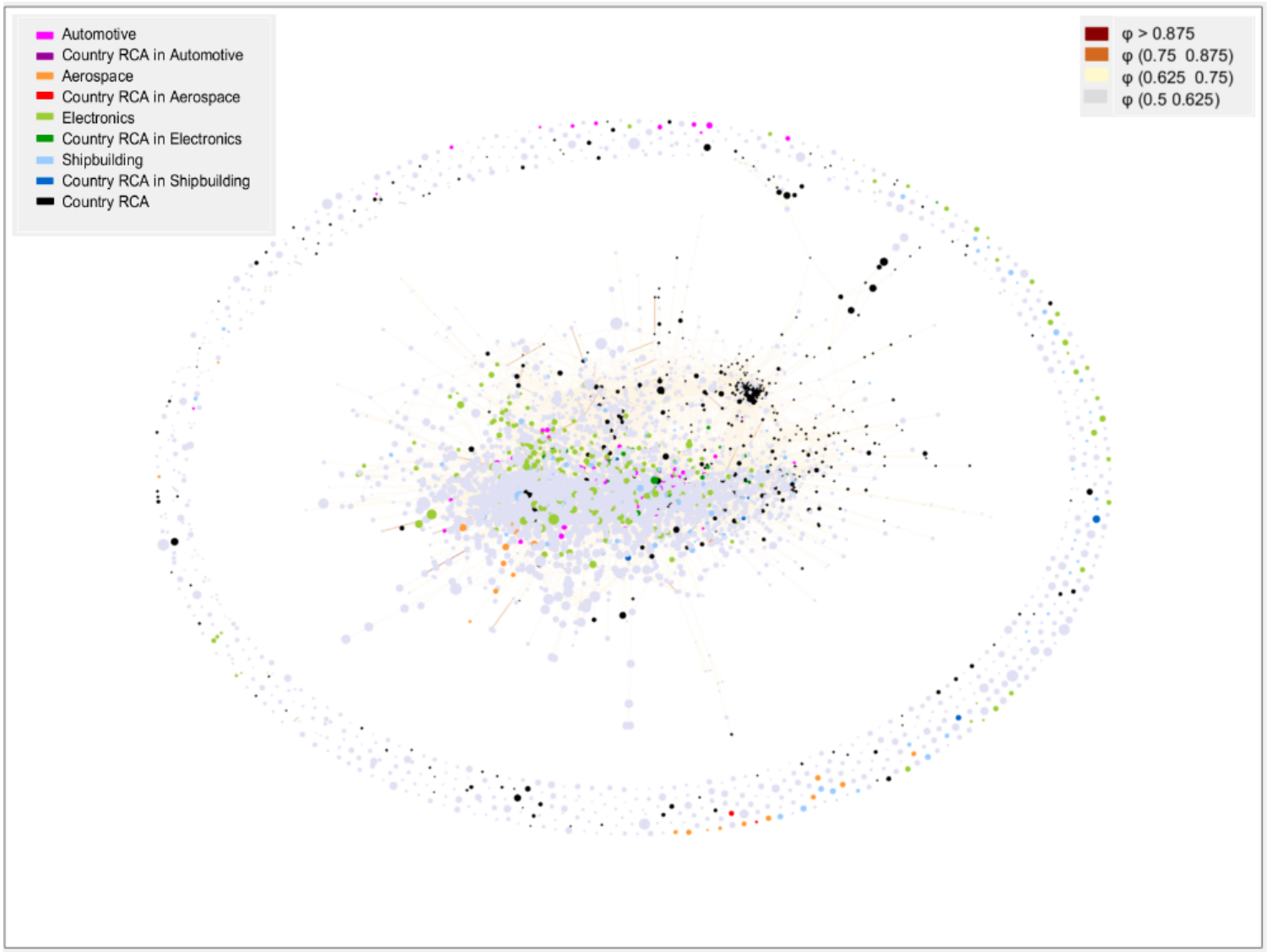
Notes: Author's elaboration. Node size: PRODY.

Figure 3.8: GVCs on the product space



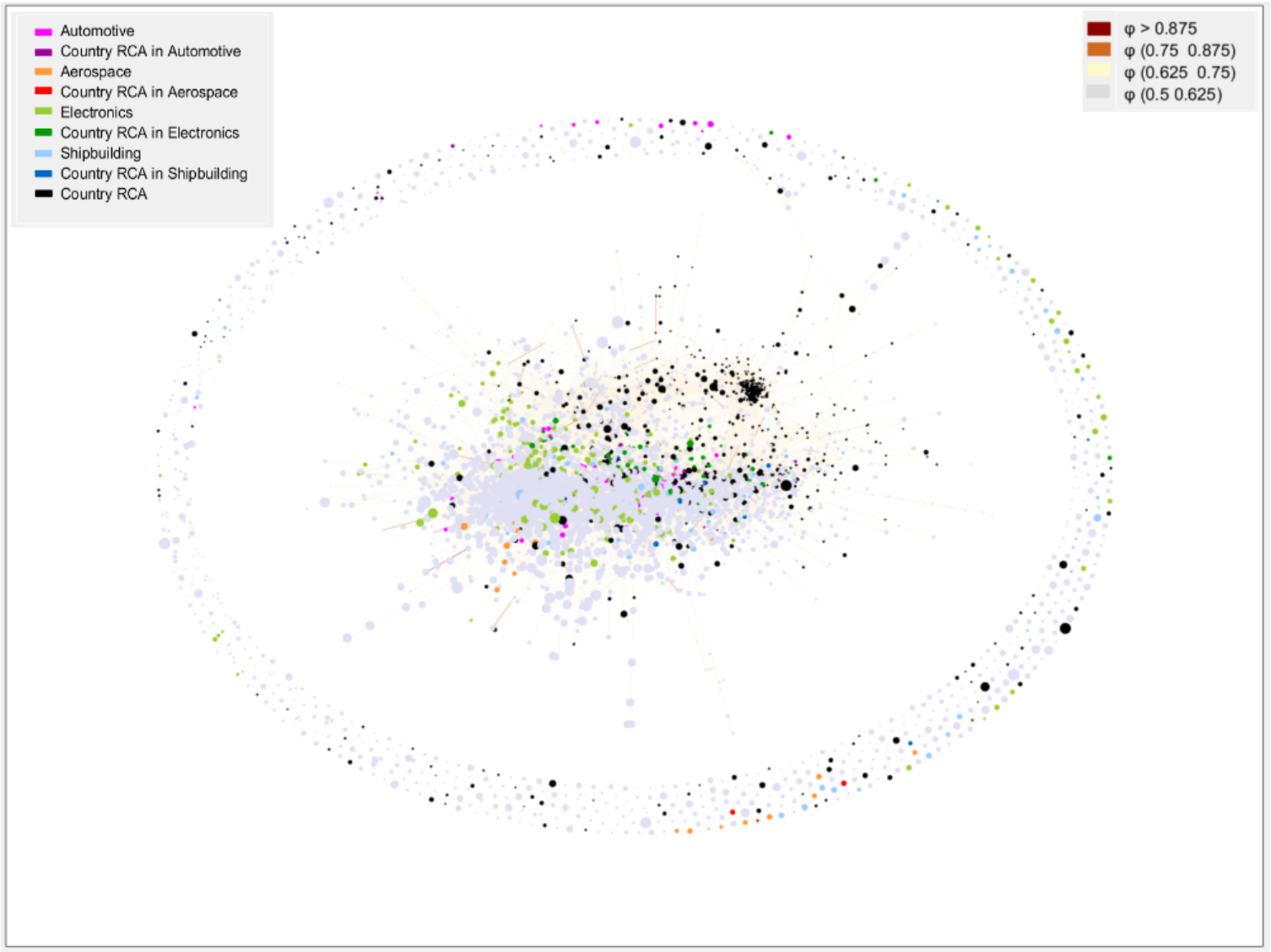
Notes: Author's elaboration. Node size: PRODY. Node colour: belonging to one of the selected chain. Grey nodes do not belong to any of the selected chains.

Figure 3.9: Morocco positioning and GVCs participation on the product space



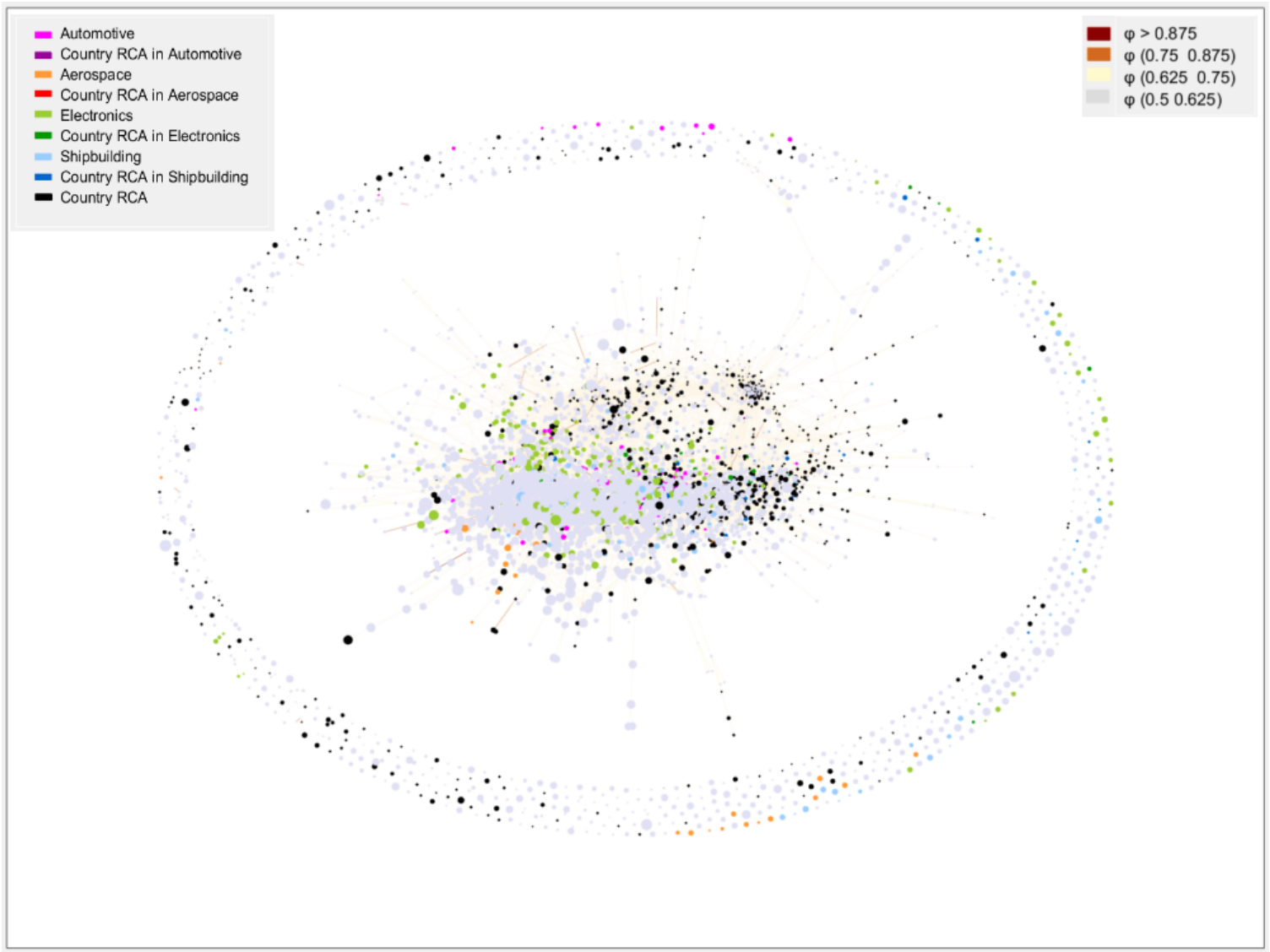
Notes: Author's elaboration. Node size: PRODY. Node colour: belonging to one of the selected chains. Darker shades identifies GVCs products in which the country as a RCA. Black nodes denote country RCA out of the selected GVCs. Grey nodes do not belong to any of the selected chains nor to country RCA basket.

Figure 3.10: Tunisia positioning and GVCs participation on the product space



Notes: Author's elaboration. Node size: PRODY. Node colour: belonging to one of the selected chains. Darker shades identifies GVCs products in which the country as a RCA. Black nodes denote country RCA out of the selected GVCs. Grey nodes do not belong to any of the selected chains nor to country RCA basket.

Figure 3.11: Egypt positioning and GVCs participation on the product space



Notes: Author's elaboration. Node size: PRODY. Node colour: belonging to one of the selected chains. Darker shades identifies GVCs products in which the country as a RCA. Black nodes denote country RCA out of the selected GVCs. Grey nodes do not belong to any of the selected chains nor to country RCA basket.

Table 3.4: Morocco top 30 related products

	HS Code	Product Description	GVC	PRODY ($)	Av. proximity
1	730630	Pipes etc nes, iron/steel welded nes,diameter <406.4m	Shipbuilding	19016.471	0.2550
2	853810	Elictrical boards, panels, etc, not equipped	Electronics	21030.797	0.2523
3	721440	Bar/rod, iron or non-alloy steel, hot formed <0.25%C, nes	Shipbuilding	11922.298	0.2446
4	840999	Parts for diesel and semi-diesel engines	Shipbuilding	20424.266	0.2433
5	721711	Wire, iron or non-alloy steel, not plated or coated, <0.25%C	Shipbuilding	12801.557	0.2420
6	850432	Transformers electric, power capacity 1-16 KVA, nes	Electronics	17316.465	0.2396
7	721660	Sections, nes, iron or non-alloy steel, nfw than cold formed/finished	Shipbuilding	11606.913	0.2367
8	850300	Parts for electric motors and generators	Electronics	17189.941	0.2362
9	902890	Parts, accessories for gas, liquid, electricity meter	Electronics	16982.256	0.2324
10	721590	Bar/rod, iron or non-alloy steel, nes	Shipbuilding	7559.0229	0.2271
11	730660	Hollow profiles/tubes,iron/steel,non-circular, welded	Shipbuilding	12431.923	0.2268
12	940120	Seats, motor vehicles	Automotive	18219.996	0.2262
13	850422	Liquid dielectric transformers 650-10,000KVA	Electronics	18679.977	0.2246
14	721011	Flat rolled iron or non-alloy steel, coated with tin, w >600mm, t >0.5m	Shipbuilding	12876.497	0.2242
15	730490	Iron or steel tubes, pipes or hollow profiles, nes	Shipbuilding	18007.953	0.2236
16	721690	Angles/shapes/sections, iron or non-alloy steel, nes	Shipbuilding	15839.757	0.2223
17	730711	Pipe fittings of non-malleable cast iron	Shipbuilding	18603.342	0.2218
18	853720	Electrical control and distribution boards, > 1kV	Electronics	19096.693	0.2215
19	851290	Parts of cycle & vehicle light, signal, etc equipment	Automotive	16392.576	0.2186
20	870899	Motor vehicle parts nes	Automotive	13080.942	0.2184
21	730690	Tube/pipe/hollow profile, iron/steel,riveted/open sea	Shipbuilding	7536.271	0.2168
22	853649	Electrical relays for 60 - 1,000 volts	Electronics	21123.28	0.2163
23	850710	Lead-acid electric accumulators (vehicle)	Automotive	12556.96	0.2161
24	902830	Electricity supply, production and calibrating meters	Electronics	5332.99	0.2154
25	721230	Flat rolled iron or non-alloy steel, <600mm, coated with zinc, nes	Shipbuilding	23211.32	0.2150
26	853080	Electric signal, safety & traffic controls, nes	Electronics	25372.17	0.2145
27	721712	Wire, iron or non-alloy steel, plated or coated with zinc <0.25%C	Shipbuilding	5279.784	0.2140
28	721331	Hot rolled bar/rod, iron or non-alloy steel, coiled width <14mm, C<.25%	Shipbuilding	8251.904	0.2115
29	850164	AC generators, of an output > 750 kVA	Electronics	19148.87	0.2112
30	851690	Parts of electro-thermic apparatus, domestic, etc	Electronics	20616.17	0.2109

Table 3.5: Tunisia top 30 related products

	HS Code	Product Description	GVC	PRODY ($)	Av. proximity
1	853810	Elictrical boards, panels, etc, not equipped	Electronics	21030.797	0.2601
2	850490	Parts of electrical transformers and inductors	Electronics	19075.238	0.2386
3	870839	Brake system parts except linings for motor vehicles	Automotive	19293.17	0.2376
4	700711	Safety glass (tempered) for vehicles, aircraft, etc	Automotive	17615.869	0.2364
5	870892	Mufflers and exhaust pipes for motor vehicles	Automotive	21672.855	0.2338
6	721660	Sections, nes, iron or non-alloy steel, nfw than cold formed/finished	Shipbuilding	11606.913	0.2332
7	700721	Safety glass (laminated) for vehicles, aircraft, etc	Automotive	20472.654	0.2311
8	853080	Electric signal, safety & traffic controls, nes	Electronics	25372.174	0.2307
9	850164	AC generators, of an output > 750 kVA	Electronics	19148.873	0.2299
10	851190	Parts of electrical ignition or starting equipment	Automotive	16183.183	0.2292
11	721590	Bar/rod, iron or non-alloy steel, nes	Shipbuilding	7559.0229	0.2288
12	730490	Iron or steel tubes, pipes or hollow profiles, nes	Shipbuilding	18007.953	0.2282
13	721011	Flat rolled iron or non-alloy steel, coated with tin, w >600mm, t >0.5m	Shipbuilding	12876.497	0.2264
14	870829	Parts and accessories of bodies nes for motor vehicle	Automotive	23603.852	0.2240
15	854620	Electrical insulators of ceramics	Electronics	19293.303	0.2237
16	850423	Liquid dielectric transformers > 10,000 KVA	Electronics	17309.982	0.2230
17	730660	Hollow profiles/tubes,iron/steel,non-circular, welded	Shipbuilding	12431.923	0.2227
18	721230	Flat rolled iron or non-alloy steel, <600mm, coated with zinc, nes	Shipbuilding	23211.32	0.2224
19	853225	Electric capacitors, fixed, paper/plastic dielectric	Electronics	10023.945	0.2220
20	721070	Flat rolled iron or non-alloy steel, painted/plastic coated,width>600mm	Shipbuilding	13109.096	0.2211
21	850990	Parts of domestic appliances with electric motor	Electronics	17341.84	0.2203
22	721690	Angles/shapes/sections, iron or non-alloy steel, nes	Shipbuilding	15839.76	0.2173
23	401110	Pneumatic tyres new of rubber for motor cars	Automotive	14156.44	0.2165
24	830230	Motor vehicle mountings, fittings, of base metal, nes	Automotive	19245.58	0.2159
25	870891	Radiators for motor vehicles	Automotive	13911.96	0.2153
26	730690	Tube/pipe/hollow profile, iron/steel,riveted/open sea	Shipbuilding	7536.271	0.2143
27	401210	Retreaded tyres	Aerospace	18153.12	0.2137
28	720845	Hot rolled iron or non-alloy steel, flat,width >600mm, t <3mm, nes	Shipbuilding	8726.391	0.2122
29	850434	Transformers electric, power capacity > 500 KVA, nes	Electronics	18751.31	0.2121
30	721331	Hot rolled bar/rod, iron or non-alloy steel, coiled width <14mm, C<.25%	Shipbuilding	8251.904	0.2121

Table 3.6: Egypt top 30 related products

	HS Code	Product Description	GVC	PRODY ($)	Av. proximity
1	840999	Parts for diesel and semi-diesel engines	Shipbuilding	20424.266	0.2379
2	730630	Pipes etc nes, iron/steel welded nes,diameter <406.4m	Shipbuilding	19016.471	0.2363
3	721440	Bar/rod, iron or non-alloy steel, hot formed <0.25%C, nes	Shipbuilding	11922.298	0.2269
4	853080	Electric signal, safety & traffic controls, nes	Electronics	25372.174	0.2263
5	721590	Bar/rod, iron or non-alloy steel, nes	Shipbuilding	7559.0229	0.2256
6	721660	Sections, nes, iron or non-alloy steel, nfw than cold formed/finished	Shipbuilding	11606.913	0.2252
7	700721	Safety glass (laminated) for vehicles, aircraft, etc	Automotive	20472.654	0.2248
8	730490	Iron or steel tubes, pipes or hollow profiles, nes	Shipbuilding	18007.953	0.2211
9	940120	Seats, motor vehicles	Automotive	18219.996	0.2205
10	850422	Liquid dielectric transformers 650-10,000KVA	Electronics	18679.977	0.2202
11	721230	Flat rolled iron or non-alloy steel, <600mm, coated with zinc, nes	Shipbuilding	23211.32	0.2200
12	870892	Mufflers and exhaust pipes for motor vehicles	Automotive	21672.855	0.2198
13	902890	Parts, accessories for gas, liquid, electricity meter	Electronics	16982.256	0.2196
14	850300	Parts for electric motors and generators	Electronics	17189.941	0.2190
15	850432	Transformers electric, power capacity 1-16 KVA, nes	Electronics	17316.465	0.2188
16	721690	Angles/shapes/sections, iron or non-alloy steel, nes	Shipbuilding	15839.757	0.2188
17	870850	Drive axles with differential for motor vehicles	Automotive	24754.543	0.2183
18	870899	Motor vehicle parts nes	Automotive	13080.942	0.2171
19	721070	Flat rolled iron or non-alloy steel, painted/plastic coated,width>600mm	Shipbuilding	13109.096	0.2168
20	850164	AC generators, of an output > 750 kVA	Electronics	19148.873	0.2166
21	850423	Liquid dielectric transformers > 10,000 KVA	Electronics	17309.98	0.2163
22	853630	Electrical circuit protectors nes for < 1,000 volts	Electronics	15054.06	0.2154
23	870839	Brake system parts except linings for motor vehicles	Automotive	19293.17	0.2151
24	721540	Bar/rod, iron or non-alloy steel, cold formed/finished, >0.6%C	Shipbuilding	12287.56	0.2147
25	720845	Hot rolled iron or non-alloy steel, flat,width >600mm, t <3mm, nes	Shipbuilding	8726.391	0.2134
26	854790	Electrical insulating fittings except plastic/ceramic	Electronics	20751.69	0.2129
27	730660	Hollow profiles/tubes,iron/steel,non-circular, welded	Shipbuilding	12431.92	0.2123
28	851290	Parts of cycle & vehicle light, signal, etc equipment	Automotive	16392.58	0.2112
29	853620	Automatic circuit breakers for < 1,000 volts	Electronics	11012.77	0.2104
30	850590	Electro-magnets nes and parts of magnetic devices	Electronics	25407.06	0.2094