# Production integration and disintegration of North African countries into the European Union

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**Abstract**

This paper examines the involvement of North African countries into regional production networks and investigates whether economic integration has contributed to their development. A conceptual framework based on comparative advantage and Vernon's product-life cycle serves as a base for the empirical analysis. Two main hypotheses are tested. We first hypothesize that North African countries have become more integrated into regional production networks with the Euro Mediterranean process. The second hypothesis states that manufacturing companies may transfer some tasks of their production process to countries with lower labour cost generating increasing trade links between intermediate goods. Our results indicate that North African countries have indeed become more integrated into regional production networks and this has a positive impact on trade flows between the two sides of the Mediterranean Sea.

**Keywords:** production networks, North African countries, panel data, Euro Mediterranean agreements

**JEL Classification:** F10, F14

## 1. Introduction

In 1995 the European Union (EU) and fourteen countries of the Mediterranean basin signed the Barcelona Process and committed themselves to liberalise trade and to engage into deeper economic integration. This process involves the entry into force of "new generation" integration agreements between the EU and each South Mediterranean country.

In this paper we focus on the analysis of production networks and on the effects of the Euro-Mediterranean (EuroMed) agreements between the two shores of the Mediterranean Sea on the development of those networks.

Our main aim is to analyse the effect of increasing imports of intermediate goods that may be due to the Barcelona Process and link this increases to changes in exports of final goods. We follow a conceptual framework based on comparative advantage and Vernon's (1966) product-life cycle to test two main hypotheses. First, whether North African countries have become more integrated into regional production networks with the EuroMed process and second whether the EuroMed agreements may have foster the re-allocation of production to countries with lower labour cost. To our knowledge this is the first paper that focuses on the relationship between product integration networks and the ongoing regional integration process between the EU and North African countries.

We estimate a gravity-type model with disaggregated exports as target variable. Changes in exports from North African to Organisation for Economic Co-operation and Development (OECD) countries in both final and intermediate goods are explained with the usual gravity variables plus the corresponding imports of intermediate goods from the rest of the world (RoW) as a proxy for production networks. We distinguish between changes in exports due to the entry into force of the EuroMed Association Agreements *per se*, which foster links and increases economic collaboration between the EU and Middle East and North Africa (MENA) countries, and changes in the rules of origin (RoO), that occur with the entry into force of bilateral free trade agreements (FTA) and allow to take advantage of the Pan-European cumulation arrangements (Gasiorek, Augier and Lai-Tong, 2008; Bensassi, Márquez-Ramos and Martínez-Zarzoso, 2011). According to Cieslik and Hagemejer (2009) the EuroMed Association Agreements *per se* have increased significantly imports of the MENA countries from the EU; but have not contributed to the expansion of MENA exports

to the EU markets, due to the asymmetry in the trade liberalisation process between the EU and the MENA countries.

In order to fully account for the effects of the Barcelona Process on EuroMed trade, changes in the RoO regimes should also be considered, as RoO typically limit the amount of intermediate goods which a country can import from a non-PTA partner country. In fact, Amiti and Konings (2007) showed that decreasing trade protection in intermediate goods could lead to a higher productivity effect than decreasing trade protection in final goods, as lower output protection can increase productivity by increasing import competition, whereas lower input protection can raise productivity by providing an easier access to better quality and/or cheaper intermediate goods into production networks in North African countries, consequently enhancing the demand for these goods in European markets.

Our results indicate that North African countries are more integrated into regional production networks today than in the past and this has a positive impact on trade flows between the two sides of the Mediterranean Sea. This increase in exports has been mainly channelled by changes in RoO. Nevertheless, North African countries are not specialising in intermediate stages of the production process of the EuroMed production network.

The rest of the paper is organised as follows. Section 2 presents literature review. The conceptual framework and the main hypotheses are described in Section 3. Section 4 describes the data and variables. The empirical analysis is presented in Section 5. Finally, Section 6 concludes.

## 2. Literature Review

Classical thinking, which stressed international differences in technology in conjunction with international differences in real wage levels as a source of comparative advantage,

dominated trade theory until the appearance of the Heckscher–Ohlin (H–O) theory which centred on resource endowments as the main factor explaining international trade patterns. With the development of the technology gap (Posner, 1961) and the product cycle theories (Vernon, 1966), technology came once again to the forefront of trade related research. Vernon (1966) places less emphasis on the comparative cost doctrine and more on the timing of innovation. Along these lines, Jones and Bhagwati (1970) considered the way in which the H–O model could be applied to Vernon's product cycle theory. Vernon argued that developed countries tend to have a comparative advantage in producing those commodities that are newly developed, and suggested a three-factor model: capital, "ordinary" labour, and human skills. Developed countries have a relative abundance of the third factor and, due to the role this factor is assumed to play in the production of new combinations, developed countries will tend to have a comparative advantage in producing new commodities at early stages of production.

More recently, Jones and Kierzkowski (2005) suggest that the theory of international trade should put more emphasis on trade in intermediate goods. These authors focus on fragmentation of production processes, and on vertically integrated production, which can be separated into different fragments, may be located in the same country or in a different one. A particular final commodity could be produced in a vertically integrated process, with all the activity taking place locally. Nonetheless, total costs of producing output might be lowered by outsourcing some fragments of the integrated activity. Since, according to Vernon (1966), less developed countries take over labour intensive production, Jones and Kierzkowski (2005) state that “In Vernon’s hands [reinterpretation for production] explains a sequence whereby there is a continual outsourcing of production towards less developed

areas as techniques simplify, accompanied by ever-emerging new products and technologies being developed in advanced areas".[1] Also in line with H-O predictions, empirical evidence shows that low wage countries in Asia have a higher revealed comparative advantage in assembly operations, which can be assumed to be labour-intensive, while high wage countries in Asia have a higher revealed comparative advantage for the production of more sophisticated components (Ng and Yeats, 1999). Some works have also analysed the magnitude of international production networks in other geographical areas, confirming that the most labour-intensive stages are relocated in developing countries to take advantage of their lower labour costs (Yeats, 2001; Barba-Navaretti, Haaland and Venables, 2002; Zeddies, 2007).

International geographical dispersion of production fragments introduces the need of increasing empirical evidence on the role that regional trade integration plays, which decreases trade barriers between integrated areas, in fostering this process. Recent studies such as Blázquez, Diaz-Mora and Gandoy (2009) and Martínez-Zarzoso, Voicu, and Vidovic (2010) analyse whether EU integration has been a fundamental driving force behind the observed increase of intermediate goods trade, fostering integrating countries' participation in European production networks (Spain in Bláquez, Diaz-Mora and Gandoy, 2010; and Central-East European countries in Martínez-Zarzoso et al, 2010).

Holgado-Molina and Milgram-Baleix (2001) focus on the nature of trade flows between Maghreb countries and their main European trading partners and highlight an increasing trend of intra-industry trade between the European Union and Maghreb in manufactured

[1] Jones and Kierzkowski (2005), page 7.

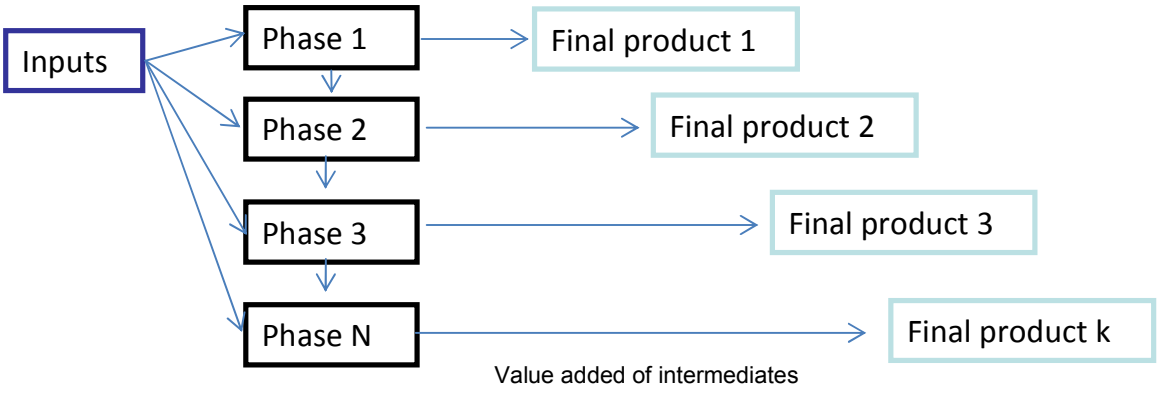
goods. To the best of our knowledge, there are no existent studies focusing on the dynamics of product integration networks in the EuroMed area.

The more recent existing literature investigating the effects of the Barcelona process on aggregate trade finds that imports of the MENA countries from the EU have significantly increased after the entry into force of the EuroMed Association Agreements (Cieslik and Hagemejer, 2009); but the agreements have not contributed to the expansion of MENA exports to the EU markets. However, using disaggregated trade flows Bensassi et al (2011) find a positive effect of the bilateral trade liberalisation process on the extensive and the intensive margin of exports of the MENA countries to the main EU markets. Their results also show that the effect of an increase in imported inputs from the EU has a positive effect on MENA's exports of manufactured products, and consequently the new RoO have allowed the integration of better quality/less expensive intermediate goods into production networks in North African countries, enhancing also the demand for these goods in European markets. In this study, imports of Machinery and Equipment (Sector 84 of the harmonized system) are used as a proxy for imported intermediates from the main countries of the European Union (France, Germany, Italy, Spain and the United Kingdom) and from the main producers of the rest of the world (RoW) (Japan, South Korea, Honk Kong, the USA), not fully accounting for the effect of EuroMed regional integration on both exports and imports of final and intermediate goods, and hence on EuroMed fragmentation of production processes. To advance in this line of research we are going to use in this paper a more accurate proxy for trade in intermediate goods, namely we will use the BEC trade classifications to distinguish between intermediate and final goods.

## 3. Conceptual framework and main hypotheses

We base our conceptual framework on Jones and Kierzkowski (2005) and on his adaptation of Vernon's product cycle theory to trade in intermediate goods and to the fragmentation of production processes. Figure 1 summarises a vertically integrated production network where different inputs can be used in different phases of the productive process and, additionally, intermediate goods obtained in the different phases can be used in the production of both final and intermediate goods for consumers in national or foreign markets. It is worth noting that the longer the vertical production network, the higher the number of phases or fragments (N) in the production process of a final product (k) and hence, we assume that the value added of intermediate goods to the final product k increases.

***Figure 1. A vertically integrated production network***

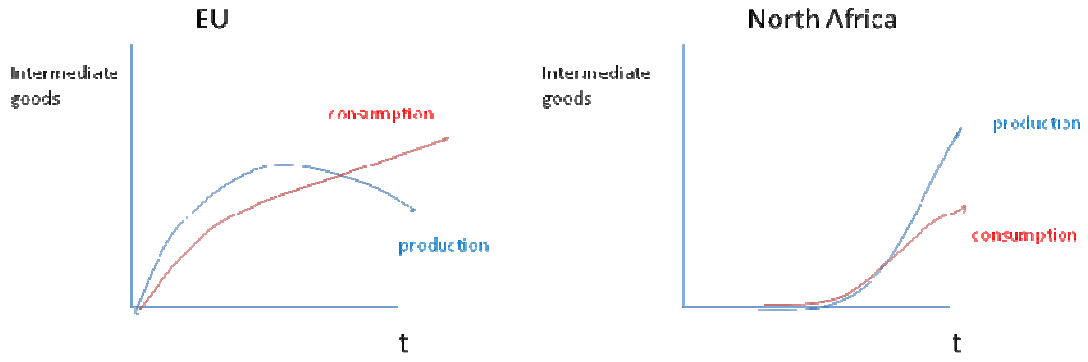



Vernon (1966) considers different stages in the life of a product. In early stages of the introduction of a new product, price elasticity of demand is comparatively low due to the high degree of product differentiation or to the existence of imperfect competition, and hence the cost of inputs is not as relevant as it is in more advanced stages of the life cycle. If labour cost differences are large enough to offset trade costs, then international fragmentation of production processes could become profitable. Consequently, developed countries might export goods in process to developing countries; developing countries

might process these goods, and export intermediate goods to developed countries, which assembly and sell the final good.

When demand for a particular product increases, and a certain degree of standardisation takes place (Vernon, 1966), increases in the consumption of the final product could deal to an increase in the consumption of the intermediate inputs associated to the final good. Additionally, at an advanced stage in the standardisation of the final product, other countries might offer competitive advantages as production locations and hence the production of the intermediate good could partly move from developed countries to developing countries. Regional integration agreements, and in particular the EuroMed agreements might have fostered the integration of production networks between EU and North African countries. At initial stages, EU countries are net exporters of some intermediate goods required for the production of a final good, whereas in advanced stages EU countries could become net importers. Correspondingly, North African countries are net importers of a particular intermediate good required for the production of a final good (which they can use in the production of other goods), whereas in advanced stages North African countries could become net exporters.

***Figure 2. Product-life cycle of an intermediate good***



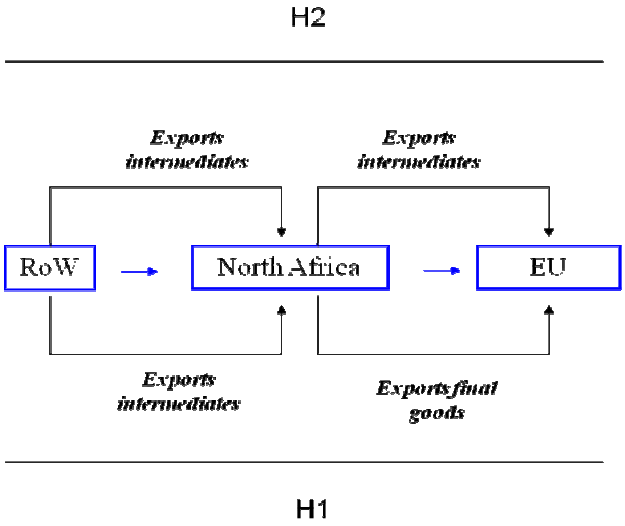
We aim to test two main hypotheses that relate to the abovementioned theories. First, we test whether North African countries have become more integrated into regional production networks following the EuroMed process. In particular, the higher the imports of intermediate goods in North African countries, the higher the exports of final goods from North African countries to the European Union (H1) will be.

The second hypothesis to be tested is that the effect of the EuroMed agreements may have fostered the relocation of some intermediate stages of production to countries with lower labour cost. On the one hand, a displacement effect might occur and higher North African imports of intermediate goods will lead to lower exports of intermediate goods to the EU. On the other hand, a "complementary" effect might also emerge and higher imports of intermediate goods in North African countries will foster exports of intermediate goods from North African countries to the EU hence revealing an even stronger and complex integration relationship through various stages of production (H2).

The two effects stated in H1 and H2 are summarised in Figure 3. Under H1, an increase in imports of intermediate goods from the rest of the world[2] to a particular North African country would lead to an upturn in exports of final goods to the EU. Under H2, a direct relationship, an increase in imports of intermediate goods in North African countries would lead to higher exports of intermediate goods bound for EU trading partners.

[2] Note that RoW denotes countries other than the exporting or importing country.

*Figure 3. H1 and H2 production integration networks*




With the Barcelona Process, EuroMed countries agreed to open MENA markets to EU products. Firstly, signatory countries had to relax all tariffs paid on industrial products imported from the EU over a twelve-year period. Secondly, rules of origin applying to signatory countries had to be modified. In this paper, we distinguish between both the EuroMed Association Agreements *per se* (FTA) and the additional changes in the rules of origin (RoO)[3]. We consider tight rules of origin as a hidden fixed cost to trade, as they can limit the use of intermediate goods from countries outside bilateral agreements and hence put a fixed and, sometimes, overwhelming price premium on these goods. Therefore, a third hypothesis (H3) to be tested is that the effect of the change in RoO on North African trade is positive and of higher magnitude than the effect of the FTA, as decreasing trade protection in intermediate goods could lead to a higher productivity effect than decreasing trade protection in final goods (Amiti and Konings, 2007).

[3] Table A.1 shows the years in which each BP entered into force (column 1) and the new rules of origin have to be applied (column 2).

## 4. Data and variables

### 4.1. Main data sources

The main data source is UN Comtrade. We use data for the trade in goods between four North African countries (Algeria, Egypt, Morocco and Tunisia) and OECD countries.[4] The products are classified according to the Broad Economic Categories (BEC) codes at the BEC 2-digit level.[5] Income data are taken from the World Development Indicators Database 2008 and distances are from CEPII.

A number of authors have introduced comparative advantage measures in trade regressions to link trade and the international fragmentation of production to the exploitation of comparative advantages (Kimura, Takahashi and Hayakawa, 2007; Athukorala, and Yamashita, 2006; Blázquez et al, 2009), however, these authors define comparative advantages in terms of per capita income differences to proxy for factor endowment differences. For the Spanish case, Blázquez et al (2009) used a gravity model and interpreted a negative sign in the coefficient of the absolute difference in per capita income between two trading partners, which is used as a proxy of differences between countries in terms of technology, human capital and quality of the institutional framework, as an obstacle to participate in international production networks. Additionally, they introduce in their trade regressions relative differences in income per capita to isolate the impact of the basic requirements for establishing networks (measured by the absolute differences in per capita income). A higher per capita income in country *i* compared to country *j*, is interpreted as an increasing comparative advantage in a particular good k, hence the relative

[4] Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Japan, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom and the United States.

[5] See Table A.2 in Appendix.

per capita income variable is expected to have a positive effect on exports of a given good. In the present paper, we specify in the model a RCA index, which provides a more accurate proxy for product composition differences, in comparison with GDP per capita differences. The next section introduces the RCA index and explains how is calculated.

**4.2. Comparative advantage in production of intermediate goods**

Traditionally, revealed comparative advantage (RCA) indices have been computed using export statistics. RCA can be calculated according to Balassa's (1965) measure of relative export performance by country and industry to determine in which goods countries are specialised. The RCA index can be defined as country's share of world exports of a good divided by its share of total world exports, as expressed in equation (1):

$$RCA_{ikt} = \frac{X_{ikt} / X_{wkt}}{X_{iNt} / X_{wNt}} \cdot 100 \qquad (1)$$

where $RCA_{ikt}$ is the revealed comparative advantage index of commodity $k$ for country $i$ in year $t$, $X_{ikt}$ is the value of exports of commodity $k$ by country $i$ in year $t$,, $X_{wkt}$ is the value of world exports of commodity $k$ in year $t$, $X_{iNt}$ is the value of exports of all commodities by country i in year $t$, and $X_{wNt}$ is the value of world exports of all commodities in year $t$. According to equation (1), country $i$ has a comparative advantage in exporting commodity $k$ when $RCA_{ikt}$ is greater than 100 (Márquez-Ramos, 2007). Suárez, Fernández and García (1996) noted that this index indicates an "exporting advantage" more than a comparative advantage since imports are not taken into account. In this line, Ng and Yeats (1999) pointed out that when RCA indices are computed using import statistics for a given intermediate good, the results should indicate whether a country has a comparative advantage in assembly operations. Most intermediate goods have no general end use in themselves, but are exchanged for further assembly into a product that does. Therefore,

countries with average import shares for intermediate goods have a comparative advantage in the assembly operation. If we also consider the dynamics of the production network in a particular country, the modified RCA index can be written as follows:

$$RCA_{ipt} = \frac{M_{ipt} / M_{wpt}}{M_{iPt} / M_{wPt}} \cdot 100 \qquad (2)$$

where $M_{ipt}$ is the value of imports of intermediate good $p$ by country i in year $t$, $M_{wpt}$ is the value of world imports of intermediate good $p$ in year $t$, $M_{iPt}$ is the value of imports of all goods $P$ by country $i$ in year t and $M_{wPt}$ is the value of world imports of all goods $P$ in year $t$.

In this study we use data on exports and imports from four North African countries (Algeria, Egypt, Morocco and Tunisia) in relation to the world exports (equation 1) and imports (equation 2) from the years 1995 to 2008.

The interpretation of the modified index is twofold. On the one hand, if relative imports of country $i$ (Algeria, Egypt, Morocco, Tunisia) in year $t$ of the intermediate good $p$ is higher than relative imports of country $i$ of all goods, then country $i$ has a comparative advantage in assembly operation and goods in process [3a]. On the other hand, if relative imports of country $i$ in year t of the intermediate good $p$ (compared to imports of all sectors) is higher than relative world imports of the intermediate good $p$ (compared to imports of all sectors), then country $i$ presents a comparative advantage in assembly operation and goods in process [3b].

$$M_{ipt} / M_{wpt} > M_{iPt} / M_{wPt} \qquad (3a)$$

$$M_{ipt} / M_{iPt} > M_{wpt} / M_{wPt} \qquad (3b)$$

Table A.3 in Appendix shows the evolution of comparative advantages in intermediate goods in the four North African countries considered in the analysis, from the year 1995 onwards, whereas Table A.4 in Appendix shows the dynamics of final goods over the period 1995 onwards. These two tables show that North African countries have revealed comparative advantage in food and beverages and have also become increasingly specialised in some intermediate goods, gaining comparative advantages in importing primary food and beverages (sector 11) and primary industrial supplies (sector 21). In the case of final goods, Egypt and Morocco have comparative advantage in exporting processed food and beverages (sector 22) and in semi-durable and non-durable consumer goods (sectors 62 and 63), Egypt seems to be gaining comparative advantages in sectors 22 and 32 and 62, Morocco in sector 22 and Tunisia mainly in processed food (sector 12). It is worth noting that in the empirical analysis sectors 22 and 32 are considered to be intermediate goods, as both processed industrial supplies and processed fuels and lubricants can be used to produce other goods (see Appendix in Baldwin and Taglioni, 2011). Increasing specialisation of North African countries in assembly operations might be beneficial if they are getting involved in more complex vertical production networks (see Figure 1), indicating the importance of analysing empirically the effect of regional integration on production networks for these countries.

## 5. Empirical Analysis

### 5.1. Model Specification

A gravity model is specified and estimated using sectoral trade data. A "theoretically justified" specification augmented with imports of intermediate goods and with RCA variables is considered. These two variables are added to account for the increasing importance of outsourcing in the production and exports of final goods and to deal with

Baldwin and Taglioni (2011) critique that the gravity model performs poorly when there is significant trade in intermediate goods. Exporter-and-time, importer-and-time dummy variables are added to proxy for the so-called multilateral resistance terms and sector-specific fixed effects are included to model unobservable characteristics at the sectoral level that are common to all trade flows. Similar to Anderson and van Wincoop (2003), the LHS variable in the gravity model is bilateral exports divided by the product of the GDPs of the exporter and the importer. Two gravity models are specified, the first for final goods -equation (4)- and the second intermediate goods -equation (5)-. The log-linearized versions are given by:

$$\ln\left(\frac{X\_final_{ijkt}}{Y_{it}\cdot Y_{jt}}\right)=\alpha_0+\alpha_1\ln M\_\text{int}_{ik,t-1}+\alpha_2\cdot FTA_{ijt}+\cdot\alpha_3 RoO_{ijt}+\alpha_4\cdot\ln RCA_{ikt}+\alpha_5\cdot\ln Dist_{ij}+ \quad (4)$$
$$+\alpha_6 Contig_{ij}+\alpha_7\cdot Lang_{ij}+\alpha_8\cdot Colony_{ij}+\gamma_{it}+\phi_{jt}+s_k+\varepsilon_{ijkt}$$

$$\ln\left(\frac{X\_\text{int}_{ijkt}}{Y_{it}\cdot Y_{jt}}\right)=\beta_0+\beta_1\cdot\ln M\_\text{int}_{ik,t-1}+\beta_2\cdot FTA_{ijt}+\beta_3\ln RoO_{ijt}+\beta_4\ln RCA_{ipt}+\beta_5\ln Dist_{ij}+$$
$$\beta_6\cdot Contig_{ij}+\beta_7\cdot Lang_{ij}+\beta_8\cdot Colony_{ij}+\eta_{it}+\varphi_{jt}+z_k+\delta_{ijkt} \quad (5)$$

where *ln* denotes natural logarithms. $X\_final_{ijkt}$ ($X\_int_{ijkt}$) denotes the value of exports of final (intermediate) good *k* from country *i* (Algeria, Egypt, Morocco and Tunisia) to *j* (OECD countries) in the year t; $Y_{it}$ ($Y_{jt}$) are GDPs in the exporter (importer)'s market; $Contig_{ij}$, $Lang_{ij}$ and $Colony_{ij}$ are dummies for countries sharing a common border, an official language and colonial ties, respectively, whereas $Dist_{ij}$ is the geographical great circle distance between countries *i* and *j*. $RCA_{ikt}$ ($\text{RCA}_{ipt}$) denotes revealed comparative advantage in good k (in intermediate good *p*) in the exporter country given by equations (1) and (2) for final and intermediate goods, respectively. $FTA_{ijt}$ denotes a Barcelona Process

dummy that takes the value of one when a bilateral interim agreement enters into force between countries *i* and *j* in year *t*, zero otherwise; whereas $RoO_{ijt}$ is a dummy that takes the value of one when the Protocol allowing for more flexible rules of origin for North African countries with EU countries entered into force[6]. $M\_int_{ik,t-1}$ denotes the value of imports of intermediate goods from the RoW in year (*t-1*) required to produce a final or an intermediate good *k* in country *i*. The fist lag instead of the level of this variable is added because imported intermediates can only be used in the production of goods after they have been imported. This will also help to prevent misspecification of the model due to endogeneity bias caused by this variable. Finally, $\varepsilon_{ijkt}$ and $\delta_{ijkt}$ are the error terms that are assumed to be independently and identically distributed. In the next sub-section we present and discuss the estimation results of equations (4) and (5) that are used to tests the stated hypotheses.

**5.2. Main results**

Equations (4) and (5) are estimated using bilateral exports from four North African countries (Algeria, Egypt, Morocco and Tunisia) to OECD countries over the period 1995 to 2008. A correspondence table between final and intermediate industries is used to link intermediate goods with final goods production (Table A.1.2, Appendix).

Equations (4) and (5) are estimated using panel data techniques. In particular, the presence of unobserved heterogeneity that is specific to each trading pair is modelled alternatively as being random or fixed. A Hausman test indicates that a random effects model provides more efficient and also consistent estimates for exports of equation (4) is estimated (final goods), whereas only fixed effects estimates are consistent when equation (5) is estimated

[6] See Table A.1 in the Appendix.

(intermediate goods). Hence only the results obtained using the preferred method are reported. In addition to model bilateral unobserved country-pair heterogeneity, we also model multilateral resistance and sectoral unobservable heterogeneity as explained in the previous section (coefficients of the country-and-time and the sectoral dummies are not shown in Tables 1 and 2 in order to save space).

Table 1 and Table 2 show the main estimation results that include the lagged value of our target variable, namely imported intermediates ($M\_int_{ik,t-1}$) and the constructed RCA index. By using lagged values of imports we aim to take into account that this variable may be endogenous. In particular, higher exports in a given sector may also induce higher demand for imports in related products of the same sector. For comparison Table A.5 and A.6 show the estimation results when including the variable in levels ($M\_int_{ikt}$).

**Table 1. The effect of imports of intermediate goods on exports of final goods**

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Imports of intermediate goods from RoW (t-1) | 0.669*** | 0.661*** | 0.659*** | 0.551** | 0.690*** | 0.683*** |
| | 3.363 | 3.314 | 3.323 | 2.469 | 3.378 | 3.391 |
| FTA Agreement | 0.478 | 1.982 | -3.758 | 0.544 | 0.498 | 0.497 |
| | 1.383 | 0.531 | -0.878 | 1.58 | 1.216 | 1.443 |
| Pan_EuroMed_RoO | 1.882*** | 1.845*** | 15.143*** | 1.968*** | 1.882*** | 1.325** |
| | 3.362 | 3.314 | 3.158 | 3.483 | 3.352 | 2.123 |
| RCA | 0.332*** | 0.329*** | 0.307*** | 0.338*** | 0.337*** | 0.335*** |
| | 4.037 | 3.959 | 3.691 | 4.125 | 4.088 | 4.09 |
| Distance | -1.686*** | -1.683*** | -1.698*** | -1.739*** | -1.681*** | -1.710*** |
| | -5.042 | -4.941 | -4.917 | -5.468 | -5.04 | -5.13 |
| Contiguity | -5.476*** | -5.485*** | -5.460*** | -5.561*** | -5.474*** | -5.528*** |
| | -2.708 | -2.703 | -2.692 | -2.783 | -2.706 | -2.744 |
| Language | 0.95 | 0.952 | 0.981 | 1.122* | 0.965 | 1.01 |
| | 1.348 | 1.329 | 1.353 | 1.666 | 1.374 | 1.439 |
| Colony | -0.361 | -0.366 | -0.335 | -0.456 | -0.378 | -0.369 |
| | -0.629 | -0.626 | -0.566 | -0.833 | -0.66 | -0.645 |
| Imports of intermediate goods from RoW* FTA | | -0.073 | 0.202 | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | -0.412 | 0.987 | | | |
| Imports of intermediate goods from RoW* RoO | | | -0.629*** | | | |
| | | | -2.798 | | | |
| Imports of intermediate goods from RoW*BEC4 | | | | 0.559 | | |
| | | | | 1.591 | | |
| Imports of intermediate goods from RoW*BEC5 | | | | 1.082*** | | |
| | | | | 2.708 | | |
| (FTA)*BEC4 | | | | | -0.068 | |
| | | | | | -0.227 | |
| (FTA)*BEC5 | | | | | 0.19 | |
| | | | | | 0.443 | |
| (RoO)*BEC4 | | | | | | 0.448 |
| | | | | | | 1.313 |
| (RoO)*BEC5 | | | | | | 1.333*** |
| | | | | | | 2.931 |
| Constant term | -38.346*** | -38.141*** | -37.981*** | -53.509*** | -38.867*** | -38.440*** |
| | -7.208 | -7.122 | -7.093 | -4.101 | -7.136 | -7.161 |
| Number of observations | 1304 | 1304 | 1304 | 1304 | 1304 | 1304 |
| R2_within | 0.4401221 | 0.444176 | 0.4488139 | 0.4365276 | 0.4401662 | 0.4445514 |
| R2_overall | 0.7528151 | 0.7516317 | 0.7530738 | 0.7608284 | 0.7533986 | 0.7558129 |
| RMSE | 1.402993 | 1.389282 | 1.370862 | 1.430372 | 1.408122 | 1.397704 |

Notes: ***, **, * indicate significance at 1%, 5% and 10%, respectively. T-statistics are provided below every coefficient. Random effects model.

First, Columns (1) to (3) in Table 1 show the main results for exports of final goods from North African countries to OECD countries. The estimated coefficient of lagged imports of intermediate goods from the RoW is positively signed and statistically significant, indicating that increases in imported intermediate goods have a positive effect on exports of final goods to OECD destinations. This could be interpreted as evidence of the increasing involvement of North African countries into global production networks. The RCA variable is also statistically significant and presents the expected positive sign indicating that exports are higher in sectors with increasing comparative advantage as it is expected from the Ricardian trade theory. The trade policy variables, FTA and RoO, both are positively

signed, but only the second is statistically significant at conventional levels, indicating that the more flexible rules of origin with EU countries are fostering exports of final goods from North African to EU countries.

Column (4) shows results of adding interactions between the different product categories and imports of intermediate goods. The variable $\ln M\_\text{int}_{ik,t-1}$ interacts with sectors 4 and 5, respectively (sector 6 is the default). The estimated coefficients for the interaction terms show empirical evidence of the existence of a stronger relationship between imports of intermediate goods and exports of final goods for transport equipment (BEC5) in comparison with the default category (BEC6). Columns (5) and (6) in Table 1 test hypothesis H1, whereas no evidence is found for the significance of production networks for the EuroMed FTA agreements, more flexible rules of origin have a stronger and significant effect on exports of final goods to the European Union in BEC5 (in comparison with BEC6).

With regard to exports of intermediate goods (equation (5)), Column (1) in Table 2 shows that the RCA variable is the only relevant factor in explaining exports of intermediate goods, it is significant and present the expected positive sign. With respect to our target variable, imports of intermediate goods, it is not statistically significant when all sectors are considered for exports from North Africa to OECD destinations. A positive and significant effect is only found for exports of intermediate capital goods (BEC4). Columns (5) and (6) in Table 2 indicate evidence showing the existence of an EuroMed production network for exports of intermediate capital goods (BEC4) emerging only after changes in the rules of origin took place (Column (6)), but not with the Barcelona Process *per se* (FTA).

**Table 2. The effect of imports of intermediate goods on exports of intermediate goods**

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Imports of intermediate goods from RoW (t-1) | 0.071 | 0.093 | 0.09 | 0.001 | 0.12 | -0.021 |
| | 0.349 | 0.615 | 0.6 | 0.009 | 0.733 | -0.133 |
| FTA Agreement | 0.263 | -5.812 | -4.72 | 0.363 | 0.706 | 0.251 |
| | 0.743 | -1.278 | -1.076 | 0.94 | 1.265 | 0.641 |
| Pan_EuroMed_RoO | 0.399 | 0.401 | -2.298 | 0.408 | 0.401 | 0.32 |
| | 0.763 | 0.756 | -0.587 | 0.769 | 0.756 | 0.574 |
| RCA | 0.385*** | 0.390** | 0.389** | -0.620* | 0.417** | 0.313* |
| | 2.831 | 2.219 | 2.208 | -1.938 | 2.345 | 1.764 |
| Imports of intermediate goods from RoW* FTA | | 0.292 | 0.239 | | | |
| | | 1.337 | 1.132 | | | |
| Imports of intermediate goods from RoW* RoO | | | 0.127 | | | |
| | | | 0.695 | | | |
| Imports of intermediate goods from RoW*BEC4 | | | | 0.483*** | | |
| | | | | 2.918 | | |
| Imports of intermediate goods from RoW*BEC5 | | | | 0.005 | | |
| | | | | 0.04 | | |
| (FTA)*BEC4 | | | | | -0.476 | |
| | | | | | -1.074 | |
| (FTA)*BEC5 | | | | | -0.606 | |
| | | | | | -1.192 | |
| (RoO)*BEC4 | | | | | | 0.579* |
| | | | | | | 1.707 |
| (RoO)*BEC5 | | | | | | -0.429 |
| | | | | | | -1.02 |
| Constant term | -41.734*** | -42.462*** | -42.086*** | -39.123*** | -43.257*** | -39.170*** |
| | -9.93 | -13.068 | -13.011 | -12.715 | -11.854 | -11.567 |
| Number of observations | 1783 | 1783 | 1783 | 1783 | 1783 | 1783 |
| R2_within | 0.368186 | 0.370216 | 0.370606 | 0.377968 | 0.369952 | 0.377031 |
| RMSE | 1.399776 | 1.199507 | 1.199561 | 1.192525 | 1.200185 | 1.193423 |

Notes: ***, **, * indicate significance at 1%, 5% and 10%, respectively. T-statistics are provided below every coefficient. Within fixed effects estimation.

With regard to H3, results show that the effect of the changes in the RoO on exports from North African countries is positive signed and more relevant than the effect of the EuroMed Association Agreements *per se* (FTA) for exports of final goods (Columns (2) and (3) in

Table 1), but not relevant for exports of intermediate goods (Columns (2) and (3) in Table 2).

Columns (4) and (6) in Tables 1 and 2 show that those North African countries that have increased imports of intermediates in BEC4, export more intermediate goods in BEC4 to the European Union after the change in the RoO, whereas those that have increased imports of intermediates in BEC5 export more final goods in BEC5. Finally, North African countries do not seem to be specialising within EuroMed in stages of the production process closer to the consumption end of the vertical production networks as they do not export more intermediates of BEC4 or BEC5 to the EU when their imports of intermediates in these sectors increase.[7]

**6. Conclusions and policy implications**

Previous research on the ex-post effects of the new FTAs in North African countries on exports to Europe shows mixed results. Studies using aggregate trade flows find that the EuroMed Association Agreements have not contributed to the expansion of North African exports to the EU markets (Cieslik and Hagemejer, 2009), whereas studies using disaggregated trade data find that more flexible rules of origin foster EuroMed trade by simplifying red tape for firms in cases of full and diagonal cumulation (Bensassi et al, 2011). The present paper advances in this analysis by adding imports of intermediate goods as an additional explanatory factor of exports of final and intermediate goods. In this context, the effect of the Barcelona Process on both exports of final and intermediate goods from North African countries to the European Union is re-examined and whether North African countries have become more integrated into EuroMed regional production

[7] Equation (5) was estimated adding two interaction terms: (imports of intermediate goods from RoW* Barcelona Process (RoO)*BEC4) and (imports of intermediate goods from RoW* Barcelona Process (RoO)*BEC5). These results are available upon request from the authors.

networks is tested. This analysis also tests whether the effect of EuroMed agreements may lead to a relocation of production. In particular, higher imports of intermediate goods might lead lower exports of intermediate goods to European Union countries. Our results indicate that North African countries show greater profits due to being closer to the consumption end of EuroMed production networks, partly as a consequence of the changes in rules of origin and especially for transport equipment (BEC5). Evidence is also found concerning the existence of a "complementary" effect in capital goods (BEC4), as higher imports of intermediate goods lead to higher exports of intermediate goods from North African countries to the European Union than to the OECD members. Furthermore, the effects of the EuroMed Association Agreements *per se* (FTA) and the effects of additional changes in the RoO are tested separately. Obtained results show that the effect of RoO on exports from North African countries is positive and of higher magnitude than the effect of the FTA, which is not statistically significant. However, an increase in North African imports of intermediate goods does not seem to increase exports of intermediate goods to the European Union. This result suggests that North African countries are not specialised in intermediate stages of the production process; instead they are specialised in assembly of final goods. This is in line with previous results obtained in Blázquez, Díaz-Mora and Gandoy (2010) who stated that "sunk costs" might exist in the involvement of production sharing networks and then when countries with cost advantages are incorporated into a trade integration area, the production network will expand to these regions rather than replacing the traditional locations.

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## APPENDIX

Table A.1. Entry into force dates

| Bilateral Interim Agreements | Rules of origin/cumulation |
|---|---|
| **Algeria** (01.09.2005)<br>Euro-Mediterranean Association Agreement, OJ L 265, 10.10.2005 | Protocol No 6<br>OJ L 297 of 15.11.2007<br>*Bilateral, diagonal and full cumulation* |
| **Tunisia** (01.03.1998)<br>Euro-Mediterranean Association Agreement , OJ L 97, 30.03.1998, p.2. | Protocol No 4<br>OJ L 260 of 21.9.2006<br>*Bilateral, diagonal and full cumulation* |
| **Morocco** (01.03.2000)<br>Euro-Mediterranean Association Agreement, OJ L 70, 18.03.2000, p.2 | Protocol No 4<br>OJ L 336 of 21.12.2005<br>*Bilateral, diagonal and full cumulation* |
| **Egypt** (01.06.2004)<br>Mediterranean Association Agreement, OJ L304 of 30.09.2004, p.39 | Protocol No 4<br>OJ L 73 of 13.3.2006<br>*Bilateral and diagonal cumulation* |

Source: http://ec.europa.eu/taxation_customs/customs/customs_duties/rules_origin/preferential/article_779_en.htm#paneuro.

Table A.2.1 Classification by Broad Economic Categories.

**1 - Food and beverages**
- 11 - Primary
- 12 - Processed

**2 - Industrial supplies not elsewhere specified**
- 21 - Primary
- 22 - Processed

**3 - Fuels and lubricants**
- 31 - Primary
- 32 - Processed

**4 - Capital goods (except transport equipment), and parts and accessories thereof**
- 41 - Capital goods (except transport equipment)
- 42 - Parts and accessories

**5 - Transport equipment and parts and accessories thereof**
- 51 - Passenger motor cars
- 52 - Other
- 53 - Parts and accessories

**6 - Consumer goods not elsewhere specified**
- 61 - Durable
- 62 - Semi-durable
- 63 - Non-durable

**7 - Goods not elsewhere specified Revealed Comparative Advantage dynamics in intermediate goods.**

Source: United Nations Statistics Division, http://unstats.un.org/unsd/cr/registry/default.asp

A.2.2. Use of intermediate goods in the production of final goods

| Final | Intermediate |
|---|---|
| 51, 52 | 53 |
| 61, 62, 63 | 21, 22 |
| 41 | 42 |

Table A.3. Revealed Comparative Advantage dynamics in intermediate goods.

| BEC | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Algeria | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | % increase |
| 11 | 353.62 | 160.29 | 248.74 | 326.36 | 343.96 | 468.58 | 345.51 | 372.59 | 307.76 | 287.38 | 283.35 | 297.33 | 317.03 | 417.52 | 18.07 |
| 21 | 72.89 | 129.50 | 232.25 | 101.05 | 121.22 | 111.60 | 112.76 | 117.13 | 88.56 | 83.79 | 72.30 | 82.62 | 74.20 | 63.94 | -12.28 |
| 31 | 6.45 | 0.00 | 0.35 | 9.61 | 6.12 | 3.65 | 4.52 | 5.79 | 4.24 | 3.65 | 4.61 | 4.45 | 3.25 | 3.73 | -42.12 |
| 42 | 85.85 | 26.65 | 12.08 | 82.95 | 72.40 | 66.10 | 82.24 | 71.70 | 77.00 | 79.49 | 79.17 | 74.78 | 75.18 | 70.01 | -18.45 |
| 53 | 102.81 | 336.72 | 90.41 | 95.09 | 97.97 | 95.83 | 89.18 | 90.34 | 90.81 | 92.88 | 70.71 | 77.19 | 80.81 | 80.83 | -21.38 |
| Egypt | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | % increase |
| 11 | 297.11 | 32.62 | 151.81 | 229.42 | 238.32 | 295.83 | 284.17 | 303.51 | 272.22 | 321.73 | 265.50 | 296.77 | 365.42 | 340.54 | 14.62 |
| 21 | 158.62 | 108.96 | 119.45 | 160.79 | 180.96 | 227.98 | 255.98 | 265.60 | 257.73 | 257.50 | 223.44 | 207.82 | 184.13 | 218.64 | 37.84 |
| 31 | 19.17 | 0.00 | 0.05 | 13.34 | 6.87 | 5.69 | 11.84 | 37.61 | 56.71 | 26.14 | 47.39 | 42.52 | 10.00 | 12.82 | -33.13 |
| 42 | 77.59 | 23.33 | 34.5 | 85.02 | 84.99 | 75.15 | 80.47 | 80.43 | 72.91 | 73.71 | 68.12 | 72.99 | 75.39 | 81.13 | 4.56 |
| 53 | 83.28 | 97.31 | 220.7 | 77.47 | 83.62 | 96.06 | 79.13 | 82.36 | 110.7 | 101.4 | 92.55 | 85.7 | 86.39 | 99.24 | 19.16 |
| Morocco | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | % increase |
| 11 | 264.88 | 173.85 | 139.94 | 231.43 | 248.00 | 353.79 | 313.29 | 279.65 | 205.45 | 226.92 | 237.55 | 193.35 | 299.22 | 291.59 | 10.08 |
| 21 | 134.56 | 191.09 | 145.99 | 131.01 | 127.21 | 138.29 | 122.47 | 120.72 | 119.73 | 114.39 | 106.60 | 94.08 | 97.06 | 178.05 | 32.32 |
| 31 | 20.64 | 88.62 | 209.3 | 35.22 | 6.805 | 9.812 | 33.09 | 26.3 | 66.51 | 33.53 | 91.46 | 73.39 | 28.05 | 9.511 | -53.93 |
| 42 | 71.13 | 15.43 | 4.368 | 81.09 | 85.69 | 74.98 | 77.28 | 72.79 | 77.07 | 84.12 | 75.01 | 77.34 | 74.68 | 80.92 | 13.76 |
| 53 | 52.55 | 64.22 | 52.51 | 63.6 | 56.19 | 56.25 | 57.78 | 57.61 | 58.95 | 58.56 | 57.31 | 63.44 | 66.96 | 80.85 | 53.86 |
| Tunisia | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | % increase |
| 11 | 166.86 | 417.76 | 68.74 | 102.01 | 89.24 | 155.56 | 138.25 | 184.26 | 117.07 | 111.10 | 124.49 | 157.21 | 271.94 | 232.85 | 39.55 |
| 21 | 99 | 187.6 | 148.7 | 109.7 | 109 | 132.1 | 119.1 | 132 | 128.8 | 112.9 | 95.78 | 82.88 | 80.64 | 167.5 | 69.19 |
| 31 | 37.81 | 0 | 0 | 6.52 | 13.65 | 8.53 | 10.64 | 9.55 | 8.53 | 15.92 | 6.14 | 7.31 | 1.89 | 30.59 | -19.10 |
| 42 | 67.33 | 20.21 | 9.264 | 71.24 | 62.49 | 63.55 | 68.82 | 72.32 | 85.31 | 85.92 | 89.47 | 104.2 | 104.2 | 100.8 | 49.74 |
| 53 | 61.63 | 63.85 | 192.5 | 59.61 | 57.12 | 74.46 | 79.12 | 70.49 | 80.86 | 77.73 | 75.74 | 75.66 | 69.3 | 64.99 | 5.45 |

Notes: Values higher than 100 indicate that country i presents a comparative advantage in intermediate sector p in year t. A positive value in the last column indicates an improvement in comparative advantage in intermediate sector p over the period 1995-2008. Source: Own elaboration with UN Comtrade data.

Table A.4. Revealed Comparative Advantage dynamics in final goods.

| Algeria | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BEC | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | % increase |
| 12 | 3.91 | 26.67 | 30.18 | 1.56 | 1.26 | 1.11 | 1.19 | 1.56 | 1.95 | 2.19 | 1.34 | 1.68 | 1.15 | 1.88 | -51.90 |
| 22 | 9.05 | 11.98 | 63.71 | 9.12 | 11.59 | 7.88 | 7.98 | 9.08 | 8.24 | 6.53 | 5.15 | 5.31 | 5.47 | 5.55 | -38.68 |
| 32 | 2430.84 | 2344.07 | 1232.73 | 2748.59 | 2514.08 | 1618.58 | 1614.80 | 1396.62 | 1221.88 | 862.16 | 648.84 | 547.88 | 583.09 | 469.46 | -80.69 |
| 41 | 0.52 | 1.85 | 1.93 | 0.69 | 0.68 | 0.36 | 0.47 | 0.71 | 0.43 | 0.32 | 0.31 | 0.28 | 0.49 | 0.60 | 13.93 |
| 51 | 0.57 | 0.16 | 0.62 | 0.07 | 0.07 | 0.05 | 0.02 | 0.03 | 0.02 | 0.04 | 0.07 | 0.01 | 0.04 | 0.05 | -91.65 |
| 52 | 2.17 | 3.76 | 30.62 | 37.53 | 1.19 | 0.46 | 5.16 | 3.35 | 1.87 | 1.66 | 35.83 | 2.21 | 0.22 | 0.49 | -77.59 |
| 61 | 0.63 | 0.02 | 9.10 | 0.25 | 0.13 | 0.09 | 0.08 | 0.10 | 0.13 | 0.07 | 0.05 | 0.03 | 0.18 | 0.06 | -90.00 |
| 62 | 0.38 | 2.98 | 6.21 | 0.28 | 0.18 | 0.13 | 0.16 | 0.14 | 0.32 | 0.14 | 0.12 | 0.12 | 0.16 | 0.25 | -34.88 |
| 63 | 1.10 | 1.95 | 1.58 | 3.47 | 0.42 | 0.31 | 0.45 | 0.28 | 0.26 | 0.18 | 0.14 | 0.14 | 0.22 | 0.24 | -78.38 |
| Egypt | | | | | | | | | | | | | | | |
| BEC | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | % increase |
| 12 | 49.66 | 139.98 | 147.24 | 97.06 | 108.67 | 97.12 | 127.74 | 110.89 | 103.69 | 116.70 | 123.81 | 109.40 | 127.69 | 88.47 | 78.13 |
| 22 | 74.15 | 74.35 | 72.67 | 76.42 | 63.56 | 85.16 | 116.47 | 116.22 | 123.34 | 128.55 | 118.53 | 111.63 | 117.45 | 111.93 | 50.95 |
| 32 | 510.76 | 175.16 | 219.46 | 405.70 | 452.39 | 434.69 | 429.00 | 538.41 | 497.97 | 466.85 | 631.91 | 658.07 | 625.37 | 529.26 | 3.62 |
| 41 | 5.30 | 7.17 | 11.73 | 10.55 | 10.73 | 11.45 | 9.82 | 13.14 | 12.51 | 11.70 | 10.31 | 11.79 | 9.62 | 11.76 | 121.99 |
| 51 | 0.78 | 0.32 | 0.89 | 1.52 | 0.32 | 0.30 | 0.30 | 0.44 | 5.23 | 0.56 | 0.34 | 0.98 | 0.77 | 0.70 | -9.54 |
| 52 | 20.17 | 18.82 | 1.25 | 6.27 | 3.26 | 9.50 | 5.42 | 5.53 | 14.88 | 23.85 | 19.32 | 22.43 | 16.49 | 33.44 | 65.78 |
| 61 | 53.59 | 70.16 | 66.39 | 93.17 | 102.63 | 99.57 | 110.90 | 90.94 | 93.40 | 82.34 | 89.33 | 68.76 | 78.39 | 73.39 | 36.94 |
| 62 | 122.33 | 92.14 | 92.80 | 176.67 | 166.26 | 172.58 | 172.39 | 154.54 | 147.34 | 140.16 | 115.48 | 111.26 | 112.61 | 115.82 | -5.32 |
| 63 | 89.84 | 192.40 | 135.19 | 133.00 | 125.75 | 135.02 | 114.58 | 105.42 | 95.96 | 98.22 | 92.59 | 78.97 | 77.09 | 77.45 | -13.79 |
| Morocco | | | | | | | | | | | | | | | |
| BEC | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | % increase |
| 12 | 146.56 | 338.19 | 94.52 | 131.14 | 138.30 | 153.86 | 142.94 | 146.83 | 158.12 | 173.49 | 173.65 | 202.78 | 163.85 | 147.50 | 0.64 |
| 22 | 72.82 | 137.86 | 270.10 | 72.49 | 79.16 | 77.59 | 81.36 | 75.27 | 73.27 | 79.67 | 83.28 | 82.03 | 84.07 | 110.53 | 51.79 |
| 32 | 39.39 | 201.66 | 14.27 | 49.03 | 77.28 | 121.13 | 96.78 | 79.28 | 53.79 | 72.93 | 84.20 | 60.81 | 54.73 | 32.37 | -17.83 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 41 | 12.37 | 4.34 | 1.81 | 10.28 | 8.48 | 6.98 | 8.58 | 8.90 | 10.32 | 10.31 | 7.90 | 7.99 | 7.41 | 6.97 | -43.65 |
| 51 | 0.13 | 0.08 | 0.00 | 0.48 | 2.09 | 0.12 | 0.24 | 0.25 | 0.37 | 0.24 | 0.14 | 0.27 | 7.97 | 6.93 | 5443.08 |
| 52 | 1.25 | 2.39 | 0.02 | 26.31 | 2.15 | 20.33 | 7.18 | 1.42 | 0.88 | 3.20 | 23.08 | 16.34 | 2.95 | 7.18 | 473.50 |
| 61 | 34.44 | 40.12 | 3.52 | 15.34 | 14.14 | 13.56 | 11.62 | 12.39 | 12.11 | 15.78 | 15.87 | 18.93 | 10.19 | 6.71 | -80.52 |
| 62 | 469.38 | 150.21 | 49.81 | 452.76 | 427.52 | 434.59 | 444.54 | 439.11 | 453.86 | 454.97 | 428.07 | 441.73 | 435.73 | 405.36 | -13.64 |
| 63 | 105.89 | 42.92 | 10.46 | 124.53 | 130.53 | 148.22 | 152.22 | 142.86 | 145.27 | 138.98 | 120.83 | 129.32 | 123.51 | 99.38 | -6.15 |
| Tunisia | | | | | | | | | | | | | | | |
| BEC | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | % increase |
| 12 | 146.96 | 84.70 | 91.23 | 79.17 | 138.21 | 104.09 | 72.09 | 29.75 | 75.56 | 180.70 | 120.36 | 184.75 | 128.56 | 118.50 | -19.37 |
| 22 | 61.68 | 258.69 | 282.78 | 70.78 | 70.11 | 68.16 | 67.85 | 67.64 | 66.32 | 70.31 | 71.14 | 69.55 | 66.86 | 88.49 | 43.46 |
| 32 | 91.31 | 46.77 | 23.47 | 63.53 | 41.32 | 62.14 | 56.39 | 65.46 | 56.74 | 55.48 | 66.84 | 66.83 | 62.92 | 56.28 | -38.36 |
| 41 | 13.37 | 8.93 | 4.72 | 19.19 | 16.75 | 16.40 | 16.34 | 18.33 | 22.27 | 25.42 | 29.35 | 40.97 | 47.86 | 45.26 | 238.45 |
| 51 | 0.17 | 0.84 | 0.06 | 0.20 | 0.17 | 0.37 | 0.19 | 0.21 | 0.22 | 0.20 | 0.27 | 0.26 | 0.16 | 0.54 | 213.17 |
| 52 | 5.54 | 19.04 | 0.01 | 3.03 | 3.23 | 20.83 | 11.09 | 8.51 | 13.15 | 11.92 | 18.42 | 23.42 | 27.21 | 32.28 | 482.90 |
| 61 | 31.54 | 15.68 | 3.51 | 38.16 | 21.76 | 17.37 | 16.82 | 14.63 | 14.85 | 15.34 | 13.35 | 23.82 | 28.28 | 38.81 | 23.06 |
| 62 | 689.55 | 49.94 | 74.41 | 694.17 | 672.52 | 679.20 | 667.52 | 659.62 | 639.88 | 613.07 | 611.86 | 578.72 | 550.37 | 548.78 | -20.41 |
| 63 | 186.94 | 26.58 | 32.78 | 191.70 | 164.25 | 192.77 | 171.25 | 184.33 | 184.33 | 169.36 | 166.33 | 158.95 | 142.96 | 123.99 | -33.67 |

Notes: Values higher than 100 indicate that country i presents a comparative advantage in final sector k in year t. A positive value in the last column indicates an improvement in comparative advantage in final sector k over the period 1995-2008. Source: Own elaboration with UN Comtrade data.

Table A.5. The effect of imports of intermediate goods on exports of final goods

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Imports of intermediate goods from RoW | 0.240** | 0.240** | 0.257** | 0.593** | 0.230** | 0.227** |
| | 2.232 | 2.204 | 2.355 | 2.099 | 2.064 | 2.096 |
| FTA Agreement | 0.116 | -0.009 | -4.663* | 0.114 | 0.117 | 0.126 |
| | 0.523 | -0.004 | -1.884 | 0.514 | 0.478 | 0.565 |
| Pan_EuroMed_RoO | 1.023** | 1.019** | 10.708*** | 1.020** | 1.020** | 0.733* |
| | 2.513 | 2.505 | 3.995 | 2.51 | 2.507 | 1.74 |
| RCA | 0.285*** | 0.284*** | 0.260*** | 0.271*** | 0.285*** | 0.262*** |
| | 5.508 | 5.473 | 4.986 | 5.198 | 5.486 | 5.021 |
| Distance | -1.428*** | -1.428*** | -1.435*** | -1.444*** | -1.428*** | -1.441*** |
| | -4.859 | -4.836 | -4.915 | -4.906 | -4.833 | -4.913 |
| Contiguity | 7.492*** | 7.494*** | 7.325*** | 7.493*** | 7.476*** | 7.516*** |
| | 3.077 | 3.07 | 3.023 | 3.075 | 3.061 | 3.093 |
| Language | 0.578 | 0.577 | 0.598 | 0.592 | 0.573 | 0.596 |
| | 0.915 | 0.91 | 0.953 | 0.936 | 0.902 | 0.945 |
| Colony | 0.492 | 0.492 | 0.495 | 0.479 | 0.492 | 0.497 |
| | 0.93 | 0.926 | 0.944 | 0.904 | 0.927 | 0.942 |
| Imports of intermediate goods from RoW* FTA | | 0.006 | 0.228* | | | |
| | | 0.057 | 1.952 | | | |
| Imports of intermediate goods from RoW* RoO | | | -0.449*** | | | |
| | | | -3.654 | | | |
| Imports of intermediate goods from RoW*BEC4 | | | | -0.157 | | |
| | | | | -1.395 | | |
| Imports of intermediate goods from RoW*BEC5 | | | | 0.032 | | |
| | | | | 0.278 | | |
| Barcelona Process (FTA)*BEC4 | | | | | 0.059 | |
| | | | | | 0.315 | |
| Barcelona Process (FTA)*BEC5 | | | | | -0.156 | |
| | | | | | -0.628 | |
| Barcelona Process (RoO)*BEC4 | | | | | | 0.336* |
| | | | | | | 1.713 |
| Barcelona Process (RoO)*BEC5 | | | | | | 0.765*** |
| | | | | | | 2.973 |
| Constant term | -31.575*** | -31.567*** | -31.842*** | -39.379*** | -31.336*** | -30.981*** |
| | -8.811 | -8.742 | -8.874 | -5.697 | -8.559 | -8.625 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Number of observations | 2640 | 2640 | 2640 | 2640 | 2640 | 2640 |
| R2_within | 0.2988153 | 0.2990341 | 0.3027849 | 0.2994834 | 0.2990186 | 0.303483 |
| R2_between | 0.72534 | 0.7250603 | 0.7275265 | 0.7271637 | 0.7254249 | 0.7245887 |
| R2_overall | 0.6948121 | 0.6946656 | 0.6962996 | 0.6964315 | 0.6949247 | 0.6942221 |
| RMSE | 1.393158 | 1.391768 | 1.391265 | 1.391353 | 1.391451 | 1.391039 |

Notes: ***, **, * indicate significance at 1%, 5% and 10%, respectively. T-statistics are provided below every coefficient. Random effects model.

Table A.6. The effect of imports of intermediate goods on exports of intermediate goods

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Imports of intermediate goods from RoW | 0.351** | 0.326* | 0.337* | -0.144 | 0.331* | 0.371* |
| | 1.981 | 1.662 | 1.713 | -0.391 | 1.672 | 1.916 |
| FTA Agreement | 0.17 | 2.058 | 0.907 | 0.185 | 0.02 | 0.165 |
| | 0.747 | 0.597 | 0.283 | 0.712 | 0.067 | 0.624 |
| Pan_EuroMed_RoO | -0.068 | -0.072 | 2.473 | -0.061 | -0.073 | -0.363 |
| | -0.169 | -0.177 | 0.877 | -0.149 | -0.177 | -0.839 |
| RCA | 0.278* | 0.279* | 0.272* | -0.159 | 0.238 | 0.185 |
| | 1.954 | 1.704 | 1.659 | -0.911 | 1.511 | 1.162 |
| Imports of intermediate goods from RoW* FTA | | -0.09 | -0.034 | | | |
| | | -0.554 | -0.227 | | | |
| Imports of intermediate goods from RoW* RoO | | | -0.118 | | | |
| | | | -0.915 | | | |
| Imports of intermediate goods from RoW*BEC4 | | | | 0.428*** | | |
| | | | | 2.769 | | |
| Imports of intermediate goods from RoW*BEC5 | | | | 0.077 | | |
| | | | | 0.64 | | |
| Barcelona Process (FTA)*BEC4 | | | | | 0.314 | |
| | | | | | 1.242 | |
| Barcelona Process (FTA)*BEC5 | | | | | 0.133 | |
| | | | | | 0.326 | |
| Barcelona Process (RoO)*BEC4 | | | | | | 0.909*** |
| | | | | | | 3.334 |
| Barcelona Process (RoO)*BEC5 | | | | | | 0.023 |
| | | | | | | 0.065 |
| Constant term | -47.665*** | -46.513*** | -46.705*** | -36.630*** | -47.328*** | -47.775*** |
| | -14.667 | -13.434 | -13.509 | -6.161 | -13.499 | -14.068 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Number of observations | 2977 | 2977 | 2977 | 2977 | 2977 | 2977 |
| R2_within | 0.2476156 | 0.2479265 | 0.2483352 | 0.2544686 | 0.2484555 | 0.2560852 |
| R2_between | 0.0572058 | 0.0106165 | 0.013783 | 0.1662219 | 0.0462223 | 0.0221646 |
| R2_overall | 0.0568453 | 0.0169062 | 0.0169592 | 0.1146618 | 0.0516452 | 0.0299199 |
| RMSE | 1.460835 | 1.325226 | 1.325127 | 1.31971 | 1.325021 | 1.318278 |

Notes: ***, **, * indicate significance at 1%, 5% and 10%, respectively. T-statistics are provided below every coefficient. Within fixed effects estimation.