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Do Environment Regulations Matter for EU-MENA Trade?

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Abstract

This study examines the impact of environmental regulation stringency on agricultural trade between the European Union (EU) and Middle East and North Africa (MENA countries). Using a gravity model and applying the Zero Inflated Poisson (ZIP) model, we estimate the impact of environmental regulation stringency on bilateral agricultural exports between 28 EU and 20 MENA countries during the period 2001-2014. The results have showed that environmental regulations do matter for agricultural trade between both regions because, in the presence of excessive zero trade observations, they act as significant fixed export costs that affect the probability of trade. More stringent environmental regulations stimulate innovative efforts in cost-saving green technologies, which increase productivity and positively affect agricultural exports. The results have favoured the revisionist Porter Hypothesis (PH), according to which environmental regulations may stimulate innovative efforts, which mitigate the negative effects of higher fixed abatement costs and enhance trade competitiveness.

Keywords: MENA, EU, Trade, Environment, Regulations.

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Introduction

The ongoing debate on the linkages between trade and environment is becoming crucial at both the research and the policymaking levels. The enactment of new environmental laws in developed countries since the early seventies, and the increasing tendency towards trade liberalization in the nineties have sparked two main types of concern. First, environmentalists have expressed concerns that increasing economic activity resulting from trade liberalization would unavoidably lead to more pollution, unsustainable use of natural resources, and deterioration of environmental quality (Esty, 2001). Second, free trade advocates have expressed concerns that more stringent environmental regulations in developed countries would negatively affect their comparative advantage in pollution-intensive goods (Brunnermeir and Levinson, 2004). These concerns have inspired the evolution of one strand of literature examining the impact of environmental regulations on international trade patterns. Thus, theoretical literature is polarized towards two contrasting points of view: the Pollution Haven Hypothesis (PHH) and the Porter Hypothesis (PH)

First, the traditional "Pollution Haven Hypothesis" (PHH) has been examined within the standard Heckscher–Ohlin (H-O) international trade model. These models have predicted that more stringent regulations in developed countries reduce the availability of their environmental inputs and increase environmental control costs in pollution-intensive sectors. Hence, these countries tend to have a relative cost disadvantage in the production of pollution-intensive goods and specialize in the production of clean goods. By contrast, developing countries with less stringent regulations gain comparative advantages in pollution-intensive goods and are turned into pollution havens. Second, the "Porter Hypothesis" (PH), according to which "*strict environmental regulations do not inevitably hinder competitive advantage against foreign rivals; indeed, they often enhance it. Tough standards trigger innovation and upgrading […] the nations with the most rigorous requirements often lead in exports of affected products*" (Porter, 1991, p.168). Hence well-designed environmental policies combined with innovation strategies would lead to productivity gains, improved international competitiveness, and environmental efficiency (Costantini and Mazzanti, 2011).

At the empirical level, the literature has produced inconclusive results. Some studies have failed to find significant support for the PHH, such as Tobey (1990), Ratnayake (1998), and Cole and Elliott (2003). Few studies have found evidence for PHH, such as Wilson et al. (2002), and Ederington and Minier (2003). Other studies have produced mixed results, such as Van Beers and Van den Bergh (1997), Feix et al. (2008), and Tsurumi et al. (2015). Finally, some studies have found strong support for the PH, such as Costantini and Mazzanti (2011) and De Santis (2011).

This study tackles the impact of environmental regulation stringency on bilateral exports of agricultural products between the European Union (EU) and Middle East and North Africa (MENA) countries during the period 2001-2014[1]. It makes three important contributions.

First, unlike most empirical studies that have focused on the manufacturing sector, this study solely considers the agricultural sector. Despite the small share of the agricultural sector

[1] For the list of EU and MENA countries and agricultural products, see tables (A-1) and (A-2) in Appendix A.

in global trade[2], the potentially harmful impact of trade liberalisation on the environment is a challenging issue in agriculture. This is explained by the fact that agriculture is an environmentally-sensitive sector that is heavily dependent on natural resources and is an important driver of environmental pressures on climate change, water use, land degradation, and biodiversity (Walls, 2006). For example, according to the United Nations Conference on Trade and Development (2013), agriculture contributes up to 15 percent of global greenhouse gas (GHG) emissions. In turn, concerns have grown over the potential effects of environmental regulations on world agricultural trade patterns and the international competitiveness of some commodities (Fontagé et al., 2001).

Second, the study examines the trade-environmental regulations interaction within the Euro-Mediterranean trade integration framework, which is relatively scarce in existing literature. Most empirical studies have either focused on the United States, such as Ederington and Minier (2003) or the EU, such as Costantini and Mazzanti (2011) vis-à-vis other developed and developing countries. Also, since agricultural products are still considered strategically sensitive in free trade agreements (FTAs) between both regions, they are more protected than manufactured products,which makes them an interesting point of analysis.

Third, from a methodological perspective, using an augmented gravity model with proxies for exporting and importing countries' environmental regulations, this paper's contribution is twofold. First, given the excessive zero trade flows in the EU-MENA trade relations, we opt for the Zero-Inflated Poisson (ZIP) model. Indeed, since environmental regulation stringency is considered to be fixed export costs, it can explain and affect the probability of zero trade flows between EU and MENA countries. Second, to allow for the endogeneity of environmental regulations, we use a two-step estimation.

Our main findings show that environmental regulation stringency does matter for agricultural trade between EU and MENA countries. It has been reported that an increase in the stringency of environmental regulations enhances the probability of trade between both regions, by stimulating innovative efforts in green technologies. Hence, more productive exporters become more able to absorb the fixed costs imposed by environmental regulations and to break down the barriers to exporting; lending support to the PH. The same findings have been confirmed when separate regressions have been run for EU exporters and MENA importers, MENA exporters and MENA importers, at the product level, and after controlling for the endogeneity problem between environmental regulations and trade.

This paper is organized as follows: Section 2 describes some stylized facts regarding environmental regulations and trade in EU and MENA. Section 3 presents the methodology in terms of econometric model specification, estimation techniques and data sources. Section 4 discusses the results. Section 5 provides the conclusion.

[2] In 2014, agricultural products have accounted for 9.5 percent of world merchandise trade, whereas manufacturing products have accounted for 66.2 percent of world merchandise trade (World Trade Organization, 2015).

Stylised Facts: Trade and Environmental Regulations in EU and MENA

Environmental Regulations in EU and MENA

As argued by Walter and Ugelow (1979), many economic, social and political factors imply that societies may differ, quite legitimately, in their views as to what constitutes an "acceptable" level of environmental quality. Accordingly, the EU is taking the leading position in adopting stringent environmental regulations, due to rising concerns over environmental quality and human health. Yet, basic developmental challenges related to health, education, agricultural development, and food production and security remain primary concerns for MENA countries.

As EU member countries have been working toward the goal of economic integration, they have gradually elevated actions on the environment to the level of the EU's Environmental Policy (Calfee, 1994). Accordingly, their major environmental commitments have evolved from solving their most pressing local environmental problems (air and water pollution) to tackling global environmental challenges (climate change). Moreover, many environmental programmes have been implemented to ensure the complementarity between economic and environmental objectives. On one hand, these programmes have involved a commitment towards developing an environmentally-integrated "sectoral approach" in order to analyse the environmental impact of strategic economic sectors (agriculture, industry, energy, transport, fisheries, regional development, research and innovation). On the other hand, they have expanded the range of environmental policy instruments from command-and-control to incentive-based policy instruments (taxes, subsidies, tradable emission permits) or technical instruments (eco-labeling) (Hey, 2005). Finally, a complex body of environmental legislation to ensure the harmonisation of environmental standards, to avoid free trade distortions and to preserve the competitiveness of EU industries in global markets (Stojanović and Radukić 2006; European Commission, 2013a).

In the MENA region, environmental considerations are insufficiently integrated in their national development plans and policies. The region faces many environmental challenges, such as water scarcity, salinity and pollution; desertification and land degradation; coastal and marine environment degradation; loss of biodiversity and climate change (Wingqvist and Drakenberg, 2010). The costs of environmental degradation in the region are high as they range from 2-3 percent of GDP (in Tunisia, Jordan, and Syria) to 5-7 percent of GDP (in Egypt and Iran) (Croitoru and Sarraf, 2010). Thus, as environmental issues have become more salient, some countries have undertaken institutional reforms in the environmental sector. First, they have developed their own environmental agencies or ministries and integrated environmental issues into the activities of ministries of water, electricity, agriculture, and health. Second, they have developed a fully-fledged legal system of environmental protection and produced a set of legal texts addressing local environmental concerns[3]. Third, they have developed national environmental action plans to elaborate more

[3] For example, Egypt has enacted Law no.4/1994 on environment protection and Law no.116/1983 on the inviolability of agricultural land and the preservation of its fertility. Also, Algeria has enacted Law no.3/10 on environment protection within the framework of sustainable development, and Law no.84-12/1984 on forestry order and Law no.1-19/12/2001 on waste movement, control and disposal.

meaningful estimates that reflect environmental issues in clearer economic terms (Hussein, 2007; Saab and Tolba, 2008).

However, improvements in the MENA region are considered to be relatively limited for several reasons. First, central governments with public deficits are not able to afford a proper implementation and enforcement of environmental policies. Their budgetary allocations for environmental purposes are below one percent of GDP (Wingqvist and Drakenberg, 2010). By contrast, environmental protection expenditures in EU have stood at 14 percent of GDP for specialised producers[4], 0.67 percent for the public sector and 0.39 percent for industry in 2013; and accounted for total of 1.7 percent of government expenditures in 2014 (Eurostat, 2015). Second, environmental institutions and legal frameworks in MENA are sufficiently weak to stimulate a market change towards sustainable development. They do not create sufficient economic incentives for the development and utilization of clean technologies, and disregard the use of economic tools as an expedient to ensure environmental compliance[5] (Saab and Tolba, 2008). By contrast, the EU growth strategy (called Europe 2020) recognises that its environmental policy can help transform into a knowledge-based resource-efficient economy. The EU environmental policy makes use of existing economic instruments to put in place financial incentives to protect the environment, by using cost-effective technologies (European Commission, 2013a). Third, there is a lack of coordination between authorities in charge of the execution of environmental laws; contributing to non-compliance in MENA. The region also lacks effective and organized civil society groupings working to address key environmental challenges (Saab and Tolba, 2008). Yet, the process of developing EU environmental legislation is highly democratic, based on extensive consultation, giving national authorities, non-governmental organizations, environmental experts and the general public opportunities to express their views. The European Commission helps member states have effective implementation by ensuring the availability of capacity-building, financial resources and a better knowledge of the state of the environment. Also, the EU has witnessed a mounting wave of environmentalism, where membership of environmental organizations has increased considerably, and green parties have become popular (Hey, 2005; European Commission, 2013a). Fifth, MENA countries face the difficulty of sorting out and recording data and information on emissions from plants, which limit knowledge on the current state of the environment and the areas of stress (Saab and Tolba, 2008). By contrast, the EU has put in place a global monitoring environmental system that produces a wide range of robust and accurate datasets to help environmental policymaking and support its implementation (European Commission, 2013a).

In terms of data, the choice of indicators of environmental regulation stringency is rarely theoretically motivated, but rather driven by the availability of data (Sauter, 2014). Thus, the literature has solved this problem by relying on various proxies, such as monetary indicators, including private pollution abatement and control expenditures (PACE) or public expenditures for environmental protection; perception surveys including the United Nations Conference on Trade and Development (UNCTAD) survey with government officials and the World Economic Forum (WEF) survey with business executives asking environmentally-related questions; emission levels and energy consumption indicators; and general composite

[4] They are producers whose principal activity is the production of environmental protection services, regardless of whether they belong to private or public producers group, or whether they carry out market or non-market activities (Eurostat, 2007).

[5] With only a few laws making reference to the utilisation of financial incentives, such as The Tunisian laws on the environment that are responsible for making Tunisia the first Arab country to accord the environmental label on its products, to indicate the highest quality level in terms of environment preservation (Saab and Tolba, 2008).

indices, such as the Environmental Sustainability Index (ESI) and the Environmental Performance Index (EPI) (Brunel and Levinson, 2013; Sauter, 2014).

In this study, assessing EU and MENA's environmental performance and regulation stringency is based on two types of measurement. First, the aggregate Environmental Performance Index (EPI) and the agriculture policy category score assesses policies related to the effects of intensive agriculture, agricultural subsidies and pesticide regulations. Second, emission-based indicators, such as total GHG emissions levels (in kt of CO_2 equivalent) and total agricultural emissions (in gigagrams CO_2 equivalent)[6].

The EPI and agriculture policy score have generally increased between 2001 and 2014 in EU and MENA regions (see Figures 1 and 2). However, while the EPI levels are on average higher in the EU; agriculture policy scores are on average higher in MENA. This is justified by the fact that developed countries can financially afford the subsidisation of their agricultural sector (see Appendix B).

[Figures (1) and (2) about here]

In terms of GHG emissions, Figures (3) and (4) show that emission levels tend to decrease in the EU and to increase in the MENA region. These findings confirm the previous argument that EU countries tend to have more stringent environmental regulations than MENA countries.

[Figures (3) and (4) about here]

Figure (5a) represents a linear positive relationship between means levels of GHG emissions and mean levels of GDP per capita across countries, whereas Figure (5b) represents an inverted U-shaped relationship, when the GDP per capita is used in its quadratic form. This confirms the environmental Kuznets curve theory (EKC); implying that low levels of income growth lead to higher emission levels until a turning point is reached at a middle level of income, then further growth leads to fewer emissions and more environmental improvements. This also confirms the fact that higher-income countries have higher demands for environmental quality; hence, more stringent environmental regulations than lower-income ones.

[Figures (5a) and (5b) about here]

After presenting the evolution of different environment indicators, it is worth examining the trade structure between both the EU and the MENA region.

Overview of Trade between EU and MENA

The trade integration process between EU and MENA countries started with the "Global Mediterranean Policy" in 1972, resulting in bilateral Cooperation Agreements to liberalise industrial exports from MENA to the European Community (Robles et al., 2012). Then, the 1995 Barcelona Process resulted in a series of bilateral Association Agreements among EU and MENA countries, and a series of horizontal free trade agreements between

[6] For more details about environmental performance indicators, see Appendix B.

MENA countries themselves[7] to establish a Euro-Mediterranean Free Trade Area (EMFTA) by 2010 (Cieslik and Hagemejer, 2009). The process resulted in a gradual levying of tariffs and non-tariffs trade barriers for manufacturing products, and a gradual liberalisation for agricultural products and services by reciprocating preferential access to their respective markets (Adamo and Garonna, 2009; Cieslik and Hagemejer, 2009). Then, the EU-MENA partnership was reinforced with the launch of the European Neighbourhood Policy (ENP) in 2003 and the Union for the Mediterranean (UfM) in 2008 to promote further trade liberalisation, covering agriculture, fishery and services, and investment liberalisation. Following the Arab Spring in 2011, a new generation of Deep and Comprehensive Free Trade Areas (DCFTAs) agreements have recently been negotiated with Egypt, Jordan, Morocco and Tunisia. These agreements cover agricultural and service sectors and promote harmonisation in the fields of competition policy, regulatory barriers to trade (technical barriers to trade (TBT) and sanitary and phytosanitary (SPS) measures), investments, and intellectual property rights (Lopez et al., 2013; Talks, 2015).

It has been theoretically argued that the implementation of regional and bilateral trade agreements between EU and MENA countries would significantly increase trade flows in both directions, and would provide a chance for overprotected industries (agriculture in MENA) to catch up with their EU competitors (Benassi et al., 2012). However, the empirical findings of Ferragina et al. (2009) have proved the existence of a sizeable, unexploited trade potential between EU and MENA countries[8]. Also, Cieslik and Hagemejer (2009) and Robles et al. (2012) have reported a large degree of asymmetry in trade liberalisation, because EU markets remain relatively more closed to imports of agricultural and industrial products from MENA countries[9]. This is reflected in the low share of MENA countries in the EU's total imports (11.68 percent), as compared to the share of EU in MENA's total imports (28.60 percent) in 2014[10].

Regarding the implications for agricultural trade, agriculture has traditionally benefitted from special treatment that sheltered it from full trade liberalisation. Figure (6) shows that MENA countries have maintained higher average tariffs levels on primary products imports than those applied by EU countries from 2001 to 2014. Also, at more disaggregated product levels, it has been found that bilateral average tariffs on agricultural products are relatively higher than those on manufacturing products. For example, in 2014, Morocco's tariffs on its agricultural imports from Belgium were 46.9 percent for cereals, 36.6 percent for dairy products, 36.3 percent for edible fruits and nuts, and 17 percent for cocoa and its preparations, whereas tariffs on manufacturing imports of organic and inorganic chemicals,

[7] South-South trade integration has been initiated through the Greater Arab Free Trade Area (GAFTA) that came into existence in 1997 between Bahrain, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, the United Arab Emirates, and Yemen. In 2005, Algeria was accepted into the GAFTA. Then, the Agadir Economic Agreement was signed in 2004 and came into force in 2007 between Egypt, Jordan Morocco, and Tunisia (Abdmoulah, 2011).

[8] Ferragina et al. (2009) found that the ratio of potential to actual trade between 5 EU and 12 Mediterranean countries ranged between 3.5 and 5, whereas the ratio between 5 EU and 10 Central and Eastern European Countries (CEECs) ranged between 2 and 2.6 from 1995 to 2002.

[9] Cieslik and Hagemejer (2009) found that while bilateral Association Agreements significantly increased MENA imports from EU by 41 percent, MENA exports to EU markets decreased by 19 percent during the period 1980-2004. Robles et al. (2012) reported that trade agreements essentially served EU exporters benefitting from duty-free access to MENA markets, whereas MENA exports significantly decreased by 33 percent and their imports significantly increased by 28 percent during the period 1994-2010.

[10] These are authors' calculations using UN COM trade data using HS at two-digit level.

electrical machinery and mechanical appliances, mineral fuels and oils, and man-made textile materials were approximately equal to zero percent. Also, in 2013, Croatia's tariffs on its agricultural imports from Turkey were 14.7 percent for edible vegetables, 7.8 percent for edible fruits, and 16.7 for sugar and its confectionary, whereas tariffs on manufacturing its imports of organic and inorganic chemicals, mineral fuels and oils, man-made textile, and electrical machinery and mechanical appliances were zero percent (World Databank, UNCTAD-Trade Analysis Information System, online, 2017).

[Figure (6) about here]

In addition, the agricultural trade is subject to non-tariffs barriers imposed by the EU. First, the EU imposes limits (quotas) on agricultural imports from MENA during seasons of intensive competition for certain products such as wine, olive oil, and fruits and vegetables (citrus, cucumbers, figs, grapes, tomatoes, apricots, peaches, and dried vegetables and fresh fruits) (Lopez et al., 2013). Second, the threshold prices or "entry price system" adopted by EU countries aims to protect domestic markets of fruits and vegetables by preventing the entry of "very low priced" imports, which could destabilize EU markets (David and Maria, 2005). Third, domestic price supports are provided for strategic commodities, such as wheat and comparative advantage (sensitive) commodities such fruits and vegetables (Chaherli and El-Said, 2007). Fourth, sanitary and phytosanitary (SPS) and technical barriers to trade (TBT), as well as environmental regulations, do restrict the entry of MENA agricultural products to the EU (Liargovas, 2013).

Figures (7-9) present the main patterns and structure of bilateral agricultural exports. Figure (7) shows that agricultural exports from EU to MENA countries steadily increased from 2001 to 2008, with some fluctuations from 2009 to 2014. Yet, agricultural exports from MENA to EU countries have witnessed greater fluctuations throughout the whole period. Moreover, on average, agricultural exports from EU to MENA countries are found to be relatively higher than those from MENA to EU countries.

[Figure (7) about here]

Accordingly, the shares of agricultural products in EU's total exports to MENA increased from 1.48 percent in 2001 to 8.51 percent in 2014, whereas the shares of agricultural exports in MENA's total exports to EU decreased from 6.67 percent in 2001 to 5.40 percent in 2014[11]. The slight decrease of MENA countries' agricultural exports to the EU might reflect the many obstacles that are facing MENA countries in complying with increasingly stringent EU standards and requirements, which might push some MENA countries to reallocate their agricultural exports towards other markets, such as Russia and other European East countries[12] (Lopez et al., 2013).

Figure (8) presents the leading EU and MENA exporting countries in 2014. Among the EU countries, France, Italy and the Netherlands have the highest mean levels of agricultural exports; followed by Belgium, Germany, Spain, Poland, Romania, and Lithuania. Regarding

[11] These are authors' calculations by using UN COM trade data using HS at two-digit level.

[12] In 2010-2011, Russia has overtaken the lead from the EU as the main destination market for Turkey's citrus exports, and absorbed about 50 percent of Morocco's fresh citrus exports, while the EU market has accounted for 37 percent. This is compared to a reverse situation in 2009-2010 when EU has imported about 45 percent of Morocco's total citrus exports, while Russia has imported 40 percent (Lopez et al., 2013).

MENA countries, Turkey, Morocco, and Israel are the leading MENA suppliers of agricultural products to EU countries; followed by Egypt, Jordan and the United Arab Emirates.

[Figure (8) about here]

Regarding the structure of agricultural exports of EU and MENA countries, it is largely shaped by differences in relative factor endowments of both regions, as resource-based trade is likely to occur mostly within the "North- South" trade framework (Giovannetti, 2013). EU countries have a comparative advantage in the production of cereals, sugar, dairy products, and livestock products, which their relative abundant supplies of arable land and of fresh water allow to produce (Petit, 2009). By contrast, MENA countries' environmental problems (water and rainfall shortages, desertification, poor soil and the loss of arable lands) and their relative abundance of cheap labour imply their specialisation in irrigated and labour-intensive agricultural products, such as fruits and vegetables, aromatic and medicinal foliage, seeds and roots, cut flowers, trees and tree nuts, and ornamental plant (Awwad, 2003; Kirkpatrick et al., 2006; Minot et al., 2010). Thus, Figure (9) shows that, in 2014, EU's agricultural exports mainly consist of dairy products; cereals and their processed products; meat products; various edible preparations and beverages; and tobacco and its manufactured substitutes. For MENA countries, their agricultural exports mainly consist of edible vegetables and fruits; preparations of vegetables, fruits and nuts; live trees, cut flowers and ornamental foliage and coffee, tea and spices. Also, final agro-food products for direct consumption are an important part of EU agricultural exports to MENA, reflecting the growing demand for final goods (cigars and cigarettes, and food preparations) (European Commission, 2013b). Therefore, the structure of agricultural trade reflects a certain degree of complementarity between both regions; trade thus being the result of specialisation (H-O trade theory) (Petit, 2009).

[Figure (9) about here]

Trade and environment relationship in EU and MENA

While examining the link between trade and the environment, three effects could be identified. First, the "the scale effect" refers to the fact that, on average, the higher the level of agricultural exports, the higher the level of agricultural emissions. Second, the "technique effect" refers to the fact that trade-induced income gains create political demands for tougher environmental standards that bring forth cleaner and innovative techniques of production; implying that the higher the levels of agricultural exports, the lower the levels of GHG emissions. The technique effect is the critical factor underlying the hypothetical environmental Kuznets Curve (EKC). Third, the "composition effect" refers to the change in pollution levels, due to a change in the range of pollution-intensive products produced by different countries. The composition effect may always dominate when trade is driven by differences in the relative factor of supplies in goods (Copeland and Taylor, 1994).

The scale effect is confirmed by Figure (10) that displays a positive relationship between the mean levels of GHG emissions and agricultural exports for the whole sample.

[Figure (10) about here]

Figure (11) shows two contrasting results, in terms of the relationship between mean levels of agricultural exports and GHG emissions in EU and MENA countries. While GHG emissions are positively related to agricultural exports in MENA countries, both variables are negatively related in the case of EU countries. This highlights the possibility of the dominance of the scale and composition effects in the former and the dominance of the technique effect in the latter case.

[Figure (11) about here]

Regarding the relationship between mean levels of agriculture exports and EPI for the whole sample, Figure (12) displays a positive relationship between both indicators; in line with the PH argument.

[Figure (12) about here]

Also, Figure (13) displays the same positive relationship for EU and MENA countries. However, the fitted line tends to be flatter in MENA countries, suggesting that the relationship is weaker than in EU countries.

[Figure (13) about here]

Another important fact that characterises agricultural trade between EU and MENA countries is the existence of excessive zero trade flows. As shown in Figure (14), zero trade flows represent approximately 70 percent of total observations throughout the whole period. The elevated percentage of zero trade flows occurs at the more disaggregated trade data, due to the fact that neither do all countries produce all available goods nor do they have an effective demand for all available goods. Accordingly, MENA countries do not export all their products and do not serve all destinations. Thus, the study employs the ZIP model to estimate the gravity model as will be shown in section 3.

[Figure (14) about here]

Methodology and Data

Econometric Specification

The methodology of this study is based on using an augmented gravity model with proxies for exporting and importing countries' environmental regulation stringency, to examine their impact on bilateral agricultural exports between EU and MENA countries during the period 2001-2014.

Indeed, using the Harmonized Commodity Description and Coding System (HS) trade data at the two-digit level has implied the fact that zero trade flows constitute around 70 percent of the total number of observations. The existence of zero trade flows may reflect misreporting and mismeasurement, especially in the case of small and poor countries. Yet, they might contain valuable information that should be exploited for efficient estimation and appropriate econometric techniques should be employed to allow the extraction of more information from the data (Salvatici, 2013)[13]. Hence, in order to overcome the problem of

[13] When traditional panel data estimation techniques (Fixed Effects and Random Effects) are used, the zero problem is circumvented either by omitting all zero trade flows, which leads to biased results when zero trade flows are not

excessive zeros in trade observations, we employ a modified Poisson pseudo-maximum likelihood (PPML) regression, which is the Zero-Inflated Poisson (ZIP) regression.

The ZIP estimator explains the occurrence of excess zero trade flows by two different processes. First, the complete lack of trade between countries due to trade embargos, the complete mismatch between demand and supply, lack of resources, influence of government policies and large fixed costs. This process implies that not all pairs of country have the potential to trade, which means that their trade probability is identically zero by definition. It includes factors that affect the probability of belonging to a never-trading group of countries. Second, some factors that might affect the expected value of trade comprising geographical, institutional or cultural distance between countries that may be too large for trade to be profitable. This refers to the group of countries that do not trade but can potentially trade in the future, and their trade probability is theoretically different from zero. Therefore, the ZIP model consists of two separate parts; the Logit regression that there is no bilateral trade at all, and the Poisson regression of the probability of each count for the group that has a non-zero probability or interaction intensity than zero (Burger et al., 2009).

Applying to the current model, environmental regulation stringency is included in the Logit regression of the ZIP model, in order to examine its impact on the probability of trade taking place, i.e. to explain the probability of zero trade flows. This is explained by the fact that more stringent regulations are often associated with higher fixed costs, required to install abatement technologies or to design cleaner production processes. Conforming to Bernard et al. (2003) and Melitz (2003)[14], only larger and more productive firms are able to cover these fixed costs and to enter the export market, because they spread their fixed costs over larger output and export levels, whereas less productive ones exit the market and seek to relocate their plants in countries with less stringent regulations (Bernard et al., 2003). Thus, differences in environmental regulations over space and time may significantly impact firms' exporting status and their probability of belonging to never-trading group (Holladay, 2015).

The main ZIP model to be estimated is specified as follows:

Logit regression:

$$P(Trade = 0)_{ijt} = \beta_0 + \beta_1 lnENV_{it}, + \beta_2\, lnENV_{jt} + \beta_3\, lnINNOV_{it} * lnENV_{it} + \beta_4\, X + \varepsilon_{it}$$

Poisson regression:

$$AGREXP_{ijt} = \beta_0 + \beta_1\, lnINNOV_{it} + \beta_2\, X + \varepsilon_{it}$$

where the dependent variable $AGREXP_{ijt}$ denotes bilateral agricultural exports from exporting country i to importing country j in year t.

randomly distributed; or by adding an arbitrary small positive number, which lacks theoretical and empirical justification and leads to distorted results (Burger et al., 2009).

14 Bernard et al. (2003) and Melitz (2003)'s theoretical contributions are relevant to justify the current model's specification and estimation technique. They have focused on the fact that not all existing firms operate on international markets. The heterogeneity in firms' behaviour is due to the fact that their exposure to trade hinges on firms' ability to cover fixed costs of entry to export markets, which varies according to their productivity levels (Melitz, 2003). The main implication of firm heterogeneity for modeling the gravity equation is the occurrence of excessive zero trade flows (Salvatici, 2013).

For the independent variables, the main variables of interest ENV_{it} and ENV_{jt} refer to environmental regulation stringency of i and j in year t. Two proxies are used; the EPI and the agriculture policy category score. The sign of ENV_{it} coefficient is ambiguous because it is expected to be either negative and lending support to the PH, or positive and lending support to PHH[15]. Also, for the coefficient of ENV_{jt}, it is expected to be negative; suggesting the fact that more stringent regulations in importing countries relatively improve the competitiveness of agricultural products of exporting countries[16]. $INNOV_{it}$ refer to i' innovative capacity in year t measured by research and development (R&D) expenditures (as a percentage of GDP) and R&D expenditures in agricultural sciences (as a percentage of GDP). The interaction term between ENV_{it} and $INNOV_{it}$ examines the impact of i's environmental regulation stringency on bilateral agricultural exports through their impact on innovative efforts. The coefficient of the interaction term is expected to be negative; confirming the prevalence of PH[17]. X is a vector of control variables where GDP_{it} and GDP_{jt} are gross domestic products of i and j in year t; POP_{it} and POP_{jt} are populations of i and j in year t; $DIST_{ij}$ is the bilateral geographical distance between i and j; $CONT_{ij}$, $COMLANG\_OFF_{ij}$, $COLONY_{ij}$, are dummy variables that take the value of one if both i and j are contiguous, share a common official language and have a colonial link, and zero otherwise; $EMFTA_{ijt}$, $AGADIR_{ijt}$, $GAFTA_{ijt}$ are three free trade dummy variables that take the value of one if both i and j are members of the Euro-Mediterranean Free Trade Agreement (EMFTA), AGADIR and the GAFTA in year t since the year of its entry coming into force, and zero otherwise; $OILEXP_{ij}$, is a dummy variable that takes the value of one if MENA countries are oil-exporting[18], and zero otherwise; $AGRLAND_{it}$, $AGRIMACH_{it}$, $EMPLOYAGR_{it}$ account for the effect of i's factor endowment in terms of agricultural land[19] (as a percentage of land area), agricultural machinery (number of tractors per 100 sq. Km of arable land), and employment in agricultural sector (as a share of total employment) in year t; and ε_{it} is the error term.

We run the baseline ZIP model estimation by using both the EPI and agriculture policy scores and their interactions with R&D expenditures and R&D expenditures in agricultural science. Then, we run separate regressions for EU exporters and MENA importers, for MENA exporters and EU importers, and at the disaggregated level for each of the 23 agricultural products. Moreover, we account for the endogeneity between environmental regulations and trade. The endogeneity problem between trade and environmental regulations is accounted for by following a two-stage analysis. The first step consists of predicting the fitted values of environmental regulation stringency proxies for exporting and importing countries. This prediction is done by using two instrumental variables; an institutional quality proxy (Government Effectiveness Percentile Rank) and the per capita GDP. The use of institutional

[15] If the coefficient is negative, this implies that the higher the stringency of environmental regulations in exporting countries, the lower the probability of zero trade flows, which supports the PH. And if the coefficient is positive, this implies that the higher the stringency of environmental regulations in exporting countries, the higher the probability of zero trade flows, which supports the PHH.

[16] If the coefficient is negative, this implies that the higher the stringency of environmental regulations in importing countries, the lower the probability of zero trade flows. This means that the competitiveness of exporting countries is relatively improved.

[17] The negative coefficient implies that innovative efforts would mitigate the negative effects of more stringent regulations on agricultural exports, and reduce the probability of zero trade flows.

[18] Oil-exporting MENA countries are defined as those whose oil exports represent 80 percent of their domestic consumption, including Algeria, Bahrain, Iran, Iraq, Kuwait, Libya, Oman, Qatar, Saudi Arabia, Syria, United Arab Emirates and Yemen (Minot et al., 2010; Ianchovichina, 2011).

[19] Agricultural land refers to the share of land area that is arable, under permanent crops, and under permanent pastures (FAO Statistics Division, online, 2016).

quality is based on the work of Ederginton and Minier (2003) who have explained the endogenous setting of environmental regulation by using the political economy theory. The level of regulation stringency is determined endogenously by self-interested regulators serving special interest groups. For example, greater political influence of industries seeking protection from foreign competition may result in regulatory relief and effective lobbying against regulations. Thus, a higher government effectiveness score reflects greater independence from political pressures and the ability of the government to better implement and enforce regulations, which would enhance the country's environmental performance. Also, per capita GDP is used as a proxy for the level of economic development that affects the level of environmental regulation stringency (Cole and Elliott, 2003). Then, in the second step, the predicted values of environmental regulations proxies are introduced in the ZIP model equations.

The data is collected for 28 EU countries and 20 MENA countries during the period 2001-2014.Trade data is obtained from the United Nations Commodity Trade Statistics Database (2016) using the HS at the two-digit level[20]. The GDPs, per capita GDP, populations, agricultural factor endowments, R&D expenditures (as a percentage of GDP) and the Government Effectiveness Estimate indicator are obtained online from World Development Indicators (2016). Traditional gravity variables, such as distance, common language, contiguity and colonial links are obtained from the CEPII database. EMFTA membership is e obtained online from the EU commission website and from Robles et al. (2012). AGADIR and GAFTA agreements' membership are obtained online from Abdmoulah (2011). Oil-exporting MENA countries are obtained from Ianchovichina (2011). Also, R&D in agricultural science as a percentage of GDP is obtained from the UNESCO Institute for Statistics (2016). And finally, the EPI and agriculture policy scores are obtained from the Yale Center for Environmental Law and Policy (2016).

Empirical findings

Baseline estimation results

The empirical findings of the baseline equation are presented in Table (1). In the Poisson regression, the classical gravity variables, such as exporting and importing countries' GDP, populations, distance, contiguity, colonial links, common official language, and free trade agreements have the expected signs and significance levels. Being a MENA oil-exporting country negatively affects agricultural exports. Regarding the effects of agricultural factor endowments, agricultural land's coefficient is positive and highly significant in all regressions; implying that agricultural exports are land-intensive. By contrast, coefficients of agricultural machinery and employment have varying signs; implying that their effect on agricultural exports is ambiguous. R&D expenditures positively affect agricultural exports, whereas R&D

[20] The study adopts the World Trade Organization (WTO)'s definition of agricultural products in its Agreement on Agriculture. It mainly includes basic and processed agricultural products in chapters 1-24, excludes chapter 3 of fishery and fishery products, and adds other manufactured agricultural products that exist in the headings and sub-headings of Chapters 29, 33, 35, 38, 41, 43, 50, 51, 52 and 53. However, the study did not include the latter products because it focused on HS at two-digit level, whereas these products are identified at four- and six-digit levels.

expenditures in agricultural science have a negative effect[21]. In the Logit regression, coefficients of exporting countries' EPI are negative and significant. If EPI increases by one unit, the odds of zero trade decrease by a factor of 1.59 and 3.62[22]. When the EPI is interacted with R&D and R&D in agricultural science, the odds of zero trade decrease by 1.15 and 1.16. These findings support the PH, because more stringent environmental regulations positively affect the probability of exporting agricultural products. Regulatory-induced innovations enhance productivity levels and mediate the relationship between environmental fixed costs and agricultural trade (Girma et al., 2008). Regarding the coefficients of importing countries' EPI, they are negative and significant; implying that the higher the EPI in importing countries, the lower the probability of belonging to never-trading group of countries. Therefore, the stringency of environmental regulations in importing countries entails higher costs for their firms, which relatively improve the international competitiveness of their exporting partners. The same findings are supported by the negative and significant coefficient of exporting countries' agriculture policy score and the interaction terms with R&D expenditures and R&D expenditures in agricultural science. However, the coefficients of importing countries' agriculture policy scores are insignificant.

[Table (1) about here]

Table (2) presents the results when EU are exporters and MENA are importers. In the Poisson regression, gravity variables have the expected signs and significance levels. Agricultural land, machinery and employment turn out to be important determinants of agricultural exports for EU countries, as their coefficients are positive and significant. In the Logit regression, the results confirm those of the baseline estimation and tend to support the prevalence of the PH. Table (3) presents the results when MENA are exporters and EU are importers[23]. Among agricultural factor endowments, only agricultural machinery positively affects MENA's agricultural exports. Also, the coefficients of R&D expenditures are positive and significant. In the Logit regression, although the coefficients of exporting countries' EPI and agriculture policy scores support the PH, it is found that the coefficient of interaction term between EPI and R&D expenditures is positive[24]. Also, the coefficient of the interaction term between agriculture policy scores and R&D expenditures confirms previous results.

[Tables (2) and (3) about here]

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[21] The negative effect of R&D in agricultural science on agricultural exports might be explained by the existence of high sinking costs. Also, in a non-manufacturing sector, spending on R&D does not increase the likelihood of producing an innovation; suggesting that agricultural R&D might be misdirected and inefficient (Harris and Moffat, 2011).

[22] In the Logit Regression, in order to calculate the marginal effect of an increase by one unit in the EPI on the probability of - zero trade flows, we use the exp(β) formula.

[23] Due to the lack of observations in R&D expenditures in agricultural science for MENA countries, no estimation has been performed for their interaction with EPI and agriculture policy score.

[24] The contrasting results might be explained by the fact that an increase in MENA's EPI enhances their probability of exporting, by improving the appeal of their products conforming to environmental standards in EU countries. Yet, the positive coefficient on the interaction term implies that MENA countries incur higher costs for undertaking R&D efforts, which negatively affect their probability of exporting.

Tables (4) and (5) present the product-level estimation results[25]. In Tables (4a) and (4b), the interaction terms of environmental regulation proxies with R&D expenditures and R&D expenditures in agricultural science is negative and significant in all estimations; lending support to the PH. These results highlight the fact that even if more stringent environmental regulations reduce the probability of exporting some agricultural products, innovative efforts at the aggregate level and at the sectoral level would mitigate the negative effects of higher costs and improve their international competitiveness[26]. Also, in Tables (5a) and (5b), the signs and significance levels of both exporting country's agriculture policy scores and the interaction terms do support the PH.

[Tables (4) and (5) about here]

Table (6) presents the results obtained after accounting for the endogeneity between environmental regulations and trade. In the Poisson regression, gravity variables have the expected signs and significance levels. Agricultural land endowments remain a significant determinant that positively affects agricultural exports in all estimations, whereas the effect of agricultural machinery and employment remains ambiguous. In the Logit regression, the coefficients of exporting country's EPI, agriculture policy score and the interactions terms are negative and significant; lending support to the PH. Regarding the magnitudes of coefficients of EPI, agriculture policy score and their interaction term, they did not vary significantly when compared with those of the baseline estimation.

[Tables (6) about here]

Conclusion

This study explores the impact of environmental regulation stringency on the bilateral exports of 23 agricultural products, between 28 EU countries and 20 MENA countries during the period 2001-2014. It accounts for the importance of employing an appropriate model specification and econometric technique to obtain more robust results. Due to the occurrence of excessive zero trade flows in trade observations, the study adopts the ZIP model that includes two types of regression; the Poisson regression of the probability that each count for the group has a non-zero probability, and the Logit regression of the probability that there is no bilateral trade at all. Accordingly, the study contributes to the empirical literature by considering environmental regulation stringency as potential candidates for fixed exports costs, which affects the odds of having zero trade flows. Also, the study considers the simultaneity between environmental regulations and trade by adopting a two-stage analysis. In general, the results reject the pollution haven hypothesis in favour of the Porter hypothesis. More stringent environmental regulations do not hinder, but enhance the probability of agricultural trade between EU and MENA countries. The results also highlight the role of innovative efforts (proxied by R&D efforts at the aggregate and agricultural sector levels) in mitigating the

[25] For the sake of brevity, we only report Logit regression results for selected products (live animal, meat, dairy products, live trees and flowers, vegetables and fruits, cereals, vegetable and animal oils and fats and sugar), which are mainly traded between EU and MENA countries.

[26] It has been found for some products (meat (product code=2) and cereals (product code=10)) that an increase in the EPI increases the odds of zero trade, lending support for the PHH. However, when the EPI is interacted with R&D expenditures and R&D expenditures in agricultural sciences, the coefficients turn out to be negative and significant, lending support to the PH.

negative effects of environmental regulations, by encouraging firms to employ environmental technologies, which increase their productivity as well as reduce pollution levels

Following these results, it could be argued that environmental regulations should no longer be regarded as an impediment to trade, but rather as an impulse to innovate, to enhance productivity, and to improve trade competitiveness. Thus, sustainable development requires the stimulation of innovative efforts through environmental regulations. Countries must enforce their environmental regulations and to enhance their innovative efforts, as these elements are becoming central to achieving Sustainable Development Goals (SDGs) that balance the environmental, social and economic dimensions of development. On one hand, the enforcement of environmental regulations contributes to conservation and sustainable use of natural resources, and on the other hand, it indicates the successful integration of environmental needs into the rule of law, which provide a basis for continuous reforming environmental laws, policies and governance to ensure that balance.

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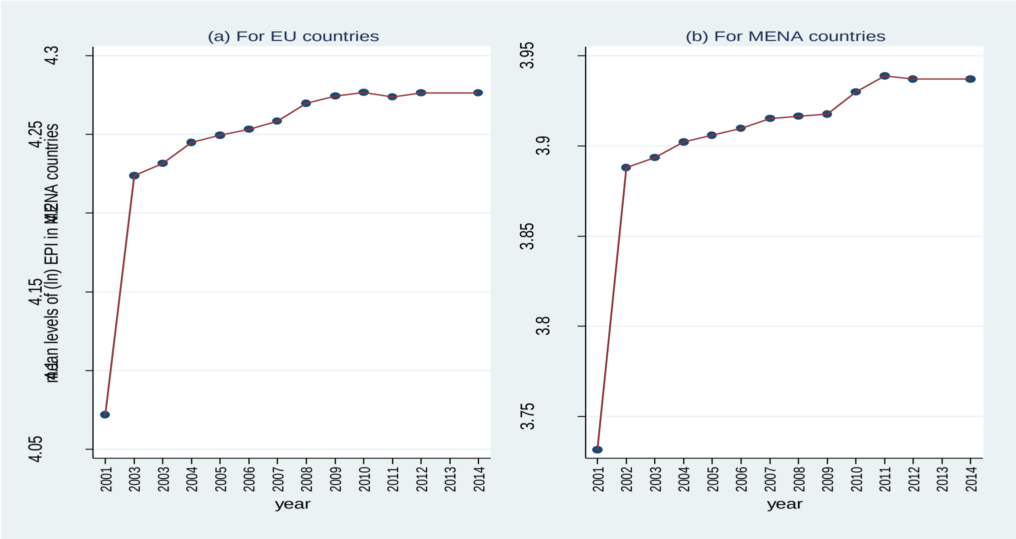
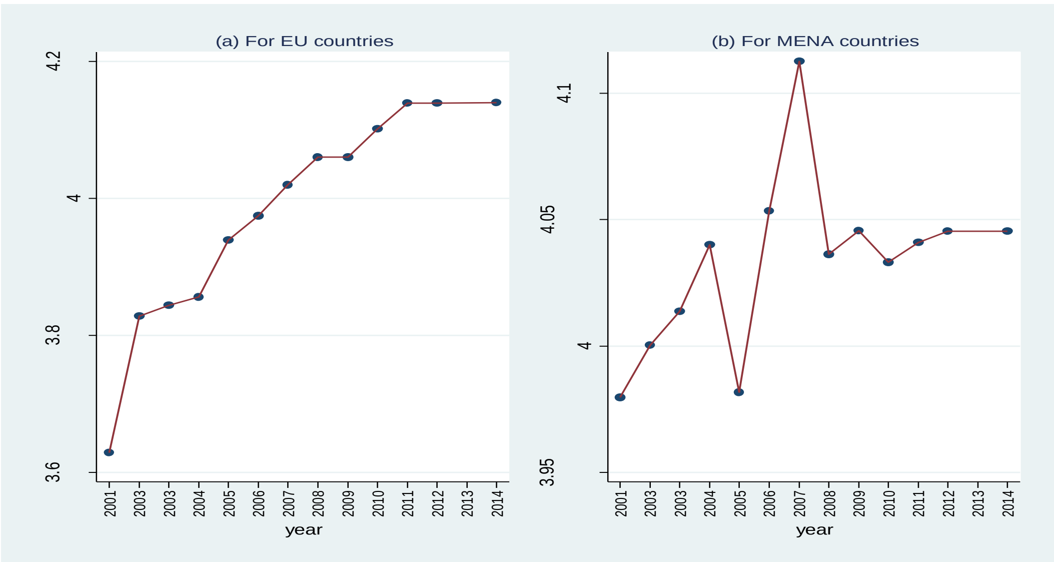
Figure (1): The evolution of EPI in EU and MENA from 2001 to 2014



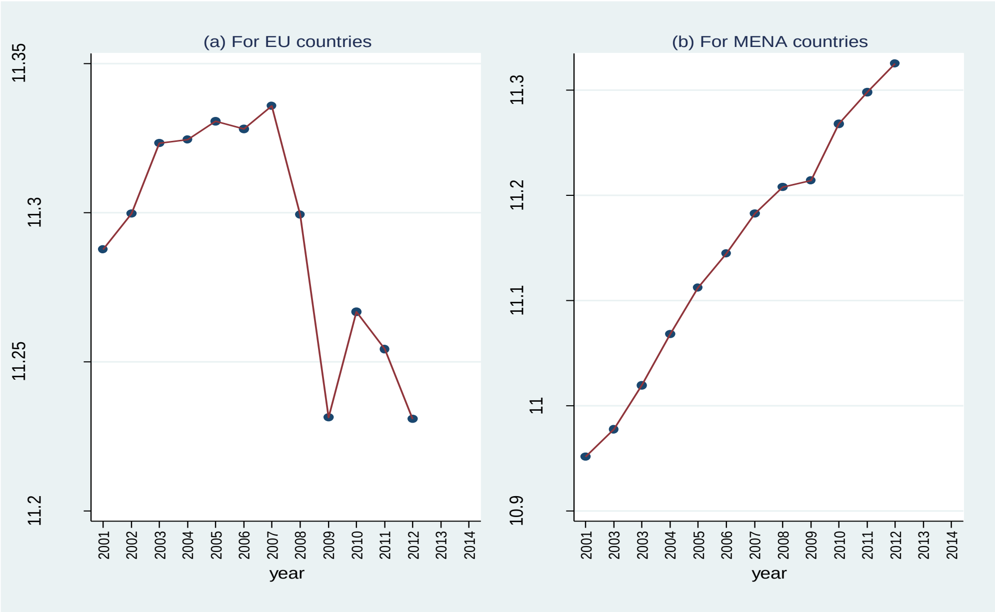
Source: Constructed by the authors using data from the Yale Center for Environmental Law and Policy (YCELP), online, 2016.

Figure (2): The evolution of agriculture policy score in EU and MENA from 2001 to 2014



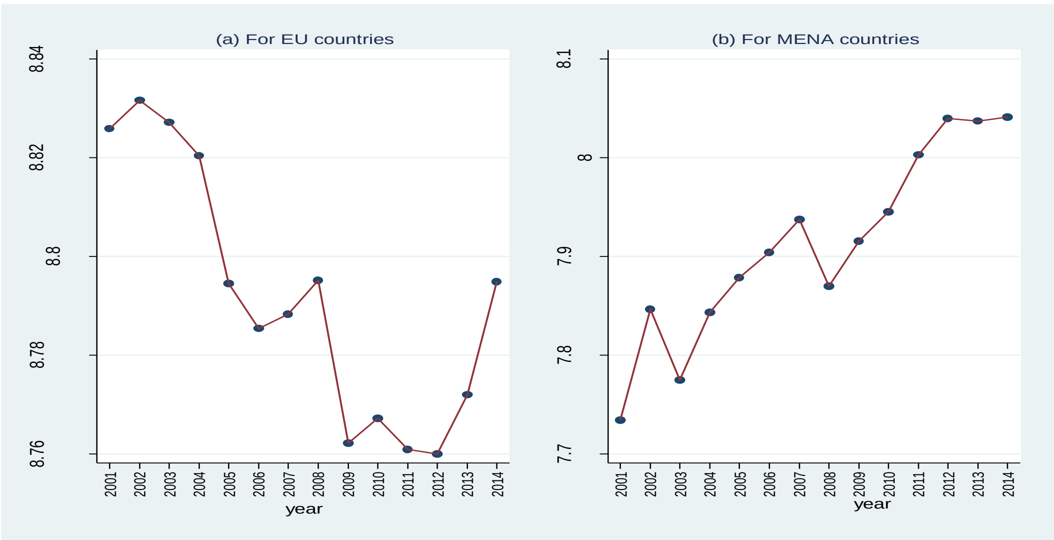
Source: Constructed by the authors using data from YCELP, online, 2016.

Figure (3): The evolution of GHG emission levels in EU and MENA from 2001 to 2014



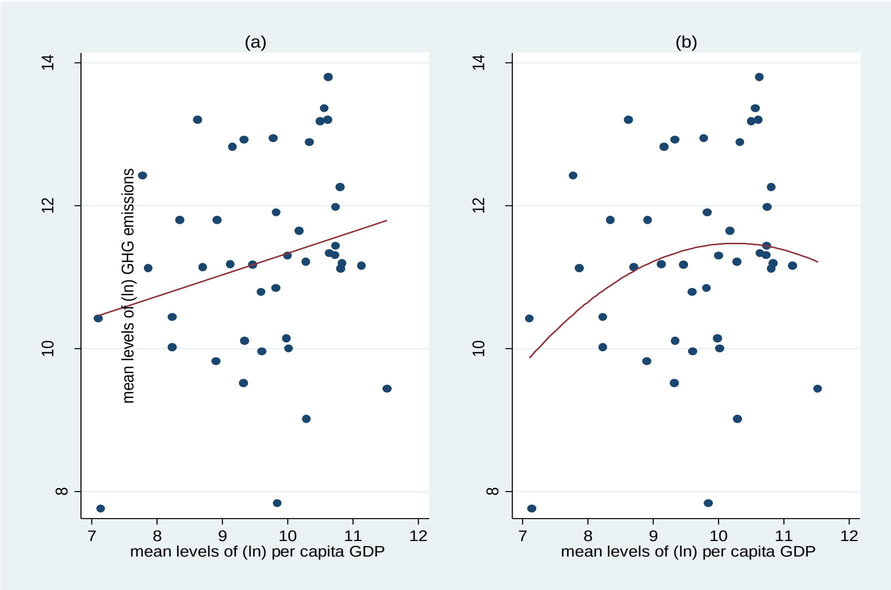
Source: Constructed by the authors using data obtained from World Development Indicators (WDI), online, 2016.

Figure (4): The evolution of agriculture emission levels in EU and MENA from 2002 to 2014



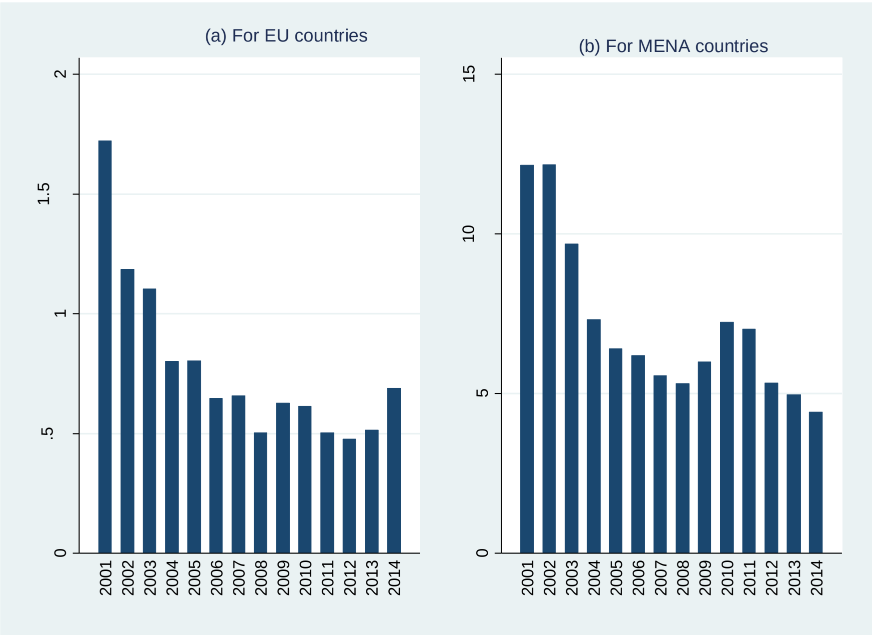
Source: Constructed by the authors using data obtained from FAO Statistics Division, online, 2016.

Figure (5): Relationship between GHG emission levels, per capita GDP, and per capita GDP in its quadratic form



Source: Constructed by the authors using data obtained from WDI, online, 2016.

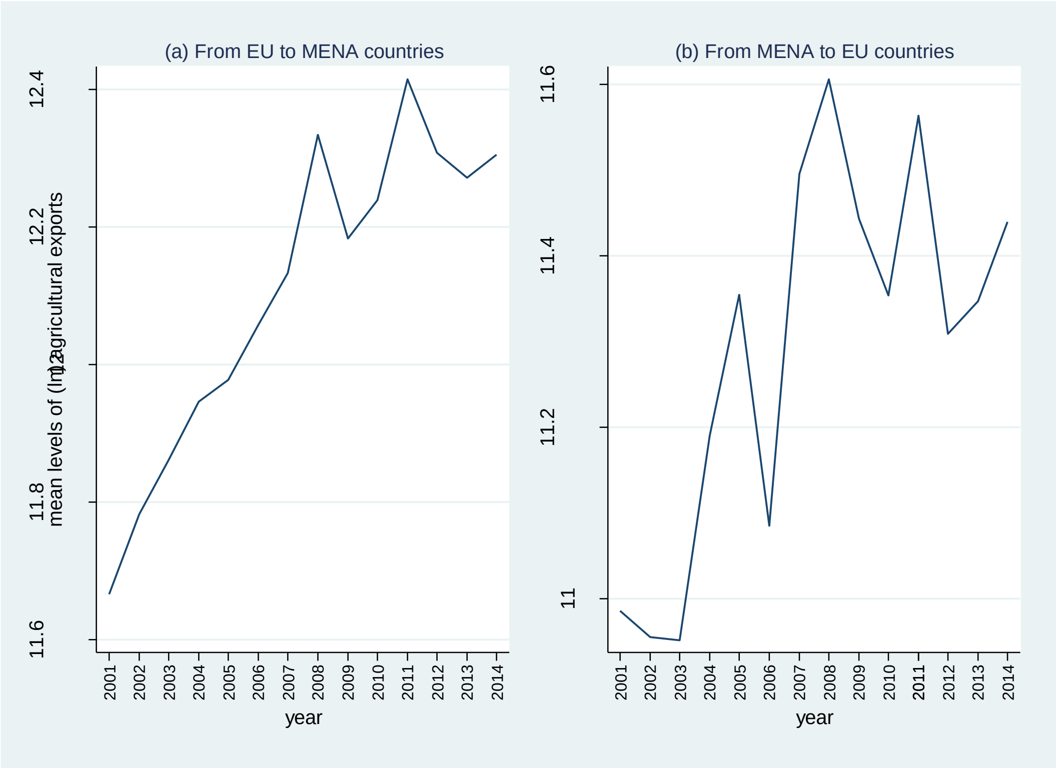
Figure (6): The mean levels of weighted average tariffs (%) applied by EU and MENA countries on primary products' imports from 2001 to 2014



Source: Constructed by the authors using data obtained from WDI, Online, 2017.

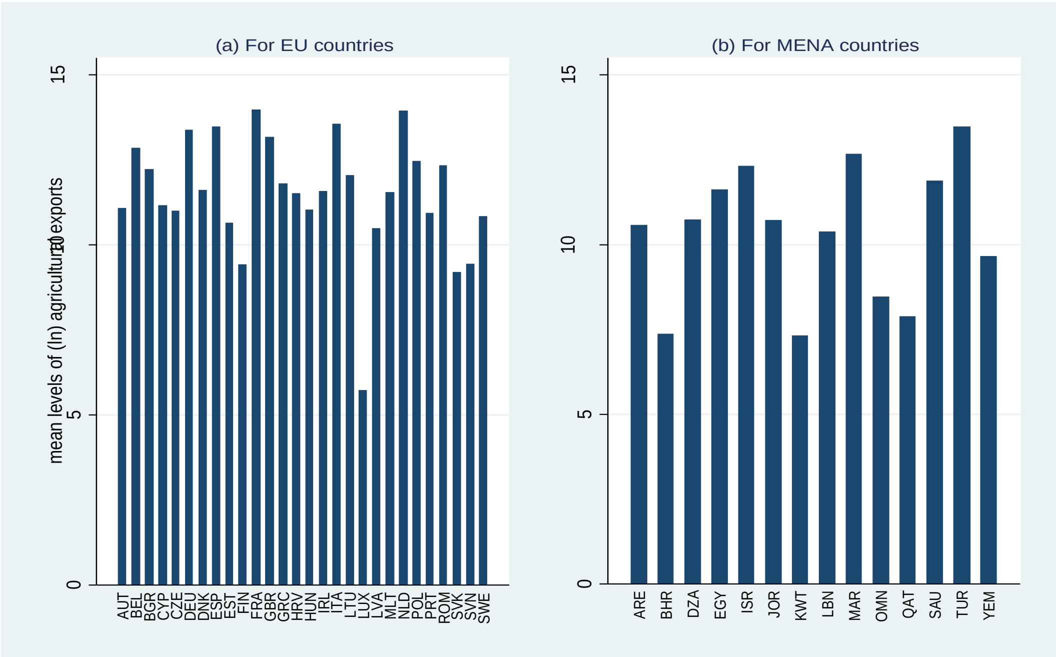
Notes: The average tariff rates of products are weighted by the country's own imports from the world in the same or nearest available year as tariff. The tariff rate for each product is itself a simple average rate of included tariff lines.

Figure (7): The evolution of bilateral agricultural exports between EU and MENA countries from 2001 to 2014



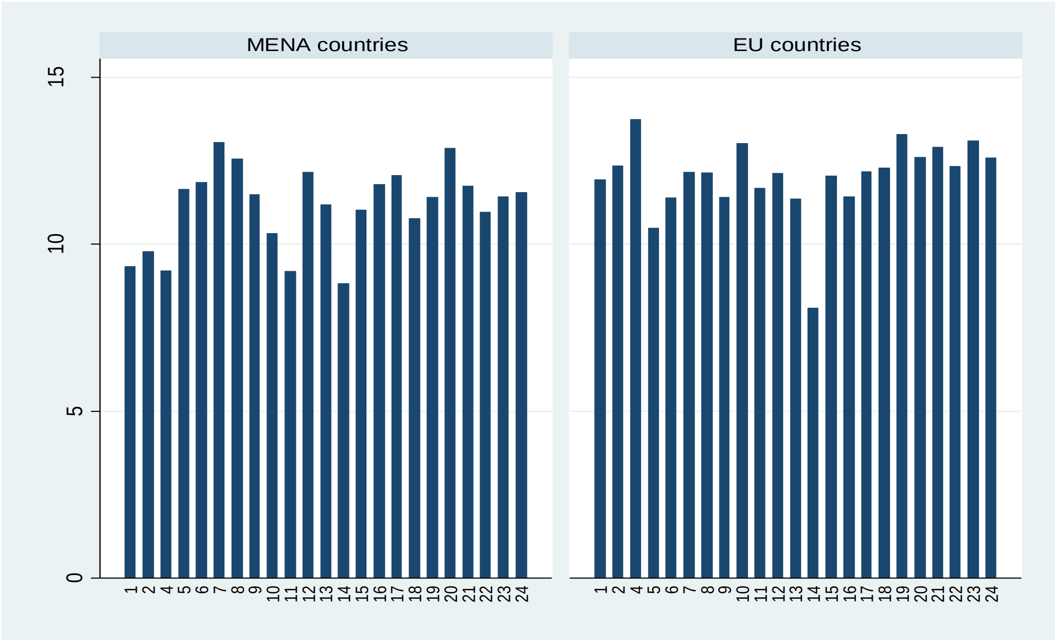
Source: Constructed by the authors using UN COMTRADE DATA, online, 2016.

Figure (8): The leading exporting EU and MENA countries in 2014



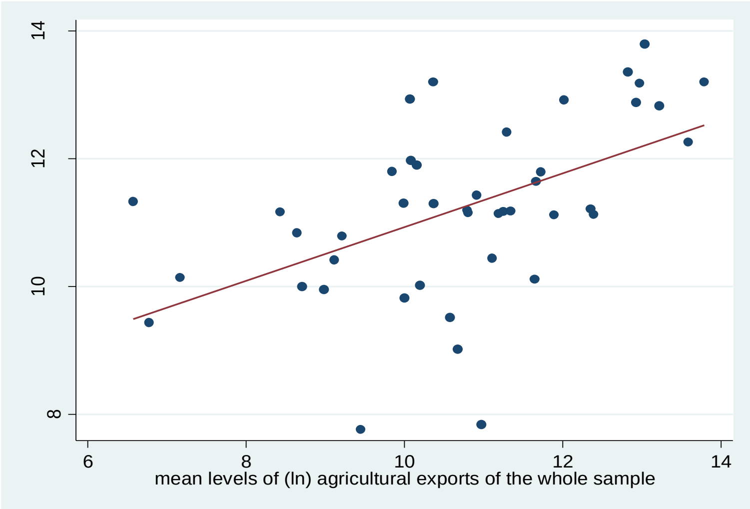
Source: Constructed by the authors using UN COM trade data, online, 2016.
Note: EU countries ISO refer to AUT: Austria; BEL: Belgium; BGR: Bulgaria; CZE: Czech Republic; DEU: Germany; DNK: Denmark; ESP: Spain; EST: Estonia; FIN: Finland, FRA: France; GBR: United Kingdom; GRC: Greece; HRV: Croatia; HUN: Hungary; IRL: Ireland; ITA: Italy; LTU: Lithuania; LUX: Luxembourg; LVA: Latvia; MLT: Malta; NLD: Netherlands; POL: Poland; PRT: Portugal; ROM: Romania; SVK: Slovakia, SVN: Slovenia; SWE: Sweden. MENA countries ISO refer to ARE: United Arab Emirates; BHR: Bahrain; DZA: Algeria; EGY: Egypt; ISR: Israel; JOR: Jordan; KWT: Kuwait; LBN: Lebanon; MAR: Morocco; OMN: Oman; QAT: Qatar; SAU: Saudi Arabia; TUR: Turkey; YEM: Yemen.

Figure (9): The main agricultural products exported by EU and MENA countries in 2014



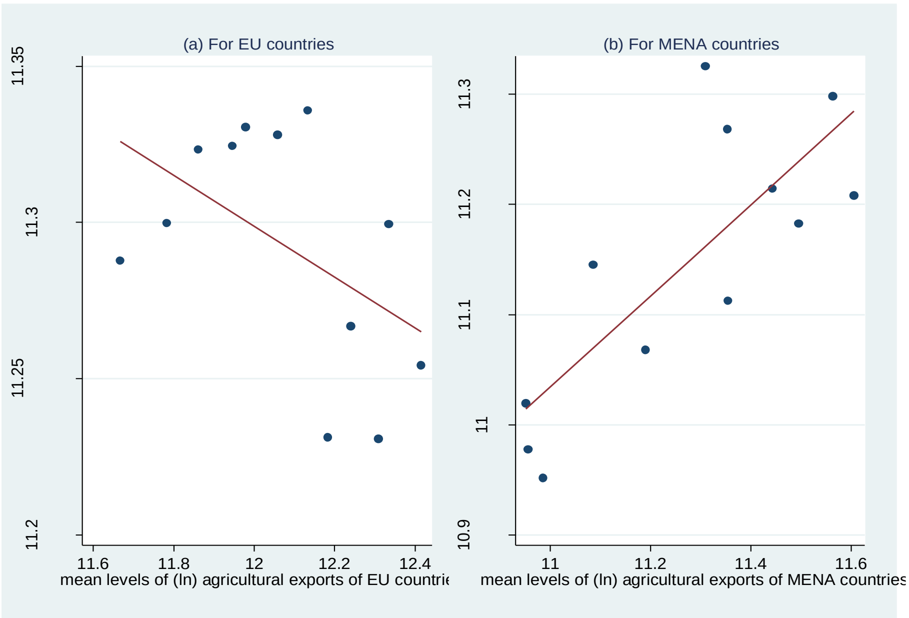
Source: constructed by the authors using UN COMTRADE data, online, 2016.
Note: Product codes refer to 1: Live animals; 2: Meat and edible meat offal; 4: Dairy products, eggs, honey, edible animal product nes; 5: Products of animal origin, nes; 6: Live trees, plants, bulbs, roots, cut flowers etc; 7: Edible vegetables and certain roots and tubers; 8: Edible fruit, nuts, peel of citrus fruit, melons; 9: Coffee, tea, mate and spices; 10: Cereals; 11: Milling products, malt, starches, inulin, wheat gluten; 12: Oil seed, oleagic fruits, grain, seed, fruit, etc, nes; 13: Lac, gums, resins, vegetable saps and extracts nes; 14: Vegetable plaiting materials, vegetable products nes; 15: Animal, vegetable fats and oils, cleavage products, etc; 16: Meat, fish and seafood food preparations nes; 17: Sugars and sugar confectionery; 18: Cocoa and cocoa preparations; 19: Cereal, flour, starch, milk preparations and products; 20: Vegetable, fruit, nut, etc food preparations; 21: Miscellaneous edible preparations; 22: Beverages, spirits and vinegar; 23: Residues, wastes of food industry, animal fodder; 24: Tobacco and manufactured tobacco substitutes.

Figure (10): Relationship between GHG emission levels and agricultural exports for the whole sample



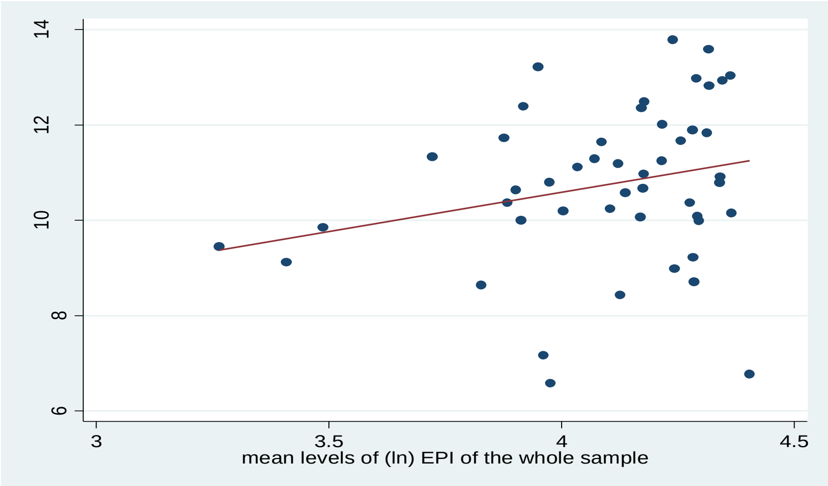
Source: Constructed by the authors using UN COM trade data, online, 2016; and WDI data, online, 2016.

Figure (11): Relationship between agricultural exports and agricultural emission levels in MENA countries



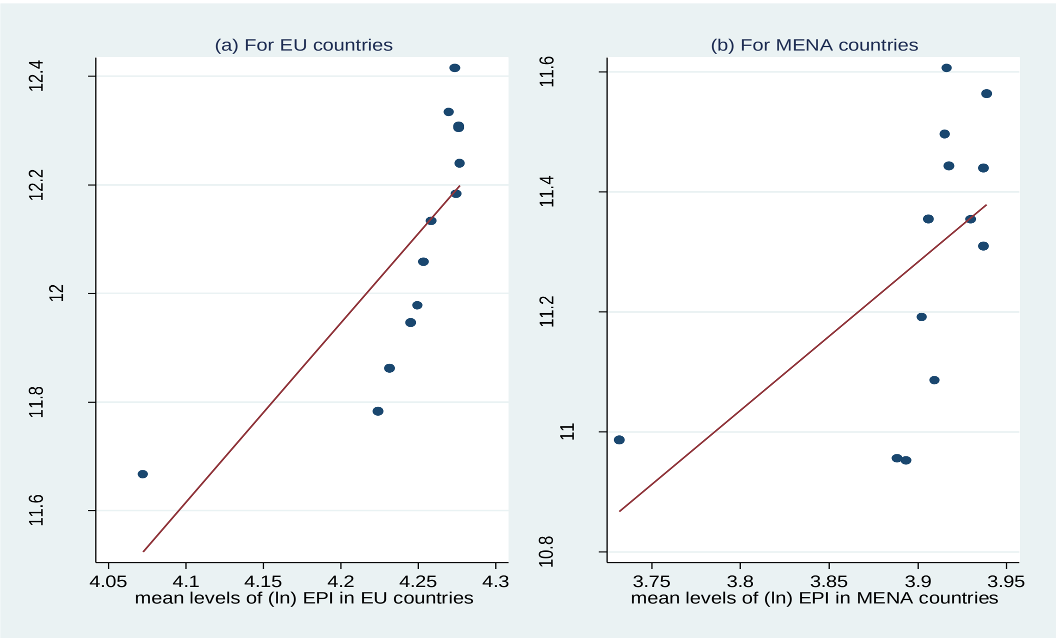
Source: Constructed by the authors using UN COM trade data, online, 2016; WDI data, online, 2016.

Figure (12): Relationship between EPI and agricultural exports for the whole sample



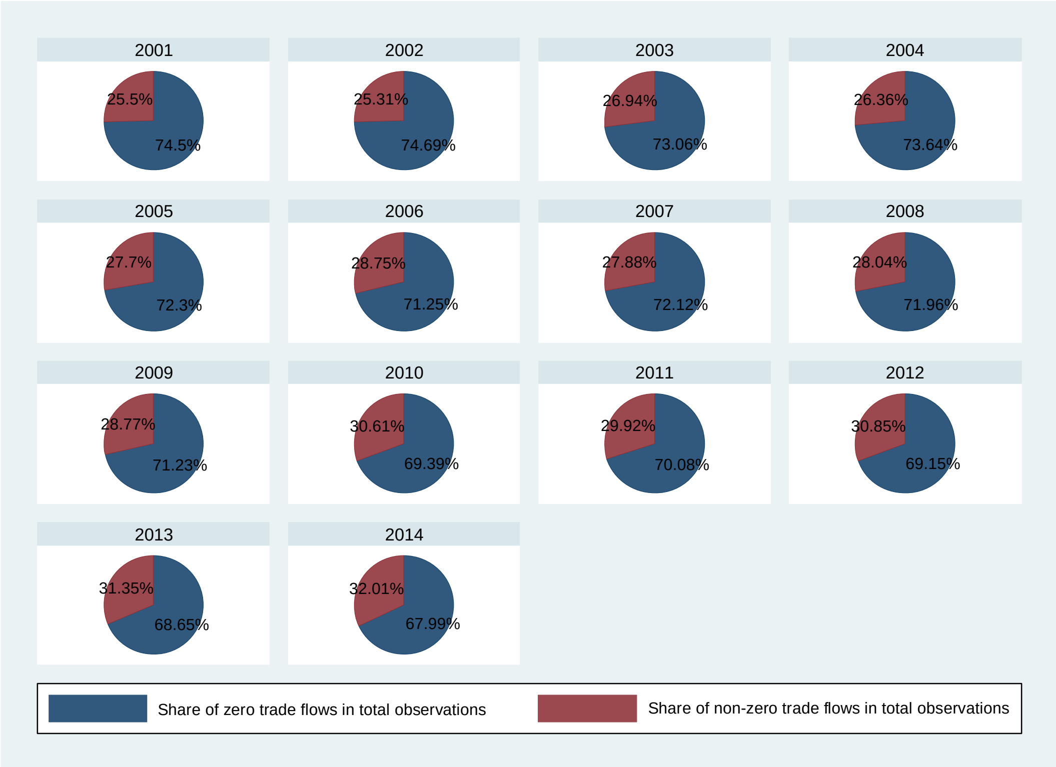
Source: Constructed by the authors using UN COM trade data, online, 2016; and EPI data obtained from YCELP, online 2016.

Figure (13): Relationship between EPI and agricultural exports in EU and MENA countries



Source: Constructed by the authors using UN COM trade data, online, 2016; and EPI data obtained from YCELP, online, 2016.

Figure (14): The share of zero trade flows in bilateral agricultural trade between EU and MENA countries by year



Source: Constructed by the authors using UN COM trade data, online, 2016

Table 1. Baseline Regressions with EPI and Agricultural Policy Index

	With EPI				With Agr. Pol. Index			
	Ln(Exp.)	P(Exp=0)	Ln(Exp.)	P(Exp=0)	Ln(Exp.)	P(Exp=0)	Ln(Exp.)	P(Exp=0)
Ln(Agr. Land)	0.395***		0.856***		0.391***		0.907***	
	(1.19e-05)		(0.000117)		(1.19e-05)		(0.000118)	
Ln(Agri. Mach.)	-0.0165***		0.0594***		-0.0328***		0.0742***	
	(1.05e-05)		(2.35e-05)		(1.08e-05)		(2.36e-05)	
Ln(Emp. Agr.)	-0.0577***		0.205***		-0.0160***		0.182***	
	(1.57e-05)		(3.95e-05)		(1.61e-05)		(3.97e-05)	
RD	0.423***				0.450***			
	(2.26e-05)				(2.31e-05)			
Ln(EPI exp.)		-0.467***		-1.288***				
		(0.0737)		(0.110)				
Ln(EPI imp.)		-1.756***		-2.017***				
		(0.0363)		(0.0660)				
RD*EPI exp		-0.141***						
		(0.00366)						
RD Agr.			-0.415***				-0.443***	
			(4.70e-05)				(4.74e-05)	
RD Agr.*EPI exp				-0.157***				
				(0.00726)				
Ln(Agr. Pol. Exp)						-0.573***		-0.133**
						(0.0370)		(0.0581)
Ln(Agr. Pol. Imp)						0.0168		0.0172
						(0.0108)		(0.0175)
RD*Ln(Agr. Pol. Exp)						-0.143***		
						(0.00330)		

RD Agr.*Ln(Agr. Pol. Exp)								-0.122***
								(0.00715)
Observations	66470	66470	32453	32453	65481	65481	31970	31970

Note: (i) Gravity controls and a constant term are included in the regressions. They are not reported here for the sake of brevity. See Appendix C1 for the whole table. (ii) Standard errors in parentheses. (iii) *** p<0.01, ** p<0.05, * p<0.1.

Table 2. Bilateral estimation results: EU exporters and MENA importers

	With EPI				With Agr. Pol. Index			
	Ln(Exp.)	P(Exp=0)	Ln(Exp.)	P(Exp=0)	Ln(Exp.)	P(Exp=0)	Ln(Exp.)	P(Exp=0)
Ln(Agr. Land)	0.974***		0.856***		0.997***		0.907***	
	(2.69e-05)		(0.000117)		(2.74e-05)		(0.000118)	
Ln(Agri. Mach.)	0.0355***		0.0594***		0.0159***		0.0742***	
	(1.10e-05)		(2.35e-05)		(1.13e-05)		(2.36e-05)	
Ln(Emp. Agr.)	-0.0250***		0.205***		0.0339***		0.182***	
	(1.60e-05)		(3.95e-05)		(1.66e-05)		(3.97e-05)	
RD	0.714***				0.776***			
	(2.64e-05)				(2.73e-05)			
Ln(EPI exp.)		-0.146*		-1.288***				
		(0.0763)		(0.110)				
Ln(EPI imp.)		-1.703***		-2.017***				
		(0.0389)		(0.0660)				
RD*EPI exp		-0.160***						
		(0.00395)						
Ln(Agr. Pol. Exp)						-0.155***		-0.133**
						(0.0415)		(0.0581)
Ln(Agr. Pol. Imp)						0.0206*		0.0172
						(0.0110)		(0.0175)

RD*Ln(Agr. Pol. Exp)						-0.173***		
						(0.00368)		
RD Agr			-0.415***				-0.443***	
			(4.70e-05)				(4.74e-05)	
RD Agr*EPI exp				-0.157***				
				(0.00726)				
RD Agr*Ln(Agr. Pol. Exp)								-0.122***
								(0.00715)
Observations	60030	60030	32453	32453	59041	59041	31970	31970

Note: (i) Gravity controls and a constant term are included in the regressions. They are not reported here for the sake of brevity. See Appendix C2 for the whole table. (ii) Standard errors in parentheses. (iii) *** p<0.01, ** p<0.05, * p<0.1.

Table 3. Bilateral estimation results: MENA exporters and EU importers

	Ln(Exp.)	P(Exp=0)	Ln(Exp.)	P(Exp=0)
Ln(Agr. Land)	-10.12***		-10.12***	
	(0.00820)		(0.00820)	
Ln(Agri. Mach.)	0.188***		0.188***	
	(0.000975)		(0.000975)	
Ln(Emp. Agr.)	-4.108***		-4.108***	
	(0.00330)		(0.00330)	
RD	1.608***		1.608***	
	(0.000741)		(0.000741)	
Ln(EPI exp.)		-11.07***		
		(0.472)		
Ln(EPI imp.)		-1.559***		
		(0.262)		
RD*EPI exp		0.138***		
		(0.0182)		
Ln(Agr. Pol. Exp)				-36.99***
				(1.571)
Ln(Agr. Pol. Imp)				-0.235**
				(0.105)
RD*Ln(Agr. Pol. Exp)				-0.401***
				(0.0241)
Observations	6440	6440	6440	6440

Note: (i) Gravity controls and a constant term are included in the regressions. They are not reported here for the sake of brevity. See Appendix C3 for the whole tables.

(ii) Standard errors in parentheses. (iii) *** p<0.01, ** p<0.05, * p<0.1.

Table 4a. Sectoral Regressions with EPI and RD

	1	2	4	6	7	8	10	15	17
	P(Exp=0)	P(Exp=0)	P(Exp=0)	P(Exp=0)	P(Exp=0)	P(Exp=0)	P(Exp=0)	P(Exp=0)	P(Exp=0)
Ln(EPI exp.)	-0.00661	1.777***	-1.337***	-0.826*	0.670*	0.573*	1.702***	0.312	-1.386***
	(0.376)	(0.425)	(0.332)	(0.422)	(0.353)	(0.344)	(0.355)	(0.355)	(0.341)
Ln(EPI imp.)	-2.548***	-1.806***	-1.171***	-2.376***	-2.830***	-2.606***	-1.650***	-1.326***	-2.165***
	(0.202)	(0.219)	(0.151)	(0.222)	(0.197)	(0.188)	(0.183)	(0.169)	(0.168)
RD*EPI exp	-0.173***	-0.255***	-0.224***	-0.129***	-0.125***	-0.0231	-0.0411**	-0.232***	-0.165***
	(0.0187)	(0.0215)	(0.0175)	(0.0202)	(0.0179)	(0.0175)	(0.0183)	(0.0181)	(0.0172)
Observations	2890	2890	2890	2890	2890	2890	2890	2890	2890

Note: (i) Gravity controls and a constant term are included in the regressions. They are not reported here for the sake of brevity. (ii) Standard errors in parentheses. (iii) *** p<0.01, ** p<0.05, * p<0.1.

Table 4b. Sectoral Regressions with EPI and RD in Agriculture

	1	2	4	6	7	8	10	15	17
	P(Exp=0)	P(Exp=0)	P(Exp=0)	P(Exp=0)	P(Exp=0)	P(Exp=0)	P(Exp=0)	P(Exp=0)	P(Exp=0)
Ln(EPI exp.)	-2.885***	1.755***	-4.599***	-1.747**	-1.177**	0.915*	3.113***	1.161*	-3.543***
	(0.557)	(0.646)	(0.467)	(0.831)	(0.584)	(0.492)	(0.488)	(0.604)	(0.515)
Ln(EPI imp.)	-2.843***	-2.347***	-2.150***	-1.558***	-2.395***	-1.418***	-1.830***	-1.078***	-2.412***
	(0.340)	(0.458)	(0.243)	(0.475)	(0.367)	(0.296)	(0.306)	(0.362)	(0.289)
RD Agr.*EPI exp	-0.250***	-0.269***	-0.328***	-0.237***	-0.258***	-0.107***	-0.232***	-0.0927**	-0.146***
	(0.0355)	(0.0433)	(0.0337)	(0.0488)	(0.0376)	(0.0340)	(0.0342)	(0.0416)	(0.0326)
Observations	1411	1411	1411	1411	1411	1411	1411	1411	1411

Note: (i) Gravity controls and a constant term are included in the regressions. They are not reported here for the sake of brevity. (ii) Standard errors in parentheses. (iii) *** p<0.01, ** p<0.05, * p<0.1.

Table 5a. Sectoral Results with Agricultural Policy Score and RD

	1	2	4	6	7	8	10	15	17
	P(Exp=0)	P(Exp=0)	P(Exp=0)	P(Exp=0)	P(Exp=0)	P(Exp=0)	P(Exp=0)	P(Exp=0)	P(Exp=0)
Ln(Agr. Pol. Exp)	-0.697***	-0.262	-0.250	-1.669***	-1.664***	-1.440***	-1.129***	-0.616***	-0.719***
	(0.192)	(0.234)	(0.157)	(0.240)	(0.198)	(0.187)	(0.195)	(0.187)	(0.168)
Ln(Agr. Pol. Imp)	-0.0863	0.00398	-0.0302	0.00551	0.0302	0.0449	-0.143**	0.0439	0.0516
	(0.0558)	(0.0615)	(0.0501)	(0.0607)	(0.0522)	(0.0515)	(0.0593)	(0.0522)	(0.0494)
RD*Ln(Agr. Pol. Exp)	-0.151***	-0.195***	-0.256***	-0.168***	-0.107***	-0.0102	-0.000744	-0.221***	-0.192***
	(0.0166)	(0.0194)	(0.0160)	(0.0190)	(0.0163)	(0.0159)	(0.0169)	(0.0166)	(0.0154)
Observations	2847	2847	2847	2847	2847	2847	2847	2847	2847

Note: (i) Gravity controls and a constant term are included in the regressions. They are not reported here for the sake of brevity. (ii) Standard errors in parentheses. (iii) *** p<0.01, ** p<0.05, * p<0.1.

Table 5b. Sectoral Results with Agricultural Policy Score and RD in Agriculture

	1	2	4	6	7	8	10	15	17
	P(Exp=0)	P(Exp=0)	P(Exp=0)	P(Exp=0)	P(Exp=0)	P(Exp=0)	P(Exp=0)	P(Exp=0)	P(Exp=0)
Ln(Agr. Pol. Exp)	-0.0376	-0.266	-1.119***	0.989***	0.467*	0.442*	-1.063***	1.120***	-0.410
	(0.263)	(0.346)	(0.254)	(0.321)	(0.273)	(0.267)	(0.298)	(0.304)	(0.261)
Ln(Agr. Pol. Imp)	-0.113	-0.0975	-0.0759	-0.0581	0.0556	-0.0330	-0.172*	0.135	-0.0426
	(0.0859)	(0.120)	(0.0686)	(0.137)	(0.0907)	(0.0859)	(0.0907)	(0.100)	(0.0757)
RD Agr.*Ln(Agr. Pol. Exp)	-0.179***	-0.263***	-0.187***	-0.289***	-0.252***	-0.135***	-0.207***	-0.168***	-0.0635**
	(0.0336)	(0.0454)	(0.0300)	(0.0525)	(0.0383)	(0.0351)	(0.0342)	(0.0458)	(0.0302)
Observations	1390	1390	1390	1390	1390	1390	1390	1390	1390

Note: (i) Gravity controls and a constant term are included in the regressions. They are not reported here for the sake of brevity. (ii) Standard errors in parentheses. (iii) *** p<0.01, ** p<0.05, * p<0.1.

Table 6. Controlling for the endogeneity of Environmental variables

	With EPI				With Agr. Pol. Index			
	Ln(Exp.)	P(Exp=0)	Ln(Exp.)	P(Exp=0)	Ln(Exp.)	P(Exp=0)	Ln(Exp.)	P(Exp=0)
Ln(Agr. Land)	0.380***		0.952***		0.380***		0.952***	
	(1.23e-05)		(0.000124)		(1.23e-05)		(0.000124)	
Ln(Agri. Mach.)	0.00920***		0.0675***		0.00920***		0.0675***	
	(1.14e-05)		(2.52e-05)		(1.14e-05)		(2.52e-05)	
Ln(Emp. Agr.)	-0.0758***		0.204***		-0.0758***		0.204***	
	(1.74e-05)		(4.29e-05)		(1.74e-05)		(4.29e-05)	
RD	0.417***				0.417***			
	(2.42e-05)				(2.42e-05)			
Ln(EPI exp.)		-0.281**		-0.915***				
		(0.129)		(0.251)				
Ln(EPI imp.)		-1.480***		-1.357***				
		(0.0404)		(0.0672)				
RD*EPI exp		-0.123***						
		(0.00637)						
RD Agr.			-0.432***				-0.432***	
			(5.36e-05)				(5.36e-05)	
RD Agr.*EPI exp				-0.147***				
				(0.00912)				
Ln(Agr. Pol. Exp)						-0.227**		-1.831***
						(0.0996)		(0.223)
Ln(Agr. Pol. Imp)						-0.0238		-0.367***
						(0.0489)		(0.0819)
RD*Ln(Agr. Pol. Exp)						-0.125***		

						(0.00508)		
RD Agr.*Ln(Agr. Pol. Exp)								-0.120***
								(0.00792)
Observations	57362	57362	28405	28405	57362	57362	28405	28405

Note: (i) Gravity controls and a constant term are included in the regressions. They are not reported here for the sake of brevity. See Appendix C4 for the whole table. (ii) Standard errors in parentheses. (iii) *** p<0.01, ** p<0.05, * p<0.1.

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