# Natural resources endowment, international trade and convergence

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« Dotation en ressources naturelles, commerce international et convergence »

Sous la direction de **Monsieur Michel DUPUY**, Professeur

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# Dédicace

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# Abstract

In this thesis, we examine the effect of the unequal distribution of natural resources between countries on three main aspects. In chapter one, we empirically examine potential asymmetric effects of the accession of the World Trade Organization (WTO) across members, focusing specifically on the developing countries. The results suggest that membership in the WTO contributed to greater exports for all countries, except for non-emerging resource-rich countries. In contrast, emerging resource-rich countries are the greatest beneficiaries from the accession of the WTO. In chapter two, we empirically explore the impact of natural resource endowments on the gains of six Regional Trade Agreements (RTA) across members through three axes: complementarity between countries, diversification of resource-rich countries, and trade creation and diversion. We conclude that the complementarity between resource-rich and resource-poor countries has been achieved in the ECOWAS, SADC and CIS agreements. The results also indicate that in all RTAs, the resource-rich countries increased exports in non-natural resource sectors and thereby diversified their export structures, especially with regional partners. Moreover, in most RTAs, poor countries boosted their exports to resources-rich partners, while resource-rich countries suffer from trade diversion in terms of imports. In the last chapter, we study the impact of natural resource endowments on the process of convergence among PAFTA countries. First, the results demonstrate that sigma-convergence was only observable between 1970-1990 among PAFTA countries. The estimation reveals that natural resources are one of the main determinants of conditional convergence within PAFTA. Therefore, the asymmetry between countries in terms of natural resource endowment did not impede the convergence in PAFTA. Club convergence analysis identify three main clubs among PAFTA countries. In addition, the factors that determined clubs' formation are natural resources, quality of institutions, and investment. Further, an abundance of natural resources is alone not enough to be the best club, but must be accompanied by high-quality institutions.

**Keywords:** Natural resources, World Trade Organization (WTO), Regional Trade Agreements (RTA), Convergence, Pan Arab Free Trade Agreement (PAFTA)

# Résumé

Dans cette thèse, nous étudions l'effet de la répartition inégale des ressources naturelles entre les pays sur trois aspects principaux. Dans le premier chapitre, nous examinons empiriquement les effets asymétriques potentiels de l'adhésion à l'Organisation Mondiale du Commerce (OMC) entre les membres, en nous concentrant spécifiquement sur les pays en développement. Les résultats suggèrent que l'adhésion à l'OMC a contribué à l'augmentation des exportations de tous les pays, à l'exception des pays non-émergents riches en ressources. En revanche, les pays émergents riches en ressources sont les plus grands bénéficiaires de l'accession à l'OMC. Dans le deuxième chapitre, nous explorons empiriquement l'impact de la dotation en ressources naturelles sur les gains de six Accords Commerciaux Régionaux (ACR) entre les membres à travers trois axes : la complémentarité entre les pays, la diversification des pays riches en ressources ainsi que la création et le détournement des échanges. Nous concluons que la complémentarité entre les pays riches et les pays pauvres en ressources a été atteinte dans les accords de l'ECOWAS, du SADC et du CIS. Les résultats indiquent également que, dans tous les ACR, les pays riches en ressources ont accru leurs exportations hors secteurs des ressources naturelles et diversifié ainsi leurs structures d'exportation, en particulier avec les partenaires régionaux. En outre, dans la plupart des ACR, les pays pauvres ont accru leurs exportations vers leurs partenaires riches en ressources, tandis que ces derniers souffrent du détournement des échanges en termes d'importations. Dans le dernier chapitre, nous étudions l'impact de la dotation en ressources naturelles sur le processus de convergence entre les pays du PAFTA. Premièrement, les résultats démontrent que la sigma-convergence n'était observable qu'entre 1970 et 1990 dans les pays du PAFTA. De plus, l'estimation révèle que les ressources naturelles sont l'un des principaux déterminants de la convergence conditionnelle au sein du PAFTA. Par conséquent, l'asymétrie entre les pays en termes de dotation en ressources naturelles n'a pas empêché la convergence dans le PAFTA. L'analyse de la convergence des clubs a identifié trois principaux clubs parmi les pays du PAFTA. En outre, les facteurs qui ont déterminé la formation des clubs sont les ressources naturelles, la qualité des institutions et l'investissement. Par ailleurs, une abondance de ressources naturelles n'est pas suffisante pour être le meilleur club, mais doit être accompagnée d'institutions de qualité.

**Mots clés :** Ressources naturelles, Organisation mondiale du commerce (OMC), Accords Commerciaux Régionaux (ACR), Convergence, Zone panarabe de libre-échange (PAFTA)

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# General Introduction

The natural resources endowment and its effects on general economic aspects is one of the most important issues at both academic and political levels. In fact, they are indispensable inputs for production and also necessary for maintaining a high quality in standards of living. In recent years, the share of natural resources in world trade has increased from 15 percent to about 30 percent of world total trade between 1995 and 2015, see Figure (I.1). In addition, there are some regions in the world that heavily depend on natural resources such as: Africa, the Middle East and North Africa (MENA) and the Commonwealth of Independent States (CIS), see Figure (I.2). Indeed, the importance of natural resources in international trade and their role in economic growth and development process of many economies depends on several geographical and economic dimensions.

First, natural resources are unevenly distributed between countries. They are concentrated in small number of countries while others have limited domestic supplies. This disparity makes for profitable trading opportunity among countries. Therefore, international trade allows moving natural resource from abundant areas to poor areas and alleviating the disparity between them, (Fouquin and al. 2006)

Second, one important implication of the uneven distribution of natural resources between nations is the dominant position of this sector in many countries. Many natural resource producers depend totally on resource exports, where their exports tend to be highly concentrated in few products and trade can encourage over-specialization in resource extraction. Hence, this endowment of natural resources increased the contribution of mining and agriculture sectors in GDP in these countries. From sample of 200 countries over the period (1995-2015), there are about 80 countries that their share of natural resource in total exports is more than 40 per cent, about 70 countries that their concentration index is more than 0.40 and about 40 countries that the contribution of mining and agriculture in GDP is more than 20 per cent, see Table A.1 in appendix. These statistics reflect the importance of natural resource sectors in these economies. Therefore, it poses some policy challenges, in particular making difference between natural resources curse and their role in the development.

**Figure I. 1: Share of natural resource exports of total world exports, 1995-2015**

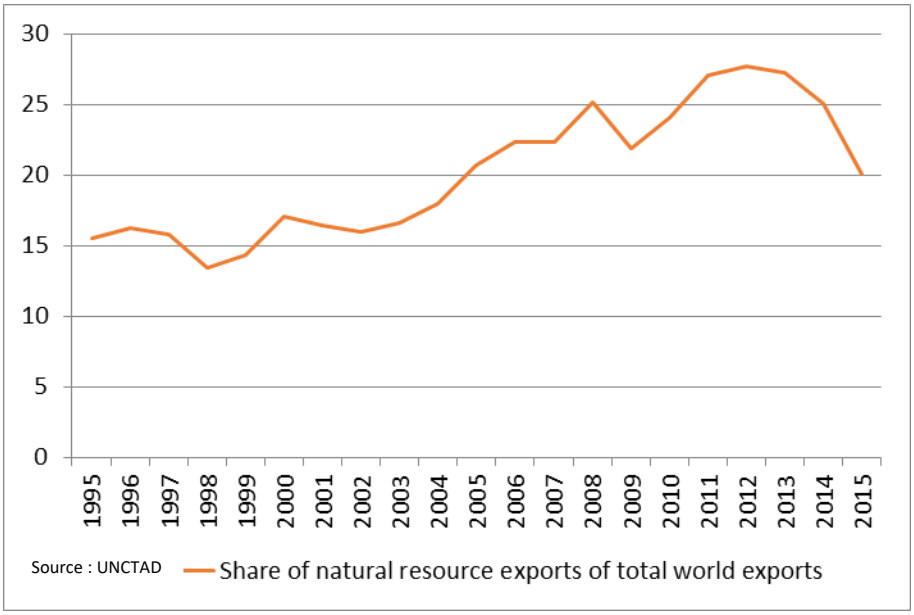
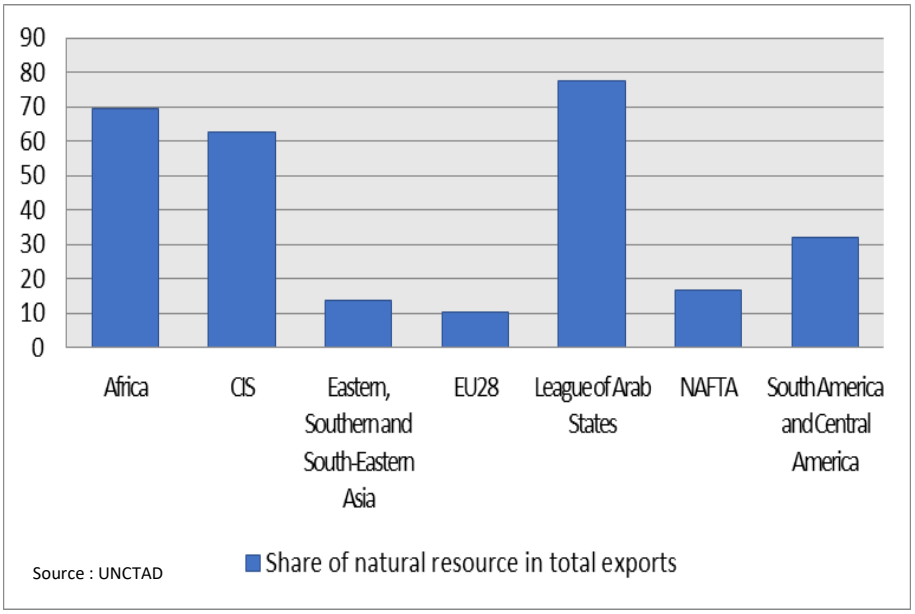



**Figure I. 2: Shares of natural resource by regions, 1995-2015 in average**




Third, natural resources provide a variety of products. We can distinguish between three main categories of natural resources, agricultural raw materials, minerals and fuel. There are several rationales for this distinction. At first, the impact of each type of natural resources on growth is different. In a study to what extent does the kind of endowment in natural resources have an impact on growth, Fouquin and al. (2006) show that there is a strong correlation between the kind of international specialization and growth. A simple

comparison between specialization structure and growth per head yields that the group of countries which show the strongest specialization in manufacturing reach the highest unweighted average annual GDP per head growth over the 1993-2003 period with 2.9%, followed by countries specialized in agriculture with 1.50%, then by those specialized in minerals with 1.47% and finally by oil-rich countries with the lowest average growth of 0.76%. According to the same study, dependency on resource exports varies according to the kind of commodity considered. It is very high for energy exporters: it ranges from more than 93% of total exports are made of energy in the case of Algeria to 32% for the sixteenth country of the sample called here the rest of sub-Saharan Africa, compare to a maximum of 21% for Papua New Guinea to 2% in Argentina for minerals and 54% to 12% for agricultural products specialization.[1] This manner of distinction is related also to the impact on the diversification in manufacturing industries. For instance, in an empirical study of 73 countries from 1962 to 2000, Fuentes & Alvarez (2006) show that the mineral-abundant countries are unlikely to ever become net exporters of relatively capital-intensive goods. This is because of the combination of capital scarcity, mineral abundance and high world prices for primary mineral commodities. Most mineral-abundant countries are characterized by a relatively low capital-labour ratio and a capital-intensive mining sector. Given this situation, a relatively high price for the mining good implies that it is always produced, thereby taking up the extra capital accumulated by these countries.

Fourth, the fluctuation of prices in the global market is one of the most important characteristics of natural resources commodities compared to other goods. This fluctuation of prices is a source of uncertainty that adversely affects investment and production decisions. According to International Monetary Fund (IMF), the average annualized of price volatility for fuels is 24.83 % and the prices jumped 230% during the period 2000-2014. Prices for minerals and metals have also dramatically fluctuated in recent years, its average volatility is up to 17.25% and the prices of mining products rose 161% for the same period. Price volatility for agricultural raw materials is much less than for other types of natural resources, prices advanced at the relatively modest rates of 41 %, and the average price volatility is less than the fuel and minerals which is 10.88%. Concerning food and Beverage products, their prices have increased about 112 %, and the price volatility is less than others, it is up to 10.63%, see Table I.1. In addition, volatility in the price of natural resources has long been considered a problem for countries that are heavily reliant on

[11] Other studies like Auty (1997), Isham (2001), Isham et al. (2005) and Boschini et al. (2007) state that the types of natural resources available in a country determine its rate of economic growth.

commodity exports. According to the study of Fouquin and al. (2006), there are also large differences in growth volatility that is measured by the standard deviation on GDP growth applied to the different categories of countries. They note that the volatility of economic growth in countries specialized in energy up to 6.6%, while it is up to 5.2% for countries who are specializing in minerals, and agricultural countries, where the standard deviation on GDP growth is 3.6%. While manufacturing specialization coincides with the high diversity of products, which reduces volatility, with just 2.9%. Because of the high number of producers and intensive competition that puts a break on price hikes. Volatility in the price of natural resources is also a concern for countries that are heavily reliant on imports of these products. This has especially been the case for oil, due to its prominence as an input into production in virtually every sector.

**Table I. 1: Average annualized volatility and of primary commodity prices (2000-2014)**

| | Food and Beverage | Agricultural Raw Materials | Metals | Energy |
|---|---|---|---|---|
| Average Annualized Volatility | 10,63% | 10,80% | 17,25% | 24,83% |
| Rate of change | 112,48% | 41.04% | 161.78% | 230.52% |

Source: IMF Primary Commodity Prices
Author's calculations

The last characteristic of natural resource goods is the low applied tariff. Table I.2 shows that the applied tariff in the natural resource sectors is generally lower than total products and then manufacturing and food sectors.

**Table I. 2: Simple average applied tariff rates for different sectors, 2005 and 2015**

| | Total Trade | Agricultural raw materials | Fuels | Minerals | Manufactured goods | Food items |
|---|---|---|---|---|---|---|
| 2005 | 10.20 | 6.33 | 5.86 | 5.98 | 9.74 | 16.49 |
| 2015 | 8.95 | 5.78 | 4.90 | 5.78 | 8.46 | 8.46 |

Source: World integrated Trade Solutions (WITS)
Calculated by Author

These economic and geographical features of natural resources, especially their uneven distribution across economies, plays an important part in explaining international trade. Traditional trade theory emphasizes that differences in factor endowments induce countries to specialize, and to export certain goods or services where they have a comparative advantage. This fosters a more efficient allocation of resources, leading to an increase in global social welfare – the "gains from trade". Relative differences in countries' resource endowments are key to the standard version of the Heckscher-Ohlin theory of international trade. Hence, endowments of immobile and scarce natural resources may

form a source of comparative advantage that guides the pattern of international trade. Consistent with this theory, Leamer (1984) finds that the relative abundance of oil leads to net exports of crude oil and that coal and mineral abundance leads to net exports of raw materials. Trefler (1995) finds similar results with respect to trade in resource-intensive goods. This includes cases in which the natural resource is directly exported (after a minimal amount of processing), rather than being used as an input in another good that is later sold in international markets.

The Heckscher-Ohlin theory has been modified and extended by introducing other factors besides resource endowments, such as transportation costs, economies of scale and government policy, that also influence comparative advantage. Complementary inputs, such as technology, capital and skilled labor, are also significant when a natural resource sector is characterized by difficult or technically complex extraction processes.

Recent empirical literature finds support for traditional theory. However, it also suggests that only when other determinants of comparative advantage – such as infrastructure, schooling and institutional quality – are in place does the resource-abundant country reap the full benefits of exchanging its resources with countries that have relatively high endowments of capital and skilled labor and import capital-intensive goods in return. Variables such as education, infrastructure and institutions have also been observed to affect sectoral patterns of natural resources trade (Lederman and Xu, 2007). Only when these other determinants of comparative advantage are in place will a resource-abundant country tend to export resources to countries with a relative abundance in capital and skilled labour and import capital-intensive goods in return (Davis, 2010). In short, natural resource endowments may represent a necessary but not sufficient condition for the production and export of resources or resource-intensive goods.

On the other hand, low tariffs on natural resources has an impact on traditional trade policy instruments. According to the literature, the more tariffs are higher; more benefits will be generated from the removal or reduction of tariffs. While the use of tariffs is less prevalent in natural resource sectors than in other goods markets, using other trade policy instruments is more frequently. These policies principally consist of export taxes, quotas and prohibitions; import tariffs; non-tariff measures; and subsidies. However, the motivations and effects of policy interventions may differ in certain ways on account of the particular characteristics of natural resource markets.

For natural resource exporters, export taxes or restrictions can serve several purposes. They can increase the rents received by the exporting country through an improvement in

its terms of trade. Where resource-exporting countries face problems of open access, they can also help to address the over-exploitation of the resource. They can assist countries facing volatile commodity markets to stabilize producer revenues. Export taxes on a natural resource reduce the domestic price of the product in question. This can help to soften the impact of rapidly rising world prices in the domestic market, thus protecting local consumers. Export taxes have also been used to avoid deindustrialization (the so-called Dutch disease) and to promote infant industries or diversification. Since natural resources are used as inputs in many higher value-added industries, export taxes can work as an indirect subsidy to manufacturing by reducing the price of resource inputs. Finally, they can form part of a response by natural resource exporters to tariff escalation in their trade partners' markets.

For resource-importing countries, import tariffs can help "capture" some of the rents earned by exporters with market power. A tariff imposed by the resource-importing country will reduce foreign demand for the resource and so mitigate, to some extent, problems of over-harvesting and help to conserve the resource stock. Faced with "Dutch disease", industries that have been adversely affected by a boom in the natural resources sector can be partly sheltered by being given some degree of import protection through tariffs. Even if the immediate effect of a tariff is to increase the domestic price in the importing country, rigidity in supply means that the burden of the tariff will eventually fall on the exporter. The export price will fall to the point where the tariff-inclusive price in the importing country is equal to the price prevailing before the introduction of the tariff.

Subsidies can have rent-shifting and beggar thy neighbour effects, but they may also be used to address legitimate policy objectives. Economic theory generally supports the use of subsidies in case of market failures. A well-known case is that of "green" subsidies. Subsidies to natural resource industries, such as fisheries, will worsen the exploitation of stocks that already suffer from open access. Everything depends on what subsidies governments are deploying, and whether they are responding to public welfare concerns or pressures from narrow interest groups.

Another implication of the uneven distribution of natural resource between countries is that they often represent a disproportionate share of economic production and exports in certain countries. Countries in which natural resources dominate the economy run greater risks of suffering from the resource curse if trade merely intensifies resource dependency. It is often claimed that an increase in revenues from natural resources can deindustrialize

a nation's economy by raising the real exchange rate and thus rendering the manufacturing sector less competitive. This tendency towards deindustrialization has been called the "Dutch disease". Indeed, this type of deindustrialization can be direct or indirect. It is direct when production shifts from manufacturing to the natural resources sector, and indirect when additional spending caused by the increase in natural resource revenues results in a further appreciation of the real exchange rate. However, trade may also offer opportunities for diversification of the production base and therefore reduce dominance. The latter effect will depend largely on whether governments pursue relevant supporting policies for diversification.

Views have differed over the years as to whether natural resources are a "blessing" or a "curse" for economic development. Many economists have seen natural resource endowments as key to countries' comparative advantage and critical to economic growth, while others have argued that dependency on natural resource exports can trap countries in a state of under-development. The empirical literature does not reach a consensus on whether natural resource abundance leads to slower or faster growth. Earlier studies identified a negative relation between growth and resource dependency, even after taking into account a large number of other possible determinants of slow growth, such as terms of trade changes, investment activity and institutional quality, see (Sachs and Warner, 1995; Gylfason et al., 1999; Torvik, 2001, 2009; Mehlum et al., 2006a & 2006b; Rajan and Subramanian, 2011; Raveh, 2013). More recent empirical contributions have criticized the finding that natural resource abundance is a curse, arguing that natural resource dominance can have zero or even positive effects on growth if abundance is correctly measured (Lederman and Maloney, 2007; Rambaldi et al. (2006) and Brunnschweiler and Bulte (2008)), additional variables that correlate with resource abundance are taken into account (Manzano and Rigobon, 2001; Davis, 2008) and depletion of the resource over the sample period is factored into the assessment (Davis, 2006; and Alexeev and Conrad, 2009).

These economic and geographical features of natural resources, especially their uneven distribution across economies, affect two issues. First, the potential gains from the regulation of international trade. The second issue consists on the economic convergence between countries. In fact, there two forms of international trade regulation; one is multilateral ruled by World Trade Organization (WTO), and the other is bilateral or plurilateral in the form of Regional Trade Agreements (RTA). Next, we will provide the

linkages between the abundance of natural resources and the WTO, the regional integration and convergence.

The WTO has 164 members, representing about 98% of international trade and it has two main objectives. First, it aims to promote international trade by removing the tariff barriers imposed between countries. Second, it engages to resolve trade disputes between member countries. However, the impact of the WTO on international trade is a question that is not yet settled at the academic level. Some studies found that the accession to WTO does not contribute to increase the international trade between countries. Thus, there are other factors that determine global trade flows between nations. In contrast, others studies were able to prove that the WTO contributed to promote trade between members. Academic studies have also raised the question of the asymmetry in the impact of the WTO on developed and developing countries. There is also no unified view on this subject, some studies have found that developed countries benefit more from WTO accession than developing countries, while others have found the opposite.

The International Monetary Fund (IMF, 2015), classified 34 countries as developed countries and the rest as developing economies. These latter are not homogenous in several dimensions. However, we principally focus on two. First, developing countries are heterogeneous in terms of the growth of markets, where IMF (2015) classified 23 countries as emerging countries. This implies that there are developing countries which are characterized by emerging markets while others are not. In addition, they are dissimilar in terms of their economic structures depending on the natural resources endowment. This presuppose that there are natural resource-rich countries and natural resource-poor countries. Besides, they are not homogeneous in terms of the growth of markets.

The share of developing countries in international trade has increased in recent decades. Furthermore, accession to the WTO has become one of the most important objectives of these countries in order to increase the gains from international trade. Nevertheless, this heterogeneity between developing countries, in terms of economic structures, makes the gains from the accession to the WTO a debatable issue. Based on previous studies in the literature, our interest is to continue the research about WTO effects on developing countries within the framework of natural resources endowment. Therefore, we hypothesize that there are potential asymmetric effects of WTO across resource-rich and resource-poor developing countries.

Another form of the international trade regulation is the Regional Trade agreements (RTA). They have dramatically increased over the past years. This reflects the rise of

regional blocs (regionalism) in the international economy. However, regional blocs among developing countries are characterized by a low level of intra-regional trade among member countries compared to their trade with the outside world.[1] Therefore, the interest of the subject is to investigate one of the reasons for the decline of intra-regional trade in some regional blocs, namely the inequitable distribution of natural resources between countries. Does the presence of different countries in terms of the abundance of natural resources affect the gains of regional integration? Or that there are other reasons for this decline in intra-regional trade. Economic literature investigated the effects of the regional integration from both theoretical and empirical perspectives. The latter documented that there are static effects measured by trade creation and trade diversion. Investigating these effects in the context of natural resources endowment is somewhat different. This is because, relative to manufactured goods, tariff and non-tariff barriers on natural resource commodities such as oil, natural gas, metals and minerals tend to be low (Carbaugh, 2007). Hence, the analysis of potential trade creation and trade diversion effects in a resource-abundant region will be a function of the extent of specialization of countries, in particular between natural resource-rich and natural resource-poor countries.

In order to understand the impact of natural resource endowment on the gains from the regional integration, we will provide the incentives and the disincentives for both resource-abundant countries and resource-poor countries to enter into a regional integration schema.

For resource-rich countries, they have some disincentives for establishing regional integration agreements. Fouquin et al. (2006) present some them. First, they will have few incentives to trade with each other, especially when they are abundant in same natural resource. Second, resource-rich countries are world market oriented, so the integration schemes especially between developing countries don't appear as major export markets for them. Third, resource-rich countries often suffer from trade diversion in manufacturing not only because their production structure traditionally lags behind that of the industrial centres in the schemes and is characterised by dualism. The main reason is that fluctuating world market prices often expose them to temporary Dutch disease shocks. Such shocks insert additional uncertainty into investment decisions, fuel currency overvaluation and resource rent appropriation, impede diversification efforts and bias the production structure of the countries concerned towards the primary sector. In some cases, resource-abundant countries are not interested in deeper integration or even cause trade

[1] See Table A.12 in the appendix.

policy disputes with their partners countries when they restricted their resource exports, officially to protect the natural capital stock and the environment but in fact in order to implicitly subsidies their domestic processing industries. Politically, the dependency of economies on the natural resource may shape the perception of policy-makers. They are often considered as a natural and strategic capital stock which should be at the exclusive disposal for national purposes and not be opened to access for member countries in an integration scheme. Finally, the resource rich country may suffer from a significant amount of trade diversion as the resource poor country benefiting from the preferential access can increase its exports to the resource rich country of manufacturing goods, hence the resource rich country substitutes imports from the relatively more efficient rest of the world towards the regional partner, (Venables, (2009)).

On the other hand, resource abundant countries have some incentives to enter into a regional integration agreement. They are principally provided in the report of WTO (2010). First, regional integration may actually help resource-abundant countries to diversify their export basket and break into the chain of global manufacturing production. Second, resource rich countries possibly concerned about the "resource curse," including the damage that large foreign exchange windfalls might inflict on other sectors of their economies. This true with the economies which are labor constrained, where further resource earnings accumulated as foreign assets. For example, a resource boom often leads to inflation in the construction sector as supply bottlenecks are encountered. More generally, spending from resource revenues will be met by a combination of increased output and crowding out of other expenditures. But the economy has hit full employment, so no more labor is available to produce further income. In this case, regional integration appears to be a way of solving the problem. In fact, there are other channels for spreading integration benefits — notably migration. Regional integration allows the resource-rich country to import more labor from neighbor labor abundant countries to meet further potential production, which in turn it helps to reduce the effects of "Dutch disease". Politically, resource abundance today is a major asset in forming political regional coalitions and may encourage specific countries to claim a driver seat of regional integration once they are prepared to shoulder some burden of partner countries. Third, regional trade agreements can contribute to reduce the effects of the volatility in the price of natural resources on resource-rich countries. This is by ensuring access to the resource supplies by regional partners when the prices decline.

For natural resource-poor countries, they have some incentives for establishing regional integration agreements in resource abundant region. First, regional integration enables them to earn foreign exchange via their exports to the resource-rich partner. The benefits arise as the prices of these regionally traded goods are bid up, raising wages and creating a terms of trade gain for the resource poor economy. Second, as they will benefit from privileged access to markets inside the agreement and will be able to import more natural resources from the resource rich country. Regional integration is therefore a powerful tool for spreading the benefits of resource wealth within the region, thus it creates incentives for resource-poor countries to enter into regional economic integrations. However, the existence of many resource-poor countries in the same region leads to increase the competition between them, and thus countries that are less competitive may suffer from trade diversion, (Venables, (2009))

From above analysis, according to the literature, we hypothesize that the gains from regional integration in resource rich regions are unevenly distributed between countries. This reflects the potential for conflicts of interest between resource-poor countries that seek to regional integration, and resource-rich countries that prefer non-preferential opening.

After examining its impact on the regional integration gains, the disparity between countries in terms of natural resources endowment raises another issue: the success of the economic convergence between integrated countries. In fact, one of natural resources-rich regions in the world is the Middle East and North Africa (MENA). This region has some economic and geographical characteristics that need to be put at the center of convergence analysis. First, natural resources, especially in fuel, are abundant in the region but unevenly allocated across countries. This implies that countries have different economic structures in terms of the dependency on the natural resources. Some countries heavily depend on natural resources, where the contribution of mining sector in GDP and the share of fuel exports of total exports are high. Others economies are not abundant in natural resources and depend on agricultural and manufacturing sectors. According to World Bank's classification (2008), the region consists of resource-poor, labor-abundant economies (Djibouti, the Arab Republic of Egypt, Jordan, Lebanon, Morocco, and Tunisia); resource-rich, labor-abundant economies (Algeria, the Islamic Republic of Iran, Iraq, the Syrian Arab Republic, and the Republic of Yemen); and resource-rich, labor-importing economies (Bahrain, Kuwait, Libya, Oman, Qatar, Saudi Arabia, and the United Arab

Emirates). Figures (from A.1 to A.4) in the appendix show this disparity between countries in terms of natural resources endowment.

However, the economy of the region has been heavily influenced by several factors, such as energy sources, and demographic and institutional characteristics. Over the last fifteen years, the growth performance of the MENA region as a whole, despite its natural resources richness, has been unsatisfactory and not in line with other developing countries. In comparison with other regions in the world, growth rates in the MENA countries have been remarkably volatile and lower than other regions in the world. This volatility is only partly due to political and social instability, to the wars or to the marked fluctuations in oil prices that have characterized the history over the last century.

On the other hand, MENA countries tend to establish several regional integration schemas between them. According to WTO, there are different intra-regional RTA in MENA region such as; Pan Arab Free Trade Agreement (PAFTA), The Gulf Cooperation Council (GCC) and AGADIR. However, PAFTA is considered as the largest regional integration schema in MENA region. It aims to create a free trade area agreement between Arab countries. It contains 18 of the 22 Arab League Member States. The agreement was signed on 19 February 1997 and entered into force on 1 January 1998. It was signed originally by Bahrain, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, United Arab Emirates and Yemen. Algeria and Palestinian and Authority of the West Bank and the Gaza Strip joined the agreement later and there are possible members in the future: Comoros, Djibouti, Somalia and Mauritania. Duties and other restrictive regulations of commerce on substantially all trade between the signatories had to be eliminated by 31 December 2007. However, duties have been eliminated as of 1 January 2005. In addition, most countries of PAFTA tend also to liberalize trade by joining the WTO. All member countries are members in the WTO except; Algeria, Iraq, Lebanon, Libya, Sudan and the Syrian Arab Republic.

These characteristics make the study of the issue of economic convergence in such region different. Our interest of the subject is to analyze convergence process between some MENA countries after 20 years from establishment of the PAFTA. Did this regional integration contribute to reinforce the convergence between Arab countries in the MENA? What are the factors of convergence between the PAFTA countries? Does the abundance of natural resources in certain countries contribute to convergence or it impedes it?

In general, the economic growth literature has considered three main concepts of convergence, namely σ-convergence, ß-convergence and club convergence. The first type

introduced by Barro and Sala-i-Martin (1991) refers to a process in which the dispersion of real income per capita among a group of economies tends to decrease over time. The concept of ß-convergence refers to a process in which poor regions grow faster than rich ones, such that the poor regions catch up to the rich ones in terms of the level of per capita income through time. This concept of convergence, introduced by Baumol (1986), is directly related to the neoclassical growth model (Solow 1956). Lastly, the term 'convergence club' was first introduced by Baumol (1986). A convergence club is a group of economies whose initial conditions are similar enough to converge towards the same long-term equilibrium for countries displaying similar structural characteristics.

Thus, we hypothesize that the natural resource endowment has impact on the process of convergence among member countries of PAFTA. The investigation of this hypothesis allows us to conclude three points. The first is to determine the role of natural resources as a factor of convergence between PAFTA countries. The second underlines the impact of the existence of dissimilar members, natural resource-rich countries and natural resource-poor countries, on the economic convergence among PAFTA countries. Finally, the effect of natural resources in the setting up of potential convergence clubs within PAFTA.

From above introduction, the aim of this thesis is to examine on the one hand, the effect of the unequal distribution of natural resources between countries on the gains from WTO and RTA membership, and on the convergence process in MENA on the other. Therefore, it consists of three main chapters.

In the first chapter, we empirically examine the impact of the WTO on member countries, especially developing countries, in the context of the natural resource endowment. However, developing countries are not homogenous in terms of their economic structures, which depend on the natural resources endowment, and their growth of markets. We follow tow-step procedures of analysis. Firstly, we classified our sample of countries, using cluster analysis and IMF classification, into 5 main categories; advanced countries, emerging natural resource-rich countries, non-emerging natural resource-rich countries, emerging natural resource-poor countries and non-emerging natural resource-poor countries. Secondly, we rely on the gravity model as an analysis tool, using dummy variables for each category, to quantify if there are asymmetric gains from the accession to the WTO on developing countries. This study is considered as an extension of the literature by studying the effects of the WTO on member countries.

The second chapter aims to investigate empirically the regional integration gains in terms of trade creation and trade diversion in natural resource-rich regions. We used also gravity

model approach with an extension of three different sets of RTA dummy variables for 6 regional integrations that are rich-based in natural resource. This approch is considered as a genuine instrument to explore trade creation and trade diversion effects in terms of both exports and imports. In this chapter, we follow a two steps-analysis. The first one aims to estimate a basic gravity model in order to explore the overall effects of the six RTAs. Then, in the second step, we provide further analytical specifications to estimate how the effects of regional integration are likely to be distributed across countries depending on the abundance of natural resources. We put forward an augmented gravity model, in the spirit of Carrère et al. (2012), and analyze how patterns of trade creation and trade diversion vary across bilateral pairs. The latter depends on whether the exporter or importer is a resource-rich or resource-poor country. This step of analysis allows us to discuss some major issues evoked in the literature: complementarity between countries with different economic structure, trade creation and trade diversion, diversification of production and export structures of natural resource-rich countries and the relationship with the rest of the world.

In the last chapter, the objective is to examine the issue of convergence in MENA region, in particular among PAFTA members. In general, the empirical literature on convergence in MENA region is still scarce as compared to other areas and their results are quite diverse. Our methodology consists on studying three concepts of convergence, namely σ-convergence, ß-convergence and club convergence. Beforehand, we examine the σ-convergence across PAFTA member countries. This step shows if the dispersion of real income per capita among a group of economies tends to decrease over time. Our second approach is to examine the conditional convergence within PAFTA member countries. This step has two main purposes. First, we investigate the factors of convergence, including natural resources endowment, between PAFTA member countries. Second purpose is the impact of the existence of both resource-rich countries and resource-poor countries on the convergence among PAFTA members. We use panel data approach following most empirical studies based on the system GMM estimator. Last approach is to investigate the presence of club convergence in PAFTA region. To tackle this issue, we propose a two-step procedure. First, we endogenously identify groups of countries that converge to the same steady state level using club clustering algorithm methodology proposed by Phillips and Sul (2007). Then, the potential formation of a club suggests that there might be common factors among a group of countries leading them to converge to a similar steady state. Hence, we estimate several ordered logit models and analyze which factors - including natural resource endowment - play a role in determining club membership.

# Chapter (1): Natural resources endowment and WTO

## 1.1 Introduction

Since its inception in 1995, it is widely believed that the International Trade Organization (WTO), and its predecessor the General Agreement on Tariff and Trade (GATT), enhance trading systems and promote global trade. The WTO states that: "*The WTO is the only international organization dealing with the global rules of trade between nations."* Further, it states that its *"…overriding objective is to help trade flow smoothly, freely, fairly and predictably*."[1] In fact, the WTO comprises 164 members representing about 98 percent of international trade. However, the International Monetary Fund (IMF) classified 34 countries as developed economies, and the rest as developing countries.[2] This shows the dissimilarity between member countries in terms of development level. Besides, the IMF classified some developing countries as emerging markets. This implies that they are not homogeneous in terms of the growth of markets also, where there are developing countries characterized by emerging markets while others are not. In addition, one of the main economic and geographical features of natural resources is the unequal distribution between nations, in particular between developing countries. Therefore, these latter are heterogeneous in terms of their economic structures depending on the natural resources endowment. This presupposes that there are developing countries that are rich in natural resources and others are poor.

The literature measuring the effects of GATT/WTO membership on trade flows has remarkably produced diverse results. Meanwhile, it principally focused on the asymmetric effect of GATT/WTO between industrialized and developing countries. Therefore, the objective of this chapter is to investigate the potential asymmetric effect of the WTO across countries, in particular between developing members. For this purpose, according to level of development, emerging market and natural resources endowment, we classified our sample of countries into 5 main categories: *developed countries, emerging natural resource-rich countries, non-emerging natural resource-rich countries, emerging natural resource-poor countries and non-emerging natural resource-poor countries*. Thus, this study is considered as an extension of previous studies on the effects of the GATT/WTO.[3]

[1] Taken from http://www.wto.org/english/thewto_e/whatis_e/inbrief_e/inbr00_e.htm.
[2] International Monetary Fund. (2015). World Economic Outlook: Adjusting to Lower Commodity Prices. Washington
[3] Henceforth we use GATT/WTO as a synonym for expressing the impact of both the General Agreement on Tariff and Trade (GATT) and World Trade Organization (WTO), while WTO as a synonym for the impact of World Trade Organization (WTO).

This chapter is structured as following. Section 2 reviews the literature related to the impact of GATT/WTO. Section 3 presents the methodology used in the analysis which is based principally on the gravity models. Section 4 discusses the estimations results. Finally, Section 5 concludes the chapter.

## 1.2 Literature review

Given that the multilateral trade liberalization has been one of the aims of the GATT/WTO, it seems reasonable to believe that the GATT and the WTO have had a major impact on world trade. This view was initially cast in doubt by Rose (2004) who found no evidence of GATT/WTO effects on bilateral trade flows. A considerable number of papers in recent years have addressed this issue attempting to solve this mystery. The subsequent studies have provided mixed results not only about the overall impact, but also on the channels through which the effect operates (the intensive and the extensive margins of trade),[1] and the potential asymmetries that may exist across groups of countries and periods.

In this section, we will review the previous studies on the effects of the GATT/WTO on the international trade. We categorize the studies according to their objectives. First, there are studies investigated the overall impact of the GATT/WTO on the trade flows. Second, others examined the impact of the GATT/WTO on the intensive and extensive margins of trade. In addition, some authors studied the impact of the organization on the international trade but at disaggregated level. There are also studies that examined the possible asymmetric impact of WTO across countries, especially between industrialized and developing countries. Finally, some studies found that the impact of the WTO varies from time to time.

### 1.2.1 Impact of WTO on global trade

With regard to the overall impact of the membership of the GATT/WTO on the international trade, the paper of Rose (2004) is considered as the initial examination of this issue. Using a gravity model based on a large panel dataset (178 countries over the period 1948–1999), he could not find significant positive effect of the GATT/WTO membership on trade flows. Later, Tomz et al. (2007) were the first that tried to comment

[1] We define the extensive margin as the number of varieties that are exported to each destination country, and the intensive margin as the average value of exports by variety, (Berthou and Fontagné, 2008).

on this unexpected conclusion. After updating Rose's dataset to include not only *de jure* but also *de facto* GATT/WTO membership, they concluded that the GATT/WTO substantially increased trade by 72% if both trading partners are GATT/WTO members and by 30% if only one participates. However, Rose (2004) and Tom et al. (2007) used average bilateral trade and ignoring the multilateral resistance terms.

Subramanian and Wei (2007) focused on several asymmetries in the GATT/WTO system utilizing a properly specified empirical framework that controls for multilateral resistance terms. Using bilateral import flows (unidirectional trade) from 1950 to 2000 at five-year intervals, they initially worsen the Rose results about the ineffectiveness of the GATT/WTO in increasing trade. They found that membership has significant negative effects on trade when membership in the GATT/WTO is undifferentiated across groups of countries: the average WTO members trade about 22% less than the average non-WTO members.

Eicher and Henn (2011) unified Rose (2004), Tomz et al. (2007) and Subramanian and Wei (2007) approaches with the aim of minimizing several potential omitted variable biases. Their framework controls comprehensively for three sources of omitted variable bias (multilateral resistance, unobserved bilateral heterogeneity and individual PTA trade effects). Using Subramanian and Wei (2007)'s dataset with some adjustments, they didn't find evidence of positive GATT/WTO trade effects. Moreover, they show that multilateral resistance controls are suffice to negate GATT/WTO trade effects, concluding that all previous approaches produce the result that GATT/WTO membership does not generate statistically significant trade effects.

In contrast, Chang and Lee (2011) re-examined the GATT/WTO membership effect on bilateral trade flows using nonparametric methods including pair-matching, permutation tests, and a Rosenbaum (2002) sensitivity analysis. Using Rose (2004) dataset, their results suggest that membership in the GATT/WTO has large trade promoting effects that are robust to several restricted matching criteria, alternative GATT/WTO indicators, non-random incidence of positive trade flows, inclusion of multilateral resistance terms and different matching methodologies.

Cheong et al. (2014) demonstrated that although accounting for multilateral resistance terms with country-year fixed effects can mitigate omitted variable bias, it creates a hitherto unnoticed multicollinearity problem that can lead to very different estimates with even very small changes in data coverage. The multicollinearity problem arises from the structural relationships between the two variables used throughout in the literature to

indicate whether one country (*One in*) or two (*Both in*) in the pair belongs to the GATT/WTO (with non-membership being the baseline) in the presence of exporter-time and importer-time fixed effects. With data for 210 countries over the period 1950–2000 at five-year intervals, the authors showed how the multicollinearity problem leads to fragile GATT/WTO effect estimates, concluding that to get precise estimates only the (*Both in)* dummy must be included. In particular, they found that joint GATT/WTO membership increases bilateral trade by 11%.

The papers above used only the observations with positive trade, losing important information for assessing the impact of GATT/WTO on trade. Herz and Wagner (2011a) allowed for zero trade flows using the fixed-effect Poisson maximum-likelihood estimator based on annual data that covers the period 1953–2006. Defining GATT/WTO membership on *de facto* rather that *de jure* accession, they found that GATT/WTO promotes trade among members by 86%, while trade between members and non-members is also fostered by around 40%. However, an important caveat of their article is that they didn't control for multilateral resistance terms.

Other papers addressed the problem of zeros with alternative approaches that are subject to more criticism. Roy (2011) estimated a theoretically consistent gravity equation that includes zero trade observations by adding a small positive constant to all import flows to allow for log-linearization of zero trade flows. Using data for the period 1950–2000 at five-year intervals, he didn't find evidence that GATT/WTO countries engage in significantly greater bilateral trade. Moreover, separate regressions for each decade reveal that formal membership in the GATT/WTO is never found to increase bilateral trade and even when the participation definition of Tomz et al. (2007) is considered.

Kohl and Trojanowska (2015) explored the effect of the different degrees of countries' involvement in the GATT/WTO on the volume of international trade, addressing the endogenous nature of trade policy in gravity equations with matching econometrics and including zero trade flows, analogously to Roy (2011), by recoding them from 0 to 1 when zero flows are explicitly considered in the analysis. For a panel data set covering the period 1960–2005 and 187 countries, they found that the effect is positive for trade between two WTO members while it is negative for trade with an outsider.

### 1.2.2 Impact of WTO on extensive and intensive margins of trade

Other studies addressed the impact of the GATT/WTO on the international trade through examining the channels impact; intensive and extensive margins of trade. Felbermayr and Kohler (2006) relied on the *Tobit* model to incorporate zero trade flows showing that the consideration of the extensive margin generates evidence of a positive trade effect from membership. Moreover, Helpman et al. (2008) used a two-stage estimation procedure to investigate the extensive and intensive margins of world trade, they found that the probability of trade increases by 15% if both countries belong to the GATT/WTO.

Liu (2009) used a fixed-effects Poisson Pseudo-maximum Likelihood (PPML) estimator to deal with the problem of zeros, which additionally allows for the likely presence of heteroskedastic residuals (in contrast with the *Tobit* model). He found, with annual data over the period 1948–2003, that the GATT/WTO membership boosts trade among members by 60% (21% through the extensive margin and 39% through the intensive margin) while trade with non-members is enhanced by 23% (15% through the extensive margin and 8% through the intensive margin).

Felbermayr and Kohler (2010) also accounted for the extensive margin of trade using a Poisson approach year-by-year and taking averages over four different time spans. Running Poisson Pseudo-maximum Likelihood (PPML) estimator (with and without zero trade observations), they found a strong variation across GATT/WTO periods but their broad conclusion is that "the extensive margin does not prove a powerful line of defense for WTO membership as a trade-promoting force".

Dutt et al. (2013) examined the effect of GATT/WTO membership on the product-level extensive and intensive margins of trade. Using 6-digit bilateral trade data over the period 1988–2006, they found that the impact of WTO is concentrated on the extensive product margin of trade, i.e. trade in goods that were not previously traded. In particular, in their preferred specification (with time-varying fixed effects and county-pair fixed effects), WTO membership increases the extensive margin of exports by 25% whereas it has a negative impact on the volume of already-traded goods, reducing the intensive margin by 7%.

Bista (2015) extended Dutt et al. (2013) work accounting for hetersoketasticity in trade data and zero trade flows using PPML estimator. Based on disaggregated import data at the product level for 175 countries over the period 1965–2005 at five-year intervals, he found a negative and statistically significant effect on total imports (both excluding and

including zeros). With regard the product-level trade margins, he found that, for both positive and zero trade flows, the effect of GATT/WTO membership on the extensive margin is negative whereas that for the intensive margin is not statistically significant.

### 1.2.3 Impact of WTO on disaggregated trade

Some studies examined the impact of the GATT/WTO on disaggregated bilateral trade and type of product. Subramanian and Wei (2007) indicated that the GATT/WTO boosts trade in less protected sectors, but not in agriculture and textile sectors.

Kim (2010) re-examined the Rose's (2004) conclusion using the same approach but with different source of data in order to disaggregate the bilateral trade. Therefore, bilateral trade data is extracted from the COMTRADE over the period 1962-1999 for 173 countries. This source of bilateral trade allows excluding agriculture, textile and oil trade from consideration. He found that the membership in GATT/WTO increased trade by approximately 30% for member countries.

Engelbrecht and Pearce (2007) employed Rose's (2004) approach using trade data disaggregated by 'factor intensity'. In a sample of 46 countries over the period 1965-1997, the results for total trade are similar to those reported by Rose (2004). In addition, the disaggregated estimates revealed that the GATT/WTO has had a positive and statistically significant impact on trade in capital-intensive commodities, but no statistically significant impact on trade in other commodities.

Grant and Boys (2011) investigated the impact of membership in the GATT/WTO on the agricultural and non-agricultural bilateral trade. Using a large panel that consists of 215 countries over the period 1980-2004, they found that the GATT/WTO membership facilitates a 33% increase in members' agricultural trade using the Rose (2004) model; a 161% increase using the framework of Subramanian and Wei (2007); and a 114% increase when correcting for sample selection bias and the extensive margin of trade. In other words, participation in the GATT/WTO approximately doubles members' agricultural trade.

Mujahid and Kalkuhl (2016) investigated whether regional trade agreements and WTO have increased food trade among the participant countries. They used a gravity model in a large panel data with bilateral food and total trade data that are derived from the COMTRADE via World Integrated Trade Solution (WITS). The database consists of 162 countries around the globe over the period 1991–2012 with three-year intervals. Authors

attempted to address some potential problems in the estimations including multilateral trade resistances, zero trade values and endogeneity. The results suggest that both the WTO and RTAs have delivered significant positive effects on trade among the participant countries, but not food. Only RTAs are found to have increased food trade among the participant countries.

### 1.2.4 Impact of WTO on industrialized and developing countries

Some of previous studies documented also the possible asymmetric effect of GATT/WTO across countries: in particular between industrialized and developing countries. Subramanian and Wei (2007) are the first who focused on the asymmetries in the GATT/WTO system. They found that the GATT/WTO boosts trade in industrialized countries, but not in developing countries. Dutt et al. (2013) found that when the importer is a developed country, GATT/WTO membership boosts the extensive margin whereas it has an insignificant impact on the intensive margin. In contrast, for developing country importers, they found that GATT/WTO membership increases the extensive margin and significantly reduces the intensive margin. Felbermayr and Kohler (2010) documented that WTO increases trade in developing country importers, but not in industrialized country importers. Grant and Boys (2011) concluded that middle and low income developing and least-developed economies, those that have a vested interest in expanding agricultural exports, gain substantially from membership in the GATT/WTO. Bista (2015) showed differences in trade flows across countries based on their level of development, a positive impact on the extensive margin is only found in trade between industrial and developing members, whereas neither GATT/WTO members experience any positive impact at the intensive margin. Kohl (2017) found that developed countries gain more from GATT/WTO membership than developing countries. Finally, Mujahid and Kalkuhl (2016) found that although on average the WTO is found to have negative implications on food trade, it facilitates the developing countries more than the developed countries.

### 1.2.5 Impact of WTO through trade rounds

The results for sub-periods are also a source of controversy. Rose (2004) showed significant variation in the coefficients across trade rounds whereas Tomz et al. (2007) got a positive and economically significant effect in every round except the last one (1995–1999). Liu (2009) found a positive impact only during the pre-Kennedy years (1948–1963) and the post-Uruguay Round period (1995–2003). Felbermayr and Kohler (2010) revealed negative

effects for the three-time spans considered over the GATT period and a positive effect for the WTO period. Eicher and Henn (2011) and Roy (2011) reported, for each decade from 1950 to 2000, the absence of any significant trade effect of GATT/WTO. In contrast, Herz and Wagner (2011a) showed that GATT/WTO substantially fostered bilateral trade during each of the five periods considered and especially during the Pre-Kennedy rounds (1953–1963) and the Uruguay Round (1986–1994). Finally, Kohl (2017) estimated a negative effect until the Kennedy Round, no effect until the Tokyo Round and a large positive effect until the Uruguay Round.

## 1.3 Methodology

Over the past 50 years the gravity model has been considered as one of the most successful empirical framework in the international economics to analyze the determinates of bilateral trade flows. The gravity model can be justified by a variety of theories, including monopolistic competition (Helpman and Krugman, 1985) and a Heckscher–Ohlin model with specialization (Anderson, 1979; Deardorff, 1998; Anderson and van Wincoop, 2003).[1] Empirically, the gravity model has been regularly used to estimate the ex post (partial) impact of preferential trade agreements (see, for example, Baier and Bergstrand, 2007; Baier et al., 2007; Carrère, 2006; Gil-Pareja et al., 2008a; Lee et al., 2008), currency unions (Rose, 2000; Glick and Rose, 2002; Micco et al., 2003; Gil-Pareja et al., 2008b), unilateral (nonreciprocal) preference regimes (Rose, 2004; Mattoo et al., 2003; Tomz et al., 2007; Herz and Wagner, 2011b;) or, as in this chapter, GATT/WTO membership (Rose, 2004; Tomz et al., 2007; Subramanian and Wei, 2007; Liu, 2009; Felbermayr and Kohler, 2010; Eicher and Henn, 2011; Roy, 2011; Chang and Lee, 2011; Herz and Wagner, 2011a; Dutt et al., 2013; Cheong et al., 2014; Kohl and Trojanowska, 2015; Kohl, 2015; Bista, 2015).

The section is organized as follows. First, we introduce the basic gravity model which will be used to assess the overall impact of the WTO on different exports flows. Second, we present the augmented gravity models which are set up to investigate the potential asymmetric impact of the WTO across countries. Subsequently, we will explain the econometric issues that are related to the gravity models. Then, we provide the data sources of variables and the methodology of classification used in the analysis.

[1] See also, Bergstrand (1985 and 1989), Eaton and Kortum (2002), Evenett and Keller (2002) and Helpman et al. (2008)

### 1.3.1 Basic gravity model

Our benchmark specification is the gravity equation (1.1), which comprehensively accounts for multilateral resistance terms by including time-varying fixed effects and for self-selection endogeneity bias by integrating country-pair fixed effects:

$$X_{ijt} = \beta_0 + \beta_1 WTO_{ijt} + \beta_2 PTA_{ijt} + \beta_3 GSP_{ijt} + \gamma_{it} + \delta_{jt} + \varphi_{ij} + \varepsilon_{ijt} \quad (1.1)$$

where ($i$) and ($j$) denote trading partners, ($t$) is year, and the variables are defined as follows:

$\boldsymbol{X_{ijt}}$ Bilateral export flows from exporter ($\boldsymbol{i}$) to importer ($\boldsymbol{j}$) in year ($\boldsymbol{t}$),

$\boldsymbol{\beta_0}$ Constant term,

$\boldsymbol{WTO_{ijt}}$ Dummy variable takes value 1 if both exporter ($i$) and importer ($j$) are WTO/GATT members in year ($t$),

$\boldsymbol{PTA_{ijt}}$ Dummy variable takes value 1 if both exporter ($i$) and importer ($j$) are belong to a preferential trade agreement in year ($t$),

$\boldsymbol{GSP_{ijt}}$ Dummy variable takes value 1 if the importer ($j$) grants preferences under the Generalized System of Preferences (GSP) to the exporter ($i$) in year ($t$),

$\boldsymbol{\gamma_{it}}$ Exporter-varying fixed effects,

$\boldsymbol{\delta_{jt}}$ Importer-varying fixed effects,

$\boldsymbol{\varphi_{ij}}$ Country-pair fixed effects,

$\boldsymbol{\varepsilon_{ijt}}$ Error term.

The inclusion of time-varying fixed effects for exporter ($\gamma_{it}$) and for importer ($\delta_{jt}$) in the gravity equation accounts for the multilateral price terms as well as variation in all time-varying country variables such as GDPs, population, MFN tariffs of the exporter and the importer and unobservable trade costs/price indices. Moreover, the inclusion of county-pair fixed effects ($\varphi_{ij}$) controls for the impact of any time-invariant determinant of trade (observed or not) and resolves also endogeneity bias. Thus, time invariant pair-specific variables such as distance, borders, common language, or colonial links will be subsumed in these country pair fixed effects, (Baier and Bergstrand, 2007).

Following Santos Silva and Tenreyro (2006 and 2010), we deal with econometric problems resulting from heteroskedastic residuals in log-linear gravity equations and the prevalence of zero bilateral trade flows by estimating the gravity equation *in levels* rather than in *logs* with Poisson estimator (PPML).[1]

A number of studies treat the average of two-way bilateral trade as the dependent variable, that is average of country ($i$) exports to country ($j$) and country ($i$) imports to country ($j$) (see, for example Rose, 2000, 2004; Glick and Rose, 2002; or Tomz et al., 2007). Baldwin and Taglioni (2006) called this procedure as the *silver* medal mistake. They show that the unidirectional bilateral trade value is more theoretically well founded since the gravity model is a modified expenditure function which explains the value of spending by one country on the goods produced by another country. Therefore, in this study, we use unidirectional trade data.

With regard to coding issue, we use Rose's (2004) inclusive coding; where both $(WTO_{ijt})$ and $(GSP_{ijt})$ variables take on the value "1" when the two conditions are fulfilled. In addition, when the same trading partners are members in a common preferential trade agreement ($PTA_{ijt}$), mutually inclusive coding assigns the value "1" to all three dummies. Eicher and Henn (2011) point that the net effect generated by mutually inclusive coding significantly reduces the risk of omitted variable bias, while mutually exclusive coding, which is used by Subramanian and Wei (2007), holds the danger that WTO dummies are biased. For further analysis, following Eicher and Henn (2011), we split the preferential trade agreement ($PTA_{ijt}$), into two dummy variables; regional integrations ($RTI_{ijt}$) and bilateral agreements ($BTA_{ijt}$), where:

$\boldsymbol{RTI_{ijt}}$ Dummy variable takes value 1 if both exporter ($\boldsymbol{i}$) and importer ($\boldsymbol{j}$) are belong to a common regional integration in year ($\boldsymbol{t}$),

$\boldsymbol{BTA_{ijt}}$ Dummy variable takes value 1 if both exporter ($i$) and importer ($j$) are belong to a common bilateral trade agreement in year ($t$).

## 1.3.2 Augmented gravity models

The economic literature focused on the possible asymmetric effects of the GATT/WTO on the developed and developing countries. In general, the economic structures of developing countries are dissimilar in terms of two dimensions. First, developing countries are

[1] All econometric issues will be discussed in the next sub-section.

heterogeneous in terms of the growth of their markets, where there are developing countries characterized by emerging markets while others are not.

Second, developing countries are not homogenous depending on the natural resources endowment. This implies that there are countries that are abundant in natural resources and depend heavily on the production and exportation of natural-resource commodities, and others that are poor in natural resources and rely on food and manufacturing.

In order to investigate the potential asymmetric effect of the WTO across countries, in particular across developing nations, we classified our sample of countries into 5 categories:

1. Developed countries; ($dev$)
2. Emerging natural resource-rich counties; ($emg\_rich$)
3. Non-emerging natural resource-rich countries; ($non\_emg\_rich$)
4. Emerging natural resource-poor countries; ($emg\_poor$)
5. Non-emerging natural resource-poor countries; ($non\_emg\_poor$)

The first augmented model is set up to study the potential asymmetric effects of the WTO on countries as ***exporters***. Therefore, we disaggregate WTO dummy variable ($WTO_{ijt}$) into five dummies according to the category of the ***exporter***, as following:

| | |
|---|---|
| $\boldsymbol{Ex\_dev\_WTO}$ | Dummy variable takes value 1 only if both exporter ($\boldsymbol{i}$) and importer ($\boldsymbol{j}$) are members in WTO in year ($\boldsymbol{t}$) ***and*** exporter ($\boldsymbol{i}$) is a *developed country,* |
| $\boldsymbol{Ex\_emg\_rich\_WTO}$ | Dummy variable takes value 1 only if both exporter ($i$) and importer ($j$) are members in WTO in year ($t$) ***and*** exporter ($i$) is an *emerging natural resource-rich country,* |
| $\boldsymbol{Ex\_non\_emg\_rich\_WTO}$ | Dummy variable takes value 1 only if both exporter ($i$) and importer ($j$) are members in WTO in year ($t$) ***and*** exporter ($i$) is a *non-emerging natural resource-rich country,* |
| $\boldsymbol{Ex\_emg\_poor\_WTO}$ | Dummy variable takes value 1 only if both exporter ($i$) and importer ($j$) are members in WTO in year ($t$) ***and*** exporter ($i$) is an *emerging natural resource-poor country,* |
| $\boldsymbol{Ex\_non\_emg\_poor\_WTO}$ | Dummy variable takes value 1 only if both exporter ($i$) and importer ($j$) are members in WTO in year ($t$) ***and*** exporter ($i$) is a *non-emerging natural resource-poor country,* |

Further, in order to examine how the effects of regional integrations, bilateral agreements and GSP are distributed between the five categories of countries, we split also other dummy variables ($RTI_{ijt}$), ($BTA_{ijt}$) and ($GSP_{ijt}$) according to the category of the ***exporter*** as follows:

| | |
|---|---|
| ***Ex_dev_RTI*** | Dummy variable takes value 1 only if both exporter (***i***) and importer (***j***) are belong to a common regional integration in year (***t***) ***and*** exporter (***i***) is a *developed country,* |
| ***Ex_emg_rich_RTI*** | Dummy variable takes value 1 only if both exporter ($i$) and importer ($j$) are belong to a common regional integration in year ($t$) ***and*** exporter ($i$) is an *emerging natural resource-rich country,* |
| ***Ex_non_emg_rich_RTI*** | Dummy variable takes value 1 only if both exporter ($i$) and importer ($j$) are belong to a common regional integration in year ($t$) ***and*** exporter ($i$) is a *non-emerging natural resource-rich country,* |
| ***Ex_emg_poor_RTI*** | Dummy variable takes value 1 only if both exporter ($i$) and importer ($j$) are belong to a common regional integration in year ($t$) ***and*** exporter ($i$) is an *emerging natural resource-poor country,* |
| ***Ex_non_emg_poor_RTI*** | Dummy variable takes value 1 only if both exporter ($i$) and importer ($j$) are belong to a common regional integration in year ($t$) ***and*** exporter ($i$) is a *non-emerging natural resource-poor country,* |
| ***Ex_dev_BTA*** | Dummy variable takes value 1 only if both exporter ($i$) and importer ($j$) are belong to a common bilateral trade agreement in year ($t$) ***and*** exporter ($i$) is a *developed country,* |
| ***Ex_emg_rich_BTA*** | Dummy variable takes value 1 only if both exporter ($i$) and importer ($j$) are belong to a common bilateral trade agreement in year ($t$) ***and*** exporter ($i$) is an *emerging natural resource-rich country,* |
| ***Ex_non_emg_rich_BTA*** | Dummy variable takes value 1 only if both exporter ($i$) and importer ($j$) are belong to a common bilateral trade agreement in year ($t$) ***and*** exporter ($i$) is a *non-emerging natural resource-rich country,* |
| ***Ex_emg_poor_BTA*** | Dummy variable takes value 1 only if both exporter ($i$) and importer ($j$) are belong to a common bilateral trade agreement in year ($t$) ***and*** exporter ($i$) is an *emerging natural resource-poor country,* |
| ***Ex_non_emg_poor_BTA*** | Dummy variable takes value 1 only if both exporter ($i$) and importer ($j$) are belong to a common bilateral trade |

| | |
|---|---|
| | agreement in year ($t$) ***and*** exporter ($i$) is a *non-emerging natural resource-poor country,* |
| $\boldsymbol{Ex\_emg\_rich\_GSP}$ | Dummy variable takes value 1 only if the importer ($j$) grants preferences under the Generalized System of Preferences (GSP) to an *emerging natural resource-rich exporter* ($i$) in year ($t$), |
| $\boldsymbol{Ex\_non\_emg\_rich\_GSP}$ | Dummy variable takes value 1 only if the importer ($j$) grants preferences under the Generalized System of Preferences (GSP) to a *non-emerging natural resource-rich exporter* ($i$) in year ($t$), |
| $\boldsymbol{Ex\_emg\_poor\_GSP}$ | Dummy variable takes value 1 only if the importer ($j$) grants preferences under the Generalized System of Preferences (GSP) to an *emerging natural resource-poor exporter* ($i$) in year ($t$), |
| $\boldsymbol{Ex\_non\_emg\_poor\_GSP}$ | Dummy variable takes value 1 only if the importer ($j$) grants preferences under the Generalized System of Preferences (GSP) to a *non-emerging natural resource-poor exporter* ($i$) in year ($t$). |

We don't create ($Ex\_dev\_GSP$) because only developing countries can benefit from GSP while developed countries are donors.

In the second augmented model, we aim to investigate the effect of WTO across countries, but this time, as ***importers***. Therefore, we disaggregate each dummy variable ($WTO_{ijt}$), ($RTI_{ijt}$) and ($BTA_{ijt}$) into five dummies according to the category of the ***importer***. We don't split the importer ($j$) of ($GSP_{ijt}$) because the objective of GSP is to support exports not imports.

### 1.3.3 Econometric issues

Our benchmarks take into account several issues related to the potential problems in estimating the standard gravity equation. Recently, researchers have struggled with three problems inherent in the gravity models: *endogeneity*, *zero-trade flows* and *multilateral trade resistance terms*.

#### *1.3.3.1 Endogeneity*

The first problem inherent that many analyses on trade policies have encountered in the gravity model involves the issue of potential *endogeneity* of RTAs when there is potential reverse causality between RTAs and a higher level of bilateral trade between country pairs. According to the hypothesis of "natural trading partners" or "natural trading blocs" introduced by Krugman (1991), countries show a propensity to form RTAs with other partner countries where there are potentially higher trade volumes between them. Furthermore, there still are many unobserved factors between country pairs (except where the countries speak the same language and have a common colonial relationship) that may increase bilateral trade and promote the establishment of an RTA concurrently. As a result, the estimated coefficients are likely biased since the RTA dummy variables featuring the existence of the trade agreement are potentially correlated with the error term in the gravity equation. A majority of empirical studies using cross-sectional data and including dummy variables for trade agreements do not take account of the issue of RTA endogeneity. In the past literature, Trefler (1993) and Lee and Swagel (1997) are the first works that attempt to adjust for the endogeneity of trade policies on a cross-section framework by using instrumental variables. By contrast, Magee (2003), find that instrumental-variables approach does not appear efficient at adjusting the issue of endogeneity bias of the RTA dummy variable that has binary form, and it's hard to find instruments that are not likely correlated with the error term of the gravity equation. An alternative method of handling the potential endogeneity issue with RTAs is to estimate the gravity model including both bilateral fixed effects for country pairs and time-varying fixed effects for exporter and importer countries. According to Baier and Bergstrand (2007), these fixed effects specification can deal with the issue of RTA endogeneity bias because it is able to better deal with the unobserved heterogeneity among pairs of countries, which are one of the most important sources of the endogeneity problem with RTAs. In addition, Head and Mayer (2014) also found that due to lacking adequate instrumental variables, panel data method including country-pair fixed effects can control for part of potential RTA endogeneity bias. In principle, the same is true also for the GATT/WTO membership effects.

#### *1.3.3.2 Zero trade values*

The second consideration that needs to be specially addressed in analyzing sectoral trade is *zero trade values*. It is likely that zero trade values are more frequent when estimating specific sector of trade. On the one hand, some of the zero trade flows reflect a random

rounding error or random missing data. They may also come from the systematic rounding of very low reported values of bilateral trade. On the other hand, zero trade flows remaining in the database may naturally originate from the fact that bilateral trade does not exist over a period due to the remoteness of those countries, to the prohibitive transport costs or the small size of the economies, as argued by Frankel (1997), Santos Silva and Tenreyro (2006), and Helpman et al. (2008). Martin and Pham (2015) also found that most of the bilateral trade flows in aggregate trade data display a real absence of trade. The problem of zero trade flows is quite serious since almost 50% of the total observations on bilateral trade are zero in the data set used by Santos Silva and Tenreyro (2006), Helpman et al. (2008), and Burger et al. (2009). As a result, one need to take the problem of zero trade flows more seriously by using proper econometric techniques.

The conventional method for estimating gravity model is to keep the model in log-linear form. However, this approach is inappropriate as the log-linearized model is infeasible in the case of observations involving zero trade flow because the natural logarithm of zero is undefined. Hence, several ways have been proposed in the empirical literature to handle the zero trade flows problem. One of the most prevalent ways is simply excluding zero trade from the data set and then estimating the gravity model on a truncated database of country pairs that consists of only positive bilateral trade flows. By omitting observations with zero trade, this method overlooks interesting and useful insight into the real nature of zero trade between countries and induces serious problems and biased results, since these zero trade flows are generally not randomly determined, as showed by Burger et al. (2009) and Martin and Pham (2015). Other studies choose to do not exclude zero trade flows, but use some transformation involving the dependent variable, for instance, adding a small number to the zero-trade observation (value of 1 in most cases) to all trade flows before taking logarithms. Another method uses a *Tobit* model and keeps the observations involving zero trade.

Santos Silva and Tenreyro (2006) argued that these methods will induce inconsistent estimates in the case when the constant-elasticity model is used. They also pointed out that the standard methods used to estimate gravity models can lead to misleading estimated coefficients in the presence of heteroskedasticity, which appears inherently in trade data. If the problem of heteroskedasticity rises in the multiplicative model, its transformation into log-linear form can lead to a more serious bias in the estimated elasticities. Hence, they do not recommend to estimate the gravity model based on a log-linearized version. According to Santos Silva and Tenreyro (2006), the Poisson pseudo-

maximum likelihood (PPML) estimator, proposed by the authors, is a natural method to solve the problem of zero trade flows. Especially, they found that the performance of the PPML estimator is not affected when the proportion of the dependent variable with zero trade is substantial. Since the gravity model is directly estimated from its multiplicative form, where the dependent variable is measured in levels, instead of linearizing the model by using logarithms, the zero-trade problem is well handled. Moreover, they found that the PPML method seems to yield more robust and consistent results than the other econometric techniques in the presence of heteroskedasticity. PPML estimator is also consistent with general equilibrium condition when the estimation includes importer and exporter fixed effects (Fally, 2015). PPML estimation can be estimated by solving the following first-order condition:

$$\sum_p \left(X^p - exp\left(Z^p \hat{\beta}\right)\right) = 0$$

where $p$ denotes country pairs, $X^p$ is unidirectional trade (i.e. exports) between the country pairs expressed in levels not in logarithms and $Z^p$ is the full vector of the gravity equation as defined in equation above.

Several recent empirical analyses on gravity model have included PPML method and praised the estimator as one of the new workhorses to assess international trade, such as Westerlund and Wilhelmsson (2011), Anderson and Yotov (2012), and Martin and Pham (2015).

#### *1.3.3.3 Multilateral trade resistance*

Last potential problem is related to relative trade cost or '*multilateral trade resistance*' as called by Anderson and van Wincoop (2003). Anderson and van Wincoop emphasized that the propensity of trade between two countries is not simply determined by absolute trade cost between the two, but also by each country's trade cost towards its partners relative to their partners in the rest of the world. According to the two authors, the three trade resistance factors in international trade are, therefore, the bilateral trade barriers, the exporter country's trade resistance towards all other destinations as well as the importer country's trade resistance towards all other trading partners. The two latter factors are called Anderson-van Wincoop's multilateral trade resistance (MTRs). For instance, relative trade cost between two countries surrounded by oceans is different from that of country pair surrounded by other exporting or importing countries. Ignoring MTRs could lead to biased estimation results (Anderson and van Wincoop, 2003; Feenstra, 2004). However, MTRs are difficult to measure as they are not directly observable. According to

Baier and Bergstrand (2007), including bilateral fixed effects along with time-varying fixed effects for exporter and importer in the model overcomes the RTAs endogeneity bias and accounts of the Anderson and van Wincoop's multilateral resistance terms at the same time.

## 1.3.4 Data and variables construction

After introducing the models and econometric issues, we aim to explain how the variables are constructed, especially the dummies, and their data sources. We firstly provide the sources of the main variables followed by the methodologies used to classify countries.

### *1.3.4.1 Sources of variables*

The data comprises bilateral merchandise trade between 160 countries over the period 1980–2015 at four-year intervals (1980, 1984…,2012) and includes 2015, the last year of data.[1]

The dependent variable ($X_{ijt}$) is the nominal export flows from exporter ($i$) to importer ($j$) in year ($t$).[2] We estimated our *basic gravity model* using the following export flows: total exports, manufactures exports, food exports, agricultural raw materials exports, ore & metals exports, fuel exports, total natural resource exports and total non-natural resource exports, while our *augmented gravity model* is estimated using total natural resource exports and total non-natural resource exports. We defined natural resource exports as provided by WTO (2010); where they are the total exports of agricultural raw materials,

[1] It is natural to expect that the adjustment of trade flows in response to trade policy changes will not be instantaneous. For that reason, Trefler (2004) criticizes trade estimations pooled over consecutive years. In order to avoid this critique, researchers have used panel data with intervals instead of data pooled over consecutive years. For example, Trefler (2004) uses 3-year intervals, Anderson and Yotov (2016) use 4-year intervals, and Baier and Bergstrand (2007) use 5-year intervals. Olivero and Yotov (2012) provide empirical evidence that gravity estimates obtained with 3-year and 5-year interval trade data are very similar, while estimations performed with panel samples pooled over consecutive years produce suspicious estimates of the trade cost elasticity parameters.

[2] We used nominal trade values to avoid *bronze medal* mistake refers to a common practice in the literature, namely to deflate the nominal trade values by the US aggregate price index. Given that there are global trends in inflation rates, such a procedure probably creates biases via spurious correlations (Baldwin and Taglioni, 2006).

ores & metals, fuels and fish.[1] All export flows are taken from *United Nations COMTRADE via the World Bank's platform: WITS (World Integrated Trade Solution).*[2]

Data on membership in WTO comes from *World Trade Organization (WTO)* website.[3] We extract data on regional trade integrations (RTI) and bilateral trade agreements (BTA) from the *Regional Trade Agreements Information System (RTA-IS),*[4] and completed from *Mario Larch's Regional Trade Agreements Database*.[5] Our data set covers 27 regional trade integrations and 340 bilateral trade agreements.[6] Finally, Generalized System of Preferences (GSP) data is obtained from *CEPII Gravity Dataset*.[7]

#### *1.3.4.2 Classification issue*

Depending on our econometric models above, we firstly need to classify the countries according to their level of development. According to IMF (2015), 34 countries are classified as developed economies, and 23 countries as emerging markets.[8] An emerging market economy is "one in which the country is becoming a developed nation and is determined through many socio-economic factors".[9] However, we use IMF's classification

[1] We used Standard International Trade Classification (SITC), Revision 1 for disaggregated bilateral export flows; where Manufactures (SITC 5+6+7+8-68), Food (SITC 0+1+22+4-03), Agricultural Raw Materials (SITC 2-22-27-28), Ores & Metals (SITC 27+28+68), Fuels (SITC 3) and Fish (STIC 03).
[2] Data can be accessed at: http://wits.worldbank.org.
[3] Data can be accessed at:https://www.wto.org/english/thewto_e/whatis_e/tif_e/org6_e.htm
[4] Data can be accessed at:http://rtais.wto.org/UI/PublicMaintainRTAHome.aspx
[5] Data can be accessed at:http://www.ewf.uni-bayreuth.de/en/research/RTA-data/index.html
[6] Regional integrations included: Andean Community (CAN), ASEAN Free Trade Area (AFTA), Asia Pacific Trade Agreement (APTA), Baltic Free Trade Area (BAFTA), Central American Common Market (CACM), Central European Free Trade Agreement (CEFTA) 2006, Common Economic Zone (CEZ), Common Market for Eastern and Southern Africa (COMESA), Commonwealth of Independent States (CIS), Dominican Republic - Central America - United States Free Trade Agreement (CAFTA-DR), East African Community (EAC), Economic and Monetary Community of Central Africa (CEMAC), Economic Community of West African States (ECOWAS), Economic Cooperation Organization (ECO), European Union (EU) 28, Eurasian Economic Community (EAEC), European Economic Area (EEA), European Free Trade Association (EFTA), Gulf Cooperation Council (GCC), Latin American Integration Association (LAIA), North American Free Trade Agreement (NAFTA), Pan-Arab Free Trade Area (PAFTA),South Asian Free Trade Agreement (SAFTA), Southern African Customs Union (SACU), Southern African Development Community (SADC), Southern Common Market (MERCOSUR) and West African Economic and Monetary Union (WAEMU). List of Bilateral agreements is available from the author upon request.
[7] Data can be accessed at: http://www.cepii.fr/CEPII/en/bdd_modele/download.asp?id=8
[8] International Monetary Fund. (2015). World Economic Outlook: Adjusting to Lower Commodity Prices. Washington
[9] Definition is taken from:https://www.investopedia.com/terms/e/emergingmarketeconomy.asp .

to classify our sample of countries between developed countries, emerging countries and non-emerging countries.[1]

Secondly, we need to classify countries, especially developing ones, according to natural resource endowment. We review some methods of classification used in the related literature.

For IMF (2007), countries are considered rich in hydrocarbon and/or mineral resources on the basis of the following criteria: (i) an average share of hydrocarbon and/or mineral fiscal revenues in total fiscal revenue of at least 25 percent during the period 2000-2005 or (ii) an average share of hydrocarbon and/or mineral export proceeds in total export proceeds of at least 25 percent during the period 2000-2005.[2]

In a policy paper recently published by IMF (2012) also, using average data for 2006–2010, countries are classified as resource-rich countries where at least 20 percent of their total exports were natural resources, or they derived at least 20 percent of their revenue from natural resources.

The World Bank (2008) classified the countries in MENA region into resource-rich and resource-poor countries, where resource-rich counties are those with large positive net oil exports.[3]

Finally, for United Nations Conference on Trade and Development (UNCTAD), there are three groups of countries, petroleum exporters, agricultural exporters and minerals exporters. Petroleum exporters are those countries of which from 2013-2015 the average share of fuels exports was greater than 50% of their total exports and greater than 0.1 of the world total fuels exports. For agricultural products exporters are those countries of which from 2013 to 2015 the average share of exports of agricultural products was greater than 45% of their total exports and greater than 0.01% of the world total exports of agricultural products. For selected exporters of minerals and mining products, countries of which from 2013 to 2015 the average share of exports of ores, metals, precious stones

[1] In fact, there is no entire consensus on which countries are emerging markets. Morgan Stanley Capital International (MSCI) also classifies 23 countries as emerging markets (See: https://www.msci.com ), but with some difference between the two lists. Standard and Poor's (S&P) and Russell each classify 21 countries as emerging markets (See: https://us.spindices.com/ and https://russellinvestments.com ), while FTSE classifies 24 countries as emerging markets (See: http://www.ftse.com ). It depends on the criteria used in the classification.

[2] This classification is used by Venables (2009) to point out that natural resource wealth is distributed unevenly between Central Asia Regional Economic Cooperation (CAREC) countries.

[3] This classification is used by Carrère et al. (2012) to verify Venables (2009) theoretical predictions about the distribution of regional integration effects in MENA region.

and non-monetary gold was - greater than 50% of their total exports and greater than 0.01% of the world total exports of ores, metals, precious stones and nonmonetary gold. The three years used to calculate the averages change from time to time, so the classification of countries varies from one publication to another.[1]

From the foregoing, we can conclude that there is no common methodology used by the international organizations to classify countries between natural resource-rich and natural resource-poor countries. However, we can see that the average share of natural resource exports in total exports is used commonly as a main variable of classification. But on the other hand, we note that the threshold used differs from one reference to another. We can see also that chosen period or the number of years for calculating the averages differ from one method to another. Therefore, the methods that we reviewed above are based on an arbitrary selection and not on a theoretical or statistical basis. This lack of clarity made us think about finding another way in order to classify countries according to their dependence on natural resources.

Therefore, we will apply a non-arbitrary method named *Cluster Analysis* to classify countries into resource-rich countries and resource-poor countries. This method is a statistical multivariate technique that helps regrouping countries (or other entities) in a way that minimizes the distance of the clustering variables between countries belonging to the same group, while maximizing it among groups. There are number of different approaches that can be used to apply the cluster analysis. Most used approaches are the *Hierarchical method* and the *Partitioning method* (more precisely, *k-means*). However, each one follows a different approach to grouping the most similar objects into clusters.[2] For the purpose of our study, we will apply the *k-means* clustering for two reasons. The first one is the ease of application, the second one is that we can pre-determine the number of clusters desired to be created and this is in contrast to the *Hierarchical method*. In our case, we need to classify countries exclusively into two categories, natural resource-rich countries and natural resource-poor countries, thus, *k-means* clustering method is consistent with this objective. The basic *k-means* clustering algorithm is defined as follows:

Step 1: We choose the number of clusters $k$.

Step 2: We make an initial selection of $k$ centroids.

[1] Classification can be accessed at: http://unctadstat.unctad.org/EN/Classifications.html

[2] For a complete and comprehensive outlook on Cluster Analysis, see Cliff, T. (2014). Exploratory data analysis in business and economics: An introduction using SPSS. Stata, and Excel: Springer, New York, 215.

Step 3: We assign each data element to its nearest centroid (in this way $k$ clusters are formed one for each centroid, where each cluster consists of all the data elements assigned to that centroid).

Step 4: For each cluster we make a new selection of its centroid.

Step 5: We repeat step 3 until the centroids don't change (or some other convergence criterion is met).

In order to classify the countries that depend heavily on natural resources using *Cluster Analysis*, we use two main input variables. First, share of natural resources exports of total exports as an indicator of the specialization in natural resources. Second, the sum of value added shares of agriculture and mining sectors in GDP as an indicator of the contribution of natural resource sectors to GDP.

**Table 1-1: Variables of Cluster Analysis**

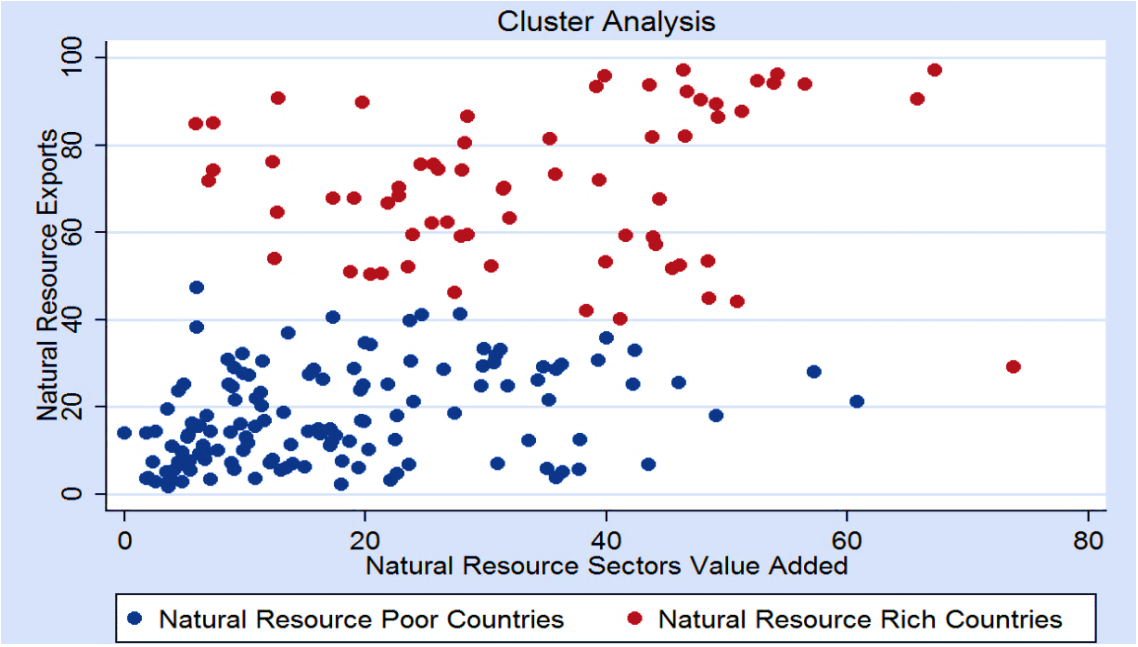
| Variable | Definition |
|---|---|
| Natural resource exports[1] | Share of natural resource exports in total exports over the period 1995-2015, in average.<br>Natural resource exports are the sum of:<br>• Agricultural raw materials (SITC 2 less 22, 27 and 28).<br>• Ores and metals (SITC 27 + 28 + 68)<br>• Fuels (SITC 3).<br>• Fish, crustaceans, molluscs and preparations thereof (SITC 03). |
| Value added of natural resource sectors | Share of value added of natural resource sectors in total value added over the period 1995-2015, in average.<br>Natural resource sectors include the following sectors:<br>• Agriculture, Forestry, Fishing and Hunting (ISIC Rev.3, divisions 01-05).<br>• Mining, Quarrying, and Oil & Gas Extraction (ISIC Rev.3, divisions 10-14). |

Source: UNCTAD
[1] We use the basic definition of natural resource exports of WTO (2010).

We applied k-means clustering method using two inputs variables; natural resource exports (% total exports) and value added of natural resource sectors (% total value added); in order to classify 200 countries into two main clusters; natural resource-rich countries and natural resource-poor countries.[1] Figure 1.1 illustrates the distribution of countries by cluster and Table A.2 in the appendix reports the results of *Cluster analysis* to classify counties between resource-rich and resource-poor countries.[2]

[1] Table A.1 in the appendix lists the 200 counties included and the data used in the Cluster analysis.
[2] For the *Adequacy of clustering*, ANOVA analysis is provided in the appendix.

**Figure 1-1: Classification of countries according to natural resource abundance**




In order to investigate the impact of the WTO across countries, we combine two classifications together: 1) Classification of countries according to the development level and growth of markets using IMF classification, 2) Classification of countries according to the abundance of natural resources obtained by Cluster Analysis. Table 1.2 list the 5 categories of countries depending on above two classifications.

**Table 1-2: Classification of countries according to development level and natural resource endowment**

| Advanced economies | Emerging resource-rich | Non-emerging resource-rich | | Emerging resource-poor | Non-emerging resource-poor | |
|---|---|---|---|---|---|---|
| Australia, (1995) | Chile, (1995) | Algeria, (nm) | Guinea, (1995) | Argentina, (1995) | Afghanistan, (nm) | Gambia, (1996) |
| Austria, (1995) | Colombia, (1995) | Angola, (1996) | Iran, (nm) | Bangladesh, (1995) | Albania, (2000) | Georgia, (2000) |
| Belgium, 1995 | Peru, (1995) | Azerbaijan, (nm) | Iraq, (nm) | Brazil, (1995) | Armenia, (2003) | Ghana, (1995) |
| Canada, (1995) | Russia, (2012) | Bahrain, (1995) | Jamaica, (1995) | Bulgaria, (1996) | Belarus, (nm) | Guatemala, (1995) |
| Cyprus, (1995) | Venezuela, (1995) | Benin, (1996) | Kazakhstan, (2015) | China, (2001) | Bhutan, (nm) | Guinea-Bissau, (1995) |
| Czech Republic, (1995) | | Bolivia, 1995 | Kuwait, (1995) | Malaysia, (1995) | Bosnia and Herzegovina, (nm) | Honduras, (1995) |
| Denmark, (1995) | | Brunei Darussalam, (1995) | Lao P.D.R, (2013) | Mexico, (1995) | Botswana, (1995) | Jordan, (2000) |
| Malta, (1995) | | Burkina Faso, (1995) | Liberia, (nm) | Pakistan, (1995) | Burundi, (1995) | Kenya, (1995) |
| Netherlands, (1995) | | Cameroon, (1995) | Libya, (nm) | Philippines, (1995) | Cabo Verde, (2008) | Kyrgyzstan, (1998) |
| New Zealand, (1995) | | Central African Republic, (1995) | Sudan, (nm) | Poland, (1995) | Cambodia, (2004) | Lebanon, (nm) |
| Norway, (1995) | | Chad, (1996) | Syria, (nm) | Romania, (1995) | Comoros, (nm) | Lesotho, (1995) |
| Portugal, (1995) | | Congo, (1997) | Tajikistan, (2013) | Hungary, (1995) | Costa Rica, (1995) | Sri Lanka, (1995) |
| Singapore, (1995) | | D.R. Congo, (1997) | Togo, (1995) | India, (1995) | Côte d'Ivoire, (1995) | Swaziland, (nm) |
| Slovakia, (1995) | | Maldives, (1995) | Turkmenistan, (nm) | Indonesia, (1995) | Croatia, (2000) | Tanzania, (1995) |
| Slovenia, (1995) | | Mali, (1995) | United Arab Emirates, (1996) | South Africa, (1995) | Cuba, (1995) | Macedonia, (2003) |
| Estonia, (1999) | | Mauritania, (1995) | Uzbekistan, (nm) | Thailand, (1995) | Djibouti, (1995) | Tunisia, (1995) |
| Finland, (1995) | | Mongolia, (1997) | Yemen, (2014) | Turkey, (1995) | Dominican Republic, (1995) | Uganda, (1995) |
| France, (1995) | | Mozambique, (1995) | Zambia, (1995) | Ukraine, (2008) | Madagascar, (1995) | Uruguay, (1995) |
| Germany, (1995) | | Myanmar, (1995) | | | Malawi, (1995) | Viet Nam, (2007) |
| Greece, (1995) | | Niger, (1996) | | | Mauritius, (1995) | Zimbabwe, (1995) |
| Iceland, (1995) | | Nigeria, (1995) | | | Moldova, (2001) | |
| Ireland, 1995 | | Oman, (2000) | | | Morocco, (1995) | |
| Israel, (1995) | | Qatar, (1996) | | | Namibia, (1995) | |
| Italy, (1995) | | Rwanda, (1996) | | | Nepal, (2004) | |
| Japan, (1995) | | Saudi Arabia, (2005) | | | Nicaragua, (1995) | |
| South Korea, (1995) | | Senegal, (1995) | | | Panama, (1997) | |
| Latvia, (1999) | | Seychelles, (2015) | | | Paraguay, (1995) | |
| Lithuania, (2001) | | Ecuador, (1996) | | | Sao Tomé and Principe, (nm) | |
| Luxembourg, (1995) | | Egypt, (1995) | | | Serbia, (nm) | |
| Spain, (1995) | | Equatorial Guinea, (nm) | | | Sierra Leone, (1995) | |
| Sweden, (1995) | | Gabon, (1995) | | | Somalia, (nm) | |
| Switzerland, (1995) | | | | | El Salvador, (1995) | |
| United Kingdom, (1995) | | | | | Eritrea, (nm) | |
| United States, (1995) | | | | | Ethiopia, (nm) | |

Notes:
- Year of accession to WTO between brackets.
- nm: not member

Sources:
- International Monetary Fund. (2015). World Economic Outlook: Adjusting to Lower Commodity Prices. Washington
- Our Cluster analysis, Table A.2 in the appendix reports the results of Cluster analysis to classify counties between resource-rich and resource-poor countries.
- World Trade Organization (WTO) website.

## 1.4 Empirical results and discussion

At first, we discuss the results of our basic gravity model which asses the overall impact of the WTO on different specifications of export flows, then, we discuss the results of our augmented models that are set up to investigate the asymmetric impact of the WTO across countries.

### 1.4.1 Overall impact of WTO

We can see from Table 1.3 that the overall impact of the WTO on total trade is insignificant. This is compatible with studies like Rose (2004), Eicher and Henn (2011) and Roy (2011). Meanwhile, we can see that WTO has promoted trade in non-natural resource sectors, about 40% in manufactures and about 20% in food.[1] This corresponds to some extent with Kim (2010) who found that GATT/WTO increased bilateral trade excluding agriculture, textile and oil trade, and with Engelbrecht and Pearce (2007) who concluded that GATT/WTO has had a positive and statistically significant impact on trade in capital-intensive commodities (in manufactures). Further, our results are opposite to Mujahid and Kalkuhl (2016) who found that GATT/WTO has no positive effect on food sectors.

In contrast, the impact of WTO on natural-resource sectors is not statistically significant. This could be explained by the low-tariff imposed on raw materials. Thus, the liberalization of trade resulting from the accession to the WTO has no impact on natural resource flows between members countries. However, we don't share the same conclusion of Grant and Boys (2011) in terms of the impact of GATR/WTO on agricultural trade.[2]

With regards to the regional integrations, we can note that they have overall positive impact on total trade and this is compatible with most studies. In addition, regional integration has promoted trade in all sectors except agricultural raw materials.

The results indicate that the impact of bilateral trade agreements on total trade is significative in contrast to Eicher and Henn (2011) who found that bilateral trade agreements has no effect on trade.[3] At the sectoral level, bilateral agreement has boosted

[1] $40\% = exp^{0.344} - 1$ and $20\% = exp^{0.191} - 1$

[2] Grant and Boys (2011) studied the impact of GATT/WTO on agricultural sectors including food sectors and agricultural raw materials. Thus, the difference in results is due to the asymmetry in the definition of agricultural sectors; where we separate between food and agricultural raw materials while they compiled them together.

[3] Our dataset covers 340 bilateral trade agreements comparing to the study of Eicher and Henn (2011) which covers 65 bilateral agreements.

trade only in manufactured sectors where they increased trade by 10%. However, estimates show that their impact in general is less important compared to WTO and regional integrations.

Concerning the impact of GSP, our estimations share that same results of Eicher and Henn (2011) who found that GSP decreased trade.

**Table 1-3: PPML panel estimates of aggregate trade effects of WTO, regional integrations, bilateral agreements and GSP on different trade flows. Sample period 1980-2015 at four-year intervals**

| VARIABLES | Total | Non-Natural Resource | Natural Resource | Manufactured | Food | Agricultural Raw Materials | Minerals | Energy |
|---|---|---|---|---|---|---|---|---|
| WTO/GATT | 0.102 | 0.288*** | 0.0434 | 0.344*** | 0.191* | 0.0601 | -0.303 | 0.00932 |
| | (0.0819) | (0.0767) | (0.118) | (0.0832) | (0.110) | (0.129) | (0.187) | (0.175) |
| Regional Integration | 0.330*** | 0.260*** | 0.359*** | 0.213*** | 0.542*** | -0.0542 | 0.311*** | 0.242** |
| | (0.0306) | (0.0286) | (0.0679) | (0.0291) | (0.0696) | (0.0800) | (0.0604) | (0.115) |
| Bilateral Agreement | 0.0917*** | 0.0992*** | 0.0688 | 0.106*** | -0.0544 | 0.0108 | 0.0311 | 0.0332 |
| | (0.0287) | (0.0284) | (0.0593) | (0.0318) | (0.0398) | (0.0494) | (0.0499) | (0.0833) |
| GSP | -0.242** | -0.185* | 0.198 | -0.151 | -0.102 | -0.180 | 0.321* | 0.243 |
| | (0.120) | (0.0956) | (0.283) | (0.100) | (0.170) | (0.144) | (0.171) | (0.329) |
| Observations | 149,902 | 146,993 | 124,649 | 143,225 | 126,756 | 107,105 | 91,962 | 79,159 |
| R-squared | 0.995 | 0.996 | 0.982 | 0.996 | 0.986 | 0.984 | 0.983 | 0.981 |

Notes:

- All regressions are performed using ppml_panel_sg STATA command written by Thomas Zylkin. This command enables faster computation of the many fixed effects required for panel PPML structural gravity estimation. Fixed effects used in all regressions are: county-pair fixed effects ($\varphi_{ij}$) to address the endogeneity problem and to absorb all time-invariant variables among country pairs, and time-varying exporter ($\gamma_{it}$) and time-varying importer ($\delta_{jt}$) fixed effects to control the multilateral resistance terms.
- Standard errors (clustered by country-pair) and t-ratios in parentheses *** p<0.01, ** p<0.05, * p<0.1.
- The dependent variable is nominal value of bilateral export flows ($X_{ijt}$).
- We used Standard International Trade Classification (SITC), Revision 1 for disaggregated bilateral export flows; where Manufactures (SITC 5+6+7+8-68), Food (SITC 0+1+22+4-03), Agricultural Raw Materials (SITC 2-22-27-28), Ores & Metals (SITC 27+28+68), Fuels (SITC 3) and Fish (STIC 03).
- Natural resources exports are the sum of Agricultural Raw Materials + Ores & Metals + Fuels + Fish., as provided by WTO (2010).
- Non-natural resource exports = Total exports - Natural resource exports.

### 1.4.2 Asymmetric impact of WTO across developed countries, resource-rich countries and resource-poor countries

In this step of discussion, we estimated two augmented gravity models in order to analyze the potential asymmetric effects of WTO across countries. The first augmented model is set up to study the possible asymmetric effects of the WTO on countries as ***exporters***. Therefore, we disaggregate each dummy variable ($WTO_{ijt}$), ($RTI_{ijt}$), ($BTA_{ijt}$) and ($GSP_{ijt}$) according to the category of the ***exporter***. In the second augmented model, we aim to investigate the effects of WTO across countries as ***importers***. Thus, we disaggregate also each dummy variable ($WTO_{ijt}$), ($RTI_{ijt}$) and ($BTA_{ijt}$) according to the category of the ***importer***. Our categories of countries included in the analysis are: *developed countries, emerging natural resource-rich countries, non-emerging natural resource-rich countries, emerging natural resource-poor countries and non-emerging natural resource-poor countries.*

Table 1.4 provides results of the impact of the WTO across different categories of countries as *exporters*. First, we can note that the accession to the WTO has contributed to increase non-natural resource exports of all categories except non-emerging resource-rich countries.

In addition, results indicate that the emerging resource-rich countries are the greatest beneficiaries from the accession to the WTO, as they have been able to increase their non-natural resource exports to other WTO members by about 60%. Note also that the average export concentration index, for the period (1995-2015), of WTO member countries in this category is small, where it ranges between 20 and 30 except for Venezuela.[1] This shows that their export structures are diversified and reflects the success of the import substitution/industrialization policies followed by those countries to some extent.[2]

In contrast, the WTO has no impact on non-emerging resource-rich members in terms of increasing non-natural resource exports to other WTO members. This can be explained by the high export concentration index of this group. The average of export concentration index, for the period (1995-2015), of the WTO members classified in this group is more

[1] For export concentration index, see Table A.1 in the appendix.

[2] All countries classified as emerging resource-rich are South American countries except Russian Federation, see Table 1.2. These countries largely adopted import substitution policies in the 70s and 80s and they are also former GATT members.

than 0.50.[1] This shows how these countries still focus on exporting raw materials, and the accession to the WTO and previously to the GATT did not contribute to increase their exports in non-resource sectors.

In addition, the WTO membership increased non-natural resource exports of emerging and non-emerging resource-poor countries. In fact, the impact on non-emerging resource-poor countries is greater. This is mainly due to the fact that countries classified as emerging resource-poor countries are considered as large exporting countries. Most of these countries have been following trade liberalization policies since the 1990s, and therefore their economies are structured and oriented to export to global markets, especially to developed countries. So, the impact of the WTO on them seems to be less than non-emerging poor countries.

Estimation results show that developed countries have benefited also from the accession to the WTO in increasing their non-natural resource exports.

Nevertheless, joining the WTO did not contribute to increase natural resource exports of any category. This is due to the low tariff imposed on natural resource commodities.

With regards to regional integration, we note that they have contributed to increase non-natural resource exports of all categories except emerging resource-rich countries. In contrast, results indicate that regional integration contributed to boost intra-regional exports in non-natural resource sectors of non-emerging resource-rich countries and thereby may help to diversify their economies.

For resource-poor countries, estimation results show that the regional integrations contributed to increase intra-regional exports in non-natural resource sectors of both emerging and non-emerging resource-poor countries. Note that the impact of regional integrations is more important compared to the effect of WTO on these countries. Further, they had benefited more from the regional integration compared to resource-rich countries.[2]

[1] In addition, 30 WTO members classified in this group has an average export concentration index, for the period (1995-2015), greater than 0.40.

[2] We noted also that regional integrated has simulated the intra- regional exports in natural resource sectors

Results indicated that regional integration increased exports of developed countries in both natural resource sectors and non-natural resource sectors.[1]

With regards to the bilateral agreements, all countries increased their non-natural resource exports to their bilateral partners after signing these agreements, with the exception of emerging resource-rich countries. However, results indicate that non-emerging resource-rich countries are the greatest beneficiaries. In general, comparing to WTO and regional integrations, the impact of this type of trade agreement is less important, especially in developed and resource-poor countries. Bilateral agreements have not contributed also to increase natural resource exports of any category of countries.

Finally, we note that only non-emerging resource-poor countries have benefited from GSP. This confirms the principle objective of GSP which is to help developing countries-particularly LDCs - in facilitating their exports to major export markets.[2]

Table 1.5 provides results of the impact of WTO accession on countries as *importers*. We note that the WTO has contributed to increase non-natural resource imports of all categories from WTO members, and also the emerging resource-rich countries are the greatest beneficiaries. We note that regional integration has also contributed to increase intra-regional imports in non-natural resource sectors. In addition, results indicate that both emerging and non-emerging resource-poor countries increased intra-reginal imports in natural resource sectors from their regional partners. Finally, bilateral agreements increased the bilateral-imports in non-natural resource sectors of both categories of resource-poor countries.

Table 1.6 shows the percentage increase in non-natural resource exports and imports by each category for each type of international trade regulation.

[1] Shares of intra-regional trade in natural resource exports of the more industrialized WTO regions in 2008 were as follows: 82 per cent for Europe, 78 per cent for Asia and 62 per cent for North America. Meanwhile, resource-dominant regions of the CIS, Africa and Middle East had very low intra-regional trade shares of 12 per cent, 5 per cent and 2 per cent, respectively. Latin America was again between the extremes with an intra-regional trade share of 22 per cent, (WTO, 2010).
[2] Most of countries classified as non-emerging resource-poor countries are least developed countries.

**Table 1-4: PPML panel estimates of trade effect of WTO, Regional integrations, Bilateral agreements and GSP across exporters. Sample period 1980-2015 at four-year intervals**

| Variable | Definition | Total trade excluding natural resource sectors | Natural resource sectors |
|---|---|---|---|
| ***Ex_dev_WTO*** | Exporter (*i*) and importer (*j*) are members in WTO, exporter is a developed country | 0.278***<br>(0.0923) | -0.0328<br>(0.145) |
| ***Ex_emg_rich_WTO*** | Exporter (*i*) and importer (*j*) are members in WTO, exporter is an emerging resource-rich country | 0.473***<br>(0.159) | 0.108<br>(0.191) |
| ***Ex_non_emg_rich_WTO*** | Exporter (*i*) and importer (*j*) are members in WTO, exporter is a non-emerging resource-rich country | 0.0877<br>(0.0963) | 0.236<br>(0.220) |
| ***Ex_emg_poor_WTO*** | Exporter (*i*) and importer (*j*) are members in WTO, exporter is an emerging resource-poor country | 0.227**<br>(0.0901) | 0.0735<br>(0.152) |
| ***Ex_non_emg_poor_WTO*** | Exporter (*i*) and importer (*j*) are members in WTO, exporter is a non-emerging resource-poor country | 0.374***<br>(0.138) | -0.232<br>(0.199) |
| ***Ex_dev_RTI*** | Exporter (*i*) and importer (*j*) are members in RTI, exporter is a developed country | 0.226***<br>(0.0340) | 0.409***<br>(0.0924) |
| ***Ex_emg_rich_RTI*** | Exporter (*i*) and importer (*j*) are members in RTI, exporter is an emerging resource-rich country | 0.201<br>(0.215) | 0.246<br>(0.359) |
| ***Ex_non_emg_rich_RTI*** | Exporter (*i*) and importer (*j*) are members in RTI, exporter is a non-emerging resource-rich country | 0.310**<br>(0.132) | 0.0633<br>(0.247) |
| ***Ex_emg_poor_RTI*** | Exporter (*i*) and importer (*j*) are members in RTI, exporter is an emerging resource-poor country | 0.326***<br>(0.0922) | 0.322**<br>(0.126) |
| ***Ex_non_emg_poor_RTI*** | Exporter (*i*) and importer (*j*) are members in RTI, exporter is a non-emerging resource-poor country | 0.375***<br>(0.0667) | 0.192<br>(0.139) |

| | | | |
|---|---|---|---|
| ***Ex_dev_BTA*** | Exporter ($i$) and importer ($j$) are members in BTA, exporter is a developed country | 0.0682** | 0.100 |
| | | (0.0340) | (0.0976) |
| ***Ex_emg_rich_BTA*** | Exporter ($i$) and importer ($j$) are members in BTA, exporter is an emerging resource-rich country | 0.0715 | 0.0440 |
| | | (0.0858) | (0.113) |
| ***Ex_non_emg_rich_BTA*** | Exporter ($i$) and importer ($j$) are members in BTA, exporter is a non-emerging resource-rich country | 0.444* | 0.0410 |
| | | (0.255) | (0.179) |
| ***Ex_emg_poor_BTA*** | Exporter ($i$) and importer ($j$) are members in BTA, exporter is an emerging resource-poor country | 0.168*** | 0.0568 |
| | | (0.0479) | (0.0851) |
| ***Ex_non_emg_poor_BTA*** | Exporter ($i$) and importer ($j$) are members in BTA, exporter is a non-emerging resource-poor country | 0.151*** | 0.0651 |
| | | (0.0570) | (0.180) |
| ***Ex_emg_rich_GSP*** | Importer ($j$) grants preferences under GSP to an emerging resource-rich exporter ($i$) | -0.760* | 1.276*** |
| | | (0.451) | (0.391) |
| ***Ex_non_emg_rich_GSP*** | Importer ($j$) grants preferences under GSP to a non-emerging resource-rich exporter ($i$) | 0.0862 | 0.201 |
| | | (0.283) | (0.409) |
| ***Ex_emg_poor_GSP*** | Importer ($j$) grants preferences under GSP to an emerging resource-poor exporter ($i$) | -0.409** | -0.452 |
| | | (0.195) | (0.298) |
| ***Ex_non_emg_poor_GSP*** | Importer ($j$) grants preferences under GSP to a non-emerging resource-poor exporter ($i$) | 0.578*** | 0.0291 |
| | | (0.208) | (0.456) |
| Observations | | 147,053 | 124,649 |
| R-squared | | 0.996 | 0.982 |

Notes:
- All regressions are performed using ppml_panel_sg STATA command written by Thomas Zylkin. This command enables faster computation of the many fixed effects required for panel PPML structural gravity estimation. Fixed effects used in all regressions are: county-pair fixed effects ($\varphi_{ij}$) to address the endogeneity problem and to absorb all time-invariant variables among country pairs, and time-varying exporter ($\gamma_{it}$) and time-varying importer ($\delta_{jt}$) fixed effects to control the multilateral resistance terms.
- Standard errors (clustered by country-pair) and t-ratios in parentheses *** p<0.01, ** p<0.05, * p<0.1.
- The dependent variable is nominal value of bilateral export flows ($X_{ijt}$).
- We use Standard International Trade Classification (SITC), Rev.1.
- Naturel resource exports = Agricultural Raw Materials (SITC 2-22-27-28) + Ores & Metals (SITC 27+28+68) + Fuels (SITC 3) + Fish (STIC 03), as provided by WTO (2012).
- Non-natural resource exports = Total exports - Natural resources exports.

**Table 1-5: PPML panel estimates of trade effect of WTO, Regional integrations, Bilateral agreements and GSP across importers. Sample period 1980-2015 at four-year intervals**

| Variable | Definition | Total trade excluding natural resource sectors | Natural resource sectors |
|---|---|---|---|
| ***Im_dev_WTO*** | Exporter (*i*) and importer (*j*) are members in WTO, importer is a developed country | 0.231**<br>(0.0941) | 0.0858<br>(0.132) |
| ***Im_emg_rich_WTO*** | Exporter (*i*) and importer (*j*) are members in WTO, importer is an emerging resource-rich country | 0.472***<br>(0.123) | 0.434<br>(0.275) |
| ***Im_non_emg_rich_WTO*** | Exporter (*i*) and importer (*j*) are members in WTO, importer is a non-emerging resource-rich country | 0.284**<br>(0.129) | 0.419*<br>(0.249) |
| ***Im_emg_poor_WTO*** | Exporter (*i*) and importer (*j*) are members in WTO, importer is an emerging resource-poor country | 0.366***<br>(0.0849) | -0.133<br>(0.109) |
| ***Im_non_emg_poor_WTO*** | Exporter (*i*) and importer (*j*) are members in WTO, importer is a non-emerging resource-poor country | 0.345***<br>(0.100) | -0.144<br>(0.166) |
| ***Im_dev_RTI*** | Exporter (*i*) and importer (*j*) are members in RTI, importer is a developed country | 0.221***<br>(0.0441) | 0.366***<br>(0.0845) |
| ***Im_emg_rich_RTI*** | Exporter (*i*) and importer (*j*) are members in RTI, importer is an Emerging resource-rich country | 1.109***<br>(0.229) | -0.772<br>(0.493) |
| ***Im_non_emg_rich_RTI*** | Exporter (*i*) and importer (*j*) are members in RTI, importer is a non-emerging resource-rich country | 0.203**<br>(0.0893) | 0.575***<br>(0.203) |
| ***Im_emg_poor_RTI*** | Exporter (*i*) and importer (*j*) are members in RTI, importer is an emerging resource-poor country | 0.332***<br>(0.0620) | 0.323*<br>(0.190) |
| ***Im_non_emg_poor_RTI*** | Exporter (*i*) and importer (*j*) are members in RTI, importer is a non-emerging resource-poor country | 0.199***<br>(0.0489) | 0.323*<br>(0.189) |

| | | | |
|---|---|---|---|
| ***Im_dev_BTA*** | Exporter ($i$) and importer ($j$) are members in BTA, importer is a developed country | 0.0608<br>(0.0423) | 0.0789<br>(0.0766) |
| ***Im_emg_rich_BTA*** | Exporter ($i$) and importer ($j$) are members in BTA, importer is an emerging resource-rich country | 0.0460<br>(0.0677) | 0.750***<br>(0.232) |
| ***Im_non_emg_rich_BTA*** | Exporter ($i$) and importer ($j$) are members in BTA, importer is a non-emerging resource-rich country | -0.0974<br>(0.0893) | -0.0402<br>(0.194) |
| ***Im_emg_poor_BTA*** | Exporter ($i$) and importer ($j$) are members in BTA, importer is an emerging resource-poor country | 0.152***<br>(0.0354) | 0.00198<br>(0.0908) |
| ***Im_non_emg_poor_BTA*** | Exporter ($i$) and importer ($j$) are members in BTA, importer is a non-emerging resource-poor country | 0.264***<br>(0.0756) | 0.0587<br>(0.150) |
| ***GSP*** | Importer ($j$) grants preferences under GSP to an exporter ($i$) | -0.175*<br>(0.0958) | 0.186<br>(0.283) |
| Observations | | 147,053 | 124,649 |
| R-squared | | 0.996 | 0.982 |

Notes:
- All regressions are performed using ppml_panel_sg STATA command written by Thomas Zylkin. This command enables faster computation of the many fixed effects required for panel PPML structural gravity estimation. Fixed effects used in all regressions are: county-pair fixed effects ($\varphi_{ij}$) to address the endogeneity problem and to absorb all time-invariant variables among country pairs, and time-varying exporter ($\gamma_{it}$) and time-varying importer ($\delta_{jt}$) fixed effects to control the multilateral resistance terms.
- Standard errors (clustered by country-pair) and t-ratios in parentheses *** p<0.01, ** p<0.05, * p<0.1.
- The dependent variable is nominal value of bilateral export flows ($X_{ijt}$).
- We use Standard International Trade Classification (SITC), Rev.1.
- Naturel resource exports = Agricultural Raw Materials (SITC 2-22-27-28) + Ores & Metals (SITC 27+28+68) + Fuels (SITC 3) + Fish (STIC 03), as provided by WTO (2012).
- Non-natural resource exports = Total exports - Natural resources exports.

**Table 1-6: Percentage increase in non-natural resource exports and imports by each category. Sample period 1980-2015 at four-year intervals**

| | World Tarde Organization (WTO) | | Regional Trade Integration (RTI) | | Bilateral Trade Agreements (BTA) | | Generalized System of Preferences (GSP) |
|---|---|---|---|---|---|---|---|
| Category | Exports | Imports | Exports | Imports | Exports | Imports | Exports |
| Developed countries | 32,05% | 25,99% | 25,36% | 24,73% | 7,06% | - | - |
| Emerging resource - rich countries | 60,48% | 60,32% | - | 203,13% | - | - | -53,23% |
| Non-emerging resource – rich countries | - | 32,84% | 36,34% | 22,51% | 55,89% | - | 0,00% |
| Emerging resource - poor countries | 25,48% | 44,20% | 38,54% | 39,38% | 18,29% | 16,42% | -33,57% |
| Non-emerging resource - poor countries | 45,35% | 41,20% | 45,50% | 22,02% | 16,30% | 30,21% | 78,25% |

Notes:
- Calculated using estimates reported in Tables 1.4 and 1.5 in this chapter.
- These effects are calculated as exp(coeff)-1
- The dependent variable is nominal value of bilateral export flows ($X_{ijt}$).
- We use Standard International Trade Classification (SITC), Rev.1.
- Naturel resource exports = Agricultural Raw Materials (SITC 2-22-27-28) + Ores & Metals (SITC 27+28+68) + Fuels (SITC 3) + Fish (STIC 03), as provided by WTO (2012).
- Non-natural resource exports = Total exports - Natural resources exports.

## 1.5 Conclusion

This chapter is considered as an extension of the studies that interested in the effects of the WTO. In fact, previous studies focused on studying the impact of the WTO between developed and developing countries which is considered as one of the main axes in this scope. However, we showed that developing countries are not homogenous in several aspects. They differ in terms of growing of theirs markets and in terms of their dependence on natural resources. The study had two main objectives. First, we examined the overall impact of the WTO on international trade. Second, we investigated the potential asymmetric impact of WTO across countries focusing on developing countries. After discussing the results of the estimates, we can present some conclusions

First, our results indicated that the WTO has no impact on any type of natural resource commodities, while it has boosted trade in manufactured and food sectors.

With respect to natural resource-rich countries, the impact of the WTO depends on the growing of markets and. Our estimation shows that the WTO has significant and positive impact on resource-rich countries that have emerging markets and diversified export structures, where they are the greatest beneficiaries from the accession to the WTO. In contrast, other forms of international trade regulation, particularly regional integration and bilateral agreements, have not contributed to increase the exports of emerging resource-rich countries towards their regional or bilateral partners. This reflects that emerging resource-rich countries are more inclined towards full trade liberalization and exporting towards global markets. Furthermore, WTO did not contribute to increase exports of non-emerging resource-rich countries. These countries heavily depend on exporting natural resources and their export structures are not diversified enough. On the other hand, regional integration and bilateral agreements stimulated their non-resource exports. This reflects that non-emerging resource-rich countries are more oriented towards regional markets. Therefore, we can conclude that the export diversification and the competitiveness improvement in the first category contributed to benefit from the accession to the WTO. On the other hand, because of the lack of competitiveness, the second category benefits more from regional and bilateral agreements rather than the WTO.

On the other hand, the impact of WTO is significant and positive across resource-poor countries. In fact, both emerging resource-poor and non-emerging resource-poor countries have benefited from the accession to the WTO but unevenly. Results indicated that

emerging markets benefited less from the accession. Because they have been adopting trade liberalization policies that essentially relay on exporting to the outside world, and thus the accession to the WTO has not affected their trade patterns. With regards to regional integrations, we note also that they have a slightly more positive effect on both categories compared to WTO impact. This reflects the importance of establishing trade blocks for resource-poor countries. Bilateral agreements have also contributed to increase exports of both resource-poor categories, but to a lesser extent. The results also showed that only non-emerging resource-poor countries who have benefited from the GPS reflecting the success of this system to some extent.

Finally, accession to the WTO has not contributed to increase natural exports between members countries due mainly, as mentioned before, to the low tariffs imposed on them. Therefore, the dramatic increase in the share of natural resources in international trade has been affected by other factors like: population growth, spreading industrialization, the rise of developing economies, revolution in transport technology, and gradual opening of commodity markets.

This research can be developed in the future by studying the WTO impact across countries focusing on extensive and intensive margins of trade. This kind of research will allow us to investigate more precisely the impact of WTO on the number of varieties that are exported to each destination country, and on the average value of exports by variety. In fact, this will be useful for developing resource-rich countries.

# Chapter (2): The impact of natural resource endowment on regional integration gains

## 2.1 Introduction

This chapter aims to empirically investigate the gains of regional integration in terms of trade creation and trade diversion between countries for several regional trade agreements in resource-rich regions. It relies, essentially, on the following literature: Fouquin et al. (2006) who provided several observations with regard to the influence of natural resources abundance on regional integration, Venables (2009) who presented his theoretical predications and showed that the gains from regional integration are unevenly distributed between resource-rich and resource-poor countries, and Carrère et al. (2012) who empirically checked Venables (2009) theoretical predictions using gravity models for different integration schemes in MENA region.

Our analysis in this chapter consists of two main steps. The first one aims to estimate a basic gravity model to explore the aggregate effects for several regional integrations established in resources-rich regions. The second step, using an augmented gravity model, provides further analysis how the effects of regional integration are distributed across countries depending on their natural resources endowment. This step allows us to discuss several issues pointed in the literature: complementarity between countries with different economic structures, theoretical predications of Venables (2009), export diversification of resource-rich countries and relationship with the rest of the world.

The chapter is structured as follows. Section 2 reviews the literature that form the analytical framework of the natural resources endowment impact on the regional integration gains. Section 3 introduces the empirical gravity models that are set up for the two steps of analysis. Section 4 discusses the empirical results. Finally, Section 5 concludes the chapter.

## 2.2 Literature review

We can divide the literature review of the relationship between natural resource endowment and the gains from regional integration into two main axes; the theoretical framework and the empirical contributions.

### 2.2.1 Analytical framework of the impact of natural resources abundance on the regional integration gains

The relationship between the abundance of natural resources and the economic integration was principally discussed in the literature through several topics such as;

potential complementarity between heterogenous countries in terms of their economic structures, theoretical predictions of Venables (2009) and export diversification of resource-rich countries.

#### *2.2.1.1 Complementarity between resource-rich and resource-poor countries*

We firstly recall that Viner (1950) and Lipsey (1960) suggested that more benefits of economic integration will accrue to competitive countries (countries producing similar products) than to complementary countries (countries producing dissimilar products). This analysis tends to be in favor of developing countries, as most developing countries specialize in exports of primary products, therefore developing countries may be said to be competitive in the Vinerian way. Although this is true, in reality, most of these exports are targeted at developed country markets. This hinders the benefits of economic integration between developing countries because it may not actually expand their levels of intra-trade (El-Naggar, 1964). Therefore, Balassa (1965) argued that the previous understanding of the criterion of competitiveness and complementarity is not at all relevant to the case of developing countries. In addition, Mikesell (1965) claimed that developing countries should aim at reaching a substantial degree of complementarity between them. In fact, the two oil price shocks of the 1970s led to the collapse of many south-south regional integration schemes, as it widened the differences between net oil importers and net oil exporters. Commodity importers decided to focus on extra-regional trade agreements and commodity exporters abandoned domestic reforms after the windfall gains, thereby creating volatility in these regional integration schemes (Fouquin et al., 2006).

Heimenz and Langhammer (1990), Inotai (1991) and Shams (2003) have argued that complementarity or dissimilarity of economic structures would be better to the case of economic integration among developing countries. Greenaway and Milner (1990), for example, argue that one significant problem of the poor trade and integration performance between South-South countries is that they are at comparable stages of development and therefore have comparable production structures. A union among similar (competitive) countries assumes that trade will come from intra-industry specialization. Such trade expansion has been evident in the case of developed industrialized countries, where market size and incomes may support such specialization. However, this is obviously less possible in the case of smaller poorer markets that characterize developing country markets. Therefore, a union among dissimilar (complementary) countries is encouraged.

#### *2.2.1.2 Trade creation and trade diversion*

Viner's study was the first to identify concrete criteria to distinguish between the possible advantages and disadvantages of economic integration. Viner's so called "static analysis" of economic integration has divided possible effects of economic integration into the well-known trade creation and trade diversion effects. Trade creation refers to the case when two or more countries enter into a trade agreement, and trade shifts from a high-cost supplier member country to a low-cost supplier member country in the union. Trade diversion may occur when imports are shifted from a low-cost supplier of a non-member country of the union (third country) to a high-cost supplier member country inside the union. This may be the case if common tariff after the union protects the high cost supplier member country inside the union.

The issue of trade creation and trade diversion in regions abundant in natural resources is somewhat different, even unique (WTO, 2010). This is because, relative to manufactured goods, tariff and non-tariff barriers on natural resource commodities such as oil, natural gas, metals and minerals tend to be low (Carbaugh, 2007).[1] However, an analysis of potential trade creation and trade diversion effects in such regions are principally discussed by Fouquin et al. (2006) and Venables (2009).

Fouquin et al. (2006) documented that if two countries formed a regional trade agreement and they are abundant in different natural resources, tariffs imposed on these resource commodities within the free trade area are unlikely to constitute a major barrier to trade within this area. Hence, trade creation effects for resource abundant countries are likely to be small. Rising demand for resource products due to integration is thus determined by indirect income effects rather than direct price effects. On the other hand, if the two resource-abundant countries are abundant in the same natural resource and member states in a regional trade agreement, they will have few incentives to trade with each other, with or without tariffs, as there is very little product differentiation in the same resource commodity.[2] Hence, once again, trade creation effects are likely to be small, (WTO, 2010). This is especially true of south-south trade as partners do not appear to be

[1] See General introduction.

[2] According to Meade (1955) and Hillmann (1956), the higher the initial tariff rates between countries entering a customs union, the larger are the expected gains of economic integration. For trade in natural resources, tariff and non-tariff barriers on natural resource commodities tend to be low. Thus, the integration of two resource-abundant countries with low tariffs and non-tariff barriers on natural resources, and similar production structures, is likely to lead to limited trade creation and potentially large trade diversion effects.

major export markets for natural resources.[1] Resource-rich poor countries often suffer from trade diversion in manufacturing not only because their production structure traditionally lags behind that of the industrial centers in the schemes and is characterized by dualism. The main reason is that fluctuating world market prices often expose them to temporary Dutch disease shocks. Such shocks insert additional uncertainty into investment decisions, fuel currency overvaluation and resource rent appropriation, impede diversification efforts and bias the production structure of the countries concerned towards the primary sector (Fouquin et al., 2006).

Venables (2009) presents a theoretical model to investigate how the gains from regional integration in resource-rich regions are distributed between countries, especially between resource-rich and resource-poor countries. He concludes that if the preferential trade agreement is signed by a natural resource-rich country and a natural resource-poor country with a small but developing manufacturing sector, then the gains from regional integration are unevenly distributed between them. Regional integration implies a reduction in tariffs on imports. This enables resource-poor country to extend their exports to the resource-rich partner of manufacturing goods and earn more foreign exchange as it will benefit from privileged access to markets inside the agreement. It will be able also to import more natural resources from the resource rich country. However, the extra foreign exchange accruing to resource-poor country raises income, thereby bidding up the prices of these regionally traded goods, increasing wages, creating a terms-of-trade gain, importing more capital goods from the rest of the world and reach a higher level of economic growth. On the other hand, resource-rich economies lose (or at best experience very modest gains) from regional integration for two raisons. First, a terms-of-trade gain for the resource-poor country is necessarily a terms-of-trade loss for the resource-rich economy. Second, the resource-rich country may suffer from a significant amount of trade diversion as it substitutes imports from the relatively more efficient rest of the world towards the regional partner. In contrast, multilateral trade liberalization will be beneficial for the resource-rich country as lower tariffs on more cost-efficient imports from non-member countries will entail trade creation, but no trade diversion. Moreover,

[1] Lipsey (1960) argued that a customs union will more likely produce welfare gains the higher is the proportion of trade with its partner in the union, and the lower the proportion with the rest of the world. It is established that trade between developing countries over the years has always been rather small in comparison to trade between developed countries, implying that welfare gains of economic integration between developing countries will tend to be small. Besides, in fact most of primary products exports are targeted at developed country markets hinders the benefits of economic integration between developing countries because it may not actually expand their levels of intra-trade, (El-Naggar, 1964).

external trade liberalization implies a reduction in tariffs on imports from the rest of the world. Since intra-regional trade takes the form of exports of manufactured goods from the resource-poor country to the resource-rich country, this reduction in the price of imports from the rest of the world is a terms-of-trade gain for the resource-rich economy. Hence, while trade is a way for the resource-rich economy to relax the constraint causing diminishing returns in the use of its resource revenues, these gains come from non-preferential opening.[1]

#### *2.2.1.3 Export diversification in resource-rich countries*

Another point discussed is the impact of regional integration on the diversification process of natural resource-rich countries. Regional integration may actually help resource-abundant countries to diversify their export basket and break into the chain of global manufacturing production, (WTO, 2010). Collier and Venables (2008) constructed a model to address this question and concluded that the integration of the two economies (one economy has no resource revenue and the other has resource revenue) would increase overall income substantially, thereby implying that there will be large efficiency gains. In general, regional integration will result in gains for both countries. The resource-poor country can increase its foreign exchange earnings to import inputs and capital equipment by gaining duty-free access to the market of its resource-rich partner country. On the other hand, the resource-rich country can import labour or goods that were previously supply constrained, thereby inhibiting economies of scale and successful diversification into manufacturing production.

The above argument that favors protection for the sake of stimulating industrial development in economic integration schemes of developing countries is more thoroughly discussed or theorized in what is called the "Training Ground Theory". This theory, according to Heimenz and Langhammer (1990), Inotai (1991), and Inotai (1997) depends on the hypothesis that during the first phase of integration between developing countries, international competitiveness of developing countries can be gradually improved by relying on the regional market in the first phase of industrialization. Free trade among member countries plus the usually high common external tariff on imports from the outside world should provide temporary protection of infant industries as well as a sufficient large market for future industrial development. This process - termed "import-substituting industrialization" by Rueda-Junquera (2006) - will secure sufficient time for

[1] For further, we present the model of Venables (2009) in the appendix.

the development of the industrial sectors of the member developing countries. Entrance or openness to world markets may then come at a later stage after developing countries have reached a reasonable degree of efficiency and technical development. Thus, economic integration among developing countries may be considered as a transitional period or a stepping stone towards open competition with the outside world after a short period of learning or training; hence the name training ground theory.

### 2.2.2 Empirical contributions

Carrère et al. (2012) empirically checked Venables (2009) theoretical predictions for different integration schemes in Middle East and North Africa (MENA) region over the period 1990-2008. They explored the extent to which MENA different integration schemes have led to trade creation and trade diversion for resource-rich and resource-poor countries. Using an augmented gravity model as an analysis tool of ex-post effects of RTAs concerning trade creation and trade diversion, results suggest that there is trade creation in most agreements, and that trade diversion may only be a problem in the Pan-Arab Free Trade Area (PAFTA), in particular when considering non-oil imports. As predicted by Venables (2009) trade diversion seems to be concentrated in resource rich importers. These are generally countries that export only a few products and with a highly concentrated export bundle. Interestingly, these countries have also significantly increased their exports of non-oil goods to resource poor countries, but these increases were not accompanied by trade diversion in resource poor countries. Hence, while further intraregional trade integration is an important avenue for enhancing diversification of resource-poor MENA countries, resource-rich countries have no strong incentive for further preferential regional integration from a purely economic standpoint, and this may explain their relative reluctance to engage in this type of scheme.

Carrère (2013) studied trade performance in the West African Economic and Monetary Union (WAEMU) and the Central African Economic and Monetary Community (CEMAC) over the period 1995- 2010. Using a panel gravity model, she found that both WAEMU and CEMAC have generated some trade diversion while only WAEMU presented significant additional intra-regional trade, i.e. trade creation. In addition, gains from regional integration are unevenly distributed among member countries. Countries that were more concentrated in their exports, when the regional agreements have been implemented, have faced a large trade diversion while countries with a relative initial diversification in their export bundles have benefited from an increase in their exports towards other members with no evidence of trade diversion.

## 2.3 Methodology

The gravity model is the most successful trade analysis tool of the last twenty-five years (Anderson, 1979). Tinbergen (1962) was the first to perform an ex post analysis of Free Trade Areas (FTAs) using a gravity equation to analyze their effects on trade flows. Many authors have spent a great deal of effort to investigate theoretical models that would map into the gravity model specification—including Anderson (1979), Helpman and Krugman (1985), Bergstrand (1985, 1989), Deardorff (1998), Evenett and Keller (2002), and Anderson and Wincoop (2003). In fact, the gravity model has also become a favored tool to assess the ex post trade creating and trade diverting effects associated with FTAs such as Endoh (1999), Soloaga and Winters (2001), Carrère (2006), Magee (2008), Martínez-Zarzoso et al. (2009), and Trotignon (2010).

The section is organized as follows. First, we provide the development of gravity models in terms of the set of Regional Trade Agreement dummy variables (RTA). Then, we introduce the basic gravity model which will be used to assess the overall impact of several RTAs. Subsequently, we present the augmented gravity model which is set up to investigate how the regional integration are distributed between resource-rich and resource-poor countries. Finally, we will explain the econometric issues followed by the data description.

### 2.3.1 Gravity model and RTA dummy variables

Began with only one dummy variable to capture the effect of RTAs on intra-regional trade, the works on RTAs effects had been extended with the addition of a second and third dummy variables to measure the effect of RTAs on the trade of member countries with non-members. This improvement changes the way researchers interpret the empirical results as they could assess more carefully the trade creation and trade diversion effects following the creation of RTAs, as introduced by Viner (1950). In the interest of evaluating the effects of an RTA on trade flows, many studies first enhanced the basic gravity model by including a regional dummy variable which takes value 1 if both exporter and importer are members in common RTA, and zero otherwise. This dummy variable measures the RTA effects on intra-bloc trade flows between member countries.[1]

Since the studies including only one regional dummy variable were not capable of capturing the effect of an RTA on trade flows between bloc members and non-members,

[1] See for example: Aitken (1973), Brada and Méndez (1985), Bergstrand (1985), Frankel et al. (1995), Bayoumi and Eichengreen (1997), Frankel (1997), Cheng and Wall (2005), and Bussière et al. (2005).

many empirical studies, in the late 1990s, have added a second regional dummy variable to measure it. This dummy is a binary variable takes value of 1 if one of the two countries is a member in a given RTA and the other not, and 0 otherwise. Frankel (1997) indicates that this variable accounts for the level of openness of RTAs. With the former regional dummy variable combining with the second one, these studies can identify the trade creation and trade diversion effects separately of an RTA. In the case when the formation of an RTA leads to an increase in intra-bloc trade and also promotes extra-bloc trade or keeps the latter unchanged, this RTA is likely to have trade creation effect. On the other hand, if an RTA increases trade flows between member countries to the detriment of their trade flows with the rest of the world, it seems to induce trade diversion effect since the intra-bloc trade can substitute for the trade flows coming from the rest of the world.[1]

Nonetheless, studies on the effects of RTAs including these two dummy variables rarely identify precisely the trade creation and trade diversion effects for RTAs. Since the dummy variable for the level of openness (extra bloc trade) covers both of members' total exports and imports of goods, it is not capable of separating the impact of the trading bloc on the extra-bloc trade regarding exports from the one regarding imports. As Soloaga and Winters (2001) noted, the import and export flows of member countries may come after different paths. When an RTA improves their trade with non-member countries, the gravity model with two regional dummy variables cannot identify whether this effect comes from the exports towards the rest of the world or the imports from non-members. Similarly, this problem also arises when an RTA has negative effects on extra-bloc trade. The most recent studies since the 2000s have once again extended the model by including a third regional dummy variable to create a set of three dummy variables individualized for each RTA. First variable takes value 1 of if exporter and importer are members in common RTA, and zero otherwise, it measures intra-bloc trade between member countries. Second variable takes value of 1 if the exporter is a member in RTA and importer is not, and zero otherwise, it explains the export flows of member countries towards nonmembers. Third variable takes value of 1 if the exporter is a non-member in RTA and the importer is a member, and zero otherwise, it captures the import flows from the rest of the world to member countries. The last two dummies seek to indicate the level of overall openness for the trading bloc in terms of export and import flows. For the purpose of interpreting the

[1] See for example Bayoumi and Eichengreen (1997), and Lee and Park (2005).

effects of a given RTA, these studies need to compare the value of coefficient estimate for intra-bloc trade and the ones for the extra-bloc trade regarding exports and imports.[1]

### 2.3.2 Basic gravity model

We follow the Vinerian specification of integration effects with an extension of three different sets of RTA dummy variables representing trade creation, export diversion and import diversion effects, as proposed by Endoh (1999), Soloaga and Winters (2001), Carrère (2006), Magee (2008), Martínez-Zarzoso et al. (2009) and Trotignon (2010). The baseline gravity model is given by:

$$X_{ijt} = \beta_0 (gdp_{it})^{\beta_1} (gdp_{jt})^{\beta_2} (dis_{ij})^{\beta_3} e^{\beta_4 (contig_{ij})} e^{\beta_5 (lang_{ij})} e^{\beta_6 (col_{ij})} e^{\beta_7 (comcol_{ij})} e^{a_{intra}\left(RTA\_intra_{ijt}^{k}\right)} e^{a_x\left(RTA\_exp_{ijt}^{k}\right)} e^{a_m\left(RTA\_imp_{ijt}^{k}\right)} \omega_{ijt} \quad (2.1)$$

The variables are defined as:

| | |
|---|---|
| $X_{ijt}$ | Value of exports from exporter ($i$) to importer ($j$) in year ($t$) at current US$, |
| $gdp_{it}$ | GDP of exporter ($i$) in year ($t$) at current US$, |
| $gdp_{jt}$ | GDP of importer ($j$) in year ($t$) at current US$, |
| $dis_{ij}$ | Distance between exporter ($i$) and importer ($j$), |
| $lang_{ij}$ | Dummy variable indicating that exporter ($i$) and importer ($j$) have a common language, |
| $contig_{ij}$ | Dummy variable indicating that exporter ($i$) and importer ($j$) have a common border, |
| $col_{ij}$ | Dummy variable indicating that exporter ($i$) and importer ($j$) have ever in colonial relationship, |
| $comcol_{ij}$ | Dummy variable indicating that exporter ($i$) and importer ($j$) have ever common colonizer post 1945, |
| $RTA\_intra_{ijt}^{k}$ | Dummy variable takes value of 1 if both exporter ($i$) and importer ($j$) belong to the same agreement ($k$) in year ($t$) and zero otherwise, |

[1] See for example Endoh (1999), Soloaga and Winters (2001), Carrère (2006), Magee (2008), Martínez-Zarzoso et al. (2009), and Trotignon (2010).

$RTA\_exp_{ijt}^{k}$ Dummy variable takes value of 1 if exporter ($i$) belongs to the same agreement ($k$) in year ($t$) and importer ($j$) does not and zero otherwise,

$RTA\_imp_{ijt}^{k}$ Dummy variable takes value of 1 if exporter ($i$) is a non-member in year ($t$) and importer ($j$) belongs to the agreement ($k$) and zero otherwise,

$\omega_{ijt}$ Error term.

The traditional approach to estimate equation (2.1) in the literature is to transform it to linear model by taking logarithms, leading to the following equation:

$$lnX_{ijt} = \beta_0 + \beta_1 lngdp_{it} + \beta_2 lngdp_{jt} + \beta_3 lndis_{ij} + \beta_4 lang_{ij} + \beta_5 contig_{ij} + \beta_6 col_{ij} + \beta_7 comcol_{ij} + a_{intra} RTA\_intra_{ijt}^{k} + a_x RTA\_exp_{ijt}^{k} + a_m RTA\_imp_{ijt}^{k} + \epsilon_{ijt} \quad (2.2)$$

where $\epsilon_{ijt} = Ln(\omega_{ijt})$ is the error term of equation (2-2). The log-linearized model is only feasible whenever $X_{ij} > 0$. Thus, the log transformation struggles with observations involving $X_{ij} = 0$ because the natural logarithm of zero cannot be determined. As explained in the previous section, our study applies the PPML estimator to deal with the challenges which the log-linear gravity equation has failed to overcome. Thus, the PPML technique is used to estimate the following gravity model:

$$X_{ijt} = exp\left\{\begin{matrix}\beta_0 + \beta_1 lngdp_{it} + \beta_2 lngdp_{jt} + \beta_3 lndis_{ij} + \beta_4 lang_{ij} + \beta_5 contig_{ij} + \beta_6 col_{ij} + \\ \beta_7 comcol_{ij} + a_{intra} RTA\_intra_{ijt}^{k} + a_x RTA\_exp_{ijt}^{k} + a_m RTA\_imp_{ijt}^{k} + \epsilon_{ijt}\end{matrix}\right\} \quad 2.3)$$

Table 2.1 provides our method of analyzing the signs of RTA coefficients, inspired by Soloaga and Winters (2001), Carrère (2006), and Trotignon (2010).

**Table 2-1: Interpretation of coefficients of RTA dummy variables**

| Sign of RTA Coefficients | | | Differences in Absolute Size | Trade Creation & Trade Diversion |
|---|---|---|---|---|
| $a_{intra}$ | $a_x$ | $a_m$ | | |
| + | + | + | | ITC, XTC and MTC |
| + | + | − | $a_{intra} > \lvert a_m \rvert$ | ITC, XTC, MTD |
| + | + | − | $a_{intra} < \lvert a_m \rvert$ | XTC, MTD |
| + | − | + | $a_{intra} > \lvert a_x \rvert$ | ITC, XTD, MTC |
| + | − | + | $a_{intra} < \lvert a_x \rvert$ | XTD, MTC |
| + | − | − | $a_{intra} > \lvert a_x + a_m \rvert$ | ITC, XTD, MTD |
| + | − | − | $a_{intra} < \lvert a_x + a_m \rvert$ | XTD and/or MTD |

ITC: Intra-bloc trade creation: Stimulating effect on trade between partners.
XTC: Export trade creation: Stimulating effect on exports to the rest of the world.
MTC: Import trade creation: Stimulating effect on imports from the rest of the world.
XTD: Export trade diversion: Exports to the rest of world are replaced by intra-bloc trade.
MTD: Import trade diversion: Imports from the rest of world are replaced by intra-bloc trade.

In sum, normally, $a_{intra} > 0$. If $a_{intra} > 0$ and $a_x > 0$ ($a_m > 0$), there is pure trade creation in terms of exports (imports). Generally, trade creation would be supported if

within-bloc trade were enhanced ($a_{intra} > 0$) and trade with non-members increased ($a_x + a_m > 0$). Trade diversion is suspected when $a_{intra} > 0$ and $a_x + a_m < 0$. Specifically, $a_{intra} > 0$ along with $a_x < 0$ ($a_m < 0$) indicates trade diversion in terms of exports (imports). At the same time, if $a_{intra} + a_x > 0$ or $a_{intra} + a_m > 0$, we also call this trade creation. If the increase in intra-regional trade is entirely offset by a decrease in regional exports to (imports from) the rest of the world, namely $a_{intra} + a_x < 0$ ($a_{intra} + a_m < 0$), this is pure trade diversion in terms of exports (imports).

### 2.3.3 Augmented gravity model

In order to provide further insights about how the effects of the regional trade agreements (RTA) will be distributed across countries in the context of the uneven allocation of natural resources between them, we estimate an augmented gravity model principally inspired from Carrère et al. (2012). We explore within the same gravity setup how patterns of trade creation and trade diversion vary across bilateral pairs depending on whether the exporter ($i$) and importer ($j$) is resource-rich country ($R$) or resource-poor country ($P$). The new gravity equation (2-4) is composed by four main groups of variables, more formally:

$$X_{ijt} = exp\begin{Bmatrix} a + \beta_1 lngdp_{it} + \beta_2 lngdp_{jt} + \beta_3 lndis_{ij} + \beta_4 lang_{ij} + \beta_5 contig_{ij} + \beta_6 col_{ij} + \beta_7 comcol_{ij} + \\ \beta_8[R_iR_jRTA^k_{ijt}] + \beta_9[R_iP_jRTA^k_{ijt}] + \beta_{10}[P_iR_jRTA^k_{ijt}] + \beta_{11}[P_iP_jRTA^k_{ijt}] + \\ \beta_{12}[R_iW_jRTA^k_{ijt}] + \beta_{13}[P_iW_jRTA^k_{ijt}] + \beta_{14}[W_iR_jRTA^k_{ijt}] + \beta_{15}[W_iP_jRTA^k_{ijt}] + \epsilon_{ijt} \end{Bmatrix} \quad (2.4)$$

The first group of variables (coefficients from $\beta_1$ to $\beta_7$) of the equation (2.4) captures the effects of the traditional explicative variables of gravity model.

The second group of variables (coefficients from $\beta_8$ to $\beta_{11}$) includes intra-regional trade dummies for each agreement ($k$), where exporter ($i$) and importer ($j$) are both members of agreement ($k$) in year ($t$). The exporters are decomposed into two categories according to their abundance in natural resources, resource-rich country ($R_i$) and resource-poor country ($P_i$), as well as the importers ($R_j$) and ($P_j$). The intra-regional trade dummy variables represent all the possible combinations of intra-regional bilateral trade in agreement ($k$) as follows: ($R_iR_j$), ($R_iP_j$), ($P_iR_j$) and ($P_iP_j$). The objective of this decomposition of intra-regional trade flows is to explore how the effects of trade creation and trade diversion are distributed within agreement ($k$) depending on whether the exporter ($i$) or importer ($j$) is resource-rich country or resource-poor country. More formally:

$R_iR_jRTA_{ijt}^k$ is unity when both exporter ($i$) and importer ($j$) are resource-rich countries within agreement ($k$) in year ($t$), or zero otherwise,

$R_iP_jRTA_{ijt}^k$ is unity when exporter ($i$) is a resource-rich country and importer ($j$) is a resource-poor country within agreement ($k$) in year ($t$), or zero otherwise,

$P_iR_jRTA_{ijt}^k$ is unity when exporter ($i$) is a resource-poor country and importer ($j$) is a resource-rich country within agreement ($k$) in year ($t$), or zero otherwise,

$P_iP_jRTA_{ijt}^k$ is unity when both exporter ($i$) and importer ($j$) are resource-poor countries within agreement ($k$) in year ($t$), or zero otherwise.

The third group of binary variables (coefficients from $\beta_{12}$ and $\beta_{13}$) captures the effects of regional integration on extra-regional trade of members in each ($k$) agreement in terms of extra regional exports. It includes tow dummy variables where the exporter ($i$) is member in ($k$) agreement and the importer ($j$) is not in year ($t$). Exporters are decomposed again into resource-rich country ($R_i$) and resource-poor country ($P_i$), and then combined with the rest of world: ($R_iW_j$) and ($P_iW_j$). We aim to explore the extent of heterogeneity in extra-regional export creation or diversion in ($k$) agreement whether the exporter ($i$) is resource-rich member or resource-poor member. More formally:

$R_iW_jRTA_{ijt}^k$ is unity if exporter ($i$) is resource-rich member within ($k$) agreement and importer ($j$) is non-member in year ($t$), or zero otherwise,

$P_iW_jRTA_{ijt}^k$ is unity if exporter ($i$) is resource-poor member within ($k$) agreement and importer ($j$) is non-member in year ($t$), or zero otherwise.

The last group of binary variables (coefficients from $\beta_{14}$ and $\beta_{15}$) captures the effects of regional integration on extra-regional trade of members in each agreement ($k$) in terms of extra-regional imports. It includes also two dummy variables where the exporter ($i$) is rest of the world (non-member in agreement ($k$)) and the importer ($j$) is member in year ($t$). Importers are decomposed also into resource-rich country ($R_j$) and resource-poor country ($P_j$), and then combined with the rest of the world: ($W_iR_j$) and ($W_iP_j$). We aim to explore the extent of heterogeneity in extra-regional import creation or diversion in agreement ($k$) whether the importer ($j$) is resource-rich member or resource-poor member. More formally:

$W_iR_jRTA_{ijt}^k$ is unity if importer ($j$) is resource-rich member within agreement ($k$) and exporter ($i$) is non-member in year ($t$), or zero otherwise,

$W_iP_jRTA_{ijt}^k$ is unity if importer (j) is resource-poor member within agreement ($k$) and exporter ($i$) is non-member in year ($t$), or zero otherwise.

## 2.3.4 Econometric issues

We estimate three panel specifications for equations (2.3) and (2.4):

**Specification (1):** with time fixed effects ($\theta_t$), to capture the time trend in trade and any shocks that affect global trade flows in a particular year.

**Specification (2):** with time ($\theta_t$), exporter ($\gamma_i$) and importer ($\delta_j$) fixed effects, to capture other variables that are difficult to measure, such as infrastructure, factor endowments, multilateral trade liberalization, and unobserved country-specific shocks.

**Specification (3):** with time ($\theta_t$), and country pair fixed effects ($\varphi_{ij}$), where time invariant pair-specific variables such as distance, borders, common language, or colonial links will be subsumed by these country pair fixed effects. Thus, they absorb all other unobservable characteristics of the country pairs (and of the individual countries) that are invariant over time and may have an impact on bilateral trade.[1] Baldwin and Taglioni (2006) argue that this specification is superior to the other two, so we will rely on the results from this specification in the discussion. This form of specification is used by Micco et al. (2003), Magee (2008), and Sun and Reed (2010).[2]

To address the presence of zero trade flows issue, we use the PPML estimator, for all specifications, as recommended by Santos Silva and Tenreyro (2006 and 2010).

## 2.3.5 Data description

The analysis is conducted using a panel data set of bilateral exports for 160 countries over the period 1980-2015.[3] We use four-year intervals (1980, 1984…,2012) and include 2015, the last year of data.[4]

[1] Using pair-country fixed effects ($\varphi_{ij}$) is recommended by Baier and Bergstrand (2007) to solve the potential endogeneity of RTAs when there is potential reverse causality between RTAs and a higher level of bilateral trade between country pairs.

[2] We don't estimate a model with time-varying fixed effects because it would not allow the identification of some of the parameters of interest, especially measuring trade diversion. However, this will be explained later in the section of Robustness check.

[3] See Table A.5 in the appendix for list of countries.

[4] We do not use consecutive years in the estimation for two raisons. First, in order to reduce the computational time required by using PPML estimator. Second, it is natural to expect that the adjustment of trade flows in response to trade policy changes will not be instantaneous. Therefore, researchers have used panel data with intervals instead of data pooled over consecutive years.

The trade data of the dependent variable ($X_{ijt}$) is the nominal export flows from exporter ($i$) to importer ($j$) in year ($t$).[1] We estimated models using the three export flows: total exports, total natural resource exports and total trade excluding natural resources exports. We defined natural resource exports as provided by WTO (2010); the total exports of Agricultural raw materials + Ores & Metals + Fuel + Fish.[2] Data on bilateral exports is collected from *United Nation's Comtrade* through *the World Bank's web platform: WITS (World Integrated Trade Solution).*[3]

Nominal GDPs are extracted from the *World Bank's World Development Indicators*.[4] Data on common language, border adjacency, colonial ties, and distance are obtained from the *Centre d'Etudes Prospectives et d'Informations Internationales (CEPII).*[5]

Dummy variables for RTAs are created from the *WTO Regional Trade Agreements Information System (RTA-IS),*[6] and completed from the *database of Mario Larch's Regional Trade Agreements Database (2017).*[7] The date when a given RTA enters into force is used to define whether the dummies for this RTA will take the value of 1 or 0. In order to study the relation between the natural resources endowment and regional integration, we have considered **6** regional trade agreements that are characterized by the abundance of natural resources, see Table 2.2.

Finally, we used our classification results of Cluster Analysis to identify natural resource-rich countries and natural resource-poor countries.[8]

[1] We used nominal trade values to avoid *bronze medal* mistake refers to a common practice in the literature, namely to deflate the nominal trade values by the US aggregate price index. Given that there are global trends in inflation rates, such a procedure probably creates biases via spurious correlations (Baldwin and Taglioni, 2006).
[2] The Standard International Trade Classification (SITC), Revision 1 for bilateral natural resource exports; Agricultural Raw Materials (SITC 2-22-27-28), Ores & Metals (SITC 27+28+68), Fuels (SITC 3), and Fish (STIC 03).
[3] We take into account nominal uni-directional trade flows as suggested by Baldwin and Taglioni (2006). Data can be accessed at: http://wits.worldbank.org.
[4] Data can be accessed at: https://data.worldbank.org/
[5] Data can be accessed at: http://www.cepii.fr/CEPII/en/bdd_modele/download.asp?id=8
[6] Data can be accessed at: http://rtais.wto.org/UI/PublicMaintainRTAHome.aspx
[7] Data can be accessed at: http://www.ewf.uni-bayreuth.de/en/research/RTA-data/index.html
[8] For methodology, see Chapter (1), and for result of clustering see Table A.2 in appendix.

**Table 2-2: List of Regional Trade Agreements**

| Name of agreement and data of entry into force | Countries and dummy year | Type♦ |
|---|---|---|
| Economic Community of West African States (ECOWAS) 1993 | Benin (1993); Burkina Faso (1993); Cabo Verde (1993); Côte d'Ivoire (1993); Ghana (1993); Guinea (1993); Guinea-Bissau (1993); Liberia (1993); Mali (1993); Niger (1993); Nigeria (1993); Senegal (1993); Sierra Leone (1993); Gambia (1993); Togo (1993) | CU |
| Common Market for Eastern and Southern Africa (COMESA) 1994[1] | Burundi (1995); Comoros (1995); DR Congo (1995); Djibouti (1995); Egypt (1999); Eritrea (1995); Ethiopia (1995); Kenya (1995); Libya (1995); Madagascar (1995); Malawi (1995); Mauritius (1995); Rwanda (1995); Seychelles (1995); Sudan (1995); Swaziland (1995); Uganda (1995); Zambia (1995); Zimbabwe (1995) | CU |
| Southern African Development Community (SADC)[2] 2000 | Botswana (2000); Lesotho (2000); Madagascar (2000); Malawi (2000); Mauritius (2000); Mozambique (2000); Namibia (2000); South Africa (2000); Swaziland (2000); United Republic of Tanzania (2000); Zambia (2000); Zimbabwe (2000) | FTA |
| Commonwealth of Independent States (CIS)[3] 1994[4] | Armenia (1995); Azerbaijan (1997-2011); Belarus (1995); Georgia (1995-2011); Kazakhstan (1995); Kyrgyz Republic (1996); Moldova, Republic of (1995); Russian Federation (1995); Tajikistan (1997); Ukraine (1995); Uzbekistan (1995-2011) | FTA |
| Latin American Integration Association (LAIA) 1981[5] | Argentina (1981); Bolivia (1981); Brazil (1981); Chile (1981); Colombia (1981); Cuba (1999); Ecuador (1981); Mexico (1981); Panama (2012); Paraguay (1981); Peru (1981); Uruguay (1981); Venezuela (1981) | PSA |
| Pan-Arab Free Trade Area (PAFTA) 1998 | Algeria (1998); Bahrain (1998); Egypt (1998); Iraq (1998); Jordan (1998); Kuwait (1998); Lebanon (1998); Libya (1998); Morocco (1998); Oman (1998); Palestine (1998); Qatar (1998); Saudi Arabia (1998); Sudan (1998); Syria (1998); Tunisia (1998); United Arab Emirates (1998); Yemen (1998) | FTA |

♦ PSA = Partial Scope Agreement, FTA = Free Trade Agreement, CU= Customs Union, IA = Economic Integration Agreement.

[1] Entry into force: 17-Feb-1999 for Egypt.

[2] Angola has not yet submitted its tariff offers to other SADC members and The Democratic Republic of Congo is a member of SADC but is not a Party to the Trade Protocol.

[3] Please note that in accordance with paragraph 23.1, 23.2 and Annex 5 of the Treaty on a Free Trade Area between Armenia, Belarus, Kazakhstan, the Kyrgyz Republic, the Republic of Moldova, the Russian Federation, Tajikistan, and Ukraine, signed on 18-Oct-2011 and entered into force on 20-Sep-2012, as for relations among the Parties, the Agreement on the Free Trade Area (CIS Agreement) signed on 15-Aprl-1994 shall be terminated.

[4] For Agreement on the Free Trade Area (CIS Agreement) signed on 15-Apr-1994, dates of entry into force: 30-Dec-1994 for Moldova, Kazakhstan and Uzbekistan; 28-Dec-1995 for Kyrgyz Rep; 18-Dec-1996 for Azerbaijan and 07-May-1997 for Tajikistan. For the new Treaty on a Free Trade Area between members of the Commonwealth of Independent States (CIS) signed on 18-Oct-2011, dates of entry into force for members: 20-Sep-2012 for the Russian Federation, Belarus and Ukraine; 17-Oct-2012 for Armenia; 8-Dec-2012 for Kazakhstan; 09-Dec-2012 for the Republic of Moldova; 13-Dec-2013 for Kyrgyz Republic.

[5] Entry into force: 26-Aug-1999 for Cuba and 10-May-2012 for Panama.

SOURCE: World Trade Organization (WTO), official websites of agreements, and Mario Larch's Regional Trade Agreements Database (2017).

## 2.4 Empirical results and discussion

We have two steps to discuss the results. At the first step, we will discuss the results of equation (2.3) which is set up to investigate the overall (aggregate) effects of each regional integration. In the second step, we will interpret the results of the augmented gravity model equation (2.4) to see how the effects of regional integration are distributed between resource-rich and resource-poor countries. However, we will discuss only the results estimated using specification (3) which includes time ($\theta_t$) and bilateral country fixed effects ($\varphi_{ij}$). Results of other specifications are reported for comparison purpose in the appendix.[1]

### 2.4.1 Overall impact of regional integration

This step of analysis aims to assess the overall impact of 6 regional trade agreements. Table 2.3 provides the results of equation (2.3), including time ($\theta_t$), and bilateral country fixed effects ($\varphi_{ij}$), for total, non-natural resource and natural resource exports.

**Table 2-3: PPML estimates of aggregate trade effects in terms of trade creation and trade diversion of several Regional Trade Agreements over the period 1980-2015 at four-year intervals**

| Regional Agreement | Total | Non-Natural resource | Natural resource |
|---|---|---|---|
| *ECOWAS_intra* | 1.528*** | 1.693*** | 1.759*** |
| | (0.197) | (0.218) | (0.268) |
| *ECOWAS_exp* | 0.729*** | 1.139*** | 1.008*** |
| | (0.223) | (0.286) | (0.277) |
| *ECOWAS_imp* | -0.391*** | -0.568*** | 0.601*** |
| | (0.116) | (0.119) | (0.177) |
| *COMESA_intra* | 0.453* | 0.520** | -0.568 |
| | (0.259) | (0.218) | (0.411) |
| *COMESA_exp* | 0.0969 | -0.167* | 0.126 |
| | (0.196) | (0.0981) | (0.269) |
| *COMESA_imp* | -0.234*** | -0.272*** | -0.108 |
| | (0.0789) | (0.0803) | (0.145) |
| *SADC_intra* | 1.227*** | 1.118*** | 1.851*** |
| | (0.193) | (0.196) | (0.315) |
| *SADC_exp* | 0.393*** | -0.0174 | 1.316*** |
| | (0.126) | (0.151) | (0.153) |
| *SADC_imp* | -0.0874 | -0.154 | 0.570*** |
| | (0.105) | (0.104) | (0.200) |
| *PAFTA_intra* | 0.207 | 0.393** | 0.185 |
| | (0.160) | (0.157) | (0.398) |
| *PAFTA_exp* | -0.597*** | 0.397*** | -0.703*** |
| | (0.192) | (0.0835) | (0.248) |

[1] See Tables (from A.6 to A.8) for basic gravity model, and Tables (from A.9 to A.11) for augmented gravity model.

| | | | |
|---|---|---|---|
| *PAFTA_imp* | -0.164** | -0.215*** | 0.405*** |
| | (0.0698) | (0.0712) | (0.112) |
| *CIS_intra* | 3.001*** | 3.550*** | 2.421*** |
| | (0.302) | (0.315) | (0.353) |
| *CIS_exp* | 2.872*** | 3.440*** | 2.405*** |
| | (0.296) | (0.246) | (0.334) |
| *CIS_imp* | 0.236*** | 0.222*** | 0.342*** |
| | (0.0659) | (0.0706) | (0.0903) |
| *LAIA_intra* | 0.340* | 0.507** | 0.315 |
| | (0.179) | (0.207) | (0.316) |
| *LAIA_exp* | 0.190 | 0.528 | 0.156 |
| | (0.207) | (0.351) | (0.136) |
| *LAIA_imp* | -0.255*** | -0.374*** | 0.324 |
| | (0.0906) | (0.0810) | (0.271) |

Notes:
- All regressions are performed by Panel Poisson estimator using xtpoisson stata command and include time fixed effect and county-pair fixed effect.
- GDPs variables are reported in Tables (from A.6 to A.8) in appendix.
- Robust Standard errors (clustered by country-pair) and t-ratios in parentheses *** p<0.01, ** p<0.05, * p<0.1.
- The dependent variable is nominal value of bilateral export flows ($X_{ijt}$).
- We use Standard International Trade Classification (SITC), Rev.1.
- Naturel resource exports = Agricultural Raw Materials (SITC 2-22-27-28) + Ores & Metals (SITC 27+28+68) + Fuels (SITC 3) + Fish (STIC 03).
- Non-natural resource exports = Total exports - Natural resources exports.

### 1. ECOWAS (Economic Community of West African States)

ECOWAS member countries could create more intra-regional trade between them in both non-natural resource and natural resource sectors. This success can be explained by the presence of another economic bloc within the region which is WAEMU. In addition, member countries increased their extra-regional exports to rest the of the world in both non-natural resource and natural resource sectors. But they suffer from trade diversion in non-natural resource. This is due to the high non-tariff barriers applied by member countries which reflects regional cooperation in supporting regional industries.[1] Finally, they increased their natural resource imports from the rest of the world explaining the economic growth in the region.

### 2. COMESA (Common Market for Eastern and Southern Africa)

The member countries of COMESA increased slightly their intra-regional trade in non-natural resource sectors. In addition, there is trade diversion in terms of non-natural resource exports/imports to/from the rest of the world in favor of the intra-regional trade. We note also that COMESA has not contributed to increase intra-regional trade in natural resource sectors both regionally and with the rest of the world. In fact, these modest results in COMESA could be explained by some factors. First, the low level of

[1] For more details, ITC. (2016). Facilitating Trade in ECOWAS: Insights from the ITC Business Surveys on Non-Tariff Measures. ITC.

infrastructure in East Africa.[1] The African Infrastructure Development Index states that East Africa ranks the 5th position compared to other African regions. Second, the conflicts between countries. Third geographical remoteness of member countries. Finally, some countries tend to integrate more with other economic blocs like SADC and EAC which in turn weakens the effectiveness of COMESA.

### 3. SADC (Southern African Development Community)

Poisson panel estimation points out that SADC agreement boosted trade creation intra-regional trade between members in both non-natural resource and natural resource sectors. This success could be explained by two factors. First, the presence of South Africa as an emerging country especially after lifting of sanction in the 1990s. Second, the existence of Southern African Customs Union (SACU) as another economic bloc in the region which reinforce the intra-regional trade between some members of SADC. In addition, there is trade creation in natural resource sectors with the rest of the world in terms of exports and imports.

### 4. PAFTA (Pan-Arab Free Trade Area)

Results point out that there is little trade creation between PAFTA member countries in non-natural resource sectors. This may due to the oil price boom in the oil-rich countries, especially in Gulf Cooperation Council (GCC) countries, which contributed to increase their imports from regional partners. However, we can explain the low value of intra-regional dummy variable in non-natural resource sectors by the disparity in the international political alliances and the political crises between members. In addition, PAFTA countries are more oriented towards the world markets rather than the regional ones. Results indicate that the non-natural resource exports of member countries to the rest of the world increased after the establishment of the agreement. This may due to the bilateral agreements between some countries of the region with rest of the world especially with the EU, United States as well as Turkey.[2] Also, PAFTA countries suffer from trade diversion in terms of non-natural resource imports from the rest of the world. With regards to natural resource sectors, we can see that the regional agreement did not contribute to

[1] The best performing is in North Africa, followed by Southern Africa, West Africa, Central Africa, and East Africa. The Africa Infrastructure Development Index (AIDI) is available online at: https://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/Africa_Infrastructure_Development_May_2016.pdf

[2] The number of bilateral agreements signed between PAFTA countries with outside-regional countries is 27 agreements according to WTO data base.

increase the intra-regional trade in natural resource sectors but increased the natural resource imports from the rest of the world.

### 5. CIS (Commonwealth of Independent States)

The CIS member countries increased their intra-regional in both non-natural resource and natural resource sectors. This successful inward orientation of trade in the CIS can be explained by three raisons. First, the existence of Russia as a dominant trading partner after the transition of the Soviet Union into newly independent countries. Second, the geographical distance of this region. Third, the rising number of bilateral agreements signed between central asian countries and the establishment of several economic communities such as; Eurasian Economic Community (EAEC), GUAM organization and Common Economic Zone (CEZ), which in turns stimulate somehow trade flows between countries.[1] Secondly, most of extra-regional dummy variables are significant in both non-natural resource and natural resource sectors which reflects the economic openness of the CIS members to the rest of world. In fact, joining the World Trade Organization (WTO) is one of the main objectives for the former Soviet countries. This led them to start and work on trade liberalization in order to accelerate the accession process. This liberalization has contributed also to strengthen the trade relations with countries outside the region such as Turkey, members of the EU in the Western Europe, China, Pakistan and India.

### 6. LAIA (Latin American Integration Association)

We can see that member countries have increased their intra-regional trade in non-natural resource sectors. This positive impact of intra-regional trade in this bloc is explained by the fact that it includes some large emerging markets like Brazil and Argentina, and other schemas of economic integration like Andean Community (CAN) and Southern Common Market (MERCOSUR) that contributed to increase intra-regional trade between countries. Meanwhile, this increase in intra-regional trade is associated by trade diversion in terms of imports from the rest of the world in non-natural resource sectors. On the other hand, LAIA countries could not create intra-regional trade in natural resource sectors which reflects the similarity between their economic structures. At the

[1] The number of bilateral agreements signed among CIS countries is 44 agreements according to WTO data base.

same time, we can note that LAIA has not increased trade with the rest of the world in terms of exports and imports in natural resource sectors.[1]

Table 2.4 summaries the trade performance and the result final for each agreement. We can note that agreements ECOWAS, SADC and CIS have better results than others like COMESA, PAFTA and LAIA.

**Table 2-4: Overall trade performance of several regional trade agreements in both natural resource and non-natural resource sectors**

| RTA | Exports | Intra-regional exports ($RTA\_intra^{k}_{ijt}$) | Extra-regional exports ($RTA\_exp^{k}_{ijt}$) | Extra-regional imports ($RTA\_imp^{k}_{ijt}$) | Result |
|---|---|---|---|---|---|
| ECOWAS | Non-natural resource | 1,693 | 1,139 | -0,568 | 2,264 |
| | Natural resource | 1,759 | 1,008 | 0,601 | 3,368 |
| COMESA | Non-natural resource | 0,52 | na | -0,272 | 0,248 |
| | Natural resource | na | na | na | 0 |
| SADC | Non-natural resource | 1,118 | na | na | 1,118 |
| | Natural resource | 1,851 | 1,316 | 0,57 | 3,737 |
| PAFTA | Non-natural resource | 0,393 | 0,397 | -0,215 | 0,575 |
| | Natural resource | na | -0,703 | 0,405 | -0,298 |
| CIS | Non-natural resource | 3,55 | 3,44 | 0,222 | 7,212 |
| | Natural resource | 2,421 | 2,405 | 0,342 | 5,168 |
| LAIA | Non-natural resource | 0,507 | na | -0,374 | 0,133 |
| | Natural resource | na | na | na | 0 |

Notes:
- Table is constructed using estimation results of basic gravity model (2.3) from Table 2.3.
- The dependent variable is nominal value of bilateral export flows ($Xijt$).
- We use Standard International Trade Classification (SITC), Rev.1.
- Naturel resource exports = Agricultural Raw Materials (SITC 2-22-27-28) + Ores & Metals (SITC 27+28+68) + Fuels (SITC 3) + Fish (STIC 03).
- Non-natural resource exports = Total exports - Natural resources exports.
- Result = Intra-regional exports + Extra-regional exports + Extra-regional imports.

[1] Although, according to WTO data base, there are about 50 trade bilateral agreements signed between LAIA countries individually, especially Chile, Colombia and Peru with the rest of the world.

### 2.4.2 Asymmetric impact of regional trade agreements across resource-rich and resource poor countries

The estimations of equation (2.4) with time and dyadic fixed effects will allow us to discuss several issues related to the relationship between the uneven distribution of natural resources and regional integration gains. The first question is the potential economic complementarity between resource-rich and resource-poor countries. The second issue is the export diversification of natural resource-rich countries. Third, we will discuss Venables (2009) theoretical predications about how the gains of regional integration are distributed between natural resource-rich and natural resource-poor countries. Finally, we will discuss the relationship with the rest of the world.[1]

On the issue of complementarity between resource-rich countries and resource-poor countries, the variables of interest in the analysis are $(P_iR_j)$ for non-natural resource exports and $(R_iP_j)$ for natural resource exports.

From Table 2.5, we can note that resources-poor countries have been able to increase non-natural resource exports to their natural resource-rich partners in all our selected agreements except COMESA. On the other hand, natural resource-rich countries increased their regional natural resource exports to poor partners in some cases like ECOWAS, SADC and CIS. Thus, we conclude that the complementarity between resource-rich countries and resource-poor countries has been achieved in the following regional conventions ECOWAS, SADC and CIS. This is compatible somehow with Heimenz and Langhammer (1990), Inotai (1991), and Shams (2003) who argued that complementarity or dissimilarity of economic structures would be better to the case of economic integration among developing countries.

[1] All tables created in this discussion are extracted from Tables (from A.9 to A.11) in the appendix, considering only results of specification (3).

**Table 2-5: Complementarity between resource-rich and resource-poor countries in several regional trade agreements**

| RTA | $P_iR_j$ (Non-natural resource exports) | $R_iP_j$ (Natural resource exports) |
|---|---|---|
| $ECOWAS$ | 2.302*** | 1.389*** |
| $COMESA$ | 0.244 | 0.323 |
| $SADC$ | 0.613*** | 3.537*** |
| $PAFTA$ | 0.361** | 0.291 |
| $CIS$ | 2.935*** | 2.428*** |
| $LAIA$ | 1.122** | 0.183 |

Notes:
- Table constructed using results estimation of augmented gravity model including time fixed effect and county-pair fixed effect, see Tables A.10 and A.11 in the appendix.
- The dependent variable is nominal value of bilateral export flows ($Xijt$).
- We use Standard International Trade Classification (SITC), Rev.1.
- Naturel resource exports = Agricultural Raw Materials (SITC 2-22-27-28) + Ores & Metals (SITC 27+28+68) + Fuels (SITC 3) + Fish (STIC 03).
- Non-natural resource exports = Total exports - Natural resources exports.

The second theme is the impact of regional integration on the export diversification of natural resource-rich countries. To tackle this issue, we will use three combinations of each agreement for non-natural resource sectors as variables of interest in the discussion; ($R_iR_j$), ($R_iP_j$), to measure the impact of RTA on export diversification of resource-rich countries at regional level, and ($R_iW_j$), to measure the impact of RTA on their export diversification at international level.

Table 2.6 indicate that the resource-rich countries have been able to create trade in non-natural resource sectors and thereby helped to diversify their exports, especially with the regional partners in all regional agreements. This is compatible with the idea that regional integration may actually help resource-abundant countries to diversify their export basket and break into the chain of global manufacturing production, (WTO, 2010). Also, it corresponds with Collier and Venables (2008) who have shown that regional integration will result in gains for the resource-rich countries. They can import labor or goods that were previously supply constrained, thereby inhibiting economies of scale and successful diversification into manufacturing production. At international level, the resource-rich members in the agreements that have a good geographical location such as ECOWAS and PAFTA or performing trade liberalization policies such as CIS could increase non-natural

resource exports with the outside world. Meanwhile, this increase is less compared to the increase towards the regional partners. However, this reflects the improved competitiveness of resource-rich countries in these agreements. This could be explained by "Training Ground Theory". According to Heimenz and Langhammer (1990), Inotai (1991), and Inotai (1997) international competitiveness of developing countries can be gradually improved by relying on the regional market in the first phase of industrialization. Entrance or openness to world markets may then come at a later stage after developing countries have reached a reasonable degree of efficiency and technical development.

**Table 2-6: Export diversification in resource-rich countries in several regional trade agreements**

| RTA | $R_iR_j$ (Non-natural resource exports) | $R_iP_j$ (Non-natural resource exports) | $R_iW_j$ (Non-natural resource exports) |
|---|---|---|---|
| $ECOWAS$ | 1.611*** | 0.984*** | 0.702*** |
| $COMESA$ | 1.207*** | 1.088*** | 0.118 |
| $SADC$ | 2.684*** | 1.724*** | 0.436 |
| $PAFTA$ | 0.309 | 0.582*** | 0.315*** |
| $CIS$ | 4.115*** | 4.000*** | 3.918*** |
| $LAIA$ | 0.366*** | -0.502** | -0.453** |

Notes:
- Table constructed using results estimation of augmented gravity model including time fixed effect and county-pair fixed effect see Table A.10 in the appendix.
- The dependent variable is nominal value of bilateral export flows ($Xijt$).
- We use Standard International Trade Classification (SITC), Rev.1.
- Naturel resource exports = Agricultural Raw Materials (SITC 2-22-27-28) + Ores & Metals (SITC 27+28+68) + Fuels (SITC 3) + Fish (STIC 03).
- Non-natural resource exports = Total exports - Natural resources exports.

Next issue, we will verify the theoretical predications of Venbales (2009). According to his model, the gains from regional integration are unevenly distributed between resource-rich country and resource-poor country. Regional integration enables the resource-poor country to extend their exports to the resource-rich partner, while the resource-rich country may suffer from a significant amount of trade diversion as it substitutes imports from the relatively more efficient rest of the world towards the regional partner. Therefore, our combinations of interest for each regional agreement are $(P_iR_j)$, to measure the trade

creation achieved by resource-poor countries in non-natural resource sectors with their resource-rich partners, and ($W_iR_j$), to mesure the trade diversion achieved by resource-rich countries in term of imports from the rest of the world in non-natural resource sectors.

We note from Table 2.7 that poor countries have benefited from regional integration by increasing their intra-regional exports to natural resources-rich countries in all regional integrations selected except COMESA. The results also indicate that countries rich in natural resources suffer from trade diversion in terms of imports from the rest of the world, except in CIS. Therefore, this corresponds to the theoretical predication of Venables (2009). In addition, our results are compatible with Carrère et al. (2012) regarding PAFTA and with Carrère (2013) concerning ECOWAS.[1]

**Table 2-7: Verification of theoretical predications of Venables (2009)**

| RTA | $P_iR_j$ (Non-natural resource exports) | $W_iR_j$ (Non-natural resource exports) |
|---|---|---|
| $ECOWAS$ | 2.302*** | -0.661*** |
| $COMESA$ | 0.244 | -0.293*** |
| $SADC$ | 0.613*** | -0.268** |
| $PAFTA$ | 0.361** | -0.214*** |
| $CIS$ | 2.935*** | 0.270*** |
| $LAIA$ | 1.122** | -0.798*** |

Notes:
- Table constructed using results estimation of augmented gravity model including time fixed effect and county-pair fixed effect see Table A.10 in the appendix.
- The dependent variable is nominal value of bilateral export flows ($Xijt$).
- We use Standard International Trade Classification (SITC), Rev.1.
- Naturel resource exports = Agricultural Raw Materials (SITC 2-22-27-28) + Ores & Metals (SITC 27+28+68) + Fuels (SITC 3) + Fish (STIC 03).
- Non-natural resource exports = Total exports - Natural resources exports.

Last issue is the relationship with the rest of the world after establishment of the regional integrations. Our variables of interest here are ($R_iW_j$), ($P_iW_j$), ($W_iR_j$) and ($W_iP_j$) in non-natural resource sectors and the ($R_iW_j$), ($W_iR_j$) and ($W_iP_j$) in natural resource sectors.

[1] Note that Carrère (2013) considered WAEMU rather that ECOWAS, but ECOWAS includes the same member countries of WAEMU.

With regards to non-natural resource sectors, results in Table 2.8 indicate that resource-rich countries suffer from trade diversion in all agreements except CIS, while poor countries suffer from trade diversion in same cases (COMESA, PAFTA and LAIA) but always with less impact than resource-rich countries. However, both categories of countries create more extra-regional exports in some agreements such as: ECOWAS, PAFTA and CIS.

**Table 2-8: Trade relationship of resource-rich and resource-poor countries with the rest of the world for several regional trade agreements, in non-natural resource sectors**

| RTA | $R_iW_j$ (Non-natural resource exports) | $P_iW_j$ (Non-natural resource exports) | $W_iR_j$ (Non-natural resource exports) | $W_iP_j$ (Non-natural resource exports) |
|---|---|---|---|---|
| $ECOWAS$ | 0.702*** | 1.439*** | -0.661*** | -0.213 |
| $COMESA$ | 0.118 | -0.318** | -0.293*** | -0.217* |
| $SADC$ | 0.436 | -0.0178 | -0.268** | -0.137 |
| $PAFTA$ | 0.315*** | 0.415*** | -0.214*** | -0.200** |
| $CIS$ | 3.918*** | 2.563*** | 0.270*** | 0.0243 |
| $LAIA$ | -0.453** | 0.615 | -0.798*** | -0.285*** |

Notes:
- Table constructed using results estimation of augmented gravity model including time fixed effect and county-pair fixed effect see Table A.10 in the appendix.
- The dependent variable is nominal value of bilateral export flows ($Xijt$).
- We use Standard International Trade Classification (SITC), Rev.1.
- Naturel resource exports = Agricultural Raw Materials (SITC 2-22-27-28) + Ores & Metals (SITC 27+28+68) + Fuels (SITC 3) + Fish (STIC 03).
- Non-natural resource exports = Total exports - Natural resources exports.

Results provided in Table 2.9 indicate that in some cases like ECOWAS, SADC and CIS, resource-rich countries increased natural resource exports to the rest of the world. Despite the presence of resource-rich countries within the regional agreements, we note that poor natural resources were able to increase their imports in natural resource sectors from the outside world, especially in agreements involving emerging countries such as South Africa in SADC or follow policies of trade liberalization such as PAFTA and CIS.

**Table 2-9: Trade relationship of resource-rich and resource-poor countries with the rest of the world for several regional trade agreements, in natural resource sectors**

| RTA | $R_iW_j$ (Natural resource exports) | $W_iR_j$ (Natural resource exports) | $W_iP_j$ (Natural resource exports) |
|---|---|---|---|
| $ECOWAS$ | 0.964*** | 0.672*** | 0.238 |
| $COMESA$ | 0.175 | -0.164 | -0.0686 |
| $SADC$ | 2.083*** | 0.270 | 0.634*** |
| $PAFTA$ | -0.725*** | 0.478*** | 0.267** |
| $CIS$ | 2.410*** | 0.399*** | 0.243** |
| $LAIA$ | 0.141 | 0.866*** | 0.262 |

Notes:
- Table constructed using results estimation of augmented gravity model including time fixed effect and county-pair fixed effect see Table A.11 in the appendix.
- The dependent variable is nominal value of bilateral export flows ($Xijt$).
- We use Standard International Trade Classification (SITC), Rev.1.
- Naturel resource exports = Agricultural Raw Materials (SITC 2-22-27-28) + Ores & Metals (SITC 27+28+68) + Fuels (SITC 3) + Fish (STIC 03).
- Non-natural resource exports = Total exports - Natural resources exports.

Tables 2.10 and 2.11 summarizes the performance of natural resource-rich countries and natural resource-poor countries for each agreement.

**Table 2-10: Overall performance of natural resource-rich and natural resource-poor countries for several regional trade agreement in non-natural resource sectors**

| RTA | Non-natural resource exports | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Resource-rich countries | | | | | Resource-poor countries | | | | |
| | $R_iR_j$ | $R_iP_j$ | $R_iW_j$ | $W_iR_j$ | Result | $P_iR_j$ | $P_iP_j$ | $P_iW_j$ | $W_iP_j$ | Result |
| ECOWAS | 1,611 | 0,984 | 0,702 | -0,661 | **2,636** | 2,302 | ns | 1,439 | ns | **3,741** |
| COMESA | 1,207 | 1,088 | ns | -0,293 | **2,002** | ns | ns | -0,318 | -0,217 | **-0,535** |
| SADC | 2,684 | 1,724 | ns | -0,268 | **4,14** | 0,613 | 1,351 | ns | ns | **1,964** |
| PAFTA | ns | 0,582 | 0,315 | -0,214 | **0,683** | 0,361 | 0,361 | 0,415 | -0,2 | **0,937** |
| CIS | 4,115 | 4 | 3,918 | 0,27 | **12,303** | 2,935 | 2,251 | 2,563 | ns | **7,749** |
| LAIA | 0,366 | -0,502 | -0,453 | -0,798 | **-1,387** | 1,122 | ns | ns | -0,285 | **0,837** |

Notes:
- Table constructed using results estimation of augmented gravity model including time fixed effect and county-pair fixed effect see Table A.10 in the appendix.
- The dependent variable is nominal value of bilateral export flows ($X\_ijt$).
- We use Standard International Trade Classification (SITC), Rev.1.
- Naturel resource exports = Agricultural Raw Materials (SITC 2-22-27-28) + Ores & Metals (SITC 27+28+68) + Fuels (SITC 3) + Fish (STIC 03).
- Non-natural resource exports = Total exports - Natural resources exports.
- Results for resource-rich countries = $R_iR_j + R_iP_j + R_iW_j + W_iR_j$. Result for resource-poor countries = $P_iR_j + P_iP_j + P_iW_j + W_iP_j$.

**Table 2-11: Overall performance of natural resource-rich and natural resource-poor countries for several regional trade agreement in natural resource sectors**

| RTA | Natural resource exports | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Resource-rich countries | | | | | Resource-poor countries | | | | |
| | $R_iR_j$ | $R_iP_j$ | $R_iW_j$ | $W_iR_j$ | Result | $P_iR_j$ | $P_iP_j$ | $P_iW_j$ | $W_iP_j$ | Result |
| ECOWAS | 1,984 | 1,389 | 0,964 | 0,672 | **5,009** | 2,734 | ns | 1,825 | ns | **4,559** |
| COMESA | ns | ns | ns | ns | **0** | -1,134 | -1,223 | ns | ns | **-2,357** |
| SADC | 0,706 | 3,537 | 2,083 | ns | **6,326** | 1,101 | 1,732 | 1,003 | 0,634 | **4,47** |
| PAFTA | ns | ns | -0,725 | 0,478 | **-0,247** | 0,506 | ns | -0,374 | 0,267 | **0,399** |
| CIS | 2,452 | 2,428 | 2,41 | 0,399 | **7,689** | 2,019 | 2,506 | 2,111 | 0,243 | **6,879** |
| LAIA | ns | ns | ns | 0,866 | **0,866** | 1,753 | ns | ns | ns | **1,753** |

Notes:
- Table constructed using results estimation of augmented gravity model including time fixed effect and county-pair fixed effect see Table A.11 in the appendix.
- The dependent variable is nominal value of bilateral export flows ($X\_ijt$).
- We use Standard International Trade Classification (SITC), Rev.1.
- Naturel resource exports = Agricultural Raw Materials (SITC 2-22-27-28) + Ores & Metals (SITC 27+28+68) + Fuels (SITC 3) + Fish (STIC 03).
- Non-natural resource exports = Total exports - Natural resources exports
- Results for resource-rich countries = $R_iR_j + R_iP_j + R_iW_j + W_iR_j$. Result for resource-poor countries = $P_iR_j + P_iP_j + P_iW_j + W_iP_j$.

## 2.4.3 Robustness check

Our key specification used in the analysis that includes dyadic fixed effect ($\varphi_{ij}$) and time fixed effect ($\theta_t$) still suffers from omitting "Multilateral resistance terms". Anderson and van Wincoop (2003) argued that due to the lack of theoretical foundation, the gravity equation seems to endure omitted variables bias. Their model suggests that bilateral trade barriers are not the sole factor can affect the bilateral trade between two trading partners. There are also each country's trade costs against all other partners. According to the two authors, the three trade resistance factors in international trade are, therefore, the bilateral trade barriers, the exporter country's trade resistance towards all other destinations as well as the importer country's trade resistance towards all other trading partners. The two latter factors are called Anderson-van Wincoop's multilateral trade resistance.

To carry out an easier computational method for taking into account these multilateral resistance terms variables, Anderson and van Wincoop (2003) and Feenstra (2004) suggest the by using fixed effects for both exporter and importer countries. However, this strategy cannot be used with a temporal dimension, the terms of multilateral resistance being themselves variable in time (see Baldwin and Taglioni, 2006). According to Baier and Bergstrand (2007), bilateral fixed effects ($\varphi_{ij}$) along with time-varying fixed effects for

exporter ($\gamma_{it}$) and importer ($\delta_{jt}$) are included in the model to overcome the RTAs endogeneity bias and to take account of the Anderson and van Wincoop's multilateral resistance terms at the same time.

Nevertheless, using exporter-year ($\gamma_{it}$) and importer-year ($\delta_{jt}$) fixed effects in the gravity model, we cannot include the trade diversion variables, and this represents a significant drawback of including time-varying fixed effects for exporter and importer. The time-varying fixed effect for importer ($\delta_{jt}$) captures the change in importer's overall imports in year ($t$). Controlling for the importer's change in overall imports, it is not possible to measure both the change in within-RTA imports and the change in extra-RTA imports since the latter two add up to the change in total imports. Thus, one advantage of the gravity model specification omitting exporter-year ($\gamma_{it}$) and importer-year ($\delta_{jt}$) fixed effects is that it allows the estimation of both intra-RTA and extra-RTA effects of regional agreements.[1] In other words, Basically, if we define ($RTA\_exp_{ijt}$) as 1 for all exports from an RTA member country to a non-member, the sum of ($RTA\_intra_{ijt} + RTA\_exp_{ijt}$) is always equal to 1 for any exporter that belongs to an agreement in year ($t$). This means there will be collinearity with the exporter-year fixed effects. The same is true for ($RTA\_intra_{ijt} + RTA\_imp_{ijt}$) on the import side.

Several researchers have proposed to construct proxies for the multilaterals resistances, often referred to as "remoteness indexes", such as GDP-weighted distance averages (Wei, 1996; Baier and Bergstrand, 2009). However, Baier and Bersgtrand (2009) initially proposed this method in a cross-section framework to allow for both efficient estimates of gravity equation and quantitative comparative-static effect without employing the structural system of equations. Carrère (2013) used this method for estimating the multilateral resistance term in panel approach.[2] The following specifications attempt to account for the multilateral resistances by considering the "multilaterals resistances terms":

$$X_{ij} = \exp\{\beta_0 + \beta_1 lngdp_{it} + \beta_2 lngdp_{jt} + \varphi_{ij} + a_{intra} RTA\_intra_{ijt}^{k} + a_x RTA\_exp_{ijt}^{k} + a_m RTA\_imp_{ijt}^{k} + \boldsymbol{lnMRT_{it}^{Distance}} + \boldsymbol{lnMRT_{jt}^{Distance}} + \boldsymbol{MRT_{it}^{RTA}} + \boldsymbol{MRT_{jt}^{RTA}} + \epsilon_{ijt}\} \quad (2\text{-}6)$$

and

[1] For a complete and comprehensive outlook on this point see Magee (2008).

[2] For more details on calculating these terms of multilateral resistance: see Baier and Bergstrand (2009) for cross-section framework and for the version adapted to the introduction of a temporal dimension, in the appendix of Carrère et al. (2013)

$$X_{ijt} = exp\Big\{a + lngdp_{it} + lngdp_{jt} + \varphi_{ij} + \beta_1\big[R_iR_jRTA_{ijt}^k\big] + \beta_2\big[R_iP_jRTA_{ijt}^k\big] + \beta_3\big[P_iR_jRTA_{ijt}^k\big] + \beta_4\big[P_iP_jRTA_{ijt}^k\big] + \beta_5\big[R_iW_jRTA_{ijt}^k\big] + \beta_6\big[P_iW_jRTA_{ijt}^k\big] + \beta_7\big[W_iR_jRTA_{ijt}^k\big] + \beta_8\big[W_iP_jRTA_{ijt}^k\big] + \boldsymbol{lnMRT_{it}^{Distance}} + \boldsymbol{lnMRT_{jt}^{Distance}} + \boldsymbol{MRT_{it}^{RTA}} + \boldsymbol{MRT_{jt}^{RTA}} + \epsilon_{ijt}\Big\} \quad (2\text{-}7)$$

where:

$$MRT_{it} = \left[\sum_k \frac{Y_{kt}}{Y_{wt}} X_{ik}\right], \quad MRT_{jt} = \left[\sum_k \frac{Y_{kt}}{Y_{wt}} X_{kj}\right],$$

$$\text{where} \quad X_{ijt} = \big[Dist_{ij}; RTA_{ijt}\big]$$

are multilateral resistance terms for distance regional trade agreements.

The multilateral term specific to the RTA makes it possible to take into account the competition existing between the numerous trade preference agreements signed by the same country and which reduces the expected effect of the agreement in question (Baier and Bersgtrand, 2009; Carrère et al., 2013; and Carrère, 2013).[1]

Results of equations (2-6) and (2-7) are reported in Tables (from A.6 to A.11) column 4 in the appendix. We can see that including these terms does not affect our estimated coefficients, and the results are very similar between column 3 (without multilaterals resistances terms) and column 4 (multilaterals resistances terms).

[1] However, the multilateral terms introduced in equations above are very little used in the literature and Head and Mayer (2014) criticize such reduced-form approaches as they bear little resemblance to the theoretical counterpart of multilateral terms.

## 2.5 Conclusion

The objective of this chapter is to examine the gains of regional integration in the context of the natural resources endowment. It aims to investigate how the gains of regional integration in terms of trade effects are distributed between resource-rich and resource-poor countries. Our sample of RTAs selected are ECOWAS, COMESA, SDAC, PAFTA, CIS and LAIA. All these regional agreements are characterized by the abundance of natural resources and by it is uneven allocation between their members. However, our analysis in this chapter consists of two main steps.

The first one aims to estimate a basic gravity model to explore the aggregate trade effects of our selected regional integrations. Our estimation indicated that the aggregate trade effects of ECOWAS, SADC and CIS have better results than others COMESA, PAFTA and LAIA.

The second step, using an augmented gravity model, provided further analysis how the effects of regional integration will be distributed across countries depending on their natural resources endowment. This step allowed us to discuss several issues pointed in the literature: complementarity between countries with different economic structures, theoretical predications of Venables (2009), export diversification of resource-rich countries and relationship with the rest of the world.

With regards to the complementarity between resource-rich and resource-poor countries, we showed that it has been achieved in ECOWAS, SADC and CIS. These regional agreements are principally characterized by two points. One, strong regional cooperation in terms of the existence of several schemes of integration in the same region. Second, they are abundant in oil and in minerals also.

In addition, our results indicated that the resource-rich countries have been able to create trade in non-natural resource sectors and thereby diversify their exports with their regional partners. At international level, the resource-rich members in the agreements that have a good geographical location such as ECOWAS and PAFTA or performing trade liberalization policies such as CIS could increase non-natural resource exports to the outside world. This reflects the improved diversification of the resource-rich countries in these regional conventions and the development of their competitiveness at the international level.

Out results are compatible with the theoretical predication of Venables (2009) in most selected regional agreements. We noticed that resource-poor countries have benefited from regional integration by increasing their intra-regional exports to natural resources-rich partners, while resource-rich countries suffered from a significant amount of trade diversion as they substitute imports from the relatively more efficient rest of the world towards the regional partners.

Finally, in some cases, resource-poor countries slightly suffered from trade diversion compared to resource-rich ones, and they were able to increase their resource imports from the outside world despite the presence of resource-rich counties in the agreements. This may be due to the presence of emerging members in the agreement, or because the region lacks one type of natural resource, especially agricultural raw materials.

We also note that the resource-rich countries, in most of the agreements, have not suffered from trade diversion in terms of exports in natural resource sectors. This reflects that the regional conventions have not affected these countries with regard to their relations with the outside world, as they remained oriented towards extra-regional markets.

This research can be developed in the future by examining the impact of regional integration on the evolution of export concentration. This will show how regional integration affects the diversification of the natural resource-rich countries and the development of industrialization in resources-poor countries. Research can be also developed by classifying rich countries by the type of natural resource, between oil-rich countries, mineral-rich countries and agricultural-rich countries. This will explain if the type of natural resource has an impact on the gains of regional integration.

# Chapter (3): The impact of natural resource on convergence: Case of PAFTA

## 3.1 Introduction

Natural resources are concentrated in a small number of countries, while others have limited domestic supplies. This helps to explain why natural resources often represent a dominant share of economic production and exports in certain countries. Oil- and mineral-rich economies, for instance, frequently exhibit very high ratios of natural resources to merchandise exports and to GDP. It is often claimed that such resource abundance does not always lead to sustained economic growth and development for the countries concerned, and that in fact it can have the opposite effect – a phenomenon termed the "resource curse hypothesis".

Indeed, important intellectual debate has focused on the question of whether natural resources are a "blessing" or a "curse" for the economic development of countries. Although economists have traditionally seen natural resource endowments as a key determinant of comparative advantage and critical to economic growth, some have argued that excessive dependency on natural resource exports can actually trap countries in a state of "underdevelopment". Empirical literature on the natural resource curse has so far failed to reach unified conclusions. Earlier literature identified a negative relation between growth and resource dependency, even after taking into account a large number of other possible determinants of slow growth, such as terms of trade changes, investment activity and institutional quality. Subsequent work pointed to institutional quality as a crucial determinant of whether natural resource abundance is a curse or a blessing, arguing that resource abundance indirectly affects economic growth through its adverse impact on institutions. More recent empirical contributions have criticized the finding that natural resource abundance is a curse, arguing that natural resource dominance can have zero or even positive effects on growth if abundance is correctly measured, additional variables that correlate with resource abundance are taken into account, and depletion of the resource over the sample period is factored into the assessment.

Consequently, the disparity between countries in natural resource abundance will also affect convergence between countries. The question of whether real per capita incomes across countries or regions are converging over time has become a central issue in the economic growth literature during the last decades. The study of convergence processes and its dynamics in both, developed and developing countries, is by itself of paramount importance not only for economists, but also for policy makers to design appropriate development policies to promote equity and growth. The attention on the topic has however led to several different interpretations of convergence and to a wide range of

empirical studies, making use of very heterogeneous methodologies. Among others, pioneering works on the subject are the cross-sectional studies by Baumol (1986), Barro (1991), Barro and Sala-i-Martin (1991, 1995a), Mankiw et al. (1992) and Sala-i-Martin (1996), all of which examine convergence across a large sample of industrial countries or their regions and find support for the convergence hypothesis.

In general, the economic growth literature has considered three main concepts of convergence, namely $\sigma$ −convergence, $\beta$ −convergence and club convergence. The first type introduced by Barro and Sala-i-Martin (1991) refers to a process in which the dispersion of real income per capita among a group of economies tends to decrease over time. The concept of $\beta$-convergence refers to a process in which poor regions grow faster than rich ones, such that the poor regions catch up to the rich ones in terms of the level of per capita income through time. Lastly, the term 'convergence club' was first introduced by Baumol (1986). Roughly spoken, the idea behind the concept of club convergence is that there are multiple steady states a country or region may approach. The 'basin of attraction' (Galor, 1996) a country belongs to is determined by the initial conditions at the beginning of the growth path. To understand which initial conditions are potentially important, a closer look at their characteristics is needed.

In this chapter, we aim to use the case of the MENA region in order to examine the impact of natural resources on the convergence. Within this region, there are natural resource-countries, especially in energy, and natural resource-poor countries. Besides, there a regional integration (PAFTA) that includes the largest number of countries in the region. However, this region has been strongly influenced by several factors, such as energy sources, and demographic and institutional characteristics. Over the last fifteen years, the growth performance of the MENA region as a whole, despite its abundance in natural resources, has been unsatisfactory, where growth rates in the MENA countries have been remarkably volatile and lower than other regions in the world. This volatility is partially due to political and social instability, wars or sharp fluctuations in oil prices.

In general, the empirical literature on convergence in MENA region is still scarce as compared to other areas and their results are quite diverse. Therefore, the objective of this chapter is to fill this gap through examining the three concepts of convergence among PAFTA countries. The outline of the chapter is as follows. First, we make a short review of previous empirical works on convergence among PAFTA countries. Then, we will study the three approaches of convergence mentioned above. We start the analysis by investigating the σ-convergence across PAFTA countries. In the second step, we will

discuss the conditional convergence in PAFAT region in order to determine the convergence factors in particular the role of natural resources. Finally, we will study the club convergence hypothesis in PAFTA region to see if there are multiple steady states that form several clubs and discus the potential factors for this formation of clubs.

## 3.2 Review Literature

We start our chapter by reviewing studies that investigated growth determinants and convergence factors in MENA region, focusing on those who examined the role of natural resources in the convergence between countries.

Rey (2005) studied the processes of real convergence in MENA region in terms of per-capita GDP for the period 1950-2005. He used the methods of dynamic analysis based on transition matrices (Markov processes) and stochastic kernels. He found that there is not a global real convergence process, but rather convergence clubs. In 1950, the density function reveals the presence of three groups of countries. In 1980, there are still three clubs, but it can be seen that the differences in GDP per capita have been reduced. This process is further reinforced at the end of the period, in 2001 there are only two groups that stand out clearly.

Guetat (2006) implanted cross-country regression models (OLS estimator) for a sample of 90 countries over the period 1960-2000 to examine the conditional convergence in terms of initial conditions, macroeconomic performance, trade openness, government size, natural resource abundance, and institutional and political structures. She used regional indicators and MENA-specific variables in order to test for the effects of each variable on the growth performance of the MENA economies. She considered the role of natural resources through two variables; dummy variable for oil exporters based on the IMF classification of the countries taking 1 for countries whose fuel exports represent 50% or more of the total of exports during the period between 1984 and 1986, and 0 others, and the second is the share of mineral production in GNP in 1971. Results of econometric analysis revealed that the direct impact of institutional variables is strongest in the MENA region relative to the regions considered. The same is true about indirect effects of corruption on growth through investment and human capital. In addition, oil and natural resources appear to have a negative impact on economic growth in the MENA region.

Makdisi et al. (2007) found that the overall growth performance of the MENA region over the period 1960-1998 has been both mixed and characterized by a higher degree of volatility compared with other regions in the world. In comparing the growth pattern of

the MENA region within an international perspective, they have found that: capital is less efficient; the natural resource curse more pronounced; trade openness less beneficial to growth; the impact of adverse external shocks higher; and the effect of output volatility on growth more detrimental. Total Factor Productivity Growth (TFPG) in the MENA region, was not an important source of growth in comparison with other regions. Non-oil and diversified economies have faired much better than oil-exporting countries both in terms of output growth and TFPG. Finally, the degree of exposure to internal and external shocks, the extent of economic diversification and international competitiveness, were found to be important factors explaining variations in growth performance within the MENA region.

Guetat and Serranito (2007) tested for both absolute and the conditional convergence hypothesis in MENA region using new tests of a unit root in panel data of 20 groups of countries during the period 1960–1990 and of 17 groups of countries from 1960 to 2000. The absolute convergence hypothesis uses panel unit roots test without fixed individual effects. The catching-up hypothesis is not rejected for most groups of countries of the region during both periods. The conditional convergence requires panel unit root tests with fixed individual effects. Again, during the whole periods, the conditional convergence is not rejected for the major part of the remaining groups of MENA countries. Empirical results confirm the importance of the exogenous shocks effect on the developing process and consequently on the convergence of MENA countries. Socio-political stability seems a determinant key of the MENA region growth. Indeed, the breaking dates in the growth strategies of the MENA countries, for absolute convergence tests as well as for the conditional convergence tests, correspond in majority to political crisis and wars. For both periods, the group of oil countries proves to be convergent after the breaking dates located between the two oil crises of 1973 and 1979, whereas the non-oil countries groups converge before the breaking dates corresponding to wars and political crises which occurred in the region. Thus, the oil countries would converge better after the oil crises and the non-oil countries, often involved in the regional wars, would converge better before these shocks.

Wolde and Bhattacharya (2010) attempted to quantify the impact of various constraints on growth in the MENA region. They used cross-country growth regressions for 98 countries including 11 countries from MENA region over the period 2002–2008. Empirical results suggest that there is strong evidence of conditional convergence, and both the population variable and the secondary school enrollment rate have statistically significant positive effects on growth, openness variable also has a small, but statistically significant,

positive impact on growth. In addition, the key direct constraints to growth in the MENA region are difficulties in access to finance, labor skill mismatches and shortages, and electricity constraints. However, they did not consider in their analysis the role of natural resources.

Nicet-Chenaf and Rougier (2011) aim at measuring the effects of exports' diversification on growth in MENA countries and the way how new exports and FDI interact with each other in the process of growth. For a panel consists in eight MENA countries over the period 1995-2004, authors estimated a growth model which includes several explanatory variables using GMM system method. However, their analysis did not take in consideration the impact of natural resource abundance, where their empirical model does not include a variable explicit to measure it. Empirical results suggest that the global convergence is verified and estimated -0.4809. In addition, they showed that while FDI and diversification favor the MENA countries' growth, some higher levels of the latter decrease the effects of FDI on growth. They also demonstrated that while FDI have a positive and significant effect on the MENA countries' growth, it is most probably rather linked to the direct effect on value added and employment than to the effects of technological transfer.

Péridy and Bagoulla (2012) analyzed and explained the real convergence process in MENA countries over the past 50 years and provided an econometric modelling of the determinants of convergence. They implanted a panel data model with yearly data from 1960 to 2007 for the seven MENA countries using Hausman and Taylor (HT) estimator to handle the endogeneity problems. It is shown that the convergence process strongly depends on education, R&D, transport and infrastructure as well as public investment. By contrast, there is no direct impact of the regional integration process with the EU, although the EIB loans positively contribute to the convergence process. Finally, trade specialization and firm agglomeration have been detrimental to convergence of MENA countries. However, they used primary exports (% of total exports) as an indicator of natural resources endowment in their panel data model. Estimation results indicate that it has a negative impact on convergence process. According to authors, this means that oil producers (Algeria, Syria and Egypt) have diverted their factor resources away from most productive industries. Another interpretation is that the large rents due to oil specialization are associated with more political instability or rent-seeking and low growth.

Nabli and Arezki (2012) addressed the economic performance of resource rich countries in MENA over more than forty years (1960-2008). Authors found that while those countries have maintained high levels of income per capita, they have performed poorly when going beyond the assessment based on standard income level measures. Resource rich countries in MENA have experienced relatively low and non-inclusive economic growth as well as high levels of macroeconomic volatility. Important improvements in health and education have taken place but the quality of the provision of public goods and services remains an important source of concerns.

Andreano, M. S. et al. (2013) attempted to empirically answer the question of whether there is convergence in per capita output across MENA countries. The empirical analysis of the natural logarithm of per-capita GDPs for 26 MENA countries from 1950 to 2007 strongly confirms the hypothesis of conditional convergence. The analysis identified the main variables on which a careful and prudent policy intervention at regional level should be based. In fact, the long-term growth in this highly heterogeneous area is the result of a set of socio-economic, technological, and governance factors. In their empirical analysis, the degree of international openness and the government intervention and expenditure are important economic control variables. The improvement of governance factors, such as actions to reduce corruption, the greater reliability and efficiency of government, political stability and violence reduction, play a role in stimulating the long-run behavior and moving up the development path of the steady-state. Technological development and human capital are both highly relevant for the growth. Authors used the ratio of the value added of agriculture and mining sectors on the total value added to evaluate the impact of natural resources richness on the economic growth of the MENA countries. However, it was estimated as non-significant variable and thus eliminated from the final model.

Apergis and Payne (2014) re-examines the impact of oil abundance on economic growth in a number of MENA (Middle East and North African) countries for the period 1990–2013. To measure the abundance of natural resource, they used crude oil reserves per 1000 individuals measured in barrels as a variable for oil wealth. They also control for other determinants of real GDP per capita often found in the literature: average years of total schooling for people aged 15 and over which proxies for the level of human capital; real trade openness defined as the sum of exports and imports as a share of GDP; private investment expenditures as a share of GDP measured by fixed capital formation; and foreign direct investment as a share of GDP; and finally number of institutional factors: i) legal structure and security of property rights; ii) freedom to trade internationally; iii)

judicial independence; and iv) business regulations. The results are quite interesting and vary by country group and over time. The baseline long-run estimates (both country groups together) reveal that the economic control variables: educational attainment, trade openness, domestic investment, and foreign direct investment each yield a positive impact on growth along with the institutional quality variables: property rights protection, judicial independence, and freedom to trade internationally. Business regulatory environment yields a negative impact on growth. However, the coefficient of oil reserves has a negative impact on growth through 2003, changing to a positive impact on growth after 2003 until the end of the sample period. They suggest that this change in the coefficient on oil reserves maybe due to the improvement in the quality of institutions and economic reforms that have occurred over time in the MENA countries. Recognizing the differences in the availability of labor across resource-rich countries, they evaluate two different country groups: Resource Rich–Labor Abundant and Resource Rich–Labor Importing. The long-run results for the Resource Rich–Labor Abundant country group provide uniform support for the oil curse hypothesis over time as the coefficient of oil reserves is negative throughout the sample period. On the other hand, the Resource Rich–Labor Importing country group provides support for the oil curse hypothesis up to 2003; however, the coefficient of oil reserves is positive beyond 2003 to the end of the sample period. These results may reflect that the importation of labor placed pressure on the Resource Rich–Labor Importing country group to demonstrate a favorable business climate to the international community. As for the Resource Rich–Labor Abundant country group, the presence of the oil curse may be due to extensive labor market rigidities, which discourages firms from expanding employment and, therefore, economic growth, in spite of significant oil revenues.

## 3.3 Sigma-convergence analysis

We start our convergence analysis by examining *sigma*-convergence across PAFTA countries over the period 1970-2014. First, we will explain the methodology used in this step of analysis followed by data description. Then, we will present and discuss the results.

### 3.3.1 Methodology

The concept of *sigma*-convergence, introduced by Barro and Sala-i-Martin (1991), refers to a process in which the dispersion of real income per capita among a group of economies tends to decrease over time. According to literature the presence of *sigme*-convergence can be detected by calculating cross-sectional standard deviation or cross-sectional coefficient

of variation. We calculate standard deviation of the logarithm of real per capita income ($y_i$) for all countries $N$ ($i = 1, 2, \ldots, N$) over the ensuing yeas ($t$) according to following formula:

$$STD_t = \sqrt{\frac{\sum_{i=1}^{N}(ln\, y_i - ln\bar{y})^2}{N}}$$

If these values are declining the phenomenon of sigma convergence occurs.

It can be measured also by calculated cross-sectional coefficient of variation. This latter is expressed as follows:

$CV_t = \frac{STD_t}{\mu_t}$, where $\mu_t = \frac{\sum_{i=1}^{N}(ln\, y_i)}{N}$ is the sample mean.

Also, when values are declining the phenomenon of $sigma$-convergence is present.

### 3.3.2 Data

We calculate the two previous measures of dispersion for two variables to examine $\sigma$ −convergence between PAFTA countries. The first variable is set to measure $\sigma$ −convergence in terms of living standards across PAFTA countries using "Expenditure-side real GDP per capita at chained PPPs (in mil. 2011US$)". The second variable is to measure the σ-convergence in terms of the capacity productive (productivity) in PAFTA region using "Output-side real GDP per person engaged at chained PPPs (in mil. 2011US$)". Data covers 21 countries (Algeria, Bahrain, Comoros, Djibouti, Egypt, Iraq, Jordan, Kuwait, Lebanon, Mauritania, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Somalia, Sudan, Syrian Arab Republic, Tunisia, United Arab Emirates, Yemen) over the period 1970-2014, obtained from Penn World Tables (PWT version 9.0).[1]

### 3.3.3 Results

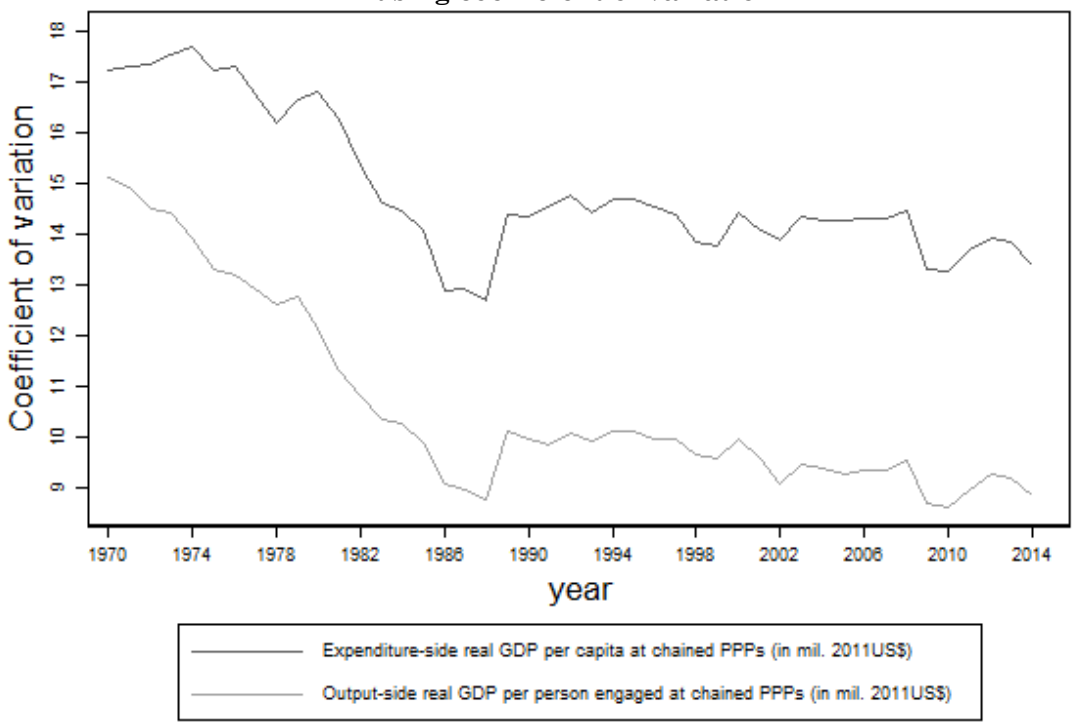
Results are presented graphically in Figures 3.1 and 3.2. We can state that that $sigma$-convergence was present from 1970 to 1990 for the two variables used in the analysis, where we can observe that there is a downward trend in both standard deviation and coefficient of variation. In contrast, we can't note that the dispersion between PAFTA economies decrease after 1990's, where both measures tend to be stagnated which reflecting the absence of σ-convergence as well as divergence. This could be related to the economic instability induced from some international economic crises such as Asian

[1] Data can be accessed online at: https://www.rug.nl/ggdc/productivity/pwt/

financial crisis in 1997, Subprime mortgage crisis in 2008 and to the volatility of oil price. Besides, this region has been suffering from multiple political crises such as Gulf war 1990-1991, war in Iraq in 2003 -2004 and Arab spring since 2010 until now.

**Figure 3-1: Sigma-convergence across PAFTA countries over the period 1970-2014 using standard deviation**


**Figure 3-2: Sigma-convergence across PAFTA countries over the period 1970-2014 using coefficient of variation**



## 3.4 Conditional convergence

Our second approach is to examine the conditional convergence within PAFTA members. It refers to a process in which poor regions grow faster than rich ones, such that the poor regions catch up to the rich ones in terms of the level of per capita income through time. Thus, a negative relationship between the growth rate and the initial level of income per capita is expected. This concept of convergence, introduced by Baumol (1986), is directly related to the neoclassical growth model (Solow, 1956). Under the assumption of diminishing returns, which implies a higher marginal productivity of capital in poorer-capital economies, poor economies will grow faster to catch-up with rich economies with similar savings rates. Moreover, the model predicts that economies tend to a long run steady state characterized by a rate of growth which depends on the rates of technological progress and labor force growth. When all economies are assumed to convergence towards the same steady state, ß-convergence is said to be absolute. However, if the steady state differs between economies, due to differences in saving rates, population growth, human capital or institutions, ß-convergence is said to be conditional.

The objective of this study is to examine the convergence factors between PAFTA countries focusing on the role of natural resource endowment. This will allow us to conclude three points. The first shows the role of natural resources endowment as a factor of convergence/divergence between PAFTA countries. The second explains the impact of the existence of dissimilar members, natural resource-rich countries and natural resource-poor countries, on the economic convergence among PAFTA members. In other words, does the asymmetry between countries in terms of natural resources endowment impede the convergence between PAFTA countries? Third, this study implicitly tests the question of the impact of regional integration between PAFTA countries. This sub-section is organized as follows. First, we will provide the conceptual framework of the economic growth determinants. Then, we will explain which variables will be integrated in our analysis of conditional convergence. Finally, we will present our econometric methodology and discus results.

### 3.4.1 Conceptual framework: The determinants of economic growth

First, we introduce the econometric framework that will be used to investigate the question of conditional convergence. We will use panel data approach as most empirical studies did. Our panel covers twenty countries from PAFTA region (Algeria, Bahrain,

Comoros, Djibouti, Egypt, Iraq, Jordan, Kuwait, Lebanon, Mauritania, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Sudan, Syrian Arab Republic, Tunisia, United Arab Emirates, Yemen) over five periods with four-year interval (1995-1998, 1999-2002, 2003-2006, 2007-2010 and 2011-2014). The use of four-year interval has several advantages; thought there is no consensus on the determination of the appropriate time intervals (Temple, 1999). First, the use of averages over several years decreases the influence of short-term shocks and business cycles on economic activity and reveals long-run relationships. Therefore, it is a way to avoid the problem of non-stationarity which could have produced biased results (regression fallacy). Second, compared to five-year or fifteen-year intervals, the use of four-year intervals allows keeping a sufficient number of observations to use the time dimension of panel data. As mentioned by Ding and Knight (2011), there is no single explicit theoretical framework that constitutes a base for empirical work on economic growth. A number of studies rely on the neoclassical model (Solow, 1956) and its extension (e.g., Mankiw et al., 1992), whereas a growing number of empirical works implement informal growth regressions which allow to include a larger set of explanatory variables (Barro, 1991; Barro and Sala-i-Martin, 1995a).

We first specify a growth level equation of the type considered typically in the literature:

$$y_{it} - y_{(t-4)} = \beta y_{\mathrm{i(t-4)}} + \gamma X_{it} + \pi Z_{it} + \epsilon_{it} \qquad (3.1)$$

where $y_{it}$ denotes the logarithm of real per-capita GDP in country $i$ in year $t$; $y_{it} - y_{(t-4)}$ is four year growth rates; $X_{it}$ is a vector of traditional determinants of growth in accordance with neoclassic and endogenous growth models; $Z_{it}$ is a vector of additional growth determinants of conditional convergence; where all explanatory variables are measured as averages from $t\ to\ t-3$ and $\epsilon_{it}$ is the error term. Under the hypothesis of conditional convergence, the associated $\hat{\beta}$ coefficient is predicted to be significant and negative (Solow, 1956; Barro and Sala-i-Martin, 1995a). All other things being equal, countries with a lower per capita GDP are predicted to grow at a faster rate than the richest countries. Equation (3.1) can be re-written as a dynamic model in the level of per capita GDP by adding $y_{i(t-4)}$ to both sides:

$$y_{it} = \alpha y_{\mathrm{i(t-4)}} + \gamma X_{it} + \pi Z_{it} + \epsilon_{it} \qquad (3.2)$$

where $\alpha = (1+\beta)$.

Secondly, we will provide the theoretical framework of main growth determinants according to the traditional growth models ($X_{it}$). First, physical capital accumulation is an

important determinant of growth in both Solow and endogenous growth models (Romer, 1986). Firms can accumulate know-how through capital accumulation and the free flow of information. Consequently, some investments can produce growing returns and promote economic growth. In addition, the augmented Solow model (Mankiw et al., 1992) shows that human capital can favorably influence growth. According to Lucas (1988), human capital refers to the stock of skills, knowledge, personality and physical health that can be used by a worker to be more efficient and more productive. An important growth determinant in neoclassical models is the rate of population growth. If population increases, a part of national investment will be used to provide capital for new workers instead of raising the level of capital per worker (Barro, 1998). As a consequence, this variable is assumed to have a negative impact on economic growth.

Third, we will review the conceptual framework for the additional determinants of growth ($Z_{it}$) that have been that highlighted in the literature.

Researches, such as North (1990), Rodrik et al. (2004), Acemoglu et al. (2005), and Petrunya and Ivashina (2010) have shown that economic institutions are primary causes of economic growth. Several reasons have been advanced for the importance of economic institutions in stimulating economic growth. One of the reasons is that economic institutions determine the incentives given to the main performers in the economy; the outcomes of economic processes are influenced by the economic institutions. Through these incentives, economic institutions influence investment in physical and human resources, research and development (R&D), technology and the organization of production (Acemoglu et al., 2005; North, 1990; Weil, 2008). This means that economic institutions determine not only the aggregate economic growth but the distribution of resources in the country and these in turn, contribute to maintaining order in the country.[1]

Literature claims that openness plays a role in economic growth. According to the theory of comparative advantage, if a country wants to trade with another country the latter will produce goods in which it has a comparative advantage. Hence, it specializes in the sector for which it has better factor endowments and produces goods on a larger scale. As a result, productivity and exports of this sector will go up and this will boost the overall economic growth. Endogenous growth theory has provided results on the positive growth effect of

[1] Empirically, many empirical studies provide evidence that institutions matter for long-term economic growth (e.g., among others, Knack and Keefer, 1995, 1997a and 1997b; Clague, 1997; Henisz, 2000; Campos, 2000; Rodrik, 2000; Dollar and Kraay, 2002; Rodrik et al., 2004; Valeriani and Peluso, 2011; Tamilina and Tamilina, 2014)

trade through innovation incentives, technology diffusion and knowledge dissemination (see, e.g., Grossman and Helpman, 1991; Rivera-Batiz and Romer, 1991; Young, 1991; Romer, 1994 Coe and Helpman, 1995; Barro & Sala-i-Martin, 1997). Monopolistic competition trade models with heterogenous firm and endogenous productivity provide theoretical results supporting the positive growth effect of trade through both increased variety of products and improved productivity due to the exit of less efficient firms (e.g., Melitz, 2003). All these arguments suggest that developing economies have much to gain from international trade with technologically advanced nations. However, some opposite arguments point out that trade openness may be detrimental to economic growth. This is the case when the country specializes in sectors where research and development activities are not the core ones (Almeida and Fernandes, 2008). Thus, another strand of research argues that increase in trade openness may be detrimental to economic growth by increasing inflation and lowering exchange rates (Cooke, 2010; Jafari Samim et al., 2012). Trade openness may impact economic growth negatively for countries which specialize in production of low-quality products (Haussmann et al., 2007). For instance, countries exporting primary products are vulnerable to terms of trade shocks.[1]

One of the surprising findings in the economic literature is that natural resource-rich countries tend to have slower economic growth than resource-poor countries. This is the opposite of our intuition that natural resource revenues should increase investment and economic growth in a country. This negative relationship is called the "resource curse" and has become a well-established finding. One of the classical explanations for the resource curse is based on Dutch disease theory. The models for Dutch disease were developed by Corden and Neary (1982), Corden (1984), van Wijnbergen (1984) and Sachs and Warner (2001). According to this theory, the manufacturing sector is assumed to be the traded and only growth inducing sector, given its positive externalities and spillover effects to other sectors such as learning-by-doing effects. Based on this theory, the local currency is

[1] On the empirical front, a number of studies point to positive growth effects of trade openness (e. g., among others, Dollar, 1992; Edwards, 1992; Harrison, 1996; Edwards, 1998; Frankel and Romer, 1999; Wacziarg, 1999; Bahmani and Niroomand, 1999; Irwin and Terviö, 2002; Wacziarg and Welch, 2003; Yanikkaya, 2003; Dollar and Kraay, 2004; Alcalá and Ciccone; 2004; Lee et al., 2004; Wang et al., 2004; Freund and Bolaky, 2008; Chang et al., 2009). Other studies contradict the existence of a positive link between trade and economic growth (e.g., Rodriguez and Rodrik, 2000; Vamvakidis, 2002; Rigobon and Rodrik, 2005; Kim and Lin, 2009 and Ulaşan, 2015). However, the openness-growth relationship also depends on whether a country is large or small, whether it is developed or developing. Most of studies suggested that trade openness boost economic growth, especially in developing countries (e.g., Sachs and Warner, 1995; Harrison, 1996; Rassekh, 2007; Chang et al., 2009). Other studies show that openness to trade has positive effects on economic growth and real income in developed countries but negative effects in developing countries (Kim et al., 2011; Kim, 2011).

predicted to appreciate substantially due to the large volume of natural resource exports after the discovery of natural resources. Furthermore, labor and other production inputs are attracted to the resource sector from the manufacturing sector. Consequently, production and exports in the manufacturing sector tend to decline, weakening the learning-by-doing effects of manufacturers. Thus, non-resource products in the manufacturing sector suffer from a loss of competitiveness in the global market. Overall, the negative effects in the manufacturing sector can predominate, and hence national income declines. The early works include Krugman (1987), Matsuyama (1992) and Gylfason et al. (1999), all of which assume that productivity growth in the manufacturing sector is generated through learning-by-doing. The theoretical models explain how the Dutch disease can emerge through different channels of various factors such as increasing returns to scale trade, agricultural productivity and exchange rate volatility.

Recent theoretical works extend existing models, deriving different interpretations concerning the Dutch disease (see, e.g., Torvik, 2001; Matsen and Torvik, 2005; van der Ploeg and Venables, 2013; and Cherif, 2013) adopt the assumption that both traded (manufacturing) and non-traded sectors generate learning-by-doing effects and shows how manufacturing sectors can grow following the discovery of natural resources. Matsen and Torvik (2005) demonstrate that "Dutch disease" can be considered part of the optimal path in his growth model, implying that the disease should not be a problem and may be cured in the long run. Cherif (2013) develops a bilateral trade model and shows that developing countries with lower productivity in the manufacturing sector are more likely to suffer from the Dutch disease. However, he also shows that an interaction effect among natural resource exports, trade partners and productivity is an important determinant of whether countries will suffer from the Dutch disease. In summary, these recent works suggest that natural resource abundance can benefit the economy of a single country and that a resource-rich country can grow in the long run.

Empirically, we can reveal that there are two waves of studies on this subject. First, studies have contributed to prove the theory of natural resource curse; the second criticized this finding and provided contradictory results about relationship between natural resources and economic growth.

The cross-section analysis of Sachs and Warner (1995) is considered as the seminal empirical investigation of the natural resource curse thesis. Sachs and Warner (1995, 2001) followed a large panel of natural resource economies from 1970 to 1989 and found that natural resource dependence was negatively correlated with economic growth.

Following their influential studies, a large volume of subsequent research has been inspired to examine the direct and indirect relationships between natural resource dependence and economic growth (e.g., Gylfason et al., 1999; Torvik, 2001, 2009; Mehlum et al., 2006a and 2006b; Rajan and Subramanian, 2011; Raveh, 2013). Many studies also find evidence of a negative relationship between resource dependence and variables thought to be closely related to growth performance. This broader set of outcome variables include human capital development (Gylfason, 2001; Stijns, 2005; Blanco and Grier, 2012; Shao and Yang, 2014), savings rates (Atkinson and Hamilton, 2003; Gylfason and Zoege, 2006; Dietz et al., 2007; Boos and Holm-Müller, 2013), growth of manufacturing exports (Wood and Berge, 1997), investment, schooling and openness (Papyrakis and Gerlagh, 2007), fiscal policy (Bornhorst et al., 2009), and institutional quality (Mehlum et al, 2006a & 2006b; Boschini et al., 2013). Most of these studies document a negative effect of natural resource abundance or dependence on the variables of interest.

By the late 2000's, a few studies have attempted to prove the opposite, particularly where resource abundance rather than dependence is the explanatory variable of interest. Brunnschweiler and Bulte (2008) find that resource abundance has a positive effect on growth, an effect which is not transmitted through resource dependence or institutional quality, and that resource dependence has no significant effect. Brunnschweiler and Bulte thus return to the earlier view that resource abundance is a blessing for economic development, and not a curse. Later, studies such as Lederman and Maloney (2007), Alexeev and Conrad (2009), Cavalcanti et al., (2011), Boyce and Emery (2011), and James (2015) obtained contradictory results also. This is attributed to different type of resources being examined, different economic backgrounds, and the choice of measure of key variables such as natural resource importance, economic growth, or years over which studies have been conducted and the econometric techniques used in the analysis.

### 3.4.2 Data and variables

Based on the theoretical presentation of the determinants of economic growth above, we will introduce the variables we have selected for our model and their sources. With regard to the explanatory variables, we have two vectors; traditional determinants ($X_{it}$) of growth which are inspired from neoclassical and endogenous growth models, and additional factors which are frequently used in literature ($Z_{it}$).

The dependent variable is the natural logarithm real GDP per capita at chained PPPs (in mil. 2011US$) in the final year of a *given sub-period*. Lagged of dependent variable is to

measure the initial income level, which is the key variable from the point of view of convergence, it is the natural logarithm real GDP per capita at chained PPPs (in mil. 2011US$) in the final year of the *preceding sub-period*. Both are obtained from Penn World Tables (PWT version 9.0).

Concerning the traditional determinants of growth, we select three main variables. Physical capital accumulation is integrated to our model via the investment ratio, calculated as the *share of gross fixed capital formation in GDP* from UNCTAD database. In this study, human capital is proxied by the variable of *mean years of schooling* from UNDP database. As it is frequently used in the literature, we take into account the *population growth rate* in our analysis obtained from UNCTAD.

As explained in the conceptual framework, we will take in consideration some additional determinants of economic growth. In this study, we will focus on fours variables.

First, we used data from *Worldwide Governance Indicators* obtained via World Bank database to control the impact of institution on economic growth. We calculated the average of four indicators: Government Effectiveness, Regulatory Quality, Rule of Law and Control of Corruption.[1]

Second, we integrated *share of trade in GDP* as a measure of economic openness which represents the sum of exports and imports of goods and services measured as a share of gross domestic product obtained from UNCTAD.

To examine the role of natural resources in the convergence process, we use two variables that measure the natural resources endowment:

1) *Share of natural resource exports in GDP* which is calculated by the sum of fuel and minerals exports divided by GDP, data obtained from UNCTAD.[2]
2) *Contribution of mining sector in GDP* which is measured by mining, value added (% of GDP), also extracted from UNCTAD.

fuels, lubricants and related materials; SITC 3

ores, metals, precious stones and non-monetary gold; SITC 27 + 28 + 68 + 667 + 971

[1] The four aggregate indicators are reported in percentile rank terms from 0 to 100, with higher values corresponding to better outcomes.
[2] Fuel exports = (Mineral fuels, lubricants and related materials; SITC 3). Minerals exports = (Ores, metals, precious stones and non-monetary gold; SITC 27 + 28 + 68 + 667 + 971)

Finally, we complete our model by adding two additional variables to control the potential impact of other sectors; *share of non-natural resource exports in GDP* which calculated by subtracting natural resource exports from total exports and divided by GDP, and *contribution of non-natural resource sectors in GDP* which is expressed by the sum of manufacturing and agriculture value added (% of GDP).

### 3.4.3 Econometric strategy

The panel estimation can be implemented by pooled Ordinary Least Squares (OLS) or by the fixed-effects estimator (FEM) which incorporates individual-specific (time-invariant) effect ($\theta_i$) and time-specific (individual-invariant) effect ($\delta_t$):

$$y_{it} = a y_{i(t-1)} + \gamma X_{it} + \theta_i + \delta_t + \epsilon_{it} \qquad (3.3)$$

where the dependent variable $y$ for country $i$ in year $t$, is explained by a set of independent variables $X_{it}$ and by unobservable characteristics: country-specific $\theta_i$ and time-specific $\delta_t$.

The fixed-effects estimator (also called within estimator) is obtained by ordinary least squares (OLS) on the deviations from the means of each individual. However, this estimator can provide biased estimations if the number of time periods is small, and if the lagged value of the dependent variable $y_{i(t-1)}$ is correlated with the individual effects $\theta_i$ (Mtys and Sevestre, 2008). In particular, the estimation of growth regression may raise several problems (Bond et al., 2001). First, explanatory variables may be endogenous because of reverse causality or measurement errors. The within estimator has been shown to produce estimations of parameters that are inconsistent and biased downward in presence of endogeneity (Nickell, 1981). Second, omitted variables can bias the estimation. In our case, the omission of characteristic variables may lead to invalidate the conditional convergence hypothesis.

To address these issues, Holtz-Eakin et al. (1988) and Arellano and Bond (1991) suggest to estimate dynamic panel data models using the generalized method of moments (GMM). Those authors propose to estimate the regression equation with a first-differentiated GMM estimator. For each period, it is necessary to first-differentiate the equation in order to eliminate individual specific effects:

$$y_{it} - y_{it-1} = a(y_{it-1} - y_{it-2}) + \gamma(X_{it} - X_{it-1}) + (\delta_t - \delta_{t-1}) + (\epsilon_{it} - \epsilon_{it-1}) \qquad (3.4)$$

By construction, $(y_{it-1} - y_{it-2})$ is correlated with the error term $(\epsilon_{it} - \epsilon_{it-1})$. As a consequence, it is necessary to resort to instrumental variables techniques (for $t \geq 2$). Arellano and Bond (1991) suggest to use the lagged levels of the lagged endogenous variable $y_{it-1}$ as instruments for $(y_{it-1} - y_{it-2})$, and the lagged levels of the explanatory variables $X_{it}$ as instruments for $(X_{it} - X_{it-1})$. Nevertheless, there are limitations to this approach. For instance, Blundell and Bond (1998) point out that the first-differentiated GMM estimator may provide biased results in the case of finite sample size, and that the lagged levels of the variables cannot be considered as reliable instruments when the dependent and the independent variables are continuous.[1]

To obviate the weak instrument problem, Arellano and Bover (1995) and Blundell and Bond (1998) suggest a second method based on the system GMM estimator. This estimator combines: (i) the standard set of equations in first-differences, $(y_{it-1} - y_{it-2})$ and $(X_{it} - X_{it-1})$ variables, with suitably lagged levels as instruments, (ii) with an additional set of equations in levels, $y_{it-1}$ and $X_{it}$ variables, with suitably lagged first-differences as instruments. Blundell and Bond (1998) have also developed a two-step GMM estimator to address the problem of heteroscedasticity. First, they suggest to get the residuals from the first-step estimation. Second, they recommend to use them in order to perform a robust estimation of the variance-covariance matrix. Using Monte Carlo simulations, Blundell and Bond (1998) show that the two-step estimation method is asymptotically more efficient than the first step method. However, they also underline that the two-step estimation may produce downward biased results when using finite samples. To eliminate this potential bias, Windmeijer (2005) proposes a finite sample correction for the variance-covariance matrix when using the two-step GMM estimator.

The consistency of the system GMM estimator relies on two hypotheses. First, the set of instrumental variables must be valid, i.e. not correlated with the error terms. This hypothesis is tested using Sargan/Hansen test of overidentifying restrictions.[2] Second, the absence of second-order autocorrelation (AR2) in residuals must be verified, while a negative first-order autocorrelation (AR1) may be detected. This second hypothesis is tested using Arellano-Bond tests for AR1 and AR2. Roodman (2009) shows that using too

[1] Blundell and Bond (1998) point out that the first-differenced GMM estimators are likely to perform poorly when the time series are persistent and the number of time periods is small. This is because lagged levels of the series provide only weak instruments for the differenced equations. Another shortcoming of using the difference estimator is that the process of differencing to remove the country specific effect also eliminates information on the cross-country variation in levels.

[2] The Hansen test is implemented instead of the Sargan test when the estimations are adjusted for heteroscedasticity.

many instruments can produce biased results in GMM estimation. Although the empirical literature provides little evidence on the maximum number of instruments to use, the minimum standard is to have less instruments than individuals (Roodman, 2009). Arellano and Bover (1995) also suggest using only the most recent difference as an instrument for the level specification of explanatory variables, because other lagged first-differences would result in redundant moment conditions. Taking all this into consideration, we estimate our growth equation using two-step GMM estimator with Windmeijer's correction method for the variance-covariance matrix.

### 3.4.4 Results and discussion

Results of our growth model estimated by system GMM two-step estimator are presented in Table 3.1. We performed two regressions to examine the factors of convergence among PAFTA countries focusing on the role of natural resources. Each regression investigates the role of natural resource using diffident measure.

First regression includes the traditional determinants of economic growth, investment; education; population; openness and quality of institution; as well share of mining sector in GDP and share of other sectors in GDP. We aim from this regression to investigate the contribution of natural resource sector in the convergence process between PAFTA members. Results of regression (1) are presented in column (1) of Table 3.1. The lagged GDP per capita $\alpha$ is positive and estimated 0.548. We must calculate the $\beta$ to test the convergence via ($\alpha = 1 + \beta$) and then calculate $t - student$ to verify if it is significate (See equation (3.2)). We found $\beta = -0.452$ , and the t-student = 0.251, it is negative and significate, so we can conclude that the hypothesis of conditional convergence is validated. However, according to the results of regression (1), the convergence process is occurred but conditionally to some factors. These factors are the investment, quality of institutions, openness and mining sectors. All of them affect the convergence positively but the openness has negative impact on the convergence process in PAFTA region.

Regression (2) represents the impact of international trade in natural resources on the convergence process within PAFTA. Therefore, we include the traditional determinants of economic growth, as well the share of fuel and minerals exports in GDP, the share of non-natural resource sectors exports, and finally the share of total imports in GDP. We aim from this regression to examine the role of natural resource as exports on the convergence process. Results of regression (2) are presented in column (2) of Table 3.1. We can note also that the hypothesis of conditional convergence is validated and conditionally to some

factors. Again, the quality of institutions plays a significant role in the convergence process in PAFTA region. In addition, we can see that the fuel and minerals export positively affect the convergence in this region, while the imports affect it negatively, this could explain that negative effect of openness in the first regression. In this regression, investment is not significant more, which shows that the dependence on fuel and mineral exports has contributed to the convergence in this region at the expense of the investment in physic capital.

The above results show that natural resources are one of the main determinants of the economic convergence in the MENA region, either as a sector of GDP or as exports. This finding is inconsistent with some previous studies that have found the negative impact of natural resources on economic growth. In fact, this can be explained by the period used in the analysis between 1995 and 2014, which is characterized by the rise in the oil prices. Therefore, this has contributed to achieve high economic growth rates in countries that are rich in natural resources such as: Arab Gulf States, Algeria, Libya, and in diversified countries also like Syria and Egypt. However, the oil prices boom led to increase their foreign exchange windfalls and boost intra-regional FDIs. On the other hand, resource-poor countries have increased their exports toward resource-rich countries benefiting from high oil prices, and from signing of the Greater Arab Free Trade Area Agreement (PAFTA) in 1998. Consequently, this has positively affected the economic growth of poor countries and contributed to converge toward rich states, especially diversified countries such as Syria and Egypt and poor countries like Tunisia and Morocco. The second factor of economic convergence between PAFTA economies is the quality of institutions. Our results correspond with most previous studies on the importance of its role is the process of economic convergence within PAFTA countries.

**Table 3-1: Determinants of convergence between PAFTA mermbers (1995-2014), System-GMM Estimator**

| Variables | Regression (1) | Regression (2) |
|---|---|---|
| Initial GDP per capita (Lagged GDP per capita) | 0.548** | 0.481*** |
| | (0.251) | (0.143) |
| Investment | 1.504*** | 1.178 |
| | (0.481) | (0.988) |
| Education | 0.110 | 0.107 |
| | (0.102) | (0.102) |
| Population | -4.323 | -1.189 |
| | (3.722) | (2.363) |
| Institutions quality | 1.218** | 1.598* |
| | (0.545) | (0.895) |
| Openness | -0.548*** | |
| | (0.171) | |
| Mining value added | 1.672** | |
| | (0.700) | |
| Other sectors value added | -1.118 | |
| | (1.128) | |
| Imports | | -1.088*** |
| | | (0.421) |
| Fuel and mineral exports | | 1.001*** |
| | | (0.298) |
| Other sectors exports | | -0.403 |
| | | (0.998) |
| $\beta$ convergence (calculated) | -0.452* | -0.519*** |
| | (0.251) | (0.143) |
| No. of observations | 77 | 77 |
| No. of individuals (countries) | 20 | 20 |
| No. of instruments | 20 | 20 |
| Hansen test of over identifying restrictions | 8.45 | 10.87 |
| | (0.295) | (0.144) |
| Arellano-Bond test for AR(1) | -1.69 | -1.92 |
| | (0.091) | (0.055) |
| Arellano-Bond test for AR(2) | -0.26 | -1.22 |
| | (0.795) | (0.222) |

Notes:
- Four-year intervals data for 20 countries (1995-1998; 1998-2002; 2003-2006; 2007-2010; 2011-2014).
- Twostep system GMM estimations with Windmeijer's (2005) finite-sample correction for the variance-covariance matrix.
- Robust standard errors into brackets for GMM estimates, p-value into brackets for Hansen and Arellano-Bond tests.
- Level of statistical significance: 1 %***, 5 %**, and 10 %*.
- Time dummies are not reported.
- In order to overcome a problem resulting from using too many instruments (Roodman, 2006), we limit the number of lags for both the dependent and explanatory variables to one and using command *collapse*, these restrictions enable us to keep the number of instruments for below or equal that of countries, as recommended by Roodman (2009).
- We used command.
- LINCOM to calculate $\beta$.

## 3.5 Club convergence

We have concluded from previous step that there is a conditional convergence among countries of PAFTA. The objective of this section is to investigate the presence of club convergence in PAFTA region. Indeed, the presence of conditional convergence does not exclude club convergence (Durlauf et al. 2005). A convergence club is a group of economies whose initial conditions are similar enough to converge towards the same long-term equilibrium for countries displaying similar structural characteristics. Under such circumstances there might be convergence among similar types of economies (club convergence), but little or no convergence among clubs. However, convergence clubs may exist even after accounting for variation in structural characteristics, as several empirical articles have stated (Papalia and Bertarelli, 2013).[1] To tackle this issue, we propose a two-step procedure. First, we endogenously identify groups of countries that converge to the same steady state level within PAFTA members using the methodology proposed by Phillips and Sul (2007). Then, the potential formation of a club suggests that there might be common factors among a group of countries leading them to converge to a similar steady state. Hence, we estimate several ordered logit models and analyze which factors play an important role in determining club membership. Due to the fact that natural resources are unequally distributed across PAFTA countries, we hypothesize that they play an role in forming convergence clubs.

### 3.5.1 Club identification

As a first step in the analysis, we will apply the methodology proposed by Phillips and Sul (2007) to test for convergence in a panel of countries and to identify any convergence clubs among PFATA countries. Phillips and Sul (2007) propose a new powerful econometric methodology for testing whether a panel of economies tends to converge to a common steady state. The proposed methodology allows for a wide range of transition paths as well as for transitional divergence. The authors argue that if a panel of economies fails to converge, this does not preclude the presence of convergence subgroups (clubs) within the panel. They introduce a clustering procedure to identify endogenously the convergence clubs (if any). However, this methodology is characterized by the endogenous determination of convergence clubs, contrary to other approaches in which economies are grouped a priori, and thus the cluster outcomes are to some extent predetermined by the

[1] For a detailed review of empirical evidence in favor of convergence clubs and multiple equilibria, see Durlauf et al. (2005).

arbitrarily selected variables for club formation and its threshold levels.[1] First, we will we outline for more technical details the methodology proposed by Phillips & Sul (2007) to test for convergence in a panel of countries and to identify any convergence clubs. Second, we will provide and discuss the results.

### *3.5.1.1 Econometric methodology: Phillips & Sul (2007)*

We present the econometric methodology we employ to analyze the existence of convergence clubs among PAFTA countries. The methodology was developed by Phillips and Sul (2007) in order to test for club convergence in a panel of countries. The origin of their methodology is a standard neoclassical growth model, allowing for heterogeneous technology progress. The departure point is the decomposition of a panel for the natural logarithm of output per capita, $log\, Y_{it}$ into two components, one systematic $g_{it}$ , and one transitory, $a_{it}$:

$$log\, Y_{it} = g_{it} + a_{it} \tag{3.5}$$

To separate common from idiosyncratic components in the panel, equation (3.5) is reformulated as:

$$logY_{it} = \left(\frac{g_{it} + a_{it}}{\mu_t}\right)\mu_t = \delta_{it}\mu_t, \text{for all } i \text{ and } t \tag{3.6}$$

where $\mu_t$ is a common component and $\delta_{it}$ is a idiosyncratic component, both of which are time varying. Thus, the idiosyncratic component, $\delta_{it}$, is a form of individual distance between the common component, $\mu_t$, and $\log Y_{it}$. Phillips and Sul (2007) model the time varying behavior of $\delta_{it}$ in semi parametric for as:

$$\delta_{it} = \delta_i + \sigma_i \xi_{it} L(t)^{-1} t^{-\alpha} \tag{3.7}$$

[1] The empirical literature on the detection of convergence clubs employs a variety of statistical methods. Durlauf and Johnson (1995) dismiss the frequently used linear model that studies cross country economic behaviour in favour of multiple regimes, using a data set of 121 countries. They reject convergence in real per capita income, while using regression tree analysis; they find evidence for club convergence in multiple steady states. Quah (1993, 1996, and 1997) proposes the distributional dynamics approach to study convergence. He examines the convergence clubs' hypothesis by viewing the evolution of the entire distribution over time. He finds that the income distributions evolve from a unimodal 'one peak' distribution towards bimodal 'twin peaks' distribution. Hansen (2000) uses a threshold regression to sort the countries into different regimes and provides evidence to support such multiple regimes, while Canova (2004) proposes a new technique for grouping converging countries in terms of real per capita income. His methodology implies that countries exhibit multiple steady states for real per capita income. He finds that the steady-state distribution income for European regions clusters around four different poles, while that for the OECD countries clusters around two different poles.

where $\delta_i$ is fixed, $\xi_{it} \sim iid\ (0,1)$ across $i$ but weakly dependent on $t$, and $L(t)$ is a slowly varying function (like $log\ t$) for which $L(t) \to \infty$ as $t \to \infty$. Equation (3.7) ensures that $\delta_{it}$ converges to $\delta_i$ for all $\alpha \geq 0$, which becomes the null hypothesis of interest. This formulation enables Phillips and Sul (2007) to develop an econometric test of convergence, by testing whether the factor loadings $\delta_{it}$ converges to a constant $\delta$. For this purpose, the authors define the relative transition parameter $h_{it}$ as:

$$h_{it} = \frac{logY_{it}}{N^{-1}\sum_{i=1}^{N} logY_{it}} = \frac{\delta_{it}}{N^{-1}\sum_{i=1}^{N} \delta_{it}} \tag{3.8}$$

which eliminates the common component by taking ratios and measures the transition path of economy $i$ relative to the panel average. Thus, it measures individual country behavior in relation to other economies and describes the relative departure of economy $i$ from the common growth path, $\mu_t$. When all economies move towards the same transition path, that is, $\delta_{it}$ converges to a constant $\delta$, the relative transition parameters $h_{it}$ converges to unity. In this case the cross-sectional variance of $h_{it}$ converges to zero:

$$H_t = \frac{1}{N}\sum_{i=1}^{N}(h_{it} - 1)^2 \to 0 \text{ as } t \to \infty \tag{3.9}$$

Using the semi parametric model represented in equation (3.7) above, the null hypothesis of convergence can be written as:

$$H_0: \delta_i = \delta \text{ and } \alpha \geq 0 \tag{3.10}$$

and the alternative:

$$H_1: \delta_i \neq \delta \text{ for some } i \text{ and/or } \alpha < 0 \tag{3.11}$$

The null hypothesis is tested using the following $log\ t$ regression:

$$\log\left(\frac{H_1}{H_t}\right) - 2\log L(t) = a + b\ Log\ t + u_t \quad , \quad t = [rT], \dots, T \tag{3.12}$$

where $L(t) = log\ (t+1)$ and the parameter of log $t$ is $b = 2\alpha$. Using the $t - statistic\ t_b$, robust to heteroscedasticity and autocorrelation (HAC), the null hypothesis of convergence is rejected when $t_b < -1.65$ (5% significance level). It is worth noting that the parameter of log $t$ above has a relevant economic interpretation, not only concerning its sign, but also its magnitude. Specifically, its magnitude is directly related to the rate of convergence, so that the higher the value of b, the faster the rate of convergence.

Moreover, an estimate of $b \geq 2$ implies absolute convergence within the panel, while if $0 \leq b < 2$ indicates only relative convergence, that is, convergence of growth rates over time. The initial observation in the regression is $[rT]$ so that the first fraction $(r)$ of the data is discarded. Since both, the limit distribution and the power properties, depend on the discarded sample fraction, the value of $r$ plays an important role. Based on Monte Carlo simulations, Phillips and Sul (2007) recommend setting $r = 0.3$.

This procedure presents several features that make it very useful in applied work. First, the test does not rely in any particular assumption concerning trend stationarity or stochastic non-stationarity in individual income per capita or the common trend, $\mu_t$. Second, the nonlinear form of equation (3.7) is sufficiently general to include the possibility of transitional heterogeneity or even transitionally divergent individual behavior. Thus, the method enables to detect convergence even in the case of transitional divergence, where other methods such as cointegration methods for long run analysis and stationary time series tests may fail.[1]

In the empirical application of the $log\ t$ statistic to identify convergence clubs from the panel of countries, Phillips and Sul (2007) suggest using the following algorithm:

**Step 1 (Ordering):** the panel members are ordered according to the last observation.

**Step 2 (Core Group Formation):** a core group of countries is identified on the basis of the maximum $t_k$ with $t_k > -1.65$, from the sequential $log\ t$ regressions based on the $k$ highest members for $2 \leq k \leq N$.

**Step 3 (Club Membership):** each individual country not included in the core group is evaluated, one at a time, for membership in this group. A new country is included if the associated $t - statistic$ is greater than zero.

**Step 4 (Recursion and Stopping):** the *log t* regression is applied to those countries not selected in Step 3. If the null of convergence is not rejected for this complement group, then they form a second convergence club. If rejected, Steps 1–3 are repeated in order to detect sub convergence clusters. If no core group is found in Step 2, then the countries from the complement group display a divergent behavior and the algorithm stops.

[1] See Phillips and Sul (2007), pp. 1778–1780, and Phillips and Sul (2009), Section 4.1, for details.

### *3.5.1.2 Log t test results*

We applied the *log t test* to real GDP per capita at chained PPPs (in mil. 2011 US $) across 20 PAFTA countries (except Libya and Somalia) from 1970 to 2014, obtained from PWT version 9.0 database.[1]

We first test the full panel convergence for all countries using the above parameters. Table 3.2 presents the results. The point estimate of $b$ (equation (3.12)) indicates that the null hypothesis of overall convergence in the real GDP per capita across PAFTA countries is clearly rejected at 5% level, where *log t* is $(-0.5418)$ and *t statistics* is $(-13.32)$. Hence, we can conclude that all PAFTA countries did not converge to the same steady state equilibrium in terms of per capita incomes.[2]

**Table 3-2: log(t) test for full panel convergence**

| Variable | Coefficient | SE | T-stat |
|---|---|---|---|
| $log(t)$ | $-0.5418$ | 0.0407 | $-13.3258$ |

The number of individuals (countries) is 20.
The number of time periods (years) is 45.

Thus, we investigate the possibility of club convergence using Phillips and Sul (2007) club clustering algorithm procedure to examine whether there are any subgroups of countries that converge into multiple steady states or so-called "clubs". Results of clustering algorithm identified **three** main clubs among PAFTA countries. Table 3.3 reports countries, the *log t* and the corresponding *t statistics* for each club. In addition, we provide a graphic illustration of club membership in Figure 3.3.

**Table 3-3: Convergence club classification**

| Club | N | Members | Coef. | T-stat |
|---|---|---|---|---|
| Club (1) | 10 | Bahrain, Egypt, Kuwait, Lebanon, Morocco, Oman, Qatar, Saudi Arabia, Tunisia, United Arab Emirates | -0.042 | -1.326 |
| Club (2) | 4 | Algeria, Iraq, Jordan, Syrian Arab Republic | 1.368 | 4.920 |
| Club (3) | 6 | Comoros, Djibouti, Mauritania, Palestine, Sudan, Yemen | -0.147 | -0.271 |

[1] We used the same data used by Phillips and Sul (2007).
[2] Stata codes are provided by Du (2017)

**Figure 3-3: Illustration of PAFTA clubs**

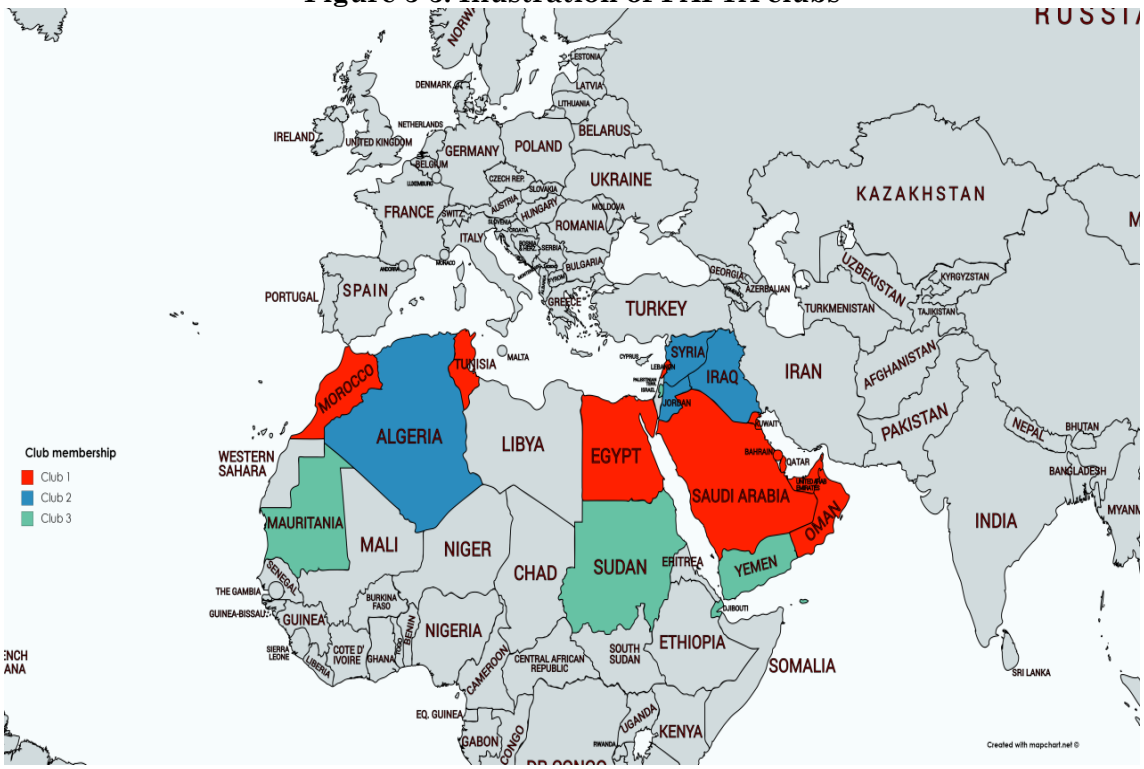
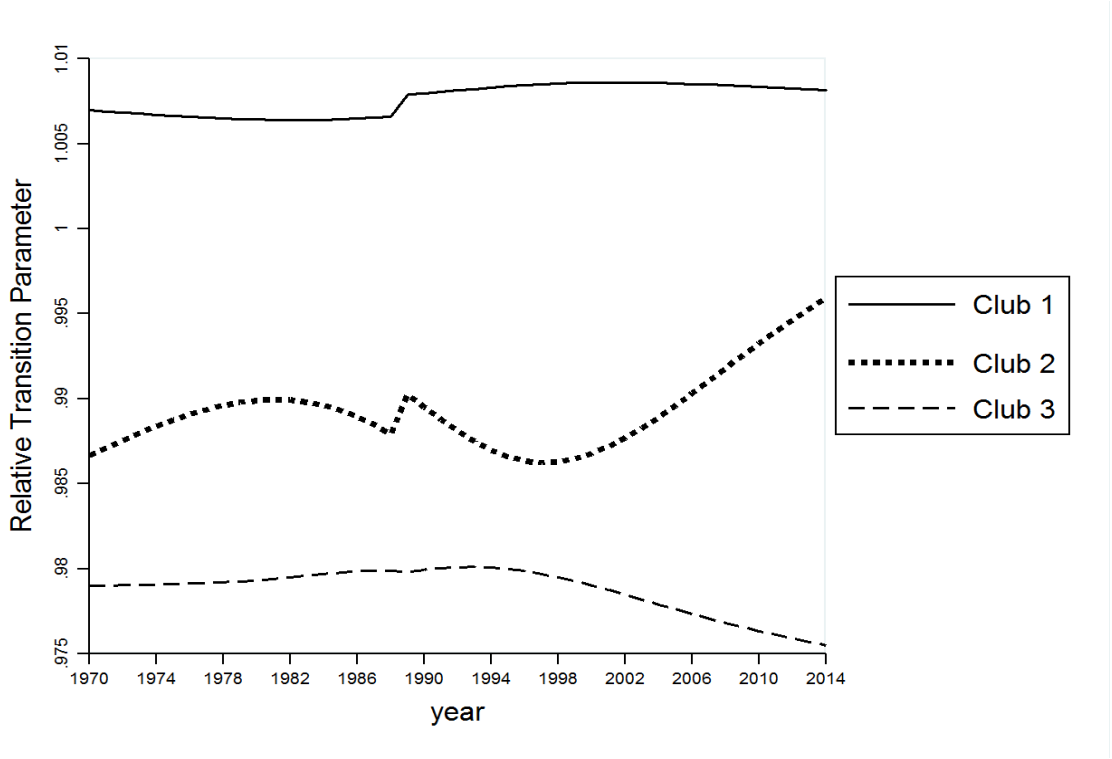



Figure 3.4 illustrates the relative transition paths of the three different clubs calculated as the cross-sectional mean of the relative transition paths of the members of each club. Under the assumption of convergence for the full panel of countries, the relative transitions paths should tend to unity, that is, all countries convergence to the same equilibrium. However, under the assumption of club convergence the relative transition paths of the members of each club tend to different constants. This regularity can be clearly appreciated in Figure 3.4, where we can observe that the first club appears distinctively above the average, whereas the second and third clubs keep below unity. We can see that there is an evidence of a convergence process between club 2 and club 1 where the average transition path of the club 2 displays a marked upward trend towards the first club after 2000, while the path of club 3 tends to decrease after 2000 and drifting away from the other clubs reflecting a divergence process between club 3 and other clubs.

**Figure 3-4: Relatives paths of PAFTA clubs, 1970-2014**




Figures 3.5, 3.6 and 3.7 plot the relative transition paths of club by country. The relative transition paths within club 1 present quite heterogeneous patterns, implying that the manner of economic transition and convergence is different across economies within a given club. We can observe that Gulf States appear distinctively above other countries in the same club, and they have the same pattern of economic transition, where their economies marked by downward trend until 1990's, then they tended to grow. This reflects the homogeneity of their economies that depend heavily on the rents of natural resources. On the other hand, other economies that depend less on natural resources like Egypt or natural resource-poor countries like Lebanon, Morocco and Tunisia share the same pattern of transition path, where their economies are marked by general upward trend.

With respect to the club 2, we can observe that the transition path is more homogeneous. They marked by downward trend between 1985 and 1995 then by upward growth until they reach the same steady state. This reflects the evidence of convergence process between club 2 and club 1. Most countries of this club are characterized by dependence on natural resources like Algeria, Iraq and Syria but Jordan is mostly natural resource-poor country.

For the last club, we observe that the transition paths of most countries are marked by stagnation with except of Yemen and State of Palestine that have upward path and Djibouti that has the inverse. This assures the divergence process between them and club

2. In addition, this club includes also some natural resource-rich countries like Sudan and Yemen.

**Figure 3-5: Relatives transition paths of Club (1) by countries in PAFTA, 1970-2014**

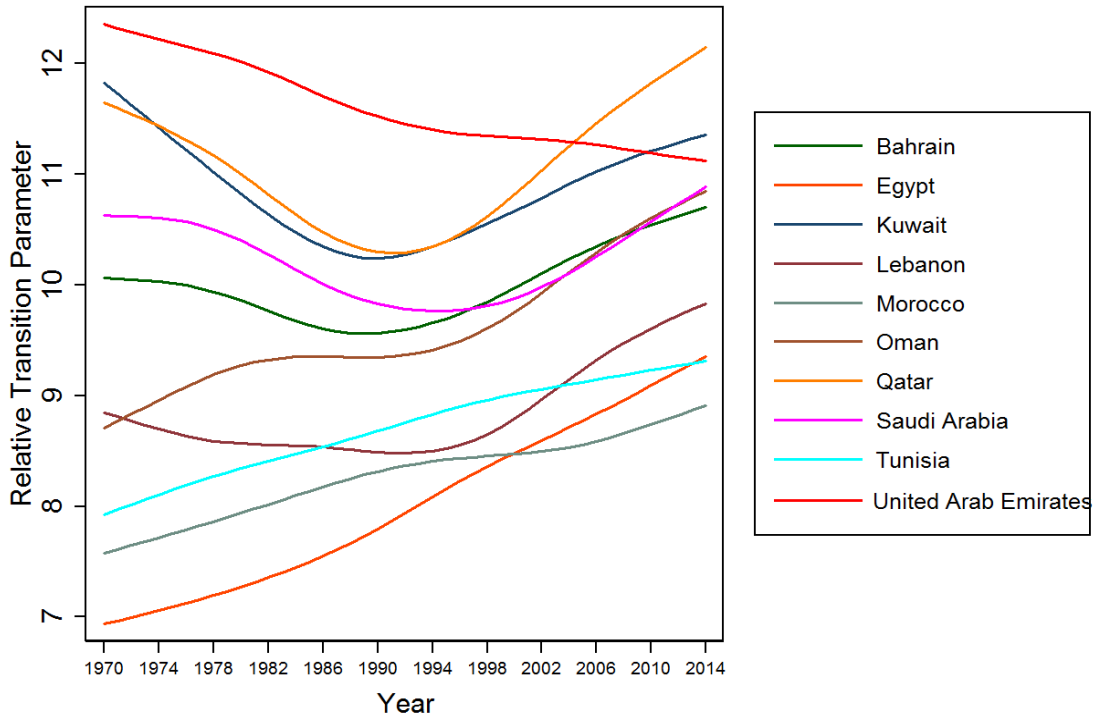



**Figure 3-6: Relatives transition paths of Club (2) by countries in PAFTA, 1970-2014**

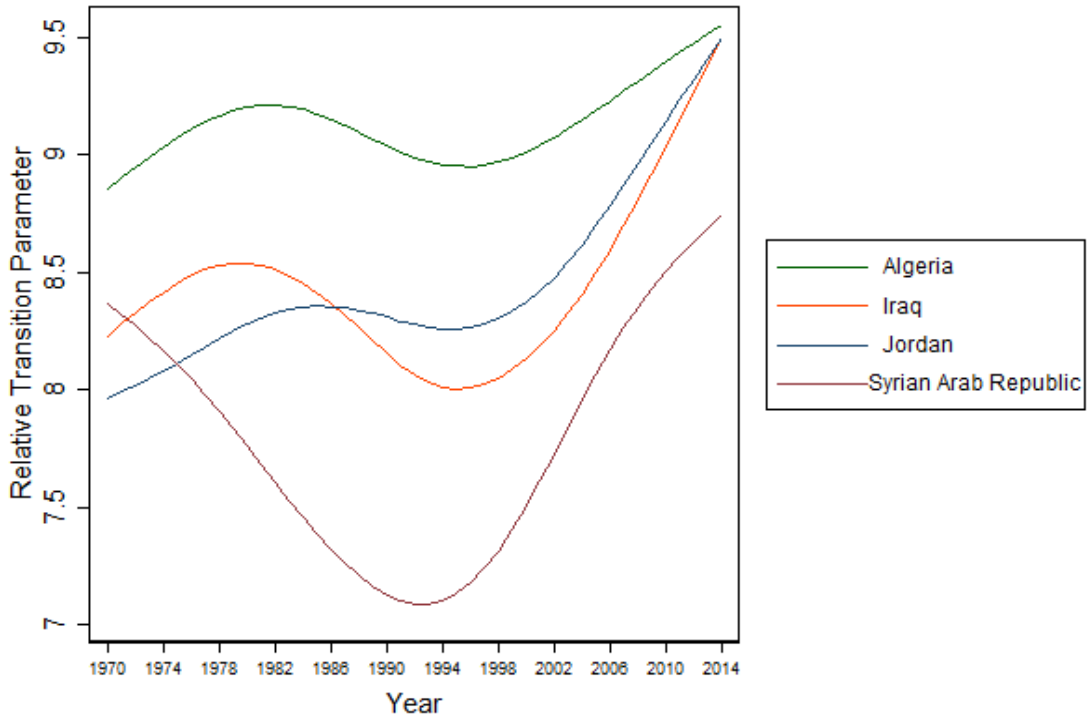
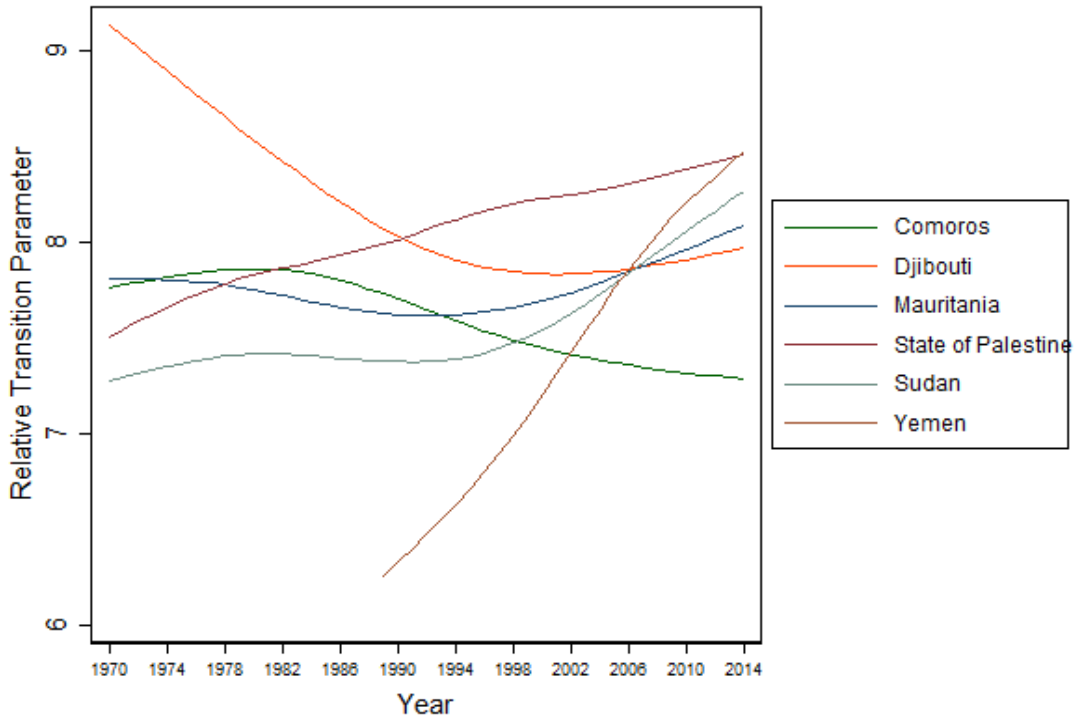


**Figure 3-7: Relatives transition paths of Club (3) by countries in PAFTA, 1970-2014**




## 3.5.2 Factors driving club membership

In order to improve our understanding of why some countries in the PAFTA grow faster than others, we estimate several ordered logit models and analyze which factors play an important role in determining club membership. We first provide the theoretical background of the main factors mentioned by growth literature as potentially responsible for the formation of convergence clubs. Specifically, we focus on the initial conditions that are crucial in determining the growth path of an economy, at the same time considering some additional structural characteristics.[1] Then, we will list the indicators (variables) that will be employed in order to empirically assess whether the theory can actually explain the convergence patterns observed among PAFTA countries. Subsequently, we will introduce our ordered regression model that will be used to explain the determinants of formation of clubs across PAFTA countries. Finally, we will discuss the regression results and conclude which factors are crucial in forming convergence clubs in PAFTA region.

[1] In fact, the club convergence hypothesis implies that per capita incomes of countries that are identical in their structural characteristics converge to one another in the long-run provided that their initial conditions are similar as well (Galor, 1996).

### *3.5.2.1 Theoretical background and variables*

From a theoretical point of view, the traditional neoclassical growth model, following Solow (1956), Cass (1965) and Koopmans (1965), explain differences in income per capita in terms of different paths of factor accumulation. The model put physical capital accumulation at the core of growth and long run income. Output per capita is determined by the stock of capital per capita and, in the long-run, differences in steady state income across countries stem from differences in savings rates, depreciation and population growth rates. Countries that save more, and countries with lower depreciation rates and fertility rates reach higher levels of steady state income per capita. Thus, the neoclassical growth model states that countries will reach the same steady state if they share fundamental parameters.

Azariadis and Drazen (1990) augment the neoclassical growth model by incorporating threshold externalities in the accumulation of human capital which can induce multiple balanced growth paths as stationary equilibria. Specifically, initial conditions with respect to human capital accumulation may determine an economy's growth path. This is due to increasing social returns to scale that become particularly pronounced when the stock of knowledge attains critical mass values. In particular, the authors argue that rapid growth can only occur with a relatively overqualified labor force, that is, a high level of human investment relative to per capita income.[1]

Traditional growth theory has focused on physical and human capital accumulation and, in its endogenous growth variant, on technological change However, following the work of North (1990), differences in institutions and property rights have received considerable attention during the last decades as a fundamental cause of differences in income per capita across countries. From this perspective, countries with better institutions will invest more in physical and human capital and will use these factors more efficiently to achieve a greater level of income.

To identify the net impact of initial factors on the formation of convergence clubs, we consider some indicators that control for an economy's structural characteristics. First, population growth is considered as an important growth determinant which expected to have negative impact according to neoclassical models. Second, theory of comparative

[1] Several extensions of the neoclassical growth model highlight the role of human capital. In the Mankiw-Romer-Weil model (Mankiw et al. 1992), human capital accumulates in a similar fashion to physical capital, and thus, both the saving rate in physical capital and the rate of investment in education determine steady state income differences.

advantage, endogenous growth theory, monopolistic competition trade models and empirical studies claim that openness plays a role in economic growth. Third, as PAFTA members are heterogeneous in terms of geography, population and economic activity, natural resources are unevenly distributed across countries, and we assume they play an important role in the formation of convergence clubs. Accordingly, many empirical studies conclude that resource-rich and resource poor countries have different patterns of growth. In addition, natural resources are also said to influence other variables like human development indicators (Bulte et al., 2005) and education (Gylfason, 2001), which in turn reflect the initial conditions at the beginning of the growth path. Finally, we account for differences in the degree of industrialization in the economies.

Departing from this theoretical background, we consider several variables for initial condition and structural characteristics of the economies in order to identify key factors conditioning club membership. Table 3.4 provides the definition of the variables and the corresponding sources.

**Table 3-4: Variables definition and sources of club convergence determinates**

| Factor | Variable | Source |
|---|---|---|
| Physical capital | Gross fixed capital formation, (% of GDP) | UNCTAD |
| Human capital | Mean years schooling (years) | UNDP |
| Institutions quality | Average of four indicators: Government Effectiveness, Regulatory Quality, Rule of Law and Control of Corruption. (Percentile Rank; with 0 corresponding to lowest rank, and 100 to highest rank) | WGI |
| Population | Population growth rate (%) | WDI |
| Natural resource abundance | - Mining, value added (% of GDP).<br>- Natural resource (fuel and minerals) exports, (% of GDP). | UNCTAD |
| Industrialization/ Diversification | - Manufacturing and agriculture value added (% of GDP).<br>- Agricultural raw materials, food and manufactured exports, (% of GDP). | UNCTAD |

UNCTAD: United Nations Conference on Trade and Development.
UNDP: United Nations Development Program.
WDI: World Development Indicators, World Bank.
WGI: Worldwide Governance Indicators, World Bank.

### *3.5.2.2 Ordered logit model*

We will estimate several ordered logit models to predict how country structural characteristics affect the likelihood that any given country would be found to be a member of each convergence clubs. In our model, the dependent variable, which is denoted by $c$, represents the club to which a country belongs, and is considered as an ordinal variable

since the observed clubs can be ranked according to the mean income per of countries in the respective club, meaning that $c$ can take values from 1 to 3. Assuming that membership in a certain club is related to a continuous, latent variable $y_i^*$ that indicates a country's individual steady state income level; the model can be written as

$$y_i^* = X_i\beta + \varepsilon_i$$

where $X_i$ contains the explanatory variables listed in Table 3.4 as well as a constant term, with $i = 1, \dots, 21$ indicating the country.[1] As the dependent variable $y_i^*$ is unobserved, the model cannot be estimated with OLS. Instead, maximum likelihood (ML) techniques are applied to compute the probabilities of observing values of $c$ given $X$ (ordered regression model). In order to use ML, the distribution of the error term $\varepsilon_i$ has to be specified. We assume the errors to have a logistic distribution with a mean of zero and a variance of $\pi 2/3$, meaning that the resulting ordered regression model can be referred to as a logit model. Since the latter is non-linear in its probability outcomes, the impact of a variable on the outcomes can be interpreted in various ways.

The column vector $\beta$ includes coefficients of initial condition and structural characteristics. In contrast to their sign, the size of the coefficients $\beta$ *has no sensible economic interpretation*. Therefore, we compute the implied probability that a given region belongs to a certain convergence club which is called the *predicted probability*. In order to explore the effect of a single variable on the probability of membership in a specific club, we follow the literature and report *marginal effects* on the probabilities of each variable evaluated at its mean and at the mean of all other explanatory variables. The marginal effects estimate how a unit changes in the explanatory variable changes the probability that an average region belongs to the respective club, while holding all other variables fixed at their sample averages. Lastly, as a goodness-of-fit measure, we report McFadden's $R2$ and McKelvey and Zavoina's $R2$ which are often used as a likelihood ratio index.

Some studies focused to study the initial conditions and structural characteristics using a specific year as a starting point and they applied the ordered logit model using data of one year for the explanatory variables (e.g., Berthélemy, 2006; Bartkowska and Riedl, 2012; von Lyncker and Thoennessen, 2017), while others used average of period (e.g., Tian et al., 2016; and Martin and Vazquez, 2015). In our study, we will follow both approaches. First, we consider 2005 as our starting point (initial year), because it is the year when

[1] In order to increase the number of overactions, we have added Libya in the analysis. We classified it in club 2 because of the similarity of its economic structure with Algeria, which depends on the export of oil but with the low quality of institutions.

PAFTA is entered into force completely. This feature will allow us to study the impact of initial conditions and structural characteristics of countries at the beginning of the regional integration process on the formation of club between PAFTA countries. Second, we take average of period (2000-2010), considering 5 years before and 5 years after the date of entry into fore of PAFTA. This allows us to examine the evolution of initial conditions and structural characteristics and their impact on the formation of club convergence within PAFTA members and it could be considered as a *robustness check*.

#### *3.5.2.3 Results and discussion*

First, we will discuss the impact of the initial conditions and structural characteristics in 2005 on the formation of convergence clubs between PAFTA members. Table 3.5 presents the descriptive statistics of the variables for each club in 2005. Then, we report in Table 3.7 the estimated coefficients of our ordered logit model in 2005. As we mentioned above that they have no sensible economic interpretation, we calculate the marginal effects of the predicted probabilities for each club in 2005 and the results are reported in Tables (from 3.8 to 3.11).

First, Tables 3.8 and 3.9 indicate that an increase of 1% in the physical capital will increase the probability of being in club 2 and reduce the probability of being in club 1 by approximately 4% and 3% respectively. This means that countries which increased their investment in physical capital in 2005 have a greater probability of being in club 2 and less in club 1.

In addition, same tables indicate that if the initial quality of institutions increased one point, this will increase the probability of belonging to the club 1 by 4%. This means that in case of improving the rank of institutions quality 10 points; which includes government effectiveness, regulatory quality, rule of law and control of corruption; the probability that country classified in club 1 is 40% and in case of decreasing the rank of institutions quantity 10 points, the probability that country drops to club 2 is 35%.[1]

With regard to the role of natural resources, results in Table 3.8 indicate that for a mean country experienced in 2005 a significant increase in its mining share in GDP, the probability of staying in club 1 increased and in club 2 decreased while no effect on the probability of being in club 3. Table 3.9 accounts the impact of the other measure of natural resources endowment, which is the share of natural resource exports in GDP. However,

[1] The marginal effects of club 3 are not significate, this is normal because there no big difference between the institution quality averages for club 2 and club 3.

an increase in share of natural resource exports in GDP in 2005 will increase the probability of being in club 1 and decrease it in club 2 and has no effect on the probability to be in club 3 also.

We can conclude from above that improvement of institutions quality and increase in natural resource contribution will boost the probability of being in club 1, while increase in gross fixed capital formation share in GDP will decrease the probability being in club 1 and increase the probability of being in club 2.

For further analysis, we note that in each club there is heterogeneity in the economic structure of member countries, where we find that there are natural resource-rich countries and other poor in natural resource. In addition, descriptive statistics of the variables in 2005 for each club indicate that the club 2 has the largest average in terms of mining and natural resource exports 40 and 39 percent respectively followed by the club 1. Therefore, we can conclude that the abundance of natural resources may contribute, but not necessary as a condition, to increase the probability of belonging the country into a club 1 in PAFTA region. On the other hand, the average of the institutions quality index is 57 percent in the club 1 and 26 and 20 percent in club 2 and club 3 respectively, reflecting the large difference between the first club and the rest. Thus, we conclude that the quality of institutions is a conditional factor in the formation of convergence clubs in the region.

For further verification, we create two interactions between two variables in order to chock the impact of institutions quality and natural resource together in forming club convergence in PAFTA region. The first one, we multiply the institutions quality index by mining share in GDP, and the second one, we multiply the institutions quality index by natural resource exports share in GDP. We aim to determine the effect of the quality of institutions and natural resources by studying these two complementary variables on the convergence clubs in the PAFTA region. The results of the marginal effects for them are reported in Tables 3.10 and 3.11. We can observe that both complementary variables have a positive effect on the formation of convergence clubs, while natural resource variables are no longer significant. This shows that the abundance in natural resources is not enough to be in the first club but must also be accompanied by good quality in the institution.

We will move now to discuss the evolution of the initial conditions and structural characteristics and its impact on the formation of the clubs' convergence in the region of PAFTA during the period between 2000 and 2010. However, this examination could be considered also as a *robustness check*. Descriptive statistics of variables for the period

(2000-2010) in average are reported in Table 3.6. We report in Table 3.7 our ordered logit model regressions results, while the marginal effects for each club during the period (2000-2010) in average are reported in Tables (from 3.12 to 3.15).

By looking at descriptive statistics of variables and the marginal effects of each club for the period (2000-2010) in average, we note that they share the same results of the initial year in 2005. Thus, if value added of mining (% GDP) or fuels & minerals exports (% GDP) increase, the probability that the country belongs to club 1 will increase. In addition, the higher the quality of institutions in the country, the more likely it is to stay in club 1. On the other hand, we note that if the contribution of investment in the GDP increases, the probability that country belongs to the second club is higher and less probable in the first club (see Tables 3.12 and 3.13). Finally, Tables 3.14 and 3.15 indicate that abundance of natural resource is not enough for the county to be in club 1 but it must be accompanied by high quality of institutions.

From the analysis above, we conclude that the factors that determined the multiple steady states and thus forming several clubs in the convergence process among PAFTA countries are: mining sector, exports of fuel and minerals, quality of institutions and investment in physical capital, where their impact are validated both in 2005 as an initial year and during their evolution between 2000 and 2010. In addition, results of additional regressions indicate that reliance on natural resources is not a condition or not sufficient to classify the country in club 1, it must be accompanied by good quality of institutions, which consider as the main factor of determining the three clubs of convergence in PAFTA region. This conclusion is compatible with Martin and Vazquez (2015) who found that differences in institutions quality among Latin America countries have played a crucial role in determining club membership.

**Table 3-5: Summary statistics of variables by club, in 2005**

| Variable | Club (1) | | | | Club (2) | | | | Club (3) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | Std. Dev. | Min | Max | Mean | Std. Dev. | Min | Max | Mean | Std. Dev. | Min | Max |
| Physical capital | 23,12 | 7,89 | 14,62 | 42,44 | 24,58 | 4,60 | 19,07 | 30,63 | 25,62 | 16,78 | 14,01 | 58,96 |
| Human capital | 6,99 | 1,63 | 3,90 | 9,00 | 6,86 | 1,63 | 5,80 | 9,70 | 3,77 | 1,98 | 1,90 | 7,60 |
| Population | 4,69 | 4,32 | 0,84 | 13,08 | 2,28 | 0,78 | 1,38 | 3,17 | 2,40 | 0,49 | 1,61 | 2,85 |
| Institutions quality | 57,13 | 11,02 | 40,82 | 71,22 | 26,95 | 22,02 | 2,68 | 59,23 | 20,48 | 12,04 | 5,12 | 38,38 |
| Openness | 94,64 | 23,63 | 64,16 | 148,31 | 111,47 | 39,66 | 71,28 | 159,42 | 73,57 | 36,52 | 24,83 | 113,20 |
| Mining | 29,77 | 21,57 | 4,21 | 59,18 | 40,79 | 25,18 | 5,68 | 66,98 | 12,02 | 11,60 | 1,82 | 33,51 |
| Other sectors | 16,67 | 9,52 | 7,29 | 31,72 | 14,01 | 7,00 | 6,84 | 22,83 | 27,58 | 15,77 | 6,21 | 43,00 |
| Natural resource exports | 30,63 | 23,30 | 1,89 | 52,77 | 39,61 | 27,24 | 4,05 | 66,32 | 8,92 | 10,82 | 0,02 | 27,43 |
| Non-Natural resource exports | 11,61 | 7,62 | 4,52 | 27,92 | 8,75 | 12,37 | 0,42 | 29,58 | 4,55 | 3,79 | 1,50 | 11,11 |

**Table 3-6: Summary statistics of variables by club, 2000-2010**

| Variable | Club (1) | | | | Club (2) | | | | Club (3) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | Std. Dev. | Min | Max | Mean | Std. Dev. | Min | Max | Mean | Std. Dev. | Min | Max |
| Physical capital | 23,65 | 5,73 | 15,66 | 36,15 | 23,48 | 7,95 | 12,51 | 34,07 | 20,68 | 6,14 | 12,77 | 30,35 |
| Human capital | 6,98 | 1,61 | 3,85 | 8,84 | 6,83 | 1,67 | 5,66 | 9,73 | 3,86 | 2,09 | 1,89 | 7,93 |
| Population | 4,19 | 3,31 | 0,93 | 10,36 | 2,26 | 0,80 | 1,42 | 3,27 | 2,50 | 0,40 | 1,78 | 2,88 |
| Institutions quality | 58,51 | 12,28 | 39,25 | 72,90 | 25,96 | 21,65 | 4,33 | 61,05 | 21,95 | 11,07 | 7,96 | 34,58 |
| Openness | 89,87 | 22,24 | 55,00 | 134,57 | 98,98 | 30,92 | 67,45 | 134,07 | 69,40 | 31,03 | 32,73 | 106,77 |
| Mining | 28,21 | 19,12 | 4,62 | 55,20 | 37,82 | 23,25 | 5,71 | 61,05 | 11,68 | 10,25 | 1,92 | 28,72 |
| Other sectors | 16,78 | 9,62 | 6,51 | 32,55 | 15,27 | 7,99 | 7,70 | 26,58 | 28,20 | 15,76 | 6,37 | 43,61 |
| Natural resource exports | 28,52 | 21,69 | 2,21 | 51,59 | 35,28 | 25,07 | 4,04 | 63,89 | 9,61 | 10,79 | 0,03 | 25,48 |
| Non-Natural resource exports | 11,63 | 7,71 | 4,14 | 28,45 | 7,99 | 10,72 | 0,58 | 25,79 | 5,00 | 3,99 | 1,84 | 11,98 |

**Table 3-7: Estimation results from ordered logit model**

| Variables | Regressions in 2005 | | | | Regressions for 2000-2010, average | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Physical capital | -0.190*** | -0.157** | -0.0747 | -0.0641 | -0.211** | -0.142** | -0.122 | -0.0862 |
| | (0.0602) | (0.0691) | (0.0625) | (0.0683) | (0.0840) | (0.0646) | (0.128) | (0.107) |
| Human capital | 0.0184 | -0.0908 | 0.415 | 0.509* | 0.158 | 0.0920 | 0.453 | 0.552* |
| | (0.423) | (0.454) | (0.408) | (0.308) | (0.379) | (0.378) | (0.381) | (0.297) |
| Population | -0.0334 | 0.00569 | -0.0880 | -0.0625 | -0.804 | -0.804* | -0.862 | -0.756 |
| | (0.306) | (0.355) | (0.326) | (0.275) | (0.509) | (0.468) | (0.769) | (0.691) |
| Institutions quality | 0.178*** | 0.166*** | | | 0.245*** | 0.219*** | | |
| | (0.0488) | (0.0581) | | | (0.0754) | (0.0841) | | |
| Openness | 0.0162 | | 0.00973 | | -0.0485 | | 0.0143 | |
| | (0.0271) | | (0.0193) | | (0.0379) | | (0.0223) | |
| Mining | 0.0925* | | -0.0235 | | 0.144* | | -0.0354 | |
| | (0.0493) | | (0.0272) | | (0.0742) | | (0.0247) | |
| Other sectors | 0.102 | | | | -0.0370 | | | |
| | (0.0968) | | | | (0.0919) | | | |
| Natural resource exports | | 0.0721** | | -0.0132 | | 0.0888* | | -0.0250 |
| | | (0.0287) | | (0.0189) | | (0.0464) | | (0.0212) |
| Non-Natural resource exports | | 0.0342 | | | | -0.107 | | |
| | | (0.144) | | | | (0.138) | | |
| Institutions quality*Mining | | | 0.00177* | | | | 0.00410 | |
| | | | (0.000999) | | | | (0.00275) | |
| Institutions quality*Natural resource exports | | | | 0.00139** | | | | 0.00291 |
| | | | | (0.000625) | | | | (0.00195) |
| Constant cut1 | 5.211 | 1.319 | 0.935 | 0.865 | -1.382 | 1.848 | -0.535 | -0.618 |
| | (4.422) | (2.128) | (1.911) | (1.689) | (5.241) | (1.720) | (2.801) | (2.883) |
| Constant cut2 | 8.396* | 4.276** | 2.713 | 2.612 | 2.136 | 4.706** | 1.406 | 1.204 |
| | (5.057) | (2.048) | (2.137) | (1.944) | (5.919) | (1.943) | (2.769) | (2.968) |
| McFadden's $R^2$ | 0.5480 | 0.5351 | 0.642 | 0.3280 | 0.5814 | 0.5062 | 0.3736 | 0.3490 |
| McKelvey & Zavoiaa's $R^2$ | 0.841 | 0.852 | 0.3350 | 0.635 | 0.888 | 0.846 | 0.809 | 0.727 |
| Wald | 35.75 | 25.09 | 37.13 | 25.51 | 54.13 | 22.77 | 19.79 | 16.93 |
| (p-value) | 0.0000 | 0.0003 | 0.0000 | 0.0001 | 0.0000 | 0.0009 | 0.0030 | 0.0046 |

Number of observations =21. Robust standard errors in parentheses

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

**Table 3-8: Marginal effects on probabilities, Ologit model, Regression (1), in 2005**

| Variables | Physical capital | Human capital | Population | Institutions quality | Openness | Mining | Other sectors |
|---|---|---|---|---|---|---|---|
| Club 3 | 0.00718 | -0.000698 | 0.00126 | -0.00672 | -0.000613 | -0.00350 | -0.00386 |
| | (0.00544) | (0.0160) | (0.0115) | (0.00494) | (0.000956) | (0.00303) | (0.00408) |
| Club 2 | 0.0402** | -0.00391 | 0.00709 | -0.0377** | -0.00343 | -0.0196* | -0.0216 |
| | (0.0169) | (0.0897) | (0.0650) | (0.0146) | (0.00598) | (0.0118) | (0.0219) |
| Club 1 | -0.0474*** | 0.00461 | -0.00835 | 0.0444*** | 0.00405 | 0.0231* | 0.0255 |
| | (0.0151) | (0.106) | (0.0764) | (0.0122) | (0.00678) | (0.0124) | (0.0242) |

Marginal effects are computed at the mean of all variables as an approximation of average marginal effects.
Robust standard errors in parenthesis. Statistical significance is indicated by *** at 1%, ** at 5% and * at 10%.

**Table 3-9: Marginal effects on probabilities, Ologit model, Regression (2), in 2005**

| Variables | Physical capital | Human capital | Population | Institutions quality | Natural resource exports | Non-Natural resource exports |
|---|---|---|---|---|---|---|
| Club 3 | 0.00634 | 0.00366 | -0.000229 | -0.00669 | -0.00291 | -0.00138 |
| | (0.00491) | (0.0181) | (0.0143) | (0.00535) | (0.00228) | (0.00583) |
| Club 2 | 0.0327* | 0.0189 | -0.00118 | -0.0345** | -0.0150** | -0.00712 |
| | (0.0171) | (0.0947) | (0.0738) | (0.0138) | (0.00710) | (0.0300) |
| Club 1 | -0.0390** | -0.0225 | 0.00141 | 0.0412*** | 0.0179*** | 0.00850 |
| | (0.0169) | (0.112) | (0.0881) | (0.0130) | (0.00691) | (0.0357) |

Marginal effects are computed at the mean of all variables as an approximation of average marginal effects.
Robust standard errors in parenthesis. Statistical significance is indicated by *** at 1%, ** at 5% and * at 10%.

**Table 3-10: Marginal effects on probabilities, Ologit model, Regression (3), in 2005**

| Variables | Physical capital | Human capital | Population | Openness | Mining | Institutions quality*Mining |
|---|---|---|---|---|---|---|
| Club 3 | 0.00964 | -0.0535 | 0.0113 | -0.00125 | 0.00303 | -0.000228* |
| | (0.00804) | (0.0567) | (0.0404) | (0.00244) | (0.00322) | (0.000123) |
| Club 2 | 0.00903 | -0.0502 | 0.0106 | -0.00118 | 0.00284 | -0.000214 |
| | (0.00916) | (0.0531) | (0.0418) | (0.00250) | (0.00400) | (0.000182) |
| Club 1 | -0.0187 | 0.104 | -0.0220 | 0.00243 | -0.00588 | 0.000442* |
| | (0.0155) | (0.101) | (0.0818) | (0.00484) | (0.00688) | (0.000255) |

Marginal effects are computed at the mean of all variables as an approximation of average marginal effects.
Robust standard errors in parenthesis. Statistical significance is indicated by *** at 1%, ** at 5% and * at 10%.

**Table 3-11: Marginal effects on probabilities, Ologit model, Regression (4), in 2005**

| Variables | Physical capital | Human capital | Population | Natural resource exports | Institutions quality*Natural resource exports |
|---|---|---|---|---|---|
| Club 3 | 0.00853 | -0.0677 | 0.00831 | 0.00176 | -0.000185** |
| | (0.00914) | (0.0433) | (0.0359) | (0.00234) | (9.02e-05) |
| Club 2 | 0.00748 | -0.0594 | 0.00729 | 0.00154 | -0.000162 |
| | (0.00886) | (0.0466) | (0.0333) | (0.00256) | (0.000115) |
| Club 1 | -0.0160 | 0.127* | -0.0156 | -0.00330 | 0.000347** |
| | (0.0169) | (0.0759) | (0.0690) | (0.00476) | (0.000161) |

Marginal effects are computed at the mean of all variables as an approximation of average marginal effects.
Robust standard errors in parenthesis. Statistical significance is indicated by *** at 1%, ** at 5% and * at 10%.

**Table 3-12: Marginal effects on probabilities, Ologit model, Regression (1), for 2000-2010**

| Variables | Physical capital | Human capital | Population | Institutions quality | Openness | Mining | Other sectors |
|---|---|---|---|---|---|---|---|
| Club 3 | 0.00718 | -0.000698 | 0.00126 | -0.00672 | -0.000613 | -0.00350 | -0.00386 |
| | (0.00544) | (0.0160) | (0.0115) | (0.00494) | (0.000956) | (0.00303) | (0.00408) |
| Club 2 | 0.0402** | -0.00391 | 0.00709 | -0.0377** | -0.00343 | -0.0196* | -0.0216 |
| | (0.0169) | (0.0897) | (0.0650) | (0.0146) | (0.00598) | (0.0118) | (0.0219) |
| Club 1 | -0.0474*** | 0.00461 | -0.00835 | 0.0444*** | 0.00405 | 0.0231* | 0.0255 |
| | (0.0151) | (0.106) | (0.0764) | (0.0122) | (0.00678) | (0.0124) | (0.0242) |

Marginal effects are computed at the mean of all variables as an approximation of average marginal effects. Robust standard errors in parenthesis. Statistical significance is indicated by *** at 1%, ** at 5% and * at 10%.

**Table 3-13: Marginal effects on probabilities, Ologit model, Regression (2), for 2000-2010**

| Variables | Physical capital | Human capital | Population | Institutions quality | Natural resource exports | Non-Natural resource exports |
|---|---|---|---|---|---|---|
| Club 3 | 0.00634 | 0.00366 | -0.000229 | -0.00669 | -0.00291 | -0.00138 |
| | (0.00491) | (0.0181) | (0.0143) | (0.00535) | (0.00228) | (0.00583) |
| Club 2 | 0.0327* | 0.0189 | -0.00118 | -0.0345** | -0.0150** | -0.00712 |
| | (0.0171) | (0.0947) | (0.0738) | (0.0138) | (0.00710) | (0.0300) |
| Club 1 | -0.0390** | -0.0225 | 0.00141 | 0.0412*** | 0.0179*** | 0.00850 |
| | (0.0169) | (0.112) | (0.0881) | (0.0130) | (0.00691) | (0.0357) |

Marginal effects are computed at the mean of all variables as an approximation of average marginal effects. Robust standard errors in parenthesis. Statistical significance is indicated by *** at 1%, ** at 5% and * at 10%.

**Table 3-14: Marginal effects on probabilities, Ologit model, Regression (3), for 2000-2010**

| Variables | Physical capital | Human capital | Population | Openness | Mining | Institutions quality*Mining |
|---|---|---|---|---|---|---|
| Club 3 | 0.00964 | -0.0535 | 0.0113 | -0.00125 | 0.00303 | -0.000228* |
| | (0.00804) | (0.0567) | (0.0404) | (0.00244) | (0.00322) | (0.000123) |
| Club 2 | 0.00903 | -0.0502 | 0.0106 | -0.00118 | 0.00284 | -0.000214 |
| | (0.00916) | (0.0531) | (0.0418) | (0.00250) | (0.00400) | (0.000182) |
| Club 1 | -0.0187 | 0.104 | -0.0220 | 0.00243 | -0.00588 | 0.000442* |
| | (0.0155) | (0.101) | (0.0818) | (0.00484) | (0.00688) | (0.000255) |

Marginal effects are computed at the mean of all variables as an approximation of average marginal effects. Robust standard errors in parenthesis. Statistical significance is indicated by *** at 1%, ** at 5% and * at 10%.

**Table 3-15: Marginal effects on probabilities, Ordered logit model, Regression (4), for 2000-2010**

| Variables | Physical capital | Human capital | Population | Natural resource exports | Institutions quality*Natural resource exports |
|---|---|---|---|---|---|
| Club 3 | 0.00853 | -0.0677 | 0.00831 | 0.00176 | -0.000185** |
| | (0.00914) | (0.0433) | (0.0359) | (0.00234) | (9.02e-05) |
| Club 2 | 0.00748 | -0.0594 | 0.00729 | 0.00154 | -0.000162 |
| | (0.00886) | (0.0466) | (0.0333) | (0.00256) | (0.000115) |
| Club 1 | -0.0160 | 0.127* | -0.0156 | -0.00330 | 0.000347** |
| | (0.0169) | (0.0759) | (0.0690) | (0.00476) | (0.000161) |

Marginal effects are computed at the mean of all variables as an approximation of average marginal effects. Robust standard errors in parenthesis. Statistical significance is indicated by *** at 1%, ** at 5% and * at 10%.

## 3.6 Conclusion

In this chapter we examined the question of convergence within PAFTA countries and the role of natural resource endowment as a factor of convergence or divergence between them. This region is principally characterized by the abundance of natural resources, and by its uneven allocation between countries. Indeed, PAFTA includes resource-rich members that are heavily specialized in exporting natural resource commodities, resource-poor members that depend on non-resource sectors, especially manufactured and food sectors, and diversified countries which are characterized by the importance of both sectors.

To tackle this question, we built or methodology on three main steps, where each step examined a different concept of convergence.

First step examined the question of sigma-convergence, where it aims to investigate whether the dispersion of real income per capita among PAFTA economies tends to decrease over time. Our results indicated that that sigma-convergence was present from 1970 to 1990. In contrast, we could not note that the dispersion between PAFTA counties decrease after 1990's, it tends to be stagnated which reflecting the absence of σ-convergence as well as divergence.

In the second step we aimed to study the convergence factors between PAFTA members, specifically focusing on the role of natural resource endowment. We measured the abundance of natural resource by using two indicators: natural resource exports as a share of GDP and contribution of natural resource sectors in GDP. Our study is based on the estimation of growth equations using system GMM estimator. Results showed that natural resources are one of the main determinants of economic convergence within PAFTA. Thus, the implies that the asymmetry between countries in terms of natural resource endowment did not impede the convergence between PAFTA countries.

In the last step of this chapter, we tested the existence of club convergence among PAFATA members. The objective of this step is to examine if all countries of PAFAT converge to the same equilibrium or there are any subgroups of countries that converge into multiple steady states or so-called "clubs". We endogenously identify **three** groups of countries that converge to the same steady state level within PAFTA members using the methodology proposed by Phillips and Sul (2007).

Then, the potential formation of a club suggests that there might be common factors among a group of countries leading them to converge to a similar steady state. When

looking at the members of each club, we observe that they are heterogenous in terms of the economic structure, where each group contains resource-rich countries and resource-poor countries as well as diversified countries. This leads us to study the potential factors of this formation of clubs. Hence, we estimate several ordered logit models and analyze which factors - including natural resource endowment - play a role in determining club membership. We conclude that the factors that determined the multiple steady states and thus several clubs in the convergence process among PAFTA countries are: mining sector, exports of fuel and minerals, quality of institutions and investment in physical capital. After further verifications, we showed the abundance of natural resources is not enough to be in the best club, but it must be accompanied by good quality of institutions which is considered as the main factor of club's formation between PAFAT members. Consequently, we can note that natural resource-rich countries with good institutions such as the Arab Gulf countries were classified in club 1, and resource-rich countries with lower level of institutions such as Syria and Algeria were classified in club 2, and resource-rich countries with poor quality of institutions such as Sudan and Yemen were classified in club 3. The same is true for resource-poor countries.

This research can be developed in the future by examining the role of natural resources in convergence among countries in other regions such as Central Asia or Africa. However, these researches will create a more comprehensive picture of the role of natural resources in the economic convergence between integrated countries.

# General conclusion

This thesis examined the impact of the uneven distribution of natural resources across countries on two main aspects. The first aspect is the potential gains from the international trade regulation which consist on the WTO on one hand, and the regional economic blocs on the other hand. The second aspect concerns the economic convergence between countries. Therefore, the dissertation consists of three main chapters. In chapter one, we empirically examined the potential asymmetric trade effects of the accession to the WTO across resource-rich and resource-poor members. In chapter two, we empirically investigated how the gains of the regional integration, in terms of trade effects, are distributed between resource-rich and resource poor countries. In chapter three, we analyzed the convergence factors between PAFTA countries, focusing on the role of natural resource endowment. However, after analyzing and discussing the results of our three studies, we can draw some general conclusions for resource-rich countries and their resource-poor partners.

With regards to natural resource-rich countries, the results of our study indicated that emerging resource-rich countries are the greatest beneficiaries from the accession to the WTO. In return, the WTO has no effect on non-emerging resource-rich members, which benefit more from regional integrations and bilateral agreements. This reflects that the export diversification and competitiveness improvement of emerging resource-rich countries contributed to incline towards trade liberalization and benefit from the accession to the WTO. On the other hand, non-emerging resource-countries were more oriented towards the regional markets because of the lack of competitiveness. This result has been supported when we examined the impact on the uneven allocation of natural resources on the gains of the regional integration in terms of trade creation and trade diversion. Our results confirmed that regional integration enabled resource-rich countries to increase intra-regional trade in non-natural resource sectors with their regional partners, and in natural resource sectors in some cases. Nevertheless, they suffered from trade diversion as they substituted imports from rest of the world towards the regional partners. Otherwise, our study about convergence among PAFTA countries indicated that the abundance of natural resources is one of the main factors of economic convergence between PAFTA members. However, after further analysis, we found that the abundance of natural resources is not sufficient to achieve high economic growth rates and to join economies that reached higher levels of steady state in the region, but it must be accompanied by good quality of institutions.

Consequently, resource-rich countries, especially non-emerging ones, are encouraged to establish and join regional integrations in order to access to the markets of their regional partners as a first stage. This will contribute to enhance the productivity and improve the competitiveness of their non-natural resource sectors. Hence, in the second stage, these gains from the regional integration, in their turn, will improve the competitiveness at the international level, which will lead resource-rich countries to be able to take advantage of the benefits of trade liberalization after accession to the WTO. However, to ensure the success of this strategy, resources-rich countries must therefore follow reform policies in order to improve their own governance. Because the good quality of institutions will allow countries to better manage the savings from the export of natural resources and to allocate part of them to export diversification.

For resource-poor countries, our study indicated that regional economic blocs stimulated their intra-regional exports towards resource-rich partners from one hand, and increased their natural resource imports from them, especially from mineral rich countries. In addition, our results indicated that the accession to WTO has positive impact on resources-poor countries whether they are emerging or not.

However, the most difficult challenge for resource-poor countries is the competition among them, especially with large emerging exporters. Therefore, resource-poor countries are called to accelerate to join regional blocs and sign bilateral agreements, especially with resource-rich countries and developed countries. Regional integration enables resource-poor countries to earn more foreign exchange, through increasing their intra-regional exports, and thus import more capital goods from the rest of the world. This will enhance the productivity and competitiveness of exports so that resources-poor countries can compete internationally, especially non-emerging ones. In addition, these countries should improve their quality of institutions to ensure several things: signing beneficial trade agreements, improving the conditions of labor and taking advantage of foreign exchange earnings to import more capital goods. These countries must also increase investment in physic capital, which will allow to increase productivity and competitiveness.

For future research directions, after examining the static effects of WTO and regional integrations on resource-rich and resource-poor countries in this thesis, we could examine their dynamic effects in the future. These effects can be principally tackled by studying the process of export diversification of resource-rich countries on the one hand, and the productivity and competitiveness of resource-poor countries. With regards to the impact of the natural resources endowment on the convergence, we can use different measures of

natural resource to verify its role in the convergence. We could distinguish between measures of abundance and those of dependence from one hand, and between type of natural resources such as: agricultural raw materials, minerals and fuel, on the other hand. In addition, we could study the factors of convergence within different regions in the world in order to evaluate the role of natural resources in the convergence between economies et determine which factors affect this role.

# Synthèse en Français

Les dimensions théoriques et politiques de la question des ressources naturelles revêtent une importance cruciale. Les ressources naturelles sont des intrants indispensables pour la production et également nécessaires pour maintenir une qualité de vie élevée. Ces dernières années, la part des ressources naturelles dans le commerce mondial a fortement augmenté, passant entre 1995 et 2015, de 15% à environ 30% du commerce mondial. Les ressources naturelles présentent certaines caractéristiques géographiques et économiques. Premièrement, les ressources naturelles sont inégalement réparties entre les pays, dans la mesure où elles sont concentrées dans un petit nombre de pays, tandis que d'autres ont des disponibilités nationales limitées. Deuxièmement, cela se traduit par une position dominante de ce secteur dans de nombreux pays, qui dépendent totalement des exportations de ressources naturelles. Troisièmement, les ressources naturelles ne sont pas homogènes, car nous distinguons trois catégories principales ; matières premières agricoles, minéraux et énergie. Quatrièmement, les fluctuations des prix sur le marché mondial sont l'une des caractéristiques les plus importantes des ressources naturelles par rapport aux autres biens. Enfin, à la différence du commerce des produits manufacturés, le commerce des ressources naturelles, comme le pétrole, le gaz naturel, les métaux et les minéraux, rencontre peu d'obstacles tarifaires et non tarifaires.

Ces caractéristiques économiques et géographiques des ressources naturelles, en particulier leur répartition inégale entre les économies ont des implications sur deux aspects principaux. Premièrement, les gains potentiels de l'ouverture des échanges, où les flux commerciaux internationaux sont principalement réglementés par l'Organisation mondiale du commerce (OMC) et les Accords commerciaux régionaux (ACR). Le deuxième aspect consiste en la convergence économique entre les pays. Par conséquent, le but de cette thèse est d'examiner d'une part, l'effet de la répartition inégale des ressources naturelles entre les pays sur les avantages de l'adhésion à l'OMC et aux ACR, et sur le processus de convergence d'autre part.

L'OMC comprend 164 membres représentant environ 98% du commerce international. La littérature économique a examiné principalement l'impact de l'OMC sur le commerce international et ses effets asymétriques sur les pays développés et en développement. En effet, les pays en développement ne sont pas homogènes en termes de structures économiques. Il existe des pays qui sont riches en ressources naturelles et qui dépendent fortement de la production et des exportations de ces produits et d'autres qui sont pauvres en ressources naturelles et qui dépendent des secteurs hors ressources naturelles. Par conséquent, l'étude de l'impact de l'OMC sur ces pays en développement hétérogènes en

termes de dotations en ressources naturelles contribuera au débat sur l'impact de cette organisation sur le commerce international. Empiriquement, nous utilisions le modèle de gravité pour documenter les questions relatives aux accords commerciaux. Plus précisément, nous avons classé notre échantillon de pays en 5 catégories ; pays avancés, pays émergents riches en ressources naturelles, pays non émergents riches en ressources naturelles, pays émergents pauvres en ressources naturelles, pays non émergents et pauvres en ressources naturelles utilisant l'analyse par grappes. Nous avons utilisé des variables fictives pour estimer l'impact de l'OMC sur chaque catégorie. Notre principale conclusion est que l'adhésion à l'OMC a contribué à promouvoir les exportations de tous les pays sauf les pays non émergents riches en ressources naturelles. Cependant, les pays émergents riches en ressources naturelles sont les principaux bénéficiaires de l'accession à l'OMC. En tant qu'importateurs, tous les pays ont augmenté leurs importations après la création de l'OMC.

Une autre forme de réglementation du commerce international est la régionalisation. A ce titre, le nombre d'accords commerciaux bilatéraux et plurilatéraux a considérablement augmenté au cours des dernières décennies. Cela reflète principalement la montée des blocs régionaux (régionalisme) dans l'économie internationale. En ce sens, la littérature économique a étudié les effets de l'intégration régionale à la fois d'un point de vue théorique et empirique. A côté des effets statiques mesurés par la création d'échanges et le détournement des échanges il existe des effets dynamiques à long terme tels que l'augmentation de productivité et l'amélioration de la compétitivité. En fait, certains blocs régionaux, en particulier parmi les pays en développement, contiennent des pays riches en ressources naturelles et d'autres pauvres en termes de dotation. Cela rend l'étude des avantages de l'intégration régionale dans le contexte de l'abondance des ressources naturelles différente. Nous avons construit notre méthodologie en s'appuyant sur les prédictions théoriques de Venables (2009), qui montre que les gains de l'intégration régionale sont inégalement répartis entre les pays riches et ceux qui sont pauvres en ressources naturelles, en termes de création et de détournement des échanges. Nous avons également utilisé l'approche du modèle de gravité avec une extension de trois ensembles différents de variables fictives RTA pour explorer la création d'échanges et les effets de détournement des échanges en termes d'exportations et d'importations. Pour cela, nous suivons une analyse en deux étapes. La première vise à estimer un modèle de gravité de base afin d'explorer les effets globaux de six blocs régionaux qui sont riches en ressources naturelles. Ensuite, dans la deuxième étape, nous fournissons d'autres spécifications analytiques pour estimer dans quelle mesure les effets de l'intégration régionale sont

susceptibles d'être répartis entre les pays en fonction de l'abondance en ressources naturelles. Nous proposons un modèle de gravité augmenté, dans l'esprit de Carrère et al. (2012), et analysons comment les modèles de création d'échanges et de détournement des échanges varient selon les paires bilatérales. Pour cela, le modèle de gravité augmenté dépend si l'exportateur ou l'importateur est un pays riche ou pauvre en ressources naturelles. Nous discutons ensuite quelques questions majeures évoquées dans la littérature : complémentarité entre pays à structures économiques différentes, création de commerce et détournement de commerce, diversification des structures de production et d'exportation des pays riches en ressources naturelles et relations avec le reste du monde. Cette étude fournit des informations supplémentaires dans le débat sur l'intégration régionale à travers les résultats suivants. Premièrement, en ce qui concerne les résultats commerciaux globaux des accords sélectionnés, l'ECOWAS, la SADC et la CIS montrent des gains finaux plus élevés que le COMESA, le PAFTA et la LAIA. Nous constatons également, d'une part, que les pays pauvres en ressources naturelles ont pu accroître leurs échanges intrarégionaux avec des partenaires riches en ressources naturelles, en particulier dans les secteurs des ressources non naturelles. Cela concerne tous les accords sélectionnés sauf le COMESA. Cependant, les pays pauvres en ressources naturelles souffrent du détournement des échanges dans certains cas tels que le COMESA, le PAFTA et LA LAIA. D'un autre côté, les pays riches en ressources naturelles ont parfois accru leurs exportations régionales de ressources naturelles vers des partenaires pauvres (CEDEAO, la SADC et la CIS). Bien qu'ils puissent accroître le commerce des exportations de ressources non naturelles et les diversifier, en particulier avec les partenaires régionaux dans tous les accords sauf l'ALADI, ils subissent un détournement des échanges d'exportations de ressources non naturelles dans tous les accords sauf la CIS.

La disparité entre les pays en matière d'abondance en ressources naturelles va également avoir des effets sur la convergence au sein des pays qui réalisent une intégration régionale. Nous avons retenu l'exemple de la région MENA. Au sein de cette région, il y a des pays riches en ressources naturelles, en particulier dans l'énergie, et des pays pauvres en ressources naturelles, et il y a une intégration régionale (PAFTA) qui inclut le plus grand nombre de pays de la région. Ainsi, la question est d'examiner l'impact des différentes structures économiques des pays membres d'un ACR sur la convergence économique entre eux. Plus précisément, nous étudions l'impact de la dotation en ressources naturelles sur le processus de convergence entre les pays membres de la PAFTA. Trois points peuvent être dégagés. Le premier met l'accent sur le rôle des ressources naturelles en tant que facteur de convergence entre les pays. Le deuxième souligne l'impact de l'existence de

membres dissemblables, de pays riches en ressources naturelles et de pays pauvres en ressources naturelles, sur la convergence économique dans ce bloc. Le troisième concerne le rôle des ressources naturelles dans la mise en place de clubs de convergence potentiels au sein du PAFTA. Notre méthodologie consiste à étudier trois concepts de convergence, à savoir la convergence-σ, la convergence-ß et la convergence des clubs. Au préalable, nous examinons la convergence σ à travers les pays PAFTA. Nous pouvons affirmer que la convergence σ n'était observable qu'entre 1970 et 1990. En revanche, nous ne pouvons pas noter que la dispersion entre les économies PAFTA diminue après 1990. Notre deuxième approche consiste à examiner la convergence conditionnelle dans les pays du PAFTA. L'objectif est d'étudier les facteurs de convergence dans la région PAFTA, y compris les ressources naturelles. Nous utilisons l'approche des données de panel à la suite de la plupart des études empiriques basées sur l'estimateur GMM du système. Nos résultats montrent que les ressources naturelles sont l'un des principaux déterminants de la convergence économique au sein de la PAFTA. Le deuxième facteur de convergence économique est la qualité des institutions. En conclusion, l'asymétrie entre les pays en termes de dotation en ressources naturelles n'a pas empêché la convergence entre les pays du PAFTA. La dernière approche consiste à étudier la présence de la convergence des clubs dans la région PAFTA. Pour étudier cette question, nous proposons une procédure en deux étapes. Premièrement, nous identifions de manière endogène les groupes de pays qui convergent vers le même niveau d'état stationnaire en utilisant la méthodologie de l'algorithme de regroupement des clubs proposée par Phillips et Sul (2007). Ensuite, la formation potentielle d'un club suggère qu'il pourrait y avoir des facteurs communs parmi un groupe de pays, les conduisant à converger vers un état stable similaire. Par conséquent, nous estimons plusieurs modèles logit ordonnés et analysons quels facteurs - y compris la dotation en ressources naturelles - jouent un rôle dans la détermination de l'appartenance à un club. Nos résultats de l'algorithme de regroupement permettent d'identifier trois principaux clubs parmi les pays PAFTA. En outre, nous concluons que les facteurs qui déterminent les états stables multiples et donc plusieurs clubs dans le processus de convergence entre les pays PAFTA sont : le secteur minier, les exportations de combustibles et minéraux, la qualité des institutions et l'investissement dans le capital physique. Après d'autres vérifications, nous avons montré que l'abondance des ressources naturelles ne suffisait pas à être dans le meilleur club, mais que celle-ci doit s'accompagner d'une bonne qualité des institutions

# Appendix

**Figure A. 1: Share of natural resource exports in GDP of PAFTA members, 1995-2015 in average**

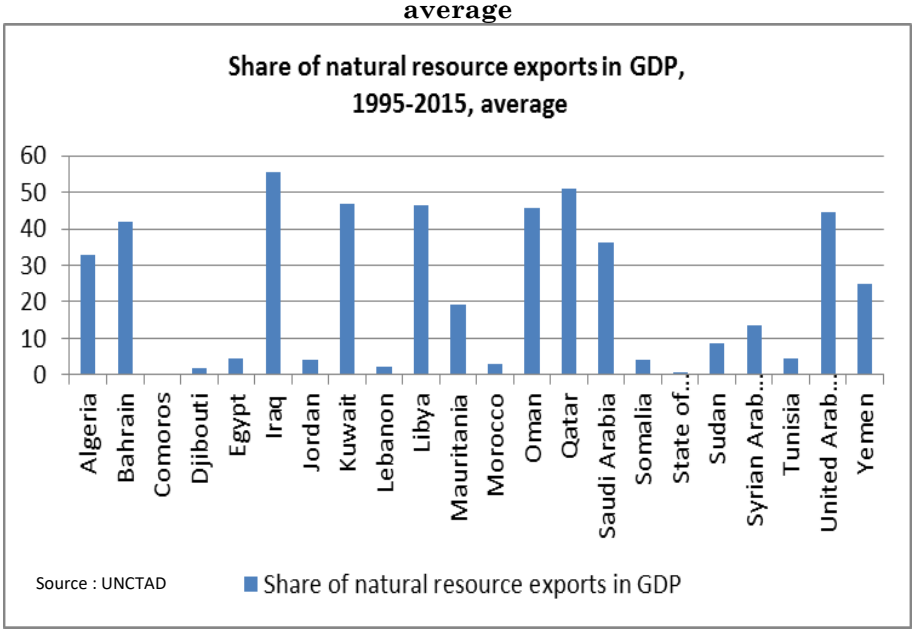



**Figure A. 2: Share of natural resource exports in GDP of PAFTA members, 1995-2015 in average**

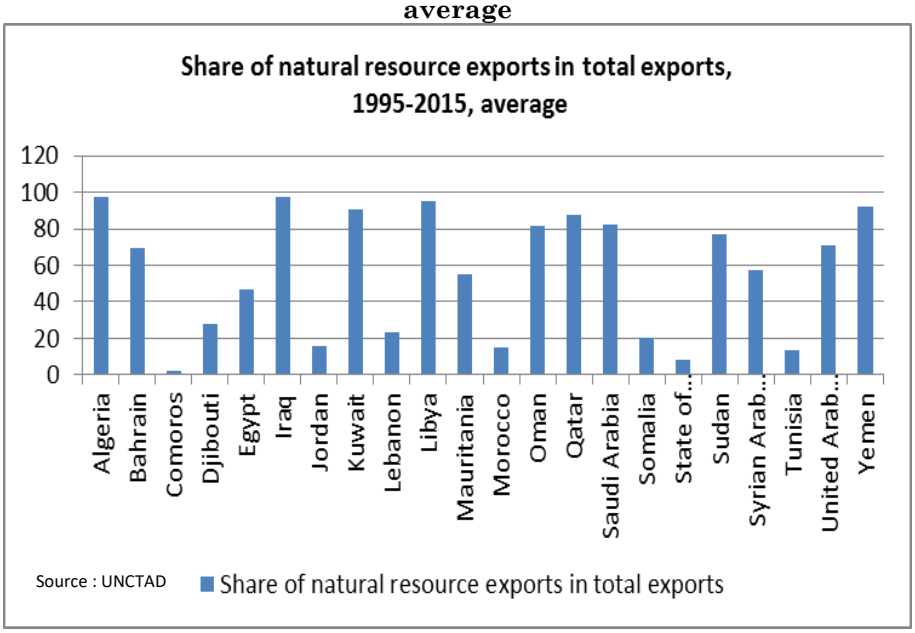


**Figure A. 3: Share of mining sector in GDP of PAFTA members, 1995-2015, in average**

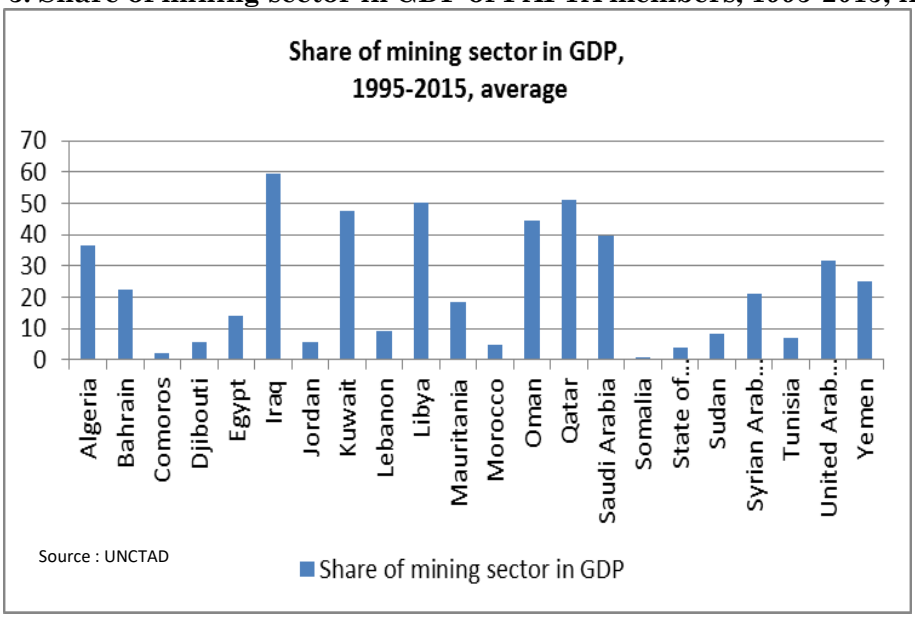



**Figure A. 4: Concentration index of PAFTA members, 1995-2015, in average**

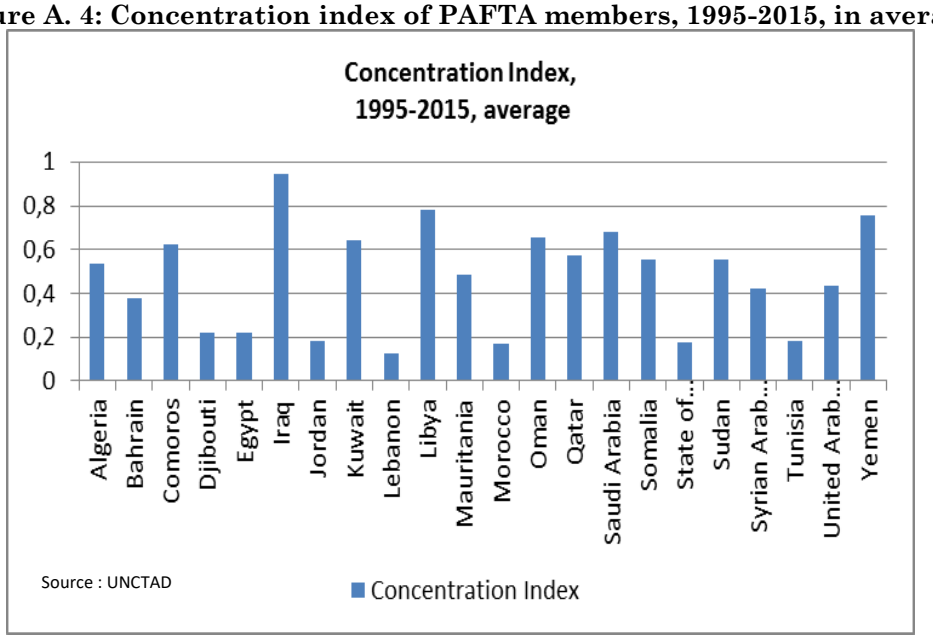


**Table A. 1: List of 200 countries and several natural resource endowment indicators over the period from 1995-2015 in average**

| Country | Share of natural resources in total exports (%) | Ratio of natural resource exports in GDP (%) | Share of natural resource sectors in GDP (%) | Agriculture, hunting, forestry, fishing (%) | Mining (%) | Concentration Index |
|---|---|---|---|---|---|---|
| Afghanistan | 34,81 | 1,32 | 41,79 | 41,30 | 0,50 | 0,30 |
| Albania | 24,82 | 2,91 | 31,79 | 26,07 | 5,71 | 0,24 |
| Algeria | 97,19 | 32,97 | 46,40 | 9,65 | 36,75 | 0,53 |
| Andorra | 4,73 | 0,16 | 1,98 | 0,50 | 1,49 | 0,20 |
| Angola | 99,69 | 55,08 | 53,36 | 6,85 | 46,51 | 0,92 |
| Anguilla | 4,30 | 0,14 | 7,12 | 2,47 | 4,64 | 0,31 |
| Antigua and Barbuda | 16,19 | 1,04 | 6,14 | 1,90 | 4,25 | 0,49 |
| Argentina | 19,97 | 2,87 | 13,30 | 7,20 | 6,10 | 0,15 |
| Armenia | 51,35 | 7,39 | 30,51 | 23,69 | 6,82 | 0,25 |
| Aruba | 86,39 | 97,08 | 7,33 | 0,44 | 6,89 | 0,76 |
| Australia | 60,25 | 9,14 | 12,38 | 2,99 | 9,39 | 0,18 |
| Austria | 7,94 | 2,78 | 5,52 | 1,68 | 3,84 | 0,07 |
| Azerbaijan | 86,44 | 35,36 | 49,26 | 12,31 | 36,95 | 0,69 |
| Bahamas | 38,93 | 2,46 | 4,93 | 1,33 | 3,60 | 0,40 |
| Bahrain | 69,52 | 42,14 | 22,75 | 0,47 | 22,28 | 0,38 |
| Bangladesh | 6,76 | 0,96 | 23,57 | 20,91 | 2,66 | 0,39 |
| Barbados | 25,46 | 2,48 | 4,78 | 2,04 | 2,74 | 0,21 |
| Belarus | 28,73 | 15,04 | 16,02 | 11,09 | 4,93 | 0,23 |
| Belgium | 16,26 | 13,48 | 3,96 | 1,05 | 2,91 | 0,10 |
| Belize | 29,10 | 8,99 | 19,08 | 14,93 | 4,15 | 0,28 |
| Benin | 67,03 | 11,43 | 26,74 | 25,61 | 1,13 | 0,46 |
| Bermuda | 14,76 | 0,09 | 2,59 | 0,74 | 1,84 | 0,56 |
| Bhutan | 30,79 | 10,55 | 39,43 | 23,46 | 15,98 | 0,33 |
| Bolivia | 64,39 | 18,70 | 28,49 | 13,81 | 14,68 | 0,33 |
| Bosnia and Herzegovina | 34,35 | 7,24 | 20,40 | 11,70 | 8,70 | 0,14 |
| Botswana | 84,98 | 37,81 | 33,16 | 2,95 | 30,21 | 0,71 |
| Brazil | 22,84 | 2,28 | 10,82 | 5,45 | 5,37 | 0,11 |
| Brunei Darussalam | 92,45 | 52,84 | 46,70 | 0,92 | 45,78 | 0,63 |
| Bulgaria | 26,30 | 11,07 | 16,41 | 9,47 | 6,94 | 0,11 |
| Burkina Faso | 74,61 | 9,49 | 39,85 | 35,52 | 4,34 | 0,61 |
| Burundi | 25,19 | 1,30 | 43,73 | 42,50 | 1,23 | 0,58 |
| Cabo Verde | 40,50 | 0,99 | 17,38 | 11,86 | 5,52 | 0,34 |
| Cambodia | 13,34 | 4,18 | 37,82 | 36,80 | 1,02 | 0,34 |
| Cameroon | 71,29 | 11,48 | 24,25 | 15,85 | 8,40 | 0,39 |
| Canada | 32,64 | 9,49 | 11,48 | 2,03 | 9,45 | 0,14 |
| Central African Republic | 87,19 | 9,20 | 45,82 | 41,21 | 4,61 | 0,47 |
| Chad | 94,45 | 25,40 | 42,91 | 29,34 | 13,58 | 0,81 |
| Chile | 69,41 | 19,79 | 19,59 | 4,74 | 14,84 | 0,32 |
| China | 6,17 | 1,45 | 34,75 | 12,91 | 21,84 | 0,09 |
| Hong Kong | 8,13 | 13,02 | 2,56 | 0,09 | 2,47 | 0,15 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Macao | 3,87 | 0,36 | 1,82 | - | 1,82 | 0,30 |
| Taiwan | 7,62 | 4,08 | 4,44 | 1,99 | 2,45 | 0,17 |
| Colombia | 54,36 | 7,35 | 18,70 | 7,94 | 10,77 | 0,29 |
| Comoros | 4,84 | 0,07 | 39,54 | 37,55 | 1,99 | 0,62 |
| Congo | 93,16 | 66,66 | 65,55 | 6,23 | 59,32 | 0,75 |
| Cook Islands | 56,53 | 2,27 | 9,78 | 7,47 | 2,31 | 0,50 |
| Costa Rica | 5,73 | 1,80 | 12,84 | 9,29 | 3,54 | 0,31 |
| Côte d'Ivoire | 34,94 | 13,61 | 30,64 | 25,42 | 5,22 | 0,35 |
| Croatia | 20,55 | 4,17 | 11,36 | 5,52 | 5,84 | 0,11 |
| Cuba | 27,71 | 1,63 | 7,75 | 5,07 | 2,67 | 0,33 |
| Cyprus | 17,02 | 1,32 | 5,66 | 3,31 | 2,36 | 0,24 |
| Czechia | 7,34 | 4,07 | 8,86 | 2,82 | 6,04 | 0,09 |
| Dem. Rep. of the Congo | 92,74 | 16,06 | 43,85 | 29,84 | 14,01 | 0,48 |
| Denmark | 14,34 | 4,36 | 7,16 | 1,92 | 5,23 | 0,08 |
| Djibouti | 27,89 | 1,87 | 8,98 | 3,52 | 5,46 | 0,22 |
| Dominica | 5,97 | 0,59 | 19,47 | 13,75 | 5,72 | 0,42 |
| Dominican Republic | 6,96 | 1,11 | 10,97 | 7,45 | 3,52 | 0,20 |
| Ecuador | 67,69 | 15,62 | 21,93 | 13,05 | 8,88 | 0,45 |
| Egypt | 47,28 | 4,45 | 27,38 | 13,47 | 13,92 | 0,22 |
| El Salvador | 6,50 | 1,35 | 13,45 | 11,16 | 2,30 | 0,22 |
| Equatorial Guinea | 93,98 | 67,20 | 55,74 | 3,19 | 52,55 | 0,75 |
| Eritrea | 43,65 | 3,62 | 19,84 | 18,41 | 1,44 | 0,34 |
| Estonia | 21,67 | 13,01 | 9,18 | 4,02 | 5,16 | 0,13 |
| Ethiopia | 22,57 | 1,44 | 48,92 | 46,61 | 2,31 | 0,41 |
| Fiji | 33,75 | 9,24 | 15,33 | 13,11 | 2,22 | 0,25 |
| Finland | 15,99 | 4,87 | 6,18 | 3,01 | 3,17 | 0,18 |
| France | 7,10 | 1,40 | 4,68 | 2,06 | 2,62 | 0,08 |
| Gabon | 94,79 | 48,72 | 52,28 | 5,39 | 46,89 | 0,76 |
| Gambia | 40,99 | 1,90 | 26,74 | 23,92 | 2,82 | 0,35 |
| Georgia | 28,69 | 3,19 | 21,87 | 17,83 | 4,04 | 0,19 |
| Germany | 5,77 | 1,91 | 4,82 | 1,07 | 3,75 | 0,10 |
| Ghana | 50,62 | 11,07 | 34,82 | 29,28 | 5,54 | 0,40 |
| Greece | 30,90 | 3,12 | 8,57 | 4,92 | 3,65 | 0,16 |
| Greenland | 91,06 | 21,01 | 13,49 | 10,46 | 3,04 | 0,47 |
| Grenada | 15,53 | 0,80 | 10,94 | 6,14 | 4,79 | 0,25 |
| Guatemala | 12,26 | 2,28 | 19,69 | 15,86 | 3,83 | 0,17 |
| Guinea | 89,59 | 16,00 | 35,32 | 19,83 | 15,49 | 0,55 |
| Guinea-Bissau | 25,77 | 3,11 | 46,00 | 45,23 | 0,77 | 0,74 |
| Guyana | 57,16 | 24,50 | 42,36 | 25,09 | 17,26 | 0,37 |
| Haiti | 3,25 | 0,29 | 22,06 | 21,18 | 0,88 | 0,45 |
| Honduras | 13,89 | 6,06 | 17,22 | 14,45 | 2,77 | 0,26 |
| Hungary | 5,67 | 3,25 | 9,05 | 5,18 | 3,88 | 0,12 |
| Iceland | 76,14 | 20,06 | 12,29 | 7,62 | 4,67 | 0,40 |
| India | 30,51 | 3,76 | 27,48 | 21,49 | 5,99 | 0,15 |
| Indonesia | 41,87 | 10,30 | 24,69 | 13,84 | 10,86 | 0,14 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Iran | 80,61 | 16,47 | 28,64 | 8,22 | 20,42 | 0,69 |
| Iraq | 97,74 | 55,45 | 66,40 | 6,66 | 59,74 | 0,94 |
| Ireland | 2,82 | 1,57 | 4,78 | 2,17 | 2,62 | 0,22 |
| Israel | 33,87 | 8,25 | 3,69 | 1,62 | 2,07 | 0,30 |
| Italy | 5,94 | 1,29 | 5,43 | 2,51 | 2,92 | 0,05 |
| Jamaica | 64,87 | 8,92 | 12,74 | 6,59 | 6,15 | 0,52 |
| Japan | 4,34 | 0,55 | 4,22 | 1,29 | 2,93 | 0,13 |
| Jordan | 15,72 | 4,26 | 8,82 | 3,01 | 5,81 | 0,18 |
| Kazakhstan | 76,57 | 30,07 | 24,63 | 7,53 | 17,10 | 0,51 |
| Kenya | 26,04 | 3,33 | 29,65 | 26,42 | 3,23 | 0,22 |
| Kiribati | 62,27 | 3,46 | 25,45 | 24,22 | 1,23 | 0,60 |
| Korea, Dem. People's Rep. of | 37,51 | 6,16 | 40,01 | 25,56 | 14,46 | 0,20 |
| Korea, Republic of | 10,50 | 3,69 | 6,24 | 3,50 | 2,74 | 0,15 |
| Kuwait | 90,41 | 46,90 | 47,87 | 0,37 | 47,51 | 0,64 |
| Kyrgyzstan | 49,76 | 15,28 | 34,30 | 30,36 | 3,94 | 0,27 |
| Lao People's Dem. Rep. | 52,85 | 10,15 | 41,87 | 30,01 | 11,85 | 0,30 |
| Latvia | 29,09 | 8,56 | 8,99 | 4,67 | 4,32 | 0,13 |
| Lebanon | 23,18 | 2,30 | 13,74 | 4,47 | 9,27 | 0,12 |
| Lesotho | 13,36 | 5,01 | 15,94 | 6,79 | 9,15 | 0,33 |
| Liberia | 43,88 | 34,80 | 73,77 | 72,11 | 1,66 | 0,59 |
| Libya | 95,04 | 46,54 | 53,91 | 3,75 | 50,16 | 0,78 |
| Lithuania | 27,24 | 12,82 | 10,29 | 5,68 | 4,62 | 0,16 |
| Luxembourg | 8,25 | 3,16 | 2,34 | 0,55 | 1,80 | 0,13 |
| Madagascar | 32,37 | 4,60 | 34,30 | 32,60 | 1,70 | 0,24 |
| Malawi | 5,36 | 0,93 | 36,41 | 34,29 | 2,11 | 0,56 |
| Malaysia | 18,23 | 15,34 | 22,59 | 9,78 | 12,81 | 0,19 |
| Maldives | 71,77 | 8,25 | 8,42 | 6,56 | 1,85 | 0,53 |
| Mali | 85,93 | 16,01 | 37,72 | 36,08 | 1,64 | 0,67 |
| Malta | 19,74 | 7,78 | 3,38 | 2,11 | 1,26 | 0,43 |
| Marshall Islands | 28,43 | 4,87 | 15,31 | 12,01 | 3,30 | 0,71 |
| Mauritania | 92,64 | 31,19 | 48,36 | 29,97 | 18,40 | 0,49 |
| Mauritius | 12,53 | 3,32 | 8,02 | 5,84 | 2,18 | 0,30 |
| Mexico | 15,62 | 4,03 | 12,40 | 3,63 | 8,77 | 0,14 |
| Micronesia | 59,19 | 6,08 | 27,98 | 25,86 | 2,12 | 0,61 |
| Mongolia | 82,94 | 30,79 | 39,13 | 20,00 | 19,13 | 0,42 |
| Montenegro | 34,85 | 4,02 | 19,99 | 13,61 | 6,38 | 0,19 |
| Montserrat | 24,14 | 1,02 | 4,45 | 1,46 | 2,99 | 0,31 |
| Morocco | 24,23 | 4,54 | 19,60 | 14,78 | 4,82 | 0,17 |
| Mozambique | 71,05 | 13,65 | 31,43 | 27,40 | 4,03 | 0,40 |
| Myanmar | 58,75 | 12,80 | 48,41 | 45,83 | 2,58 | 0,32 |
| Namibia | 63,25 | 21,33 | 23,31 | 9,47 | 13,84 | 0,28 |
| Nauru | 70,39 | 58,26 | 22,83 | 5,62 | 17,22 | 0,63 |
| Nepal | 5,73 | 0,45 | 37,74 | 35,58 | 2,16 | 0,20 |
| Netherlands | 18,11 | 11,31 | 6,84 | 2,24 | 4,60 | 0,10 |
| New Zealand | 24,40 | 5,18 | 11,11 | 6,43 | 4,67 | 0,14 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Nicaragua | 17,47 | 4,33 | 22,59 | 19,19 | 3,40 | 0,21 |
| Niger | 48,11 | 7,78 | 48,52 | 42,10 | 6,42 | 0,39 |
| Nigeria | 95,99 | 22,75 | 39,87 | 25,70 | 14,17 | 0,85 |
| Niue | 14,26 | - | 0,00 | - | 0,00 | 0,34 |
| Norway | 74,54 | 23,24 | 26,18 | 1,82 | 24,36 | 0,40 |
| Oman | 82,05 | 46,05 | 46,56 | 1,86 | 44,70 | 0,65 |
| Pakistan | 7,12 | 0,84 | 30,92 | 25,97 | 4,95 | 0,21 |
| Palau | 74,60 | 4,34 | 7,44 | 4,68 | 2,77 | 0,71 |
| Panama | 17,27 | 3,49 | 9,61 | 5,68 | 3,93 | 0,19 |
| Papua New Guinea | 77,66 | 30,27 | 41,59 | 21,73 | 19,86 | 0,33 |
| Paraguay | 33,49 | 10,94 | 29,83 | 20,01 | 9,82 | 0,39 |
| Peru | 67,92 | 12,88 | 20,35 | 8,09 | 12,26 | 0,24 |
| Philippines | 8,30 | 2,39 | 18,14 | 13,48 | 4,66 | 0,34 |
| Poland | 11,90 | 3,10 | 10,18 | 3,49 | 6,69 | 0,08 |
| Portugal | 11,56 | 2,60 | 6,55 | 3,06 | 3,49 | 0,10 |
| Qatar | 87,80 | 50,87 | 51,25 | 0,31 | 50,94 | 0,57 |
| Moldova | 4,77 | 1,64 | 23,43 | 19,84 | 3,59 | 0,20 |
| Romania | 13,91 | 3,80 | 16,19 | 10,65 | 5,54 | 0,11 |
| Russia | 68,73 | 19,06 | 17,24 | 5,33 | 11,92 | 0,32 |
| Rwanda | 44,41 | 2,43 | 39,67 | 37,02 | 2,65 | 0,47 |
| Saint Kitts and Nevis | 1,71 | 0,12 | 3,62 | 1,96 | 1,66 | 0,37 |
| Saint Lucia | 25,50 | 2,82 | 8,63 | 4,35 | 4,28 | 0,43 |
| Saint Vincent and the Grenadines | 7,46 | 0,81 | 12,11 | 7,52 | 4,59 | 0,50 |
| Samoa | 13,55 | 2,01 | 17,56 | 13,42 | 4,13 | 0,52 |
| Sao Tome and Principe | 10,32 | 0,46 | 20,27 | 17,74 | 2,53 | 0,52 |
| Saudi Arabia | 82,04 | 36,23 | 43,61 | 3,80 | 39,81 | 0,68 |
| Senegal | 54,43 | 9,83 | 21,38 | 17,04 | 4,33 | 0,24 |
| Serbia | 16,98 | 2,68 | 19,68 | 13,89 | 5,79 | 0,10 |
| Seychelles | 84,94 | 27,67 | 5,90 | 3,83 | 2,07 | 0,52 |
| Sierra Leone | 54,81 | 6,47 | 57,09 | 51,43 | 5,66 | 0,40 |
| Singapore | 14,70 | 21,72 | 1,82 | 0,07 | 1,74 | 0,25 |
| Slovakia | 10,19 | 6,43 | 9,87 | 4,25 | 5,63 | 0,14 |
| Slovenia | 8,04 | 4,46 | 6,65 | 2,76 | 3,89 | 0,13 |
| Solomon Islands | 83,94 | 26,88 | 34,99 | 32,27 | 2,72 | 0,60 |
| Somalia | 27,12 | 5,16 | 60,82 | 60,15 | 0,67 | 0,55 |
| South Africa | 44,32 | 9,37 | 13,58 | 3,10 | 10,48 | 0,13 |
| Spain | 9,95 | 1,86 | 6,76 | 3,35 | 3,41 | 0,11 |
| Sri Lanka | 10,70 | 2,15 | 14,80 | 11,16 | 3,64 | 0,22 |
| State of Palestine | 8,10 | 0,60 | 12,27 | 8,24 | 4,04 | 0,17 |
| Sudan | 77,17 | 8,70 | 44,45 | 36,04 | 8,41 | 0,55 |
| Suriname | 71,11 | 29,86 | 23,49 | 15,39 | 8,10 | 0,50 |
| Swaziland | 14,06 | 7,23 | 12,52 | 10,40 | 2,12 | 0,25 |
| Sweden | 13,91 | 4,39 | 5,32 | 1,78 | 3,54 | 0,11 |
| Switzerland | 12,11 | 4,70 | 3,50 | 1,01 | 2,49 | 0,16 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Syria | 57,33 | 13,56 | 44,14 | 23,01 | 21,13 | 0,42 |
| Tajikistan | 77,94 | 33,08 | 25,65 | 25,65 | 0,00 | 0,49 |
| Macedonia | 12,13 | 4,10 | 18,63 | 11,96 | 6,67 | 0,17 |
| Thailand | 16,58 | 8,67 | 15,23 | 9,65 | 5,58 | 0,09 |
| Togo | 50,39 | 13,14 | 36,67 | 31,79 | 4,89 | 0,27 |
| Tonga | 30,55 | 1,24 | 23,66 | 20,61 | 3,05 | 0,39 |
| Trinidad and Tobago | 59,51 | 31,40 | 23,84 | 0,85 | 22,99 | 0,35 |
| Tunisia | 15,09 | 5,01 | 17,04 | 10,15 | 6,90 | 0,18 |
| Turkey | 8,56 | 1,28 | 13,64 | 10,20 | 3,44 | 0,09 |
| Turkmenistan | 89,88 | 38,06 | 19,76 | 17,71 | 2,05 | 0,63 |
| Turks and Caicos Islands | 47,77 | 1,23 | 5,98 | 1,01 | 4,97 | 0,35 |
| Tuvalu | 21,34 | 0,13 | 23,89 | 23,03 | 0,87 | 0,39 |
| Uganda | 26,15 | 1,96 | 35,29 | 29,57 | 5,72 | 0,34 |
| Ukraine | 16,65 | 6,25 | 19,91 | 11,52 | 8,39 | 0,13 |
| United Arab Emirates | 71,05 | 44,73 | 32,83 | 1,31 | 31,52 | 0,43 |
| United Kingdom | 16,66 | 2,84 | 5,23 | 0,83 | 4,40 | 0,10 |
| United Republic of Tanzania | 52,82 | 4,81 | 36,28 | 31,56 | 4,73 | 0,26 |
| United States | 11,67 | 0,95 | 4,79 | 1,08 | 3,71 | 0,08 |
| Uruguay | 17,86 | 2,71 | 11,60 | 8,45 | 3,15 | 0,19 |
| Uzbekistan | 62,15 | 16,60 | 30,34 | 26,68 | 3,66 | 0,35 |
| Vanuatu | 41,28 | 3,61 | 27,89 | 25,88 | 2,01 | 0,50 |
| Venezuela | 86,91 | 22,28 | 27,65 | 4,83 | 22,82 | 0,63 |
| Viet Nam | 28,94 | 15,09 | 33,75 | 21,17 | 12,58 | 0,19 |
| Yemen | 94,44 | 25,39 | 38,08 | 13,05 | 25,03 | 0,76 |
| Zambia | 76,53 | 22,25 | 28,04 | 13,49 | 14,55 | 0,58 |
| Zimbabwe | 39,05 | 10,71 | 29,84 | 18,22 | 11,63 | 0,27 |

Source : UNCTAD

Resource Exports: Sum of Agricultural raw materials, Minerals, Fuels and Fish , where: SITC Codes of Agricultural raw materials: (2 - 22 + 27 + 28), SITC Codes of Minerals: (27 + 28 + 68 + 667 + 971), SITC Codes of Fuels: (3), SITC Codes of Fish: (03)

**Table A. 2: Classification of countries according to natural resource endowment, Cluster Analysis Results**

| Cluster (1) Natural resource-poor countries | | | | Cluster (2) Natural resource-rich countries | |
|---|---|---|---|---|---|
| Afghanistan | Ethiopia | Montenegro | Switzerland | Algeria | Myanmar |
| Albania | Fiji | Montserrat | Thailand | Angola | Nauru |
| Andorra | Finland | Morocco | TFYR of Macedonia | Aruba | Niger |
| Anguilla | France | Namibia | Tonga | Australia | Nigeria |
| Antigua and Barbuda | Gambia | Nepal | Tunisia | Azerbaijan | Norway |
| Argentina | Georgia | Netherlands | Turkey | Bahrain | Oman |
| Armenia | Germany | New Zealand | Turks and Caicos Islands | Benin | Palau |
| Austria | Ghana | Nicaragua | Tuvalu | Bolivia (Plurinational State of) | Papua New Guinea |
| Bahamas | Greece | Niue | Uganda | Brunei Darussalam | Peru |
| Bangladesh | Grenada | Pakistan | Ukraine | Burkina Faso | Qatar |
| Barbados | Guatemala | Panama | United Kingdom | Cameroon | Russian Federation |
| Belarus | Guinea-Bissau | Paraguay | United Republic of Tanzania | Central African Republic | Rwanda |
| Belgium | Guyana | Philippines | United States | Chad | Saudi Arabia |
| Belize | Haiti | Poland | Uruguay | Chile | Senegal |
| Bermuda | Honduras | Republic of Moldova | Vanuatu | Colombia | Seychelles |
| Bhutan | Hungary | Romania | Viet Nam | Congo | Solomon Islands |
| Bosnia and Herzegovina | India | Saint Kitts and Nevis | Zimbabwe | Dem. Rep. of the Congo | Sudan |
| Botswana | Indonesia | Saint Lucia | | Ecuador | Suriname |
| Brazil | Ireland | Saint Vincent and the | | Egypt | Syrian Arab Republic |
| Bulgaria | Israel | Grenadines | | Equatorial Guinea | Tajikistan |
| Burundi | Italy | Samoa | | Gabon | Togo |
| Cabo Verde | Japan | Sao Tome and | | Greenland | Trinidad and Tobago |
| Cambodia | Jordan | Principe | | Guinea | Turkmenistan |
| Canada | Kenya | Serbia | | Iceland | United Arab Emirates |
| China | Korea, Dem. People's Rep. of | Sierra Leone | | Iran (Islamic Republic of) | Uzbekistan |
| Hong Kong SAR | Korea, Republic of | Croatia | | Iraq | Venezuela (Bolivarian Rep. of) |
| Macao SAR | Kyrgyzstan | Cuba | | Jamaica | Yemen |
| Taiwan Province of | Latvia | Cyprus | | Kazakhstan | Zambia |
| Comoros | Lebanon | Czech Republic | | Kiribati | |
| Cook Islands | Lesotho | Singapore | | Kuwait | |
| Costa Rica | Lithuania | Slovakia | | Lao People's Dem. Rep. | |
| Côte d'Ivoire | Luxembourg | Slovenia | | Liberia | |
| Denmark | Madagascar | Somalia | | Libya | |
| Djibouti | Malawi | South Africa | | Maldives | |
| Dominica | Malaysia | Spain | | Mali | |
| Dominican Republic | Malta | Sri Lanka | | Mauritania | |
| El Salvador | Marshall Islands | State of Palestine | | Micronesia (Federated States of) | |
| Eritrea | Mauritius | Swaziland | | Mongolia | |
| Estonia | Mexico | Sweden | | Mozambique | |

Source: UNCTAD. Cluster Analysis was performed by author using STATA. We used *K-means* method in clustering.

## Adequacy of clustering

Decision on the number of clusters is based on the analysis of variance (ANOVA). It is characteristic of this parametric technique that the number of clusters is defined in advance and the significance of the obtained solution is tested. The null hypothesis of the test is that the means between the propose groups do not differ significantly, while the alternative hypothesis states that the means between the proposed groups differ significantly. The test is undertaken for two clusters solution. Since at 5% significance level, the null hypothesis (that there is no significant difference between groups) is rejected, the solution that the analyzed countries are grouping into two clusters is accepted. The results of conducted test are given in Table A.3 Namely, at the given significance level of 5% and empirical significance level of 0.000 and 0.000 for first and second variable, respectively, the null hypothesis is rejected, so it can be concluded that the means between the two proposed clusters differ significantly.

**Table A. 3: ANOVA Analysis of Clustering**

| | Classe | | Error | | F | Signification |
|---|---|---|---|---|---|---|
| | Average squares | ddl | Average squares | ddl | | |
| Natural Resource Exports | 12,803 | 1 | ,017 | 198 | 766,729 | ,000 |
| Natural Resource Value Added Sectors | 1,076 | 1 | ,020 | 198 | 54,181 | ,000 |

In addition, Table A.4 shows the class centers that determine each cluster. We can see that countries with an average share of natural resource exports in total exports is greater than 17,73 and the average share of value added of natural resources sectors in total value added is greater than 19,58 are classified as natural resource-rich countries.

**Table A. 4: Class Centers of Clusters**

| | Classe | |
|---|---|---|
| | 1 | 2 |
| Natural Resource Exports | 72,9794 | 17,7260 |
| Natural Resource Value Added Sectors | 35,5822 | 19,5824 |

**Table A. 5: List of 160 countries and year of accession to WTO**

| Country | Year of accession WTO | Country | Year of accession to WTO |
|---|---|---|---|
| Afghanistan | nm | Ecuador | 1996 |
| Albania | 2000 | Egypt | 1995 |
| Algeria | nm | El Salvador | 1995 |
| Angola | 1996 | Equatorial Guinea | nm |
| Argentina | 1995 | Eritrea | nm |
| Armenia | 2003 | Estonia | 1999 |
| Australia | 1995 | Ethiopia | nm |
| Austria | 1995 | Finland | 1995 |
| Azerbaijan | nm | France | 1995 |
| Bahrain | 1995 | Gabon | 1995 |
| Bangladesh | 1995 | Gambia | 1996 |
| Belarus | nm | Georgia | 2000 |
| Belgium | 1995 | Germany | 1995 |
| Benin | 1996 | Ghana | 1995 |
| Bhutan | nm | Greece | 1995 |
| Bolivia | 1995 | Guatemala | 1995 |
| Bosnia and Herzegovina | nm | Guinea | 1995 |
| Botswana | 1995 | Guinea-Bissau | 1995 |
| Brazil | 1995 | Honduras | 1995 |
| Brunei Darussalam | 1995 | Hungary | 1995 |
| Bulgaria | 1996 | Iceland | 1995 |
| Burkina Faso | 1995 | India | 1995 |
| Burundi | 1995 | Indonesia | 1995 |
| Cabo Verde | 2008 | Iran | nm |
| Cambodia | 2004 | Iraq | nm |
| Cameroon | 1995 | Ireland | 1995 |
| Canada | 1995 | Israel | 1995 |
| Central African Republic | 1995 | Italy | 1995 |
| Chad | 1996 | Jamaica | 1995 |
| Chile | 1995 | Japan | 1995 |
| China | 2001 | Jordan | 2000 |
| Colombia | 1995 | Kazakhstan | 2015 |
| Comoros | nm | Kenya | 1995 |
| Congo | 1997 | Korea, Republic of | 1995 |
| Costa Rica | 1995 | Kuwait, the State of | 1995 |
| Côte d'Ivoire | 1995 | Kyrgyz Republic | 1998 |
| Croatia | 2000 | Lao People's Dem. Rep. | 2013 |
| Cuba | 1995 | Latvia | 1999 |
| Cyprus | 1995 | Lebanon | nm |
| Czech Republic | 1995 | Lesotho | 1995 |
| Dem. Rep. of the Congo | 1997 | Liberia | 2016 |
| Denmark | 1995 | Singapore | 1995 |

| | | | |
|---|---|---|---|
| Djibouti | 1995 | Slovak Republic | 1995 |
| Dominican Republic | 1995 | Slovenia | 1995 |
| Madagascar | 1995 | Somalia | nm |
| Malawi | 1995 | Libya | nm |
| Malaysia | 1995 | Lithuania | 2001 |
| Maldives | 1995 | Luxembourg | 1995 |
| Mali | 1995 | South Africa | 1995 |
| Malta | 1995 | Spain | 1995 |
| Mauritania | 1995 | Sri Lanka | 1995 |
| Mauritius | 1995 | Sudan | nm |
| Mexico | 1995 | Swaziland | nm |
| Moldova, Republic of | 2001 | Sweden | 1995 |
| Mongolia | 1997 | Switzerland | 1995 |
| Morocco | 1995 | Syrian Arab Republic | nm |
| Mozambique | 1995 | Tajikistan | 2013 |
| Myanmar | 1995 | Tanzania | 1995 |
| Namibia | 1995 | Thailand | 1995 |
| Nepal | 2004 | TFYR of Macedonia | 2003 |
| Netherlands | 1995 | Togo | 1995 |
| New Zealand | 1995 | Tunisia | 1995 |
| Nicaragua | 1995 | Turkey | 1995 |
| Niger | 1996 | Turkmenistan | nm |
| Nigeria | 1995 | Uganda | 1995 |
| Norway | 1995 | Ukraine | 2008 |
| Oman | 2000 | United Arab Emirates | 1996 |
| Pakistan | 1995 | United Kingdom | 1995 |
| Panama | 1997 | United States | 1995 |
| Paraguay | 1995 | Uruguay | 1995 |
| Peru | 1995 | Uzbekistan | nm |
| Philippines | 1995 | Venezuela | 1995 |
| Poland | 1995 | Viet Nam | 2007 |
| Portugal | 1995 | Yemen | 2014 |
| Qatar | 1996 | Zambia | 1995 |
| Romania | 1995 | Zimbabwe | 1995 |
| Russian Federation | 2012 | | |
| Rwanda | 1996 | | |
| Sao Tomé and Principe | nm | | |
| Saudi Arabia | 2005 | | |
| Senegal | 1995 | | |
| Serbia | nm | | |
| Seychelles | 2015 | | |
| Sierra Leone | 1995 | | |

Source: World Trade Organization (WTO) website
nm: not member

## Model of Venables (2009)

Given the importance of the paper presented by Venables (2009) in the study of the impact of regional integration between resource rich and poor countries, we will review the model in the next section in detail.

### The Basic Model

The region contains two economies, **A** and **B**, each endowed with a fixed and equal quantity of labor, **L**, and with natural resources. Moreover, assume that these natural resources are the only exports to the rest of the world (outside the region). The values of these exports are denoted $\mathbf{N_A}$, $\mathbf{N_B}$, and the only difference between the two countries — the only source of comparative advantage — is that country **A** has more of these exports than does country **B**, $\mathbf{N_A > N_B}$. That implies that the former is resource rich while the latter is relatively resource poor. In addition, both countries produce and consume from a continuum of sectors indexed by $\mathbf{z \in [0, 1]}$. For simplicity, we assume that all these sectors have identical technologies, using an imported intermediate good and labor. Each of these goods can be produced domestically or imported from the rest of the world or imported regionally from a partner country. However, external and internal trades face *ad valorem* tariffs at rates $\boldsymbol{\tau}$ and $\boldsymbol{t}$ respectively. Consumer prices can be expressed as follow:

Product non-traded (domestically): $\boldsymbol{p_i(z) = w_i^{(1-\mu)} v^{\mu}, \; i = A, B,}$ (1)

The unit cost of output produced in country $\boldsymbol{i}$, where $\boldsymbol{w_i}$ is the wage and $\boldsymbol{v}$ the price of the imported intermediate. We take the world price of this intermediate as the numeraire and assume that it faces no tariff, so $\boldsymbol{v = 1}$.

Imports from the rest of the world: $\boldsymbol{q_i(z) = (1 + \tau)(1 + az).}$ (2)

As well as being produced domestically, each good **z** can also be imported from the rest of the world with import price $\boldsymbol{q(z)}$, strictly increasing in **z**. This variation with **z** can be thought of as capturing the different levels of transport costs for each good. Trade from the rest of the world faces also *ad valorem* at rate $\boldsymbol{\tau}$.

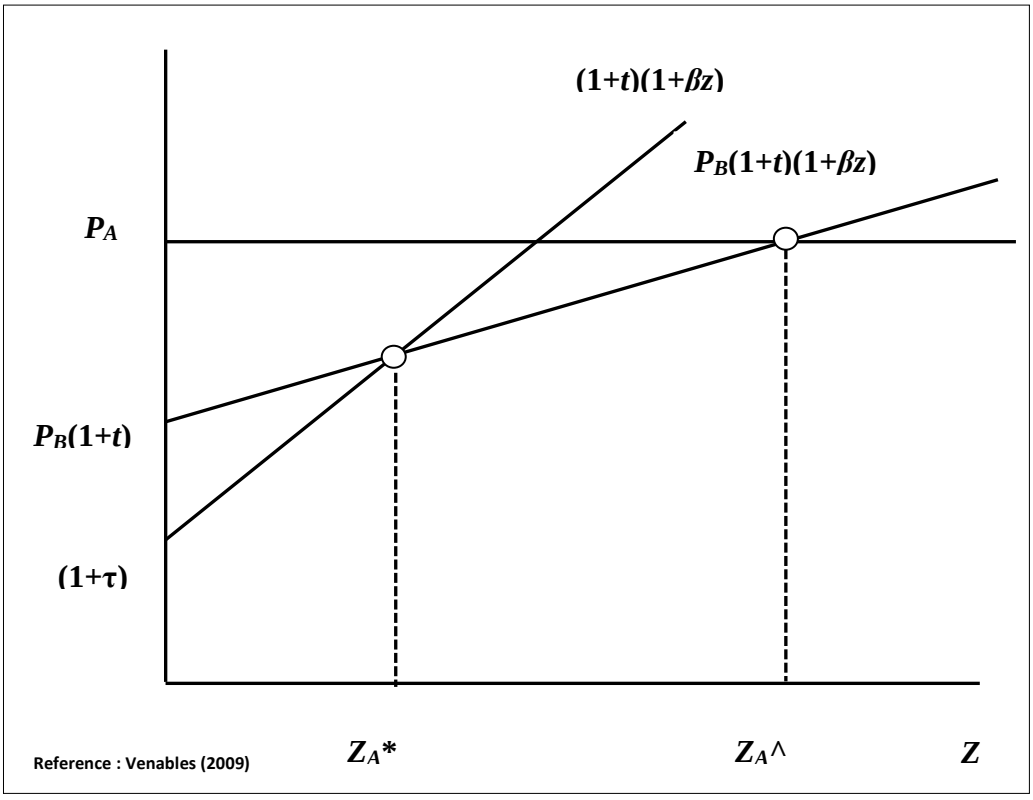
Imports from regional partner: $\boldsymbol{r_i(z) = p_j(z)(1 + t)(1 + \beta z)\; i, j = A, B, \; i \neq j.}$ (3)

In addition to importing from the rest of the world, goods may be traded intra-regionally, trade which faces transport costs but at a lower rate than external trade. Tariff is imposed to good imported from partner at rate $\boldsymbol{t}$. This structure gives an endogenous division of goods into a set that are nontraded $\boldsymbol{p_i(z)}$; a set that are traded intra-regionally $\boldsymbol{r_i(z)}$; and those goods that are imported from the rest of the world $\boldsymbol{q_i(z)}$. The need to distinguish

between "globally traded" and "regionally traded" goods, where the distinction is set by real trade costs, and barriers to trade, is important. Because, the changing sets of goods produced domestically, imported from the region, or imported from the rest of the world are indicative of the trade-creating and trade-diverting effects of regional integration. We assume likewise that given that country **A** has a comparative advantage in natural resource exports, the resource-poor country **B** will have a comparative advantage in producing the non-resources (manufactured) goods, i.e. **B** can produce those goods at a relatively lower price. This implies that the resource-poor country, **B**, will import from the rest of the world but not from country **A**, while the resource rich country, **A**, will import from **B** and the rest of the world.

We illustrate how this works, given values of prices, transport costs, and tariffs in each country. The figures (1) and (2) depict outcomes for country **A** and **B** respectively. We draw the figures with $P_A > P_B$, a property that will surely be true in equilibrium with resource endowments $N_A > N_B$. These inequalities mean as we mentioned above that resource-poor country **B** will import from the rest of the world, but not from country **A**. Resource-rich country **A**, in contrast, will import both from **B** and from the rest of the world. First, we look at the market division for country **A**:

**Figure A. 5: Market division in country (A), model of Venables (2009)**



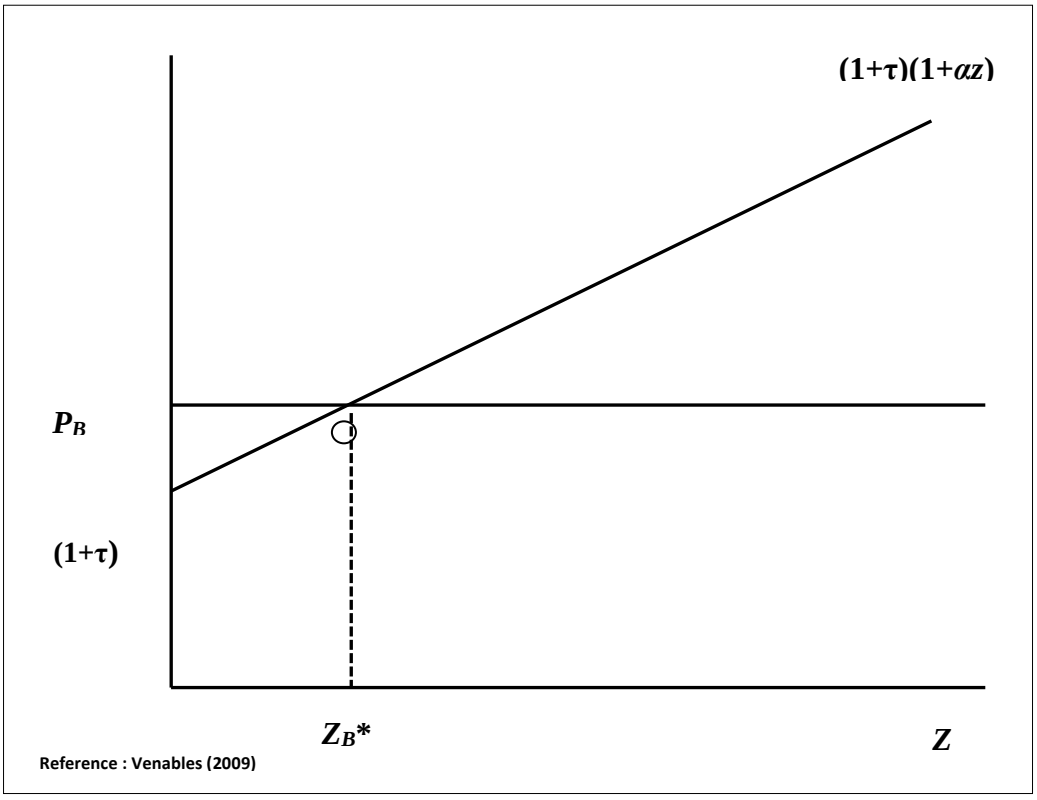
The horizontal axis is the continum of products, and the vertical axis the price of supply from different sources. For country **A** there is a range of products for which imports from the partner are cheapest. The tariff inclusive price of such products is $P_B(1+t)(1+\beta z)$, giving the flatter of the upward sloping lines in Figure 1 . In the situation illustrated the goods with the lowest transport costs are imported from the rest of the world, $z \in [0, Z_A^*]$. Those with intermediate transport costs are imported from the partner country, $z \in [Z_A^*, Z_A\hat{}]$, and domestic production supplies the remainder. The two critical values are given by,

$$Z_A^* = \frac{(1+\tau) - p_B(1+t)}{\beta p_B(1+t) - \alpha(1+\tau)}, \qquad Z_A\hat{} = \frac{1}{\beta}\left\{\frac{p_A}{p_B(1+t)} - 1\right\}. \qquad (4), (5).$$

For country **B** ,the unit cost of domestic production is $P_B$ , while imports from the rest of the world have unit cost $(1+\alpha z)$ and tariff inclusive price $(1+\tau)(1+\alpha z)$, as illustrated by the upward sloping line. The economy imports goods with the lowest consumer price, so it imports a range of low transport cost goods, $z \in [0, Z_B^*]$, and supplies the rest from domestic production, $z \in [Z_B^*, 1]$. The dividing value is given by:

$$Z_B^* = \frac{1}{\alpha}\left\{\frac{p_B}{1+\tau} - 1\right\}. \qquad (6).$$

**Figure A. 6: Market division in country (B), model of Venables (2009)**



We denote the equilibrium consumption of each product in each country by $\mathbf{X_A}$, $\mathbf{X_B}$. Given the production technology, labor market clearing for country **A** is:

$$W_A L_A = (1-\mu)\left(1-Z_A^{\wedge}\right)P_A X_A \qquad (7)$$

Where the value of domestic output is $(1-Z_A^{\wedge})\ P_A\ X_A$ and fraction **(1-μ)** goes to labor rather than to imported intermediate goods. For country **B**:

$$W_B L_B = (1-\mu)P_B\left[X_B(1-Z_B^{*}) + X_A\int_{Z_A^{*}}^{Z_A^{\wedge}}(1+\beta_S)ds\right] \qquad (8)$$

Where demand for country **B** labor additionally comes from its exports to **A**, as captured by the integral of products in the interval z ε $[Z_A^{*}, Z_A^{\wedge}]$

Finally, we have the market clearing of goods. Finally, we have goods market clearing. Given the structure of preferences, this can be written simply using the budget constraint. We assume that all tariff revenue is distributed in a lump sum manner to consumers, so the budget constraint can be expressed as the equality of the value of imports to foreign exchange earnings,

$$X_A\left[\int_0^{Z_A^{*}}(1+\alpha s)ds + P_B\int_{Z_A^{*}}^{Z_A^{\wedge}}(1+\beta_S)ds\right] + \mu P_A X_A = N_A \qquad (9)$$

$$X_B\int_0^{Z_B^{*}}(1+\alpha s)ds + \mu P_B X_B = N_B + P_B X_A\int_{Z_A^{*}}^{Z_A^{\wedge}}(1+\beta_S)ds \qquad (10)$$

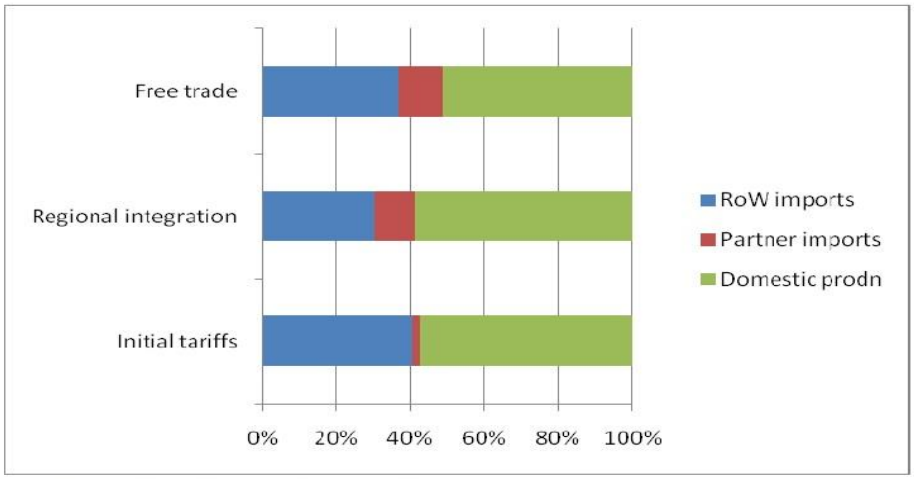
For country **A**, foreign exchange earnings are simply the resource revenue, $\mathbf{N_A}$. Imports are quantity $\mathbf{X_A}$ of each product imported times the unit cost, which depends on the source and on transport costs, as in the integrals. Additionally, the country has to import intermediate goods the value of which is fraction **μ** of the value of output. For country **B**, imports come only from one source, the rest of the world (products **z ε [0,** $Z_B^{*}$**]** and intermediates $\mu P_B X_B$ ), but foreign exchange is earned on exports to A, (products **z ε** $[Z_A^{*}, Z_A^{\wedge}]$,), the final term in equation (7), as well as resource exports.

Equations (1) – (10) fully characterize equilibrium, giving prices, wages, consumption levels and the three market-source dividing values, $Z_A^{*}$, $Z_A^{\wedge}$ and $Z_B^{*}$. Notice also that the levels of consumption, $\mathbf{X_A}$, $\mathbf{X_B}$, can be used as the real income or utility index for each country.

## Trade creation and trade diversion

We aim in this section to explore the effects of various trade policies for both countries **A** and **B**. The particular feature of the region is crucial to these effects that make the results of those liberal trade policies divergent between countries in terms of trade creation and trade diversion. We will examine firstly the regional integration between the two countries and the effect of trade liberalization policy in the second time. Comparing the results of each policy in terms of the impact on domestic production ,imports from regional partner and imports from the rest of the world will lead us to conclude the impact of each policy on both countries in terms of trade creation and trade diversion and determines the appropriate policy for each country. The author derived the conclusions by applying numerical simulation as a mechanism to study the effects of the tow policies on both countries **A** and **B**. Parameter values are: $LA = 1$, $LB = 1$, $NA \in [1, 10]$, $NB = 0.5$, $\alpha = 2$, $\beta = 0.2$, $\mu = 0.2$. In country **A**, the results of stimulation are illustrated in figure (3). Share of market taken by imports from rest of the world, range $[0, Z_A^*]$ decreased from 41% under the tariff regime to 30% with regional integration, and to 39% under the case of free trade. With respect to the share of imports from the partner (country **B**) which is expressed by the range $[Z_A^*, Z_A\hat{}]$, it increases from 1 % to more than 10 %. In case of comparing regional integration with free trade, we see that the share of imports from rest of the world increased to 38% and the share of imports from country **B**, from 11 % under the regional integration to 12 %

**Figure A. 7: Market shares in country (A), model of Venables (2009)**




**Note**: boundaries between lines are $z^*_A$, $z\hat{}_A$.

Reference : Venables (2009)

In country **B** (not illustrated) the share of the market taken by imports (i.e., fraction $\mathbf{Z_B^*}$) goes from 11% under the tariff regime, to 34% with regional integration and 39% with free trade. The regional integration regime nevertheless yields the highest country **B** real consumption because of terms of trade effects; country **B** prices are some 40% higher under regional integration than free trade, thus increasing the volume of rest of the world imports than can be purchased.

In sum, there appears to be a two-way relationship between natural resources and regional integration. However, this effect is often contingent upon the location of the countries concerned and the kind of natural resource in which they are abundant. Hence, relative resource abundance in these different contexts, in turn, may shape the incentives for countries to engage in regional integration. This model points to the importance of regional integration as a way of spreading the benefits of unevenly distributed resource wealth.

Regional integration implies a reduction in tariffs on imports from country **B** in country **A**. This enables country **B** to earn foreign exchange via their exports to the resource-rich partner country **A**. Furthermore, this extra foreign exchange accruing to country **B** raises income, thereby bidding up the prices of these regionally traded goods, increasing wages and creating a terms-of-trade gain for the resource-poor country. On the other hand, resource-rich economies lose (or at best experience very modest gains) from regional integration. First, a terms-of-trade gain for the resource poor country is necessarily a terms-of-trade loss for the resource-rich economy. In addition, regional integration results in an increase in the share of imports coming from the partner country **B**, which from the viewpoint of country **A** is largely trade diversion, i.e. goods that were being imported from more efficient producers in the rest of the world are now imported from the partner.

In contrast, multilateral trade liberalization will be beneficial for the resource-rich country as lower tariffs on more cost-efficient imports from non-member countries will entail trade creation, but no trade diversion. Moreover, external trade liberalization implies a reduction in tariffs on imports from the rest of the world. Since intra-regional trade takes the form of exports of manufactured goods from the resource-poor **B** to the resource-rich **A**, this reduction in the price of imports from the rest of the world is a terms-of-trade gain for the resource-rich economy. Hence, while trade is a way for the resource-rich economy

to relax the constraint causing diminishing returns in the use of its resource revenues, these gains come from non-preferential opening.

The analysis points to the potential for conflicting interests between resource-poor countries seeking preferential regional integration, and resource-rich countries seeking non-preferential trade opening. The way to overcome this obstacle is to look for other policy measures that can accompany a non-preferential opening. One possibility is the use of resource wealth to develop regional infrastructure. This helps maintain the competitive position of the resource-poor country while external liberalization takes place. Other ways of spreading the benefits of unevenly distributed resource wealth include labor mobility and monetary policy measures.

**Table A. 6: Estimation results of basic gravity model for 6 Regional Trade Agreements, total exports, 1980-2015 at four-year intervals**

| VARIABLES | (1) Year fixed effect Only | (2) Year, exporter and importer fixed effect | (3) Year and pair country fixed effect | (4) Year, pair country fixed effect and MRT |
|---|---|---|---|---|
| *lngdp_o* | 0.866*** | 0.750*** | 0.774*** | 0.886*** |
| | (0.0154) | (0.0355) | (0.0327) | (0.0428) |
| *lngdp_d* | 0.846*** | 0.546*** | 0.574*** | 0.628*** |
| | (0.0226) | (0.0342) | (0.0313) | (0.0340) |
| *ln_distw* | -0.573*** | -0.766*** | | |
| | (0.0361) | (0.0306) | | |
| *contig* | 0.559*** | 0.487*** | | |
| | (0.0909) | (0.0602) | | |
| *comlang_off* | 0.245*** | 0.160*** | | |
| | (0.0840) | (0.0589) | | |
| *comcol* | 0.922*** | 0.271** | | |
| | (0.238) | (0.133) | | |
| *col*45 | 0.425*** | 0.209 | | |
| | (0.104) | (0.191) | | |
| *ECOWAS_intra* | 1.064*** | 1.605*** | 1.528*** | 1.555*** |
| | (0.314) | (0.320) | (0.197) | (0.202) |
| *ECOWAS_exp* | -0.267 | 0.769*** | 0.729*** | 0.717*** |
| | (0.198) | (0.217) | (0.223) | (0.225) |
| *ECOWAS_imp* | -0.0951 | -0.258* | -0.391*** | -0.399*** |
| | (0.136) | (0.133) | (0.116) | (0.118) |
| *COMESA_intra* | 0.0176 | 1.025*** | 0.453* | 0.485* |
| | (0.206) | (0.258) | (0.259) | (0.265) |
| *COMESA_exp* | -0.684*** | 0.0317 | 0.0969 | 0.127 |
| | (0.147) | (0.190) | (0.196) | (0.197) |
| *COMESA_imp* | -0.349*** | -0.188** | -0.234*** | -0.235*** |
| | (0.0866) | (0.0860) | (0.0789) | (0.0804) |
| *SADC_intra* | 2.131*** | 1.918*** | 1.227*** | 1.347*** |
| | (0.180) | (0.232) | (0.193) | (0.190) |
| *SADC_exp* | 0.146 | 0.361** | 0.393*** | 0.437*** |
| | (0.145) | (0.145) | (0.126) | (0.125) |
| *SADC_imp* | 0.102 | -0.134 | -0.0874 | -0.0623 |
| | (0.130) | (0.114) | (0.105) | (0.105) |
| *PAFTA_intra* | -0.442*** | -0.686*** | 0.207 | 0.189 |
| | (0.171) | (0.211) | (0.160) | (0.160) |
| *PAFTA_exp* | -0.701*** | -0.497*** | -0.597*** | -0.618*** |
| | (0.131) | (0.181) | (0.192) | (0.187) |
| *PAFTA_imp* | 0.111 | -0.114 | -0.164** | -0.177*** |
| | (0.0843) | (0.0774) | (0.0698) | (0.0684) |
| *CIS_intra* | 1.291*** | 4.541*** | 3.001*** | 3.178*** |
| | (0.210) | (0.393) | (0.302) | (0.311) |
| *CIS_exp* | 0.161 | 2.828*** | 2.872*** | 2.972*** |
| | (0.147) | (0.297) | (0.296) | (0.302) |
| *CIS_imp* | -0.313** | 0.202*** | 0.236*** | 0.237*** |
| | (0.129) | (0.0603) | (0.0659) | (0.0634) |
| *LAIA_intra* | 0.421*** | 0.377** | 0.340* | 0.420** |
| | (0.0995) | (0.178) | (0.179) | (0.177) |
| *LAIA_exp* | 0.0237 | 0.152 | 0.190 | 0.228 |

| | | | | |
|---|---|---|---|---|
| | (0.215) | (0.160) | (0.207) | (0.207) |
| *LAIA_imp* | -0.132 | -0.307*** | -0.255*** | -0.158 |
| | (0.102) | (0.105) | (0.0906) | (0.0965) |
| *Other_PTA* | 0.433*** | 0.377*** | 0.139*** | 0.228*** |
| | (0.0600) | (0.0466) | (0.0426) | (0.0457) |
| *ln_MRT_DISTANCE_EX* | | | | 1.160*** |
| | | | | (0.268) |
| *ln_MRT_DISTANCE_IM* | | | | 0.203 |
| | | | | (0.290) |
| *MRT_PTA_EX* | | | | -0.0725 |
| | | | | (0.0872) |
| *MRT_PTA_IM* | | | | -0.281*** |
| | | | | (0.0941) |
| *Constant* | -26.98*** | -12.76*** | | |
| | (0.909) | (1.375) | | |
| Observations | 225,632 | 220,065 | 181,869 | 181,869 |
| R-squared | 0.753 | 0.887 | | |
| Number of id | | | 20,125 | 20,125 |

Notes:
- Dependent variable is nominal value of total exports
- Specifications (1) and (2) are performed using ppml STATA command and Specifications (3) and (4) are performed using xtpoisson STATA command.
- Time, exporter and importer dummy variables are not reported in order to save space.
- Robust Standard errors (clustered by country-pair) and t-ratios in parentheses *** p<0.01, ** p<0.05, * p<0.1.

**Table A. 7: Estimation results of basic gravity model for 6 Regional Trade Agreements, non-natural resource exports, 1980-2015 at four-year intervals**

| VARIABLES | (1) Year fixed effect Only | (2) Year, exporter and importer fixed effect | (3) Year and pair country fixed effect | (4) Year, pair country fixed effect and MRT |
|---|---|---|---|---|
| $lngdp\_o$ | 0.906*** | 0.779*** | 0.809*** | 0.911*** |
| | (0.0175) | (0.0373) | (0.0330) | (0.0468) |
| $lngdp\_d$ | 0.838*** | 0.523*** | 0.562*** | 0.614*** |
| | (0.0257) | (0.0361) | (0.0342) | (0.0371) |
| $ln\_distw$ | -0.567*** | -0.737*** | | |
| | (0.0380) | (0.0310) | | |
| $contig$ | 0.562*** | 0.459*** | | |
| | (0.0941) | (0.0592) | | |
| $comlang\_off$ | 0.205** | 0.174*** | | |
| | (0.0808) | (0.0561) | | |
| $comcol$ | 0.875*** | 0.220 | | |
| | (0.258) | (0.136) | | |
| $col45$ | 0.452*** | 0.343* | | |
| | (0.122) | (0.185) | | |
| $ECOWAS\_intra$ | 0.557* | 2.506*** | 1.693*** | 1.717*** |
| | (0.318) | (0.332) | (0.218) | (0.219) |
| $ECOWAS\_exp$ | -1.850*** | 1.055*** | 1.139*** | 1.161*** |
| | (0.190) | (0.251) | (0.286) | (0.287) |
| $ECOWAS\_imp$ | -0.0624 | -0.373*** | -0.568*** | -0.582*** |
| | (0.149) | (0.143) | (0.119) | (0.123) |
| $COMESA\_intra$ | 0.303 | 1.318*** | 0.520** | 0.550** |
| | (0.214) | (0.203) | (0.218) | (0.222) |
| $COMESA\_exp$ | -0.902*** | -0.230** | -0.167* | -0.168* |
| | (0.115) | (0.0947) | (0.0981) | (0.0990) |
| $COMESA\_imp$ | -0.357*** | -0.211** | -0.272*** | -0.277*** |
| | (0.0921) | (0.0847) | (0.0803) | (0.0818) |
| $SADC\_intra$ | 2.152*** | 1.908*** | 1.118*** | 1.228*** |
| | (0.211) | (0.264) | (0.196) | (0.194) |
| $SADC\_exp$ | -0.409*** | -0.153 | -0.0174 | 0.0322 |
| | (0.119) | (0.141) | (0.151) | (0.151) |
| $SADC\_imp$ | 0.186 | -0.204* | -0.154 | -0.138 |
| | (0.140) | (0.110) | (0.104) | (0.103) |
| $PAFTA\_intra$ | -0.407** | 1.063*** | 0.393** | 0.378** |
| | (0.187) | (0.164) | (0.157) | (0.160) |
| $PAFTA\_exp$ | -1.534*** | 0.257*** | 0.397*** | 0.384*** |
| | (0.135) | (0.0953) | (0.0835) | (0.0828) |
| $PAFTA\_imp$ | 0.213** | -0.200*** | -0.215*** | -0.234*** |
| | (0.0833) | (0.0743) | (0.0712) | (0.0700) |
| $CIS\_intra$ | 1.157*** | 5.682*** | 3.550*** | 3.737*** |
| | (0.247) | (0.388) | (0.315) | (0.321) |
| $CIS\_exp$ | -0.912*** | 3.323*** | 3.440*** | 3.516*** |
| | (0.112) | (0.271) | (0.246) | (0.248) |
| $CIS\_imp$ | -0.177 | 0.194*** | 0.222*** | 0.211*** |
| | (0.136) | (0.0722) | (0.0706) | (0.0676) |
| $LAIA\_intra$ | 0.367*** | 0.746*** | 0.507** | 0.618*** |
| | (0.111) | (0.258) | (0.207) | (0.210) |
| $LAIA\_exp$ | -0.174 | 0.404 | 0.528 | 0.560 |
| | (0.313) | (0.291) | (0.351) | (0.350) |
| $LAIA\_imp$ | -0.119 | -0.470*** | -0.374*** | -0.250*** |
| | (0.0885) | (0.104) | (0.0810) | (0.0926) |
| $Other\_PTA$ | 0.448*** | 0.418*** | 0.148*** | 0.255*** |
| | (0.0653) | (0.0451) | (0.0503) | (0.0534) |

| | | | | |
|---|---|---|---|---|
| *ln_MRT_DISTANCE_EX* | | | | 1.015*** |
| | | | | (0.293) |
| *ln_MRT_DISTANCE_IM* | | | | -0.0540 |
| | | | | (0.284) |
| *MRT_PTA_EX* | | | | -0.124 |
| | | | | (0.103) |
| *MRT_PTA_IM* | | | | -0.379*** |
| | | | | (0.105) |
| *Constant* | -28.15*** | -13.31*** | | |
| | (1.056) | (1.374) | | |
| Observations | 225,632 | 220,065 | 177,434 | 177,434 |
| R-squared | 0.725 | 0.903 | | |
| Number of id | | | 19,620 | 19,620 |

Notes:
- Dependent variable is nominal value of non-natural resource exports.
- Non-Resource Exports: Total Exports – Resource Exports
- Resource Exports: Sum of Agricultural raw materials, Minerals, Fuels and Fish where: SITC Codes of Agricultural raw materials: (2 - 22 + 27 + 28), SITC Codes of Minerals: (27 + 28 + 68 + 667 + 971), SITC Codes of Fuels: (3); SITC Codes of Fish: (03).
- Specifications (1) and (2) are performed using ppml STATA command and Specifications (3) and (4) are performed using xtpoisson STATA command.
- Time, exporter and importer dummy variables are not reported in order to save space.
- Robust Standard errors (clustered by country-pair) and t-ratios in parentheses *** p<0.01, ** p<0.05, * p<0.1.

**Table A. 8: Estimation results of basic gravity model for 6 Regional Trade Agreements, natural resource exports, 1980-2015 at four-year intervals**

| VARIABLES | (1) Year fixed effect Only | (2) Year, exporter and importer fixed effect | (3) Year and pair country fixed effect | (4) Year, pair country fixed effect and MRT |
|---|---|---|---|---|
| $lngdp\_o$ | 0.685*** | 0.377*** | 0.391*** | 0.516*** |
| | (0.0205) | (0.0609) | (0.0610) | (0.0832) |
| $lngdp\_d$ | 0.889*** | 0.715*** | 0.705*** | 0.756*** |
| | (0.0359) | (0.0572) | (0.0555) | (0.0565) |
| $ln\_distw$ | -0.628*** | -1.156*** | | |
| | (0.0794) | (0.0518) | | |
| $contig$ | 0.531*** | 0.452*** | | |
| | (0.176) | (0.102) | | |
| $comlang\_off$ | 0.433** | 0.215* | | |
| | (0.180) | (0.119) | | |
| $comcol$ | 1.062*** | 0.319 | | |
| | (0.220) | (0.206) | | |
| $col45$ | 0.285* | -0.128 | | |
| | (0.173) | (0.214) | | |
| $ECOWAS\_intra$ | 1.681*** | 1.740*** | 1.759*** | 1.793*** |
| | (0.430) | (0.409) | (0.268) | (0.272) |
| $ECOWAS\_exp$ | 1.047*** | 0.967*** | 1.008*** | 0.997*** |
| | (0.261) | (0.270) | (0.277) | (0.281) |
| $ECOWAS\_imp$ | -0.220 | 0.500*** | 0.601*** | 0.581*** |
| | (0.222) | (0.182) | (0.177) | (0.177) |
| $COMESA\_intra$ | -1.087*** | -0.204 | -0.568 | -0.516 |
| | (0.291) | (0.383) | (0.411) | (0.405) |
| $COMESA\_exp$ | -0.575** | 0.0706 | 0.126 | 0.174 |
| | (0.250) | (0.268) | (0.269) | (0.273) |
| $COMESA\_imp$ | -0.290* | -0.215 | -0.108 | -0.0926 |
| | (0.160) | (0.180) | (0.145) | (0.149) |
| $SADC\_intra$ | 2.078*** | 2.568*** | 1.851*** | 1.977*** |
| | (0.265) | (0.234) | (0.315) | (0.302) |
| $SADC\_exp$ | 1.097*** | 1.370*** | 1.316*** | 1.356*** |
| | (0.271) | (0.211) | (0.153) | (0.149) |
| $SADC\_imp$ | -0.345 | 0.585*** | 0.570*** | 0.621*** |
| | (0.213) | (0.223) | (0.200) | (0.205) |
| $PAFTA\_intra$ | -0.518** | -1.017*** | 0.185 | 0.154 |
| | (0.230) | (0.237) | (0.398) | (0.391) |
| $PAFTA\_exp$ | 0.497*** | -0.684*** | -0.703*** | -0.718*** |
| | (0.190) | (0.244) | (0.248) | (0.241) |
| $PAFTA\_imp$ | -0.550*** | 0.808*** | 0.405*** | 0.400*** |
| | (0.165) | (0.212) | (0.112) | (0.115) |
| $CIS\_intra$ | 1.781*** | 4.129*** | 2.421*** | 2.551*** |
| | (0.327) | (0.411) | (0.353) | (0.369) |
| $CIS\_exp$ | 1.671*** | 2.322*** | 2.405*** | 2.506*** |
| | (0.200) | (0.326) | (0.334) | (0.346) |
| $CIS\_imp$ | -1.553*** | 0.192* | 0.342*** | 0.357*** |
| | (0.148) | (0.0987) | (0.0903) | (0.0939) |
| $LAIA\_intra$ | 0.699*** | 0.204 | 0.315 | 0.312 |
| | (0.179) | (0.244) | (0.316) | (0.304) |
| $LAIA\_exp$ | 0.768*** | 0.204 | 0.156 | 0.183 |
| | (0.172) | (0.138) | (0.136) | (0.139) |

| | | | | |
|---|---|---|---|---|
| *LAIA_imp* | -0.276 | 0.457* | 0.324 | 0.328 |
| | (0.241) | (0.242) | (0.271) | (0.266) |
| *Other_PTA* | 0.386*** | 0.167** | 0.135** | 0.185** |
| | (0.127) | (0.0812) | (0.0642) | (0.0732) |
| *ln_MRT_DISTANCE_EX* | | | | 1.507** |
| | | | | (0.586) |
| *ln_MRT_DISTANCE_IM* | | | | 0.543 |
| | | | | (0.624) |
| *MRT_PTA_EX* | | | | 0.0603 |
| | | | | (0.151) |
| *MRT_PTA_IM* | | | | -0.0404 |
| | | | | (0.181) |
| *Constant* | -24.46*** | -5.476*** | | |
| | (1.422) | (2.082) | | |
| Observations | 225,632 | 220,065 | 148,293 | 148,293 |
| R-squared | 0.424 | 0.735 | | |
| Number of id | | | 16,243 | 16,243 |

Notes:
- Dependent variable is nominal value of natural resource exports.
- Resource Exports: Sum of Agricultural raw materials, Minerals, Fuels and Fish where: SITC Codes of Agricultural raw materials: (2 - 22 + 27 + 28), SITC Codes of Minerals: (27 + 28 + 68 + 667 + 971), SITC Codes of Fuels: (3); SITC Codes of Fish: (03).
- Specifications (1) and (2) are performed using ppml STATA command and Specifications (3) and (4) are performed using xtpoisson STATA command.
- Time, exporter and importer dummy variables are not reported in order to save space.
- Robust Standard errors (clustered by country-pair) and t-ratios in parentheses *** p<0.01, ** p<0.05, * p<0.1.

**Table A. 9: Estimation results of augmented gravity model for 6 Regional Trade agreements, total exports, 1980-2015 at four-year intervals**

| VARIABLES | (1) Year fixed effect Only | (2) Year, exporter and importer fixed effect | (3) Year and pair country fixed effect | (4) Year, pair country fixed effect and MRT |
|---|---|---|---|---|
| $lngdp\_o$ | 0.863*** | 0.749*** | 0.775*** | 0.886*** |
| | (0.0156) | (0.0356) | (0.0328) | (0.0430) |
| $lngdp\_d$ | 0.846*** | 0.547*** | 0.575*** | 0.630*** |
| | (0.0232) | (0.0344) | (0.0314) | (0.0341) |
| $ln\_distw$ | -0.571*** | -0.767*** | | |
| | (0.0364) | (0.0307) | | |
| $contig$ | 0.555*** | 0.482*** | | |
| | (0.0896) | (0.0603) | | |
| $comlang\_off$ | 0.254*** | 0.166*** | | |
| | (0.0843) | (0.0594) | | |
| $comcol$ | 0.919*** | 0.258* | | |
| | (0.242) | (0.134) | | |
| $col45$ | 0.430*** | 0.213 | | |
| | (0.104) | (0.193) | | |
| $RR\_ECOWAS$ | 0.931*** | 0.994** | 1.586*** | 1.602*** |
| | (0.354) | (0.465) | (0.219) | (0.218) |
| $RP\_ECOWAS$ | 1.159** | 1.833*** | 0.923*** | 0.929*** |
| | (0.514) | (0.550) | (0.260) | (0.271) |
| $PR\_ECOWAS$ | 1.022* | 2.680*** | 2.458*** | 2.506*** |
| | (0.615) | (0.470) | (0.692) | (0.697) |
| $PP\_ECOWAS$ | 1.426*** | 2.642*** | 1.530 | 1.579 |
| | (0.505) | (0.471) | (1.144) | (1.144) |
| $RW\_ECOWAS$ | -0.233 | 0.624** | 0.575** | 0.546** |
| | (0.222) | (0.253) | (0.258) | (0.261) |
| $PW\_ECOWAS$ | -0.501*** | 1.508*** | 1.555*** | 1.593*** |
| | (0.187) | (0.370) | (0.410) | (0.412) |
| $WR\_ECOWAS$ | -0.126 | -0.306** | -0.461*** | -0.470*** |
| | (0.157) | (0.154) | (0.133) | (0.137) |
| $WP\_ECOWAS$ | 0.0233 | -0.0609 | -0.141 | -0.153 |
| | (0.185) | (0.219) | (0.172) | (0.173) |
| $RR\_COMESA$ | 0.528 | 1.415*** | 1.209** | 1.242** |
| | (0.365) | (0.509) | (0.514) | (0.525) |
| $RP\_COMESA$ | -0.0549 | 0.981*** | 1.219*** | 1.241*** |
| | (0.302) | (0.362) | (0.369) | (0.362) |
| $PR\_COMESA$ | -0.317 | 0.827** | 0.0650 | 0.0977 |
| | (0.344) | (0.399) | (0.285) | (0.287) |
| $PP\_COMESA$ | -0.0711 | 0.879*** | -0.110 | -0.0713 |
| | (0.308) | (0.319) | (0.466) | (0.486) |
| $RW\_COMESA$ | -0.407* | 0.254 | 0.336 | 0.364 |
| | (0.209) | (0.234) | (0.246) | (0.247) |
| $PW\_COMESA$ | -1.220*** | -0.417*** | -0.323*** | -0.304** |
| | (0.139) | (0.118) | (0.122) | (0.123) |
| $WR\_COMESA$ | -0.394*** | -0.219** | -0.251** | -0.253** |
| | (0.113) | (0.110) | (0.0980) | (0.0984) |
| $WP\_COMESA$ | -0.328** | -0.127 | -0.192 | -0.195 |
| | (0.141) | (0.131) | (0.128) | (0.132) |
| $RR\_SADC$ | -1.258** | -0.0512 | 2.251*** | 2.181*** |

| | | | | |
|---|---|---|---|---|
| | (0.532) | (0.595) | (0.512) | (0.505) |
| $RP\_SADC$ | 1.617*** | 2.544*** | 2.513*** | 2.568*** |
| | (0.204) | (0.264) | (0.379) | (0.356) |
| $PR\_SADC$ | 2.384*** | 1.929*** | 0.689*** | 0.776*** |
| | (0.397) | (0.404) | (0.192) | (0.201) |
| $PP\_SADC$ | 2.305*** | 2.099*** | 1.449*** | 1.597*** |
| | (0.196) | (0.271) | (0.300) | (0.292) |
| $RW\_SADC$ | 0.452 | 1.894*** | 1.631*** | 1.561*** |
| | (0.390) | (0.384) | (0.309) | (0.304) |
| $PW\_SADC$ | 0.0484 | 0.173 | 0.282** | 0.347*** |
| | (0.109) | (0.123) | (0.121) | (0.124) |
| $WR\_SADC$ | -0.0467 | -0.210 | -0.217* | -0.281** |
| | (0.183) | (0.144) | (0.124) | (0.128) |
| $WP\_SADC$ | 0.137 | -0.122 | -0.0657 | -0.0274 |
| | (0.150) | (0.134) | (0.123) | (0.124) |
| $RR\_PAFTA$ | -0.611*** | -1.004*** | 0.137 | 0.118 |
| | (0.188) | (0.235) | (0.239) | (0.241) |
| $RP\_PAFTA$ | 0.130 | 0.0159 | 0.273* | 0.263* |
| | (0.234) | (0.222) | (0.164) | (0.159) |
| $PR\_PAFTA$ | -0.0430 | 0.656** | 0.348** | 0.331** |
| | (0.252) | (0.258) | (0.157) | (0.155) |
| $PP\_PAFTA$ | 0.0368 | 0.773*** | 0.123 | 0.118 |
| | (0.233) | (0.230) | (0.291) | (0.296) |
| $RW\_PAFTA$ | -0.750*** | -0.623*** | -0.763*** | -0.782*** |
| | (0.161) | (0.212) | (0.229) | (0.222) |
| $PW\_PAFTA$ | -0.680*** | 0.101 | 0.201** | 0.184** |
| | (0.173) | (0.0940) | (0.0891) | (0.0873) |
| $WR\_PAFTA$ | 0.155 | -0.104 | -0.168** | -0.183** |
| | (0.0977) | (0.0908) | (0.0814) | (0.0795) |
| $WP\_PAFTA$ | -0.0699 | -0.126 | -0.127* | -0.126 |
| | (0.113) | (0.0811) | (0.0766) | (0.0777) |
| $RR\_CIS$ | 0.690*** | 4.045*** | 3.071*** | 3.279*** |
| | (0.219) | (0.489) | (0.390) | (0.402) |
| $RP\_CIS$ | 1.702*** | 4.669*** | 3.040*** | 3.208*** |
| | (0.304) | (0.455) | (0.441) | (0.446) |
| $PR\_CIS$ | 1.433*** | 4.338*** | 2.827*** | 2.925*** |
| | (0.223) | (0.339) | (0.482) | (0.484) |
| $PP\_CIS$ | 1.385*** | 4.141*** | 2.249*** | 2.329*** |
| | (0.312) | (0.337) | (0.389) | (0.394) |
| $RW\_CIS$ | 0.204 | 2.901*** | 2.905*** | 3.011*** |
| | (0.168) | (0.319) | (0.324) | (0.330) |
| $PW\_CIS$ | -0.0853 | 2.116*** | 2.474*** | 2.490*** |
| | (0.132) | (0.246) | (0.248) | (0.248) |
| $WR\_CIS$ | -0.341** | 0.244*** | 0.282*** | 0.286*** |
| | (0.153) | (0.0722) | (0.0758) | (0.0731) |
| $WP\_CIS$ | -0.151 | 0.0275 | 0.0478 | 0.0357 |
| | (0.159) | (0.0582) | (0.0672) | (0.0636) |
| $RR\_LAIA$ | 0.802*** | 0.145 | 0.203 | 0.322** |
| | (0.164) | (0.179) | (0.162) | (0.159) |
| $RP\_LAIA$ | -0.152 | -0.731*** | -0.416 | -0.328 |
| | (0.241) | (0.233) | (0.336) | (0.338) |
| $PR\_LAIA$ | 0.485*** | 0.534*** | 1.308*** | 1.393*** |
| | (0.129) | (0.175) | (0.426) | (0.408) |
| $PP\_LAIA$ | 0.497*** | 0.781*** | 0.234* | 0.297** |

| | | | | |
|---|---|---|---|---|
| | (0.137) | (0.211) | (0.138) | (0.137) |
| *RW_LAIA* | -0.0321 | -0.350*** | -0.433*** | -0.379*** |
| | (0.146) | (0.127) | (0.132) | (0.135) |
| *PW_LAIA* | 0.0354 | 0.377** | 0.412* | 0.443** |
| | (0.262) | (0.162) | (0.211) | (0.215) |
| *WR_LAIA* | -0.197** | -0.461*** | -0.556*** | -0.476*** |
| | (0.0962) | (0.0940) | (0.0868) | (0.0870) |
| *WP_LAIA* | -0.111 | -0.254** | -0.189** | -0.0862 |
| | (0.121) | (0.119) | (0.0948) | (0.0983) |
| *Other_PTA* | 0.436*** | 0.377*** | 0.138*** | 0.228*** |
| | (0.0611) | (0.0468) | (0.0422) | (0.0454) |
| *ln_MRT_DISTANCE_EX* | | | | 1.156*** |
| | | | | (0.268) |
| *ln_MRT_DISTANCE_IM* | | | | 0.188 |
| | | | | (0.290) |
| *MRT_PTA_EX* | | | | -0.0802 |
| | | | | (0.0868) |
| *MRT_PTA_IM* | | | | -0.287*** |
| | | | | (0.0946) |
| *Constant* | -26.93*** | -12.77*** | | |
| | (0.919) | (1.380) | | |
| Observations | 225,632 | 220,065 | 181,869 | 181,869 |
| R-squared | 0.754 | 0.887 | | |
| Number of id | | | 20,125 | 20,125 |

Notes:
- Dependent variable is nominal value of total exports
- Specifications (1) and (2) are performed using ppml STATA command and Specifications (3) and (4) are performed using xtpoisson STATA command.
- Time, exporter and importer dummy variables are not reported in order to save space.
- Robust Standard errors (clustered by country-pair) and t-ratios in parentheses *** p<0.01, ** p<0.05, * p<0.1.

**Table A. 10: Estimation results of augmented gravity model for 6 Regional Trade agreements, non-natural resource exports, 1980-2015 at four-year intervals**

| VARIABLES | (1) Year fixed effect Only | (2) Year, exporter and importer fixed effect | (3) Year and pair country fixed effect | (4) Year, pair country fixed effect and MRT |
|---|---|---|---|---|
| $lngdp\_o$ | 0.905*** | 0.779*** | 0.810*** | 0.912*** |
| | (0.0175) | (0.0373) | (0.0329) | (0.0468) |
| $lngdp\_d$ | 0.837*** | 0.522*** | 0.563*** | 0.616*** |
| | (0.0261) | (0.0364) | (0.0344) | (0.0374) |
| $ln\_distw$ | -0.566*** | -0.736*** | | |
| | (0.0382) | (0.0310) | | |
| $contig$ | 0.553*** | 0.456*** | | |
| | (0.0892) | (0.0592) | | |
| $comlang\_off$ | 0.215*** | 0.171*** | | |
| | (0.0798) | (0.0566) | | |
| $comcol$ | 0.868*** | 0.236* | | |
| | (0.261) | (0.138) | | |
| $col45$ | 0.452*** | 0.338* | | |
| | (0.120) | (0.187) | | |
| $RR\_ECOWAS$ | 0.664* | 2.635*** | 1.611*** | 1.628*** |
| | (0.356) | (0.359) | (0.230) | (0.226) |
| $RP\_ECOWAS$ | 0.0479 | 2.962*** | 0.984*** | 0.991*** |
| | (0.397) | (0.363) | (0.297) | (0.287) |
| $PR\_ECOWAS$ | 0.709 | 2.300*** | 2.302*** | 2.336*** |
| | (0.601) | (0.572) | (0.664) | (0.670) |
| $PP\_ECOWAS$ | 1.193** | 2.425*** | 1.866 | 1.894 |
| | (0.556) | (0.487) | (1.222) | (1.222) |
| $RW\_ECOWAS$ | -2.594*** | 0.592*** | 0.702*** | 0.701*** |
| | (0.149) | (0.176) | (0.214) | (0.215) |
| $PW\_ECOWAS$ | -0.607*** | 1.433*** | 1.439*** | 1.471*** |
| | (0.231) | (0.427) | (0.466) | (0.467) |
| $WR\_ECOWAS$ | -0.109 | -0.447*** | -0.661*** | -0.675*** |
| | (0.173) | (0.164) | (0.136) | (0.142) |
| $WP\_ECOWAS$ | 0.0913 | -0.0806 | -0.213 | -0.232 |
| | (0.200) | (0.237) | (0.177) | (0.178) |
| $RR\_COMESA$ | 0.850** | 1.907*** | 1.207*** | 1.199*** |
| | (0.398) | (0.367) | (0.440) | (0.445) |
| $RP\_COMESA$ | 1.142*** | 2.071*** | 1.088*** | 1.088*** |
| | (0.329) | (0.272) | (0.300) | (0.303) |
| $PR\_COMESA$ | -0.0888 | 0.976** | 0.244 | 0.277 |
| | (0.350) | (0.425) | (0.279) | (0.284) |
| $PP\_COMESA$ | 0.175 | 0.957*** | 0.151 | 0.205 |
| | (0.309) | (0.340) | (0.385) | (0.410) |
| $RW\_COMESA$ | -0.411*** | 0.0802 | 0.118 | 0.0849 |
| | (0.158) | (0.138) | (0.126) | (0.126) |
| $PW\_COMESA$ | -1.103*** | -0.406*** | -0.318** | -0.300** |
| | (0.140) | (0.134) | (0.144) | (0.146) |
| $WR\_COMESA$ | -0.458*** | -0.233** | -0.293*** | -0.297*** |
| | (0.120) | (0.107) | (0.0994) | (0.0998) |
| $WP\_COMESA$ | -0.266* | -0.136 | -0.217* | -0.230* |
| | (0.144) | (0.130) | (0.131) | (0.134) |
| $RR\_SADC$ | -1.127** | 0.914 | 2.684*** | 2.635*** |
| | (0.489) | (0.598) | (0.399) | (0.414) |

| | | | | |
|---|---|---|---|---|
| | 0.402 | 2.200*** | 1.724*** | 1.800*** |
| $RP\_SADC$ | (0.377) | (0.462) | (0.197) | (0.199) |
| | 2.471*** | 1.911*** | 0.613*** | 0.673*** |
| $PR\_SADC$ | (0.394) | (0.427) | (0.223) | (0.232) |
| | 2.365*** | 1.955*** | 1.351*** | 1.481*** |
| $PP\_SADC$ | (0.196) | (0.305) | (0.296) | (0.285) |
| | -2.364*** | 0.529 | 0.436 | 0.425 |
| $RW\_SADC$ | (0.290) | (0.457) | (0.517) | (0.524) |
| | -0.219* | -0.154 | -0.0178 | 0.0318 |
| $PW\_SADC$ | (0.115) | (0.145) | (0.154) | (0.155) |
| | 0.0842 | -0.202 | -0.268** | -0.354*** |
| $WR\_SADC$ | (0.190) | (0.142) | (0.125) | (0.129) |
| | 0.199 | -0.210 | -0.137 | -0.106 |
| $WP\_SADC$ | (0.163) | (0.128) | (0.120) | (0.120) |
| | -0.605*** | 0.953*** | 0.309 | 0.289 |
| $RR\_PAFTA$ | (0.206) | (0.200) | (0.227) | (0.231) |
| | -0.0327 | 1.834*** | 0.582*** | 0.614*** |
| $RP\_PAFTA$ | (0.317) | (0.199) | (0.213) | (0.225) |
| | 0.270 | 0.854*** | 0.361** | 0.347* |
| $PR\_PAFTA$ | (0.263) | (0.279) | (0.183) | (0.183) |
| | 0.251 | 1.034*** | 0.262 | 0.269 |
| $PP\_PAFTA$ | (0.269) | (0.273) | (0.239) | (0.244) |
| | -1.992*** | 0.178 | 0.315*** | 0.311*** |
| $RW\_PAFTA$ | (0.139) | (0.143) | (0.111) | (0.110) |
| | -0.618*** | 0.270** | 0.415*** | 0.401*** |
| $PW\_PAFTA$ | (0.194) | (0.121) | (0.121) | (0.119) |
| | 0.280*** | -0.195** | -0.214*** | -0.238*** |
| $WR\_PAFTA$ | (0.0941) | (0.0854) | (0.0819) | (0.0804) |
| | -0.0723 | -0.199** | -0.200** | -0.191** |
| $WP\_PAFTA$ | (0.121) | (0.0829) | (0.0782) | (0.0803) |
| | 0.470* | 6.171*** | 4.115*** | 4.351*** |
| $RR\_CIS$ | (0.275) | (0.533) | (0.536) | (0.543) |
| | 1.318*** | 6.466*** | 4.000*** | 4.201*** |
| $RP\_CIS$ | (0.425) | (0.611) | (0.436) | (0.443) |
| | 1.643*** | 4.387*** | 2.935*** | 3.035*** |
| $PR\_CIS$ | (0.243) | (0.375) | (0.485) | (0.481) |
| | 1.216*** | 4.026*** | 2.251*** | 2.345*** |
| $PP\_CIS$ | (0.315) | (0.348) | (0.468) | (0.474) |
| | -1.161*** | 3.865*** | 3.918*** | 4.019*** |
| $RW\_CIS$ | (0.119) | (0.420) | (0.398) | (0.401) |
| | -0.126 | 2.148*** | 2.563*** | 2.570*** |
| $PW\_CIS$ | (0.125) | (0.270) | (0.274) | (0.271) |
| | -0.194 | 0.230*** | 0.270*** | 0.259*** |
| $WR\_CIS$ | (0.160) | (0.0877) | (0.0806) | (0.0775) |
| | -0.0781 | 0.0363 | 0.0243 | 0.00963 |
| $WP\_CIS$ | (0.168) | (0.0583) | (0.0764) | (0.0739) |
| | 0.701*** | 0.748*** | 0.366*** | 0.478*** |
| $RR\_LAIA$ | (0.174) | (0.207) | (0.135) | (0.140) |
| | -0.937*** | -0.655*** | -0.502** | -0.350* |
| $RP\_LAIA$ | (0.234) | (0.238) | (0.197) | (0.209) |
| | 0.534*** | 0.545** | 1.122** | 1.240*** |
| $PR\_LAIA$ | (0.121) | (0.256) | (0.454) | (0.440) |
| | 0.532*** | 0.902*** | 0.270 | 0.352 |
| $PP\_LAIA$ | (0.137) | (0.290) | (0.213) | (0.218) |

| | | | | |
|---|---|---|---|---|
| | -1.229*** | -0.548*** | -0.453** | -0.406* |
| *RW_LAIA* | (0.108) | (0.168) | (0.204) | (0.208) |
| | -0.0131 | 0.548* | 0.615 | 0.643* |
| *PW_LAIA* | (0.297) | (0.302) | (0.375) | (0.374) |
| | -0.175* | -0.754*** | -0.798*** | -0.712*** |
| *WR_LAIA* | (0.0921) | (0.0921) | (0.0814) | (0.0818) |
| | -0.101 | -0.400*** | -0.285*** | -0.150* |
| *WP_LAIA* | (0.104) | (0.117) | (0.0793) | (0.0875) |
| | 0.448*** | 0.420*** | 0.147*** | 0.255*** |
| *Other_PTA* | (0.0655) | (0.0452) | (0.0503) | (0.0533) |
| | | | | 1.016*** |
| *ln_MRT_DISTANCE_EX* | | | | (0.293) |
| | | | | -0.0607 |
| *ln_MRT_DISTANCE_IM* | | | | (0.285) |
| | | | | -0.126 |
| *MRT_PTA_EX* | | | | (0.103) |
| | | | | -0.388*** |
| *MRT_PTA_IM* | | | | (0.106) |
| *Constant* | -28.09*** | -13.29*** | | |
| | (1.050) | (1.379) | | |
| Observations | 225,632 | 220,065 | 177,434 | 177,434 |
| R-squared | 0.734 | 0.904 | | |
| Number of id | | | 19,620 | 19,620 |

Notes:
- Dependent variable is nominal value of non-natural resource exports.
- Non-Resource Exports: Total Exports – Resource Exports
- Resource Exports: Sum of Agricultural raw materials, Minerals, Fuels and Fish where: SITC Codes of Agricultural raw materials: (2 - 22 + 27 + 28), SITC Codes of Minerals: (27 + 28 + 68 + 667 + 971), SITC Codes of Fuels: (3); SITC Codes of Fish: (03).
- Specifications (1) and (2) are performed using ppml STATA command and Specifications (3) and (4) are performed using xtpoisson STATA command.
- Time, exporter and importer dummy variables are not reported in order to save space.
- Robust Standard errors (clustered by country-pair) and t-ratios in parentheses *** p<0.01, ** p<0.05, * p<0.1.

**Table A. 11: Estimation results of augmented gravity model for 6 Regional Trade agreements, natural resource exports, 1980-2015 at four-year intervals**

| VARIABLES | (1) Year fixed effect Only | (2) Year, exporter and importer fixed effect | (3) Year and pair country fixed effect | (4) Year, pair country fixed effect and MRT |
|---|---|---|---|---|
| $lngdp\_o$ | 0.663*** | 0.374*** | 0.388*** | 0.514*** |
| | (0.0198) | (0.0618) | (0.0619) | (0.0844) |
| $lngdp\_d$ | 0.894*** | 0.717*** | 0.705*** | 0.756*** |
| | (0.0366) | (0.0574) | (0.0555) | (0.0566) |
| $ln\_distw$ | -0.631*** | -1.158*** | | |
| | (0.0799) | (0.0520) | | |
| $contig$ | 0.535*** | 0.449*** | | |
| | (0.177) | (0.102) | | |
| $comlang\_off$ | 0.446** | 0.221* | | |
| | (0.181) | (0.120) | | |
| $comcol$ | 1.063*** | 0.291 | | |
| | (0.225) | (0.210) | | |
| $col45$ | 0.323** | -0.118 | | |
| | (0.156) | (0.216) | | |
| $RR\_ECOWAS$ | 1.262** | 0.876 | 1.984*** | 2.007*** |
| | (0.544) | (0.698) | (0.386) | (0.382) |
| $RP\_ECOWAS$ | 2.216*** | 1.876*** | 1.389*** | 1.401*** |
| | (0.644) | (0.519) | (0.429) | (0.438) |
| $PR\_ECOWAS$ | 1.285* | 3.246*** | 2.734*** | 2.810*** |
| | (0.737) | (0.508) | (0.777) | (0.783) |
| $PP\_ECOWAS$ | 1.760*** | 2.725*** | 1.299 | 1.383 |
| | (0.527) | (0.628) | (1.074) | (1.079) |
| $RW\_ECOWAS$ | 1.214*** | 0.930*** | 0.964*** | 0.948*** |
| | (0.250) | (0.290) | (0.297) | (0.302) |
| $PW\_ECOWAS$ | -0.367* | 1.639*** | 1.825*** | 1.874*** |
| | (0.207) | (0.312) | (0.341) | (0.344) |
| $WR\_ECOWAS$ | -0.165 | 0.629*** | 0.672*** | 0.651*** |
| | (0.252) | (0.217) | (0.204) | (0.204) |
| $WP\_ECOWAS$ | -0.359 | 0.0634 | 0.238 | 0.225 |
| | (0.280) | (0.259) | (0.260) | (0.255) |
| $RR\_COMESA$ | -0.180 | 0.0952 | 0.352 | 0.417 |
| | (0.415) | (0.522) | (0.893) | (0.896) |
| $RP\_COMESA$ | -2.233*** | -1.098** | 0.323 | 0.351 |
| | (0.368) | (0.478) | (0.421) | (0.417) |
| $PR\_COMESA$ | -1.536*** | -0.293 | -1.134*** | -1.072*** |
| | (0.404) | (0.435) | (0.340) | (0.331) |
| $PP\_COMESA$ | -1.174** | 0.306 | -1.223** | -1.158** |
| | (0.456) | (0.402) | (0.522) | (0.517) |
| $RW\_COMESA$ | -0.520* | 0.128 | 0.175 | 0.225 |
| | (0.307) | (0.289) | (0.294) | (0.297) |
| $PW\_COMESA$ | -1.713*** | -0.341* | -0.168 | -0.174 |
| | (0.229) | (0.180) | (0.163) | (0.157) |
| $WR\_COMESA$ | 0.0861 | -0.317 | -0.164 | -0.157 |
| | (0.182) | (0.226) | (0.163) | (0.165) |
| $WP\_COMESA$ | -0.649* | -0.179 | -0.0686 | -0.0482 |
| | (0.352) | (0.358) | (0.335) | (0.341) |
| $RR\_SADC$ | -1.811* | -0.951 | 0.706** | 0.763** |

| | | | | |
|---|---|---|---|---|
| | (0.940) | (0.861) | (0.358) | (0.352) |
| $RP\_SADC$ | 2.739*** | 3.394*** | 3.537*** | 3.589*** |
| | (0.343) | (0.325) | (0.658) | (0.628) |
| $PR\_SADC$ | 1.927*** | 1.874*** | 1.101*** | 1.254*** |
| | (0.540) | (0.342) | (0.112) | (0.136) |
| $PP\_SADC$ | 2.014*** | 2.597*** | 1.732*** | 1.915*** |
| | (0.340) | (0.323) | (0.387) | (0.396) |
| $RW\_SADC$ | 1.842*** | 2.328*** | 2.083*** | 2.030*** |
| | (0.435) | (0.402) | (0.310) | (0.308) |
| $PW\_SADC$ | 0.725*** | 0.932*** | 1.003*** | 1.103*** |
| | (0.228) | (0.162) | (0.150) | (0.164) |
| $WR\_SADC$ | -0.890** | 0.0668 | 0.270 | 0.303 |
| | (0.359) | (0.359) | (0.330) | (0.348) |
| $WP\_SADC$ | -0.185 | 0.684*** | 0.634*** | 0.687*** |
| | (0.233) | (0.260) | (0.238) | (0.242) |
| $RR\_PAFTA$ | -0.667** | -1.120*** | 0.0849 | 0.0726 |
| | (0.263) | (0.259) | (0.573) | (0.570) |
| $RP\_PAFTA$ | 0.603** | -0.549 | 0.291 | 0.225 |
| | (0.285) | (0.339) | (0.387) | (0.376) |
| $PR\_PAFTA$ | -2.210*** | -0.0153 | 0.506** | 0.463* |
| | (0.217) | (0.320) | (0.241) | (0.237) |
| $PP\_PAFTA$ | -0.924** | -0.00900 | -0.530 | -0.567 |
| | (0.406) | (0.474) | (0.370) | (0.371) |
| $RW\_PAFTA$ | 0.659*** | -0.713*** | -0.725*** | -0.739*** |
| | (0.213) | (0.259) | (0.264) | (0.257) |
| $PW\_PAFTA$ | -0.909*** | -0.372*** | -0.374*** | -0.401*** |
| | (0.183) | (0.121) | (0.122) | (0.120) |
| $WR\_PAFTA$ | -0.717*** | 0.944*** | 0.478*** | 0.478*** |
| | (0.210) | (0.276) | (0.143) | (0.147) |
| $WP\_PAFTA$ | -0.0656 | 0.488*** | 0.267** | 0.249* |
| | (0.185) | (0.175) | (0.136) | (0.133) |
| $RR\_CIS$ | 1.340*** | 4.104*** | 2.452*** | 2.595*** |
| | (0.269) | (0.498) | (0.437) | (0.456) |
| $RP\_CIS$ | 2.880*** | 3.958*** | 2.428*** | 2.554*** |
| | (0.256) | (0.416) | (0.484) | (0.499) |
| $PR\_CIS$ | 0.157 | 4.304*** | 2.019*** | 2.108*** |
| | (0.227) | (0.434) | (0.596) | (0.614) |
| $PP\_CIS$ | 1.721*** | 4.142*** | 2.506*** | 2.537*** |
| | (0.580) | (0.454) | (0.473) | (0.469) |
| $RW\_CIS$ | 1.921*** | 2.334*** | 2.410*** | 2.513*** |
| | (0.208) | (0.333) | (0.343) | (0.355) |
| $PW\_CIS$ | 0.0404 | 1.844*** | 2.111*** | 2.125*** |
| | (0.280) | (0.322) | (0.355) | (0.354) |
| $WR\_CIS$ | -1.853*** | 0.332*** | 0.399*** | 0.433*** |
| | (0.171) | (0.115) | (0.122) | (0.128) |
| $WP\_CIS$ | -0.617** | -0.0136 | 0.243** | 0.229** |
| | (0.255) | (0.155) | (0.109) | (0.109) |
| $RR\_LAIA$ | 1.100*** | 0.583* | 0.323 | 0.381 |
| | (0.307) | (0.322) | (0.342) | (0.346) |
| $RP\_LAIA$ | 0.936*** | -0.126 | 0.183 | 0.153 |
| | (0.312) | (0.332) | (0.496) | (0.478) |
| $PR\_LAIA$ | 0.308 | 0.670** | 1.753*** | 1.796*** |
| | (0.353) | (0.341) | (0.357) | (0.373) |
| $PP\_LAIA$ | 0.403 | 0.659* | 0.383 | 0.408 |

| | | | | |
|---|---|---|---|---|
| | (0.254) | (0.351) | (0.320) | (0.322) |
| *RW_LAIA* | 1.354*** | 0.189 | 0.141 | 0.175 |
| | (0.205) | (0.176) | (0.181) | (0.185) |
| *PW_LAIA* | 0.376** | 0.195 | 0.156 | 0.167 |
| | (0.187) | (0.179) | (0.158) | (0.154) |
| *WR_LAIA* | -0.366 | 0.839*** | 0.866*** | 0.915*** |
| | (0.289) | (0.305) | (0.335) | (0.333) |
| *WP_LAIA* | -0.228 | 0.418 | 0.262 | 0.261 |
| | (0.292) | (0.285) | (0.307) | (0.302) |
| *Other_PTA* | 0.412*** | 0.166** | 0.137** | 0.186** |
| | (0.129) | (0.0813) | (0.0642) | (0.0733) |
| *ln_MRT_DISTANCE_EX* | | | | 1.506** |
| | | | | (0.587) |
| *ln_MRT_DISTANCE_IM* | | | | 0.537 |
| | | | | (0.624) |
| *MRT_PTA_EX* | | | | 0.0649 |
| | | | | (0.151) |
| *MRT_PTA_IM* | | | | -0.0406 |
| | | | | (0.181) |
| *Constant* | -24.02*** | -5.466*** | | |
| | (1.523) | (2.089) | | |
| Observations | 225,632 | 220,065 | 148,293 | 148,293 |
| R-squared | 0.429 | 0.735 | | |
| Number of id | | | 16,243 | 16,243 |

Notes:
- Dependent variable is nominal value of natural resource exports.
- Resource Exports: Sum of Agricultural raw materials, Minerals, Fuels and Fish where: SITC Codes of Agricultural raw materials: (2 - 22 + 27 + 28), SITC Codes of Minerals: (27 + 28 + 68 + 667 + 971), SITC Codes of Fuels: (3); SITC Codes of Fish: (03).
- Specifications (1) and (2) are performed using ppml STATA command and Specifications (3) and (4) are performed using xtpoisson STATA command.
- Time, exporter and importer dummy variables are not reported in order to save space.
- Robust Standard errors (clustered by country-pair) and t-ratios in parentheses *** p<0.01, ** p<0.05, * p<0.1.

**Table A. 12: Export structures for selected regional trade agreements according to the abundance of natural resource and by destination, average 2005-2014**

| RTA | Total Exports | | | Resource Exports | | | Non- Resource Exports | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total Exports (in thousands of dollars) | Total Intra regional Exports (% Total Exports) | Total Extra regional Exports (% Total Exports) | Total Resource Exports (% Total Exports) | Total Intra regional Exports (% Total Exports) | Total Extra regional Exports (% Total Exports) | Total Non-Resource Exports (% Total Exports) | Total Intra regional Exports (% Total Exports) | Total Extra regional Exports (% Total Exports) |
| **CAN** (Andean Community) | 101163011,5 | 7,5% | 92,5% | 67,9% | 2,3% | 65,7% | 32,1% | 5,2% | 26,8% |
| **CEMAC** (Economic and Monetary Community of Central Africa) | 35701765,7 | 2,2% | 97,8% | 92,2% | 0,8% | 91,4% | 7,8% | 1,4% | 6,4% |
| **CIS** (Commonwealth of Independent States) | 610300000 | 17,4% | 82,6% | 69,5% | 5,1% | 64,4% | 30,5% | 12,3% | 18,2% |
| **COMESA** (Common Market for Eastern and Southern Africa) | 103087905,5 | 7,3% | 92,7% | 69,2% | 2,0% | 67,2% | 30,8% | 5,3% | 25,5% |
| **EAC** (East African Community) | 10546900,1 | 18,7% | 81,3% | 30,2% | 3,0% | 27,2% | 69,8% | 15,7% | 54,1% |
| **ECOWAS** (Economic Community of West African States) | 113592810,2 | 8,6% | 91,4% | 83,8% | 5,1% | 78,6% | 16,2% | 3,4% | 12,8% |
| **GCC** ( Cooperation Council for the Arab States of the Gulf) | 745400000 | 5,5% | 94,5% | 81,8% | 1,6% | 80,2% | 18,2% | 4,0% | 14,3% |
| **LAIA** (Latin American Integration Association) | 836100000 | 16,3% | 83,7% | 37,2% | 3,9% | 33,4% | 62,8% | 12,4% | 50,3% |
| **PAFTA** (Pan-Arab Free Trade Area) | 1003500000 | 9,9% | 90,1% | 80,4% | 3,2% | 77,2% | 19,6% | 6,7% | 12,9% |
| **MERCOSUR** (Southern Common Market) | 346300000 | 13,6% | 86,4% | 39,1% | 2,1% | 37,0% | 60,9% | 11,5% | 49,4% |
| **SACU** (Southern African Customs Union) | 88334367,7 | 9,6% | 90,4% | 48,6% | 2,3% | 46,3% | 51,4% | 7,3% | 44,1% |
| **SADC** (Southern African Development Community) | 166731581,3 | 15,4% | 84,6% | 66,0% | 4,9% | 61,1% | 34,0% | 10,5% | 23,5% |
| **WAEMU** (West African Economic and Monetary Union) | 19153908,5 | 13,7% | 86,3% | 48,1% | 5,2% | 42,9% | 51,9% | 8,4% | 43,4% |

SOURCE OF DATA: UNCTAD Statistics
Calculated by author
[1]Resource Exports: Sum of Agricultural raw materials, Minerals and Fuels, where: SITC Codes of Agricultural raw materials: 2 - (22 + 27 + 28), SITC Codes of Minerals: 27 + 28 + 68 + 667 + 971, SITC Codes of Fuels: 3
[2]Non Resource Exports : Total Exports – Resource Exports

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