

Economic Interactions based on Free Trade Agreements between European Union and African Countries: a panel VAR approach

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July, 2017

Abstract: The next complete ratification of Economic Partnership Agreements (EPAs) between European Union and African countries leads us to analyze the economic interactions existing between the two geographic entities and based on the past ACP-EU² free trade agreements. Precisely, the work consists to assess through a panel VAR model, the real effects of this cooperation on economic growth and trade balance of Sub-Saharan African countries on one side, and on the European Union economy on the other side. The exploration period going from 1986 to 2015. Once the analysis performed, first we find that the European Union takes profit from the deficit of African countries's trade balance through the conditions of agreements and reacts positively to an improvement of African countries economic growth, signatories of the agreements. Second, the level of African countries trade balance is not linked to their economic performance, but linked to the European Union demand of raw materials that African countries are doted, causing for African economies, a dependence vis-a-vis of European Union economy. The African economic structure is not advanced to produce final consumption goods that can be competitive than those of developing countries² on world markets and consequently have a positive effect on the level of their trade balance. With these results, we think that, if the past trade agreements have helped European Union aggregate economy to take enormously gains, nothing can say that the future economic agreements didn't insure the continuity. It is so important for African decision makers to do very careful with the total ratification of future economic partnership agreements and take the appropriate economic decisions.

JEL Codes : C3, C5, F1, F4, F6

Keywords: Trade agreements, economic partnership agreements, trade balance, economic growth, European Union, Africa, panel VAR.

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² ACP-EU: Sub Saharan Africa, Caribbeans and Pacific - European Union

1. Introduction and justification

For over a half-century that the European Union and the Sub-Saharan African countries maintain economic cooperation relations. These relations were based on two main axes: trade on the one hand, technical and financial assistances on the other hand. These two aspects of cooperation have taken root in the ACP-EU Partnership Agreements (Sub-Saharan Africa, Caribbean and Pacific - European Union) ratified by the two great geographic entities. The real objective of the agreements was to help ACP countries to integrate gradually the global economy and benefit from world development factors. If these agreements appeared beneficial to the ACP countries at the beginning of their implementation, some voices began to arise from the moment when African countries found that the agreements were no longer beneficial to them. Thus, according to the previous reports of Lomé and Cotonou agreements, the share of ACP countries in international trade has fallen from 7% in 1975 to 3% in 2009, affecting then the different levels of African countries trade balances (see Appendix 5.3). The supposed dissymmetrical ACP-EU agreements have shown their limits. For former Kenyan Minister Georges Saitoti, “ACP-EU economic cooperation has not only provided a source of raw materials for European industries, but has also made it possible to forge strong economic ties that have developed and consolidated over time. But these agreements are not necessarily beneficial for African countries”.

Face criticisms, the European Union has decided to propose a new trade agreements known as the Economic Partnership Agreements. The articles 36 and 37 of the Cotonou Agreement set the framework for these new free trade agreements. Despite the fact that some African countries have partially ratified these new agreements, African economics and thinkers express a great distrust against the submitted new agreements. Today free trade is decried by some geographical entities, pioneers of this economic trend. In a world of imperfect competition, free trade appears today as a way to oppress countries without capacity of production to compete with the giants of world trade, and this penalize their domestic markets. Again, we have the pioneering free trade’s entities which are now against the terms of free trade. We illustrate this latter assertion by the exit of the United Kingdom from the European Union (BREXIT) for example and the desire to brake the transatlantic agreements by the new tenant of the White House (President Donald Trump); agreements that would soon be repealed.

According to the new agreements submitted to African countries, Economic Partnership Agreements (EPAs) are designed to promote the economic development of ACP countries through free trade. These agreements would lead to an immediate elimination of custom tariffs on African countries products that enter into the economy area of the European Union. Next, the progressive abolition of customs tariffs on European Union goods that enter in the African countries area, signatories of the agreements. The aim is to improve market access for ACP countries, to strengthen their regional economic integration and to help to advance in their institutional reforms. The EPAs submitted by the European Union seem to be for African economists, a revisit of ACP-EU economic cooperation

agreements that visibly have not been really beneficial for African countries. The concern of African economists coupled with their mistrust leads us to question the literature on the effect of free trade on economic growth of countries that are open to international trade or that have ratified free trade agreements.

For the vast majority of economists, free trade is generally perceived as a good thing, a good policy. For developing countries, for example, free trade is an integration channel to the global market and a way to acquire gains from trade through learning. However, it should be noted that in a rigorous manner, free trade is linked to the perfect competition which is not the case in the current world of imperfect competition. For developed countries for example, free trade agreements allow them to protect their economies, create jobs and above all, support their economic growth. Traditional economic literature has always argued that open economies trading with other countries grow faster than closed economies.

Grossman and Helpman (1991), Barro and Sala-i-Martin (1995), among others, argue that, countries which ratify free trade agreements have great ability to develop by borrowing the technological factor from the rest of the world. Thus, the outward-oriented economies will have a high level of growth compared to the inward-oriented economies. Trade liberalization or free trade is seen as a source of economic convergence and a key factor of economic development. Such ideologies on the effects of free trade have been confirmed by empirical studies (Yanikkaya, 2003; Chandran and Munusamy, 2009). Several papers supporting or being against this economic trend have also been performed (Harrison, 1996; Capolupo and Celi, 2008; Edwards, 1998; Frankel and Romer, 1999; Levine and Renelt, 1992; Irwin and Tervio, 2002; Grossman and Helpman, 1990). Although some studies in the economic literature often demonstrate a positive correlation between free trade and growth, but others do not provide an accurate answer and do not elucidate empirically the relationship among them. The ambiguity of the nature of the relationship is found even in the empirical results available in the literature.

If Yanikkaya (2003) has shown that free trade has a positive effect on growth in developing countries, some authors as Harrison (1996), Krugman (1994) and Rodríguez and Rodrik (2001) have emit some doubt on the significantly and the robustness of the benefits of free trade on economic growth. For Harrison (1996), Rodríguez and Rodrik (2001) and Wacziarg and Welch (2008), free trade has a negative effect on the economic growth. Gries and Redlin (2012) show that the international integration through the free trade is a beneficial strategy for growth. There is a positive causality relation between trade and growth and vice versa; but this result is only valid in long run. For the authors, even if the relation in long run is positive, the short run dynamic is negative for low-income countries on the one side and positive for high-income countries on the other side. This divergence of results is due to the lack of technological factor for low-income countries and sufficient technology allocation for high-income countries. According to this latter paper, we therefore agree that the relationship between free

trade and growth is not universally positive. For Grossman and Helpman (1991), if the effective sharing of the technological factor is introduced into free trade agreements between countries, then these agreements will stimulate the economic growth of the signatories's countries. Free trade agreements allow countries to be developed economically when the technological factor, industrial development are integrated into the agreements. This is the Learning-by-doing model developed by Lucas (1988) and Young (1991). There are enormous conditions to respect before benefit for free trade agreements and, above all, more cautions are needed to ensure that there are no economic losses after ratification of the agreements. Thus, free trade agreements between industrialized and developing countries that not incorporating effectively the technological factor couldn't be beneficial for the developing countries. The lack of transfer of the technological factor from the countries of the European Union to the ACP countries is one of the criticisms of the ACP-EU agreements.

The purpose of this paper is to analyze the effects of the past ACP-EU agreements, with the aim of learning lessons. What have we learned from this past cooperation? The knowledge of these lessons is deemed necessary in order to have a clear idea of the effects of these past agreements but also to take appropriate decisions face the complete ratification of the future economic partnership agreements which officially are supposed to help African countries to be developed quickly and to converge towards developed countries. It is commonly known that, it is important to carry out an assessment of the effects of the old policy before implementing a new one. We think that, before going fast in the ratification of these new economic partnership agreements, there would be necessary to assess the effect of the past cooperation, the ACP-EU trade agreements effects on African countries economic activities. Little research papers have examined this issue. It is why, we decide to analyze this issue in the goal to fill the gaps in the literature. More precisely, our paper on one side, seeks to analyze the different interactions existing between the European Union economy and those of African countries and their trade balances. On the other side, the paper seeks to evaluate the real effects of the cooperation on the economic activities of the two geographic entities. In this way, our paper wants to analyze firstly, the effect of European Union economy on African countries economies. Secondly, it is to see if African countries economic growth react to an improvement of European Union's economic activities and vice versa. Thirdly, we analyze the incidence of these past trade and economic agreements on the trade balance of African countries. Thus, to conduct very well our analysis, we have decided to use a vector autoregressive model in panel data. This kind of model helps us to analyze the effect of economic growth shock of European Union on African countries economic growth (and vice versa) and on the trade balance of African countries.

The analysis of our work is performed through the interpretation of impulse response functions, the forecast error of variance decomposition and the non-causality test developed by Dumitrescu and Hurlin (2012). As results, the analysis show first that, the European Union takes profit from the deficit of African countries trade balance through the conditions of free trade agreements and reacts positively to

an improvement of African countries economic growth, signatories of the agreements. Second, we found that the level of African countries trade balance is not linked to their economic performance, but linked to the world demand of raw materials that they are doted. The economic structure of African countries is not advanced to produce final consumption goods that can be competitive than those of developing countries on world markets of goods and services and consequently have a positive effect on the level of their trade balances. But the improvement of their trade balances cause an improvement of their economic growth. With these results, we think that, if the ACP-EU free trade agreements have helped European Union aggregate economic activities to take enormously gains, nothing can say that the future economic agreements didn't insure the continuity. It is so important for African decision makers to do very careful with the complete ratification of future Economic Partnership Agreements. It is so preferable today for African countries to search the ratification of economic and trade agreements that can help them to improve their trade balances and economic activities. And this can be possible, if the agreements include technological factor which is necessary for the economic transformation of African countries. The free trade, without technological transfers is harmful for the evolution of less competitive economies in the world.

The rest of this paper is structured as follow: the section 2 presents the methodology and the data that we use to analyze our issue. The section 3 presents and discusses the different results. The section 4 presents some important lessons for the politicians and decision makers. The section 5 concludes our work. An appendix in section 6 is presented at the end of the paper.

2. Methodology and data

In this section we present firstly the panel vector autoregressive model and secondly the data and their different properties.

2.1. The panel VAR model

2.1.1. Utilities and specification of panel VAR models

The vector autoregressive models in panel (PVAR) are a combination of the traditional VAR approach of Sims (1980) with panel data which join a temporal dimension t and a special individual dimension i . The panel VAR models are the vector autoregressive model plus a cross sectional dimension (i). They are built in the same logic of standard VAR model and have the same structure in the sense that all the variables are endogenous but a cross section dimension is added.

The panel VAR models are particularly suitable and seem perfect to analyze on the one side the interactions between economies, markets, variables; and on the other side, the effects or reactions of economic aggregates following a world, regional, financial or economic shock; this, on a set of the countries/economies taken into account in a study. The reactions or effects are analyzed through the

impulse response functions and the forecast errors of variance decomposition. However, the interaction is analyzed through the causality analysis developed by Dumitrescu and Hurlin (2012) which is an extension of the non-causality test of Granger (1969).

Before introduce the specification of our model, it is necessary to underline that the panel VAR models have three particular characteristics (see Canova and Ciccarelli, 2013). First, all variables are lagged at the same order p and this for all individual unit i (economy, countries, markets) considered in the model : they call this feature the “*dynamic interdependence*”. This mean that, from a methodological viewpoint, the implementation of the panel VAR procedure requires to impose the same underlying structure for each cross sectional unit. Second, the idiosyncratic errors terms are generally correlated across individual dimension. They call this the “*static interdependence*”. Third, the intercept, the slope and the variance of the shocks may be unit specific : we call this the “*cross sectional heterogeneity*”³.

Let present now the specification of the vector autoregressive model on panel data. The reduce form of a panel VAR model is presented as follow. Let $X_{i,t}$ be a vector of endogenous and stationary variables⁴, $\forall i = 1, \dots, N$, (N being the total number of economies, markets considered in the model) and $\forall t = 1, \dots, T$ which presented the time index. The vector of variables $X_{i,t}$ following a panel VAR model can be written as follow:

$$X_{i,t} = \beta_i + \Gamma(L)X_{i,t} + \varepsilon_{i,t}, \quad (1)$$

where $\Gamma(L) = \Gamma_1 L^1 + \Gamma_2 L^2 + \Gamma_3 L^3 + \dots + \Gamma_p L^p$ is the matrix polynomial in the lag operator L ; β_i is the vector of individual fixed-effects (specific to each country) and $\varepsilon_{i,t}$ is finally the vector of idiosyncratic errors.

2.1.2. How estimate a panel VAR model?

Like exposed in the previous subsection 4.1.1, the panel VAR parameters are estimated only on stationary data at the second order. Most time, to estimate panel data, researchers use fixed or random effects estimators. But, according to Love and Zicchino (2006), Canova and Ciccarelli (2013), it is well knowing that the fixed and random effects are inconsistent and are correlated with regressors because of the lags in the dependent variables (Nickell, 1981). To overcome to this problem, two procedures are used. We have on one hand, the orthogonal deviation known as the *Helmert procedure* and the procedure

³ For more details, see the paper of Canova and Ciccarelli (2013) for the main characteristics of the PVAR model and Boutbane et al. (2010) for the estimation

⁴ Like in the traditional VAR model, the PVAR model is applied on stationary data. So it is important to perform some unit root test like Im, Pesaran and Shin (2003) and stationary test like Hadri (2000), to see if our series present the good properties.

of the first difference. These two procedures allow to estimate a panel VAR model and to obtain consistent estimators. In this paper, we choose to use the orthogonal deviation.

2.1.3. Choice of the optimal lag p of the panel VAR and analysis of the stability

In the traditional VAR approach of Sims (1980), the optimal lag p is chosen by minimizing the information criteria of Akaike (1969), Hannan and Quinn (1979), Schwarz (1978). The principle is the same for the panel VAR model. In the panel VAR model, for the choice of the optimal lag p , Andrews and Lu (2001) have developed a criterion (Moment and model selection criteria (MMSC) based on Hansen's (1982) J statistic of over-identifying restrictions) which is an extension of traditional criteria and which must be minimized. Thus, we have in first position, the moment and model selection criteria based on the Bayesian information criteria (MBIC; Schwarz, 1978; Rissanen, 1978; Akaike, 1977). In second position, we have the moment and model selection criteria based on the Akaike information criteria (MAIC; Akaike, 1969). In third position, we have the moment and model selection criteria based on the Hannan-Quinn information criteria (HQIC).

Once the optimal lag p identified and the estimation of the model performed, it is important to check the state of the stability of the PVAR model by computing the modulus of each eigenvalue of the estimated model. Lutkepohl (2005) and Hamilton (1994) have shown that a vector autoregressive model is stable if all the modulus of the associated matrix are strictly lower to the unity. This stability analysis is used to validate empirically a vector autoregressive model. Stability implies that the VAR in panel is invertible and has a vector of infinite-order of moving average. This, provides a known interpretation of the impulse response functions and that of the forecast errors of variance decomposition estimated.

2.1.4. Impulse response functions, forecast errors of variance decomposition, causality analysis

We stated above that the panel vector autoregressive models (PVAR) were particularly suitable to analyze the interdependence among economies, markets, financial and economy environment, variables on a set of individuals or countries. These models then analyze the impact of an economic or financial disruption in a heterogeneous bloc of countries. The reactions can be analyzed through the impulse response functions and the forecast errors of variance decomposition obtained by the Cholesky decomposition. We analyze the interactions in order to establish a causal relation through the causality analysis developed by Dumitrescu and Hurlin (2012).

The non-causality test on PVAR developed by Dumitrescu and Hurlin (2012), is an extension of the Granger (1969) non-causality test which also tests heterogeneity in panel data. The starting point of the Dumitrescu and Hurlin (2012) test is presented as follows: Let $X_{i,t}^1$ and $X_{i,t}^2$, two stationary variables used in a PVAR model with an optimal lags p

$$\begin{cases} X_{i,t}^1 = \Theta_i + \sum_{j=1}^p \lambda_i^j X_{i,t-j}^1 + \sum_{j=1}^p \delta_i^j X_{i,t-j}^2 + \varepsilon_{i,t}^1 \\ X_{i,t}^2 = \Omega_i + \sum_{j=1}^p \alpha_i^j X_{i,t-j}^1 + \sum_{j=1}^p \beta_i^j X_{i,t-j}^2 + \varepsilon_{i,t}^2 \end{cases}, \quad (2)$$

with Θ_i and Ω_i , being the specific countries fixed-effects ; λ_i^j , δ_i^j , α_i^j and β_i^j , the parameters of our model $\forall j = 1, \dots, p$; $i = 1, \dots, N$, the number of countries and $t = 1, \dots, T$, the exploration period. $X_{i,t}^1$ doesn't cause $X_{i,t}^2$ if and only if the past values of $X_{i,t}^1$ do not predict $X_{i,t}^2$. Thus, according to the equation 2, we validate the following hypothesis:

$$H_0 : \alpha_i^j = 0 ; \forall j = 1, \dots, p ; \forall i = 1, \dots, N$$

Reciprocally, $X_{i,t}^2$ doesn't cause $X_{i,t}^1$ if and only if the past values of $X_{i,t}^2$ do not predict $X_{i,t}^1$. Also, according to equation 2, we validate the following hypothesis:

$$H_0 : \delta_i^j = 0 ; \forall j = 1, \dots, p ; \forall i = 1, \dots, N$$

2.2. Data

2.2.1. Choice of our variables

To achieve our goals, we select the aggregate real gross domestic product (GDP) of European Union to quantify the EU economic activity (GDP^{euu}), the real GDP of the 42 African countries⁵ (GDP_i^{Afr}) – which have signed the ACP-EU agreements – for the African countries economic activities; the levels of real exports and imports of African countries necessary to compute their trade balance (TA_i) as the fraction of exports on imports. For the trade balance, when the fraction is greater than 1, this means that the trade balance is in surplus. Otherwise, the trade balance of African countries is deficient in mean. We get all these series in the database of the *World Development Indicators* (2016) and the period of exploration going from 1986 to 2015. We choose this period in function of the availability of data of African countries. However before starting to work with the data, it is important to see if our series present the right properties. So, we need to perform some unit root tests.

2.2.2. Panel unit root tests

To be sure that the series present the right properties, we will perform in this paper four different unit root tests such us Im et al. (2003); Levin, Lin and Chu; Augmented Dickey Fuller and Phillips Perron Fisher tests on panel data. Once panel unit root tests performed, if our series in level are stationary, we will estimate the panel VAR on the series in level. Otherwise, we differentiate the non-

⁵ See Appendix 6.3

stationary variables and perform again the unit root tests. It is important to perform these tests because the panel VAR model is suitable only on stationary data. The results are summarized in table 1. They indicate that two of our series (African countries and Aggregate European Union gross domestic products) are stationary in first difference and the trade balance in contrast is stationary in level. So, to have all our series stationaries, we differentiate the series that are not stationary in level (gross domestic products of African countries and of the European Union). Once differentiated, we can perform our analysis.

After the panel unit root tests being performed, we select the stationary variables that we can use in the rest of the paper. Thus, we have $X_{i,t}$, a vector of the stationary variables presented as follow:

$$X_{i,t} = (Growth_{i,t}^{Afr}, Growth_t^{Euu}, TA_{i,t}) \quad (3)$$

with $Growth_{it}^{Afr}$ the real GDP growth of African countries, $Growth_t^{Euu}$ the real GDP growth of European Union aggregate economy and $TA_{i,t}$ the trade balance of African countries.

Table 1: Panel unit root tests

	GDP_i^{Afr}		GDP^{Euu}		TA_i
	Level (in log)	First difference	Level (in log)	First difference	Level
LLC*	4.11363 (1.0000)	-19.1543 (0.0000)	-8.50747 (0.0000)	-24.4191 (0.0000)	-4.04531 (0.0000)
IPS**	11.1499 (1.0000)	-20.0482 (0.0000)	0.57993 (0.7190)	-19.0236 (0.0000)	-3.55732 (0.0000)
ADF Fisher	41.7287 (1.0000)	531.250 (0.0000)	50.7885 (0.9984)	481.495 (0.0000)	136.286 (0.0002)
PP Fisher	54.8815 (0.9942)	546.263 (0.0000)	51.6843 (0.9979)	464.377 (0.0000)	137.576 (0.0001)

Note: * Levin, Lin and Chu; ** Im, Pesaran and Shin, ADF for Augmented Dickey-Fuller; PP for Phillips-Perron; (.) the probability associated to the statistic. TA is the African countries trade Balance. Due the fact that trade balance is stationary un level, we don't perform unit root tests on the series in difference

2.2.3. Stylized Facts

Once sure that our series present the right properties, *i.e* stationaries after transformation, we perform a statistical analysis of our data. In view of our findings presented in the table 2, first, it is clear that over these three past decades, African economies have experienced an economic growth of 3.72% and the European Union, an economic growth of 1.91%. The African economic growth is driven more

by foreign direct investments, a flamboyant consumers market, remittances and global demand for energy and non-energy commodities.

Second, African countries have on average a trade balance deficit, a state explained by the high level of imports of manufactured goods from the industrialized countries of the rest of the world. The economies of African countries depend on their imports. Apart from the agricultural and mining raw materials needed as inputs in the production process of firms in industrialized countries (trading partners), African countries don't produce enough, no manufactured goods, and this economic situation penalize the level of their trade balance.

Table 2: Descriptive statistics

Variable	Mean	Std. Dev.	Min	Max
$Growth_i^{Afr}$	3.71664	7.67524	-71.398	91.6183
$Growth^{euu}$	1.91239	1.64536	-4.48999	4.32717
TA_i	0.76815	0.38159	0.09727	2.71911

Note: $Growth^{Afr}$ for African countries economic growth : $Growth^{euu}$ for European Union economic growth; TA_i for African countries trade balance.

3. Results

We analyze our results, first by the interpretation of the impulse response functions, followed by the forecast errors of variance decomposition and we end with the interactions between variables through the causality analysis. Economic implications are given at the end of the section.

3.1. Optimal lag ad stability of our model

For the estimation of the PVAR model necessary to achieve our main goals, we have retained a number of optimal lag p equal to 1 according to the information criteria developed by Andrews and Lu (2001) and the stability of our model. According to the figure 2 and table 7 presented in appendix 6.4, our PVAR model with one lag is stable. So, we can analyze or interpret our impulse response functions.

3.2. Impulse response functions

In the analysis of impulse response functions, we start with a positive shock of African countries economic activities, followed by a trade balance deficit shock, and we end by an improvement shock of the European Union aggregate economic activity.

First, the table 8 shows the impulse response functions following an improvement shock of African countries economic activities. Visibly, the African countries economic activities shock have no effect

on their trade balance. It means that, the level of trade balance is not linked to the economic performance of African countries, but linked to the demand of African goods (raw material or not) and services on the world markets and also, to the trade agreements existing between African countries and developing countries. The African countries don't have a developed economic structure, advanced industries, technology, necessary to produce final consumption goods that can be competitive than those of developing countries on world market of goods and services and consequently have a positive effect on the level of their trade balance (surplus trade balance). However, European Union economic activity reacts positively to an improvement shock of African countries economic activities. This result is normal for economic, financial and trade agreements partners. But how explained this improvement of European Union economy on the one side, and an improvement which don't be immediate on the other side? The positive incidence of African countries economies improvement shock on European Union aggregate economy is due to the returns on foreign direct investments and on official development assistances that European Union sends to African countries to help the to improve their economic and social development. However, the returns on investments are received by European Union some periods after the investment. It is why the response is lagged of one period.

Second, the table 9 presents the effects of trade balance deficit shock on the 42 African countries and the European Union economies. In deficit in average, the increase of trade balance deficit of African countries conducts to a decrease of African countries economic growth. The African countries take a share of their growth on the exportations of raw materials (energy or not), mineral materials in which they are doted. Thus, face the decrease of world demand of raw materials, the level of their trade balance decreases, penalizing then their economic activities. In opposite, the shock of trade balance deficit has a positive incidence on European Union economic growth. It is necessary to note that, taking into account the ACP-EU agreements, a great share of importations of African countries is composed of final goods coming from European Union industries through the inputs (energy, agricultural) coming from Africa. However, knowing that, only the process of transformation creates a significant real add-value, the European Union economy takes his enormous economic gains by exporting his final goods to Africa (which is the importations of African countries) which have an economic add-value higher than their importations of raw materials from Africa (exportations of African countries). Thus, the European Union takes profit form African countries trade balance deficit through the economic and bilateral free trade agreements.

Third, in the table 10, we analyzed the effect of improvement shock of European Union economic growth on the economic growth and the trade balance of African countries. We have noticed that the economic activity of African countries slowdowns and decreases when we have an improvement of European Union economic growth. We interpret this result by the fact that, the European Union takes his wealth to African countries by taking the explosive areas of production that must boost the economic activity of African countries. For example, facing the non-payment of bilateral debts of African countries

whose weight slows down economic activity, the bilateral partners of African countries from European Union take the African countries great firms for the payment of debt. It is the case of many ports, industries, mines in African countries. However, the European Union economy shock improves the trade balance of African countries, not consequently, but significant during three years. This improvement of the level of trade balance is due to the increase of exportations of African raw materials as inputs in the production process of goods and services of European Union industries.

3.3. Forecast errors of variance decomposition

The analysis of forecast errors of variance decomposition comes to confirm the results obtained by those of impulse response functions. Like presented in the table 3, first, the evolution of African countries economic growth after a half-decade is due to 69.86% to his own innovations, 28.92% to the innovations of their trade balance and 1.2% to the innovations of European Union economic growth. Second, the evolution of trade balance is due to 98.78% to his own innovations and 1.06% to the innovations of European Union economic growth. Third, the evolution of EU economic growth is due to 87.89% to his own innovations, 11.83% to the innovations of trade balance and 0.2% to African countries economic growth.

Table 3: Variance decomposition analysis

Response Variable	Impulse variable		
	$Growth_i^{Afr}$	TA_i	$Growth^{euu}$
t = 1, 5, 10			
t	$Growth_i^{Afr}$		
1	1	0	0
5	0.6985577	0.2892094	0.0122329
10	0.5951478	0.3851422	0.0197101
	TA_i		
1	0.0007199	0.9992801	0
5	0.0015745	0.9878253	0.0106003
10	0.0014644	0.9786566	0.019879
	$Growth^{euu}$		
1	0.0003326	0.0311656	0.9685017
5	0.0028219	0.1182754	0.8789027
10	0.0026944	0.1672057	0.8300998

3.4. Causality analysis

The results of the absence of the causality test performed by the extension of Granger (1969) non-causality test and developed by Dumitrescu and Hurlin (2012) are summarized in the table 4. After the analysis of the results, the African countries trade balances and European Union economic growth cause

the economic growth of African countries respectively to the economic threshold of 1% and 10%. Second, the European Union economic growth causes the trade balance at the threshold of 5%. However, the African countries economic growth don't cause the level of trade balance and the associated probability is equal to 0.459. These results confirm those found with the analysis of the impulse response functions where the level of African countries trade balance is not linked to their economic activities but linked to the demand of raw materials on world markets. Finally, the level of economic growth of African countries ($p = 0.003$) and their trade balance ($p = 0.001$) cause respectively at the threshold of 1% the European Union economic growth. These results took from the causality analysis come to confirm all the results obtained by the impulse responses functions analysis and those obtained by the forecast errors of variance decomposition analysis.

Table 4: Results of causality analysis

Equation / Excluded	χ^2 (p-value)		χ^2 (p-value)		χ^2 (p-value)
$Growth_i^{Afr}$		TA_i		$Growth^{euu}$	
TA_i	11.435 (0.001)	$Growth_i^{Afr}$	0.548 (0.459)	$Growth_i^{Afr}$	8.892 (0.003)
$Growth^{euu}$	3.413 (0.065)	$Growth^{euu}$	5.087 (0.024)	TA_i	11.845 (0.001)
All	12.658 (0.002)	All	6.138 (0.046)	All	15.947 (0.000)

Note : Panel VAR causality Wald test; Ho : Excluded variable does not cause the Equation variable ; in (.) the probability associated to the statistics

3.5. Economic implications

According to the results obtained on the economic interactions between the European Union and the 42 African countries, first it would be important for African policy makers and decisional authorities to be very careful on the modalities of the complete ratification of Economic Partnership Agreements (EPAs). If the ACP-EU agreements have helped European Union economy to take enormously gains by guaranty the inputs necessary for their industries, and an economic environment suitable for investment, nothing can say that the new economic agreements didn't insure the continuity of the past agreements in the sense that today European Union has some economic difficulties (recession, unemployment) and controversy African countries present extreme economic potentialities to exploit. Second, it is time to African countries to search the ratification of agreements that can help them effectively to improve their trade balance and economic activities. And this could be possible, if the agreements are based on the transfer of technological factor necessary for the African countries economic transformation. The free trade agreements without technological factor transfer is today criticized, because they don't protect low and less competitive national markets.

4. Lessons for politicians and African decision makers

The ways to improve its economic transformation is what must seek African countries in the Economic Partnership Agreements. An economic transformation that could be able to allow the countries to improve their competitiveness on the international markets. In reality, Africa has enormous economic potentialities that are still untapped, unlike to the European Union which is seeking new sources of growth (green economy, ecological transition, etc.) to exploit. This is why African decision makers need to be very careful about the modalities of ratification of economic partnership agreements. They must seek to include in their agreements conditions that allow their economies to become more competitive. However how do they get there? The EPAs submitted to African countries by the European Union, propose an immediate openness of African products on the European Union's markets against a gradual openness of African markets to European products during twenty years (total opening in twenty years). At the same time, one of the objectives of the EPAs is to strengthen the regional integration of African countries. And this, given the economic realities of African countries, is contradictory and even harmful as agreements. The African countries do not produce enough manufactured goods, goods destined for final consumption. The lack of raw material processing industries for example, does not allow the economies to create more value added and to increase their exports significantly, and consequently to increase the intra-regional trade. The transformation of goods, will make African countries, price-makers and strengthen the process of regional integration. However, during the twenty years following ratification, if African countries fail to transform their economies by producing final goods of consumption, they will open themselves completely to the goods and services of the European Union, which will be more competitiveness and will destroy the domestic markets of the very unfavorable African economies. The possible consequences could be: (1) the deterioration in terms of trade, (2) the deterioration in the current and trade balance, (3) the increase in public debt to finance the current account deficit and (4) the increase in the unemployment rate because of the business bankruptcy due to the competition.

However, what can be proposed for African decision-makers to improve the competitiveness of economies through the Economic Partnership Agreements? We propose two solutions: (1) a gradual openness in return for transparency and freedom in learning developing countries technology to create and innovate like Asian countries do it in industrialized countries (universities, industries, laboratories); and this during the first decade after the ratification of the EPAs. After this step, (2) Africa needs a willingness of decision makers to finance the research and development needed to transform economies through innovation, through the creation of national champions etc. It will also be necessary to create a conducive environment to the relocation of firms through institutional reforms. The economic partnership agreements are a way for African economies to improve their competitiveness, trade balance and economic activities. But, it would be necessary for African countries to do very careful with these agreements.

5. Conclusion

This paper searches to analyze the economic interactions existing between the aggregate economic growth of European Union and the economic growth of 42 African countries, signatories of ACP-EU free trade agreements. More precisely, the work consists to evaluate the real effects of this cooperation on economic activities and trade balance of Sub-Saharan African countries on the one hand and the European Union aggregate economic activity on the other hand. To conduct very well our analysis and achieve our fixed goals, we have decided to use a vector autoregressive model on panel data on a period going from 1986 to 2015; so these last three decades.

The analysis has been performed through the interpretation of the impulse response functions, the forecast errors of variance decomposition and the non-causality test developed by Dumitrescu and Hurlin (2012). As results, first, the European Union aggregate economic activity reacts positively to an improvement shock of the economic growth of African countries, signatories of ACP-EU agreements. We explain this, by the returns on foreign investments and official development assistances of European Union to African countries, bilateral funds which are useful for African countries to improve their economic and social development. Second, the trade balance of African countries is not linked to their economic performance but linked to the demand of raw materials – that African countries are doted – on the world markets, more precisely the demand from bilateral trade partners. The economic structure of African countries is not advanced for the production of competitive goods on the world markets. They don't dispose the technology necessary to produce final consumption goods which can be competitive than those of developing countries on world market of goods and services and consequently have a positive effect on the level of their trade balance. Third, the most relevant result of our study is to have found that the European Union aggregate economy growth takes profit of the deficit of trade balance of African countries. The increase of African trade deficit causes an improvement of European Union economic growth. Thus, our work confirms the idea that the ACP-EU didn't be beneficial for African countries but have been beneficial for European Union. Face to the results found, we think that it will be preferable to be very careful with the different modalities of the complete ratification of the next Economic Partnership Agreements. If the ACP-EU agreements have helped European Union economic activity to take enormously gains by guaranty the inputs necessary for their industries, and an economic environment suitable for investment, nothing can say that the new economic agreement didn't insure the continuity. It would be so preferable today for African countries to search the ratification of economic and trade agreements that can help them to improve their trade balance and economic activity. And this can be possible, if the agreements include technological factor transfers which is necessary for the economic transformation of African countries. The free trade, without technological transfers is harmful for the evolution of less competitive economies in the world.

6. Appendix

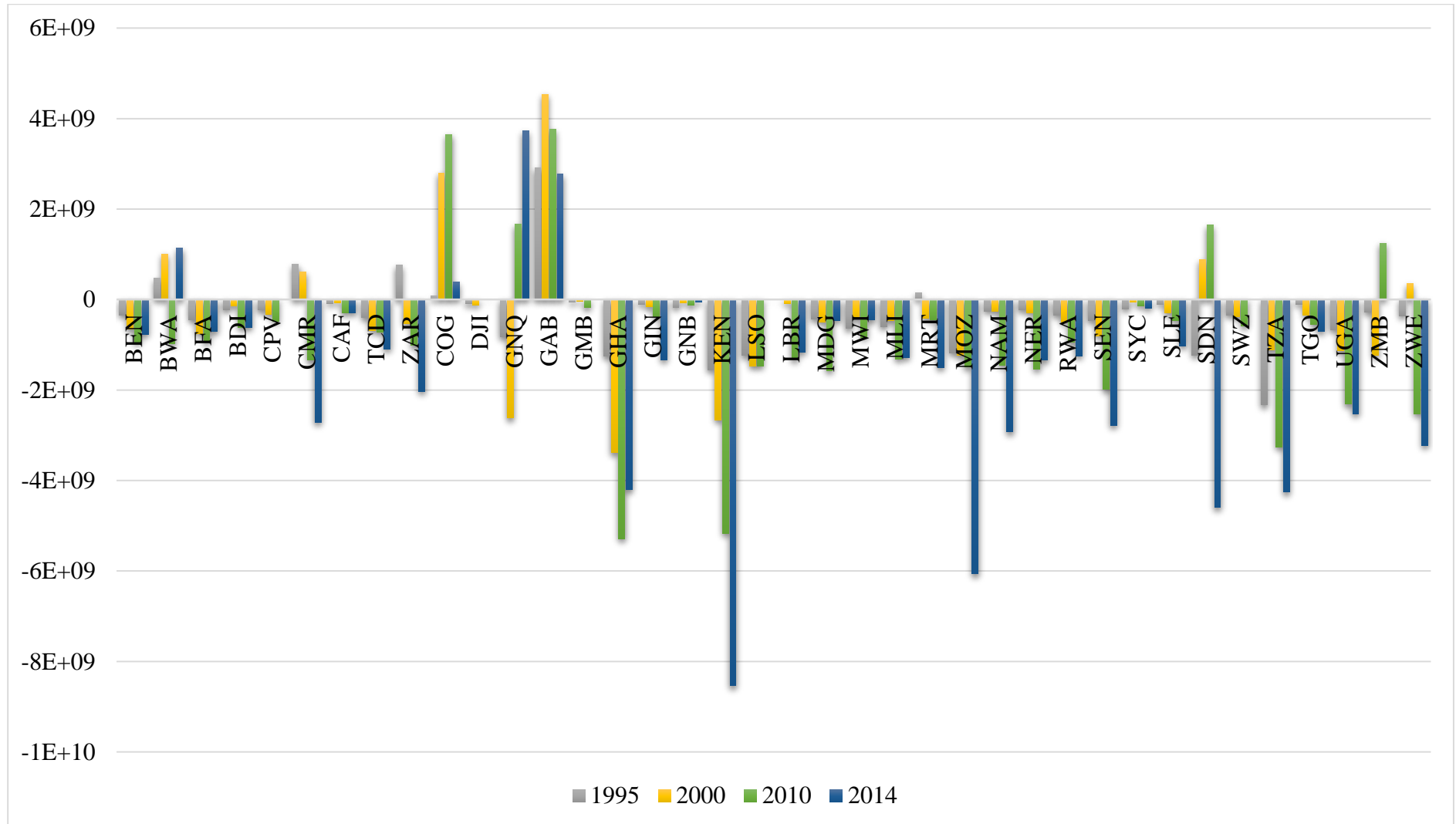
6.1. Country abbreviations

Table 5: Country abbreviations

List1	Label	List 2	Label
BEN	Benin	MDG	Madagascar
BWA	Botswana	MWI	Malawi
BFA	Burkina Faso	MLI	MLI Mali
BDI	Burundi	MRT	Mauritania
CPV	Cabo Verde	MOZ	Mozambique
CMR	Cameroon	NAM	Namibia
CAF	Central African Republic	NER	Niger
TCD	Chad	NGA	Nigeria
ZAR	Democratic Republic of Congo	RWA	Rwanda
COG	Congo	SEN	Senegal
DJI	Djibouti	SYC	Seychelles
GNQ	Equatorial Guinea	SLE	Sierra Leone
GAB	Gabon	ZAF	South Africa
GMB	Gambia	SDN	Sudan
GHA	Ghana	SWZ	Swaziland
GIN	Guinea	TZA	Tanzania
GNB	Guinea-Bissau	TGO	Togo
KEN	Kenya	UGA	Uganda
LSO	Lesotho	ZMB	Zambia
LBR	Liberia	ZWE	Zimbabwe

6.2. Evolution of trade balance of some African countries

Figure 1: Evolution of African countries's trade balance (in USD \$)



6.3. List of African countries

Table 6: List of African countries considered in our study

Angola, Benin, Botswana, Burkina Faso, Burundi, Cabo Verde, Cameroon, Central African Republic, Chad, Democratic Republic of Congo, Congo, Ivory Coast, Djibouti, Equatorial Guinea, Gabon, The Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Seychelles, Sierra Leone, South Africa, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia, Zimbabwe

6.4. Stability of our model

Figure 2: Stability of our model

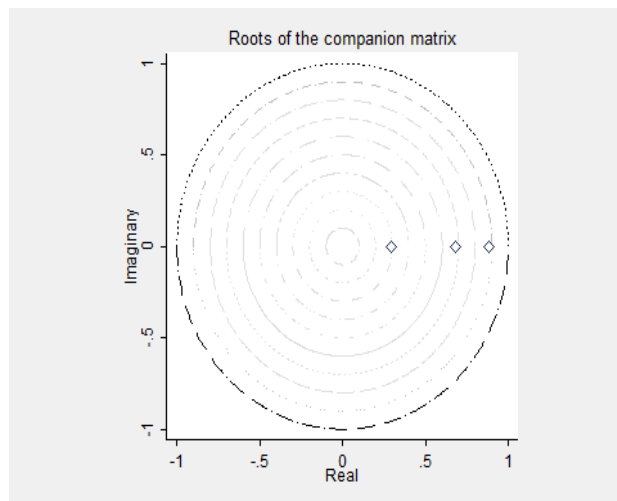


Table 7: Stability of our model

Eigenvalue		
Real	Imaginary	Modulus
0.8664929	0	0.8664929
0.6650207	0	0.6650207
0.3043971	0	0.3043971

6.5. Panel impulse response functions

Table 8: Panel impulse response functions (1/3). African economic growth shock

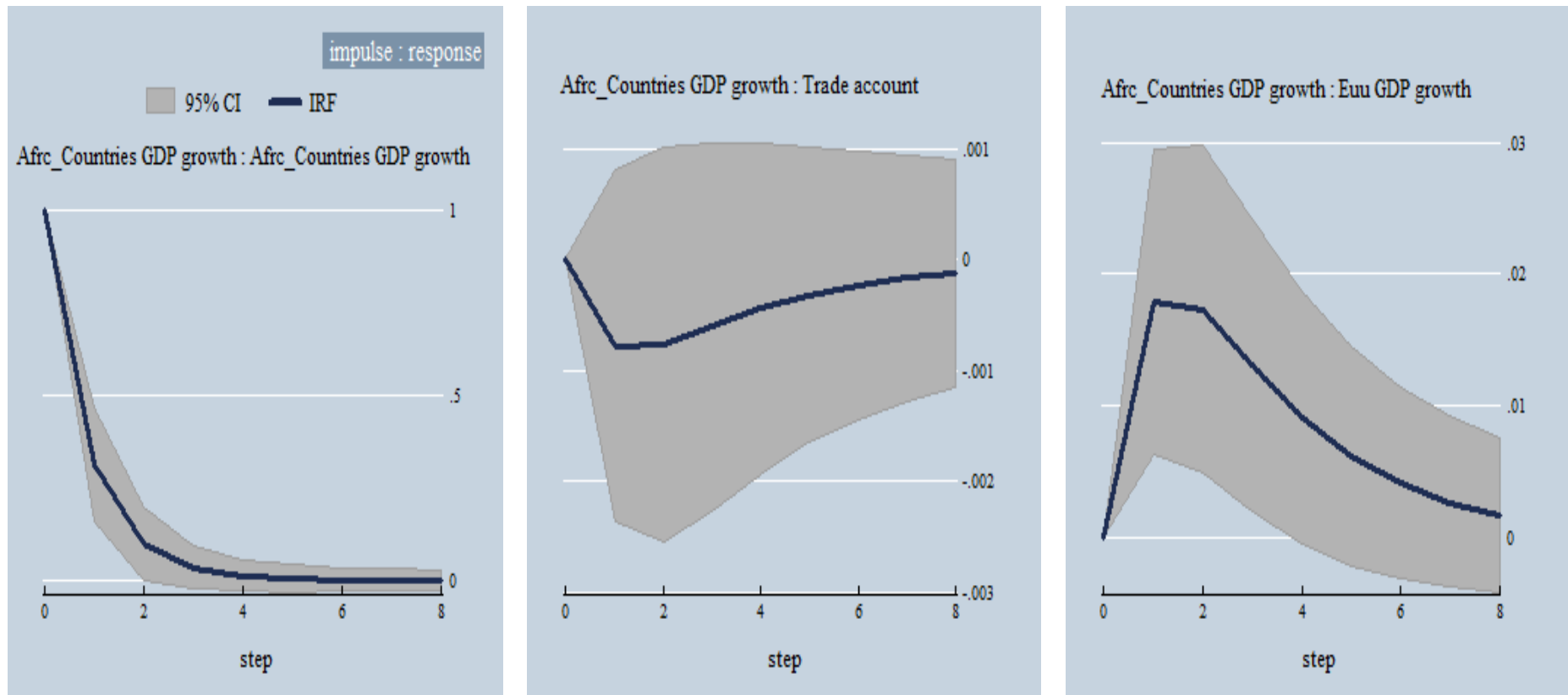


Table 9: Panel impulse response functions (2/3). African countries trade balance deficit shock

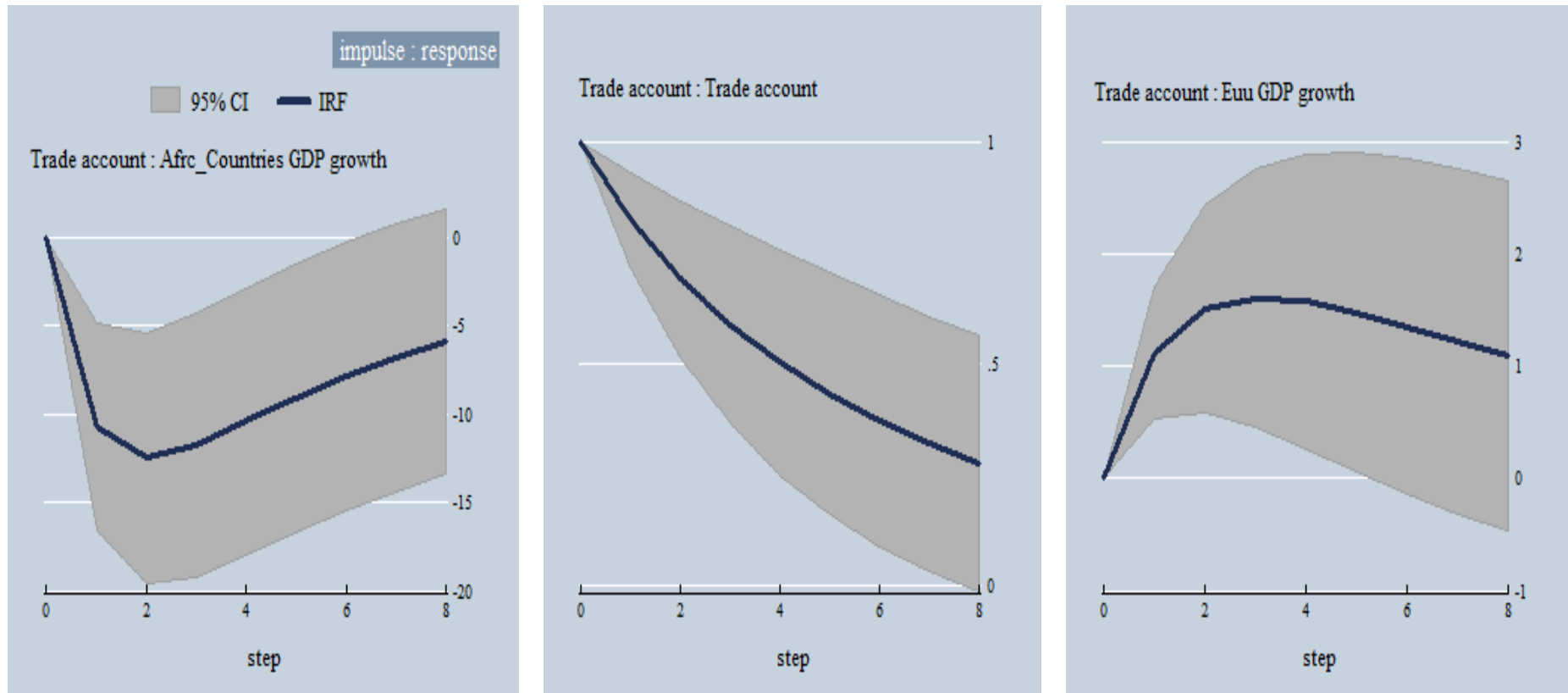
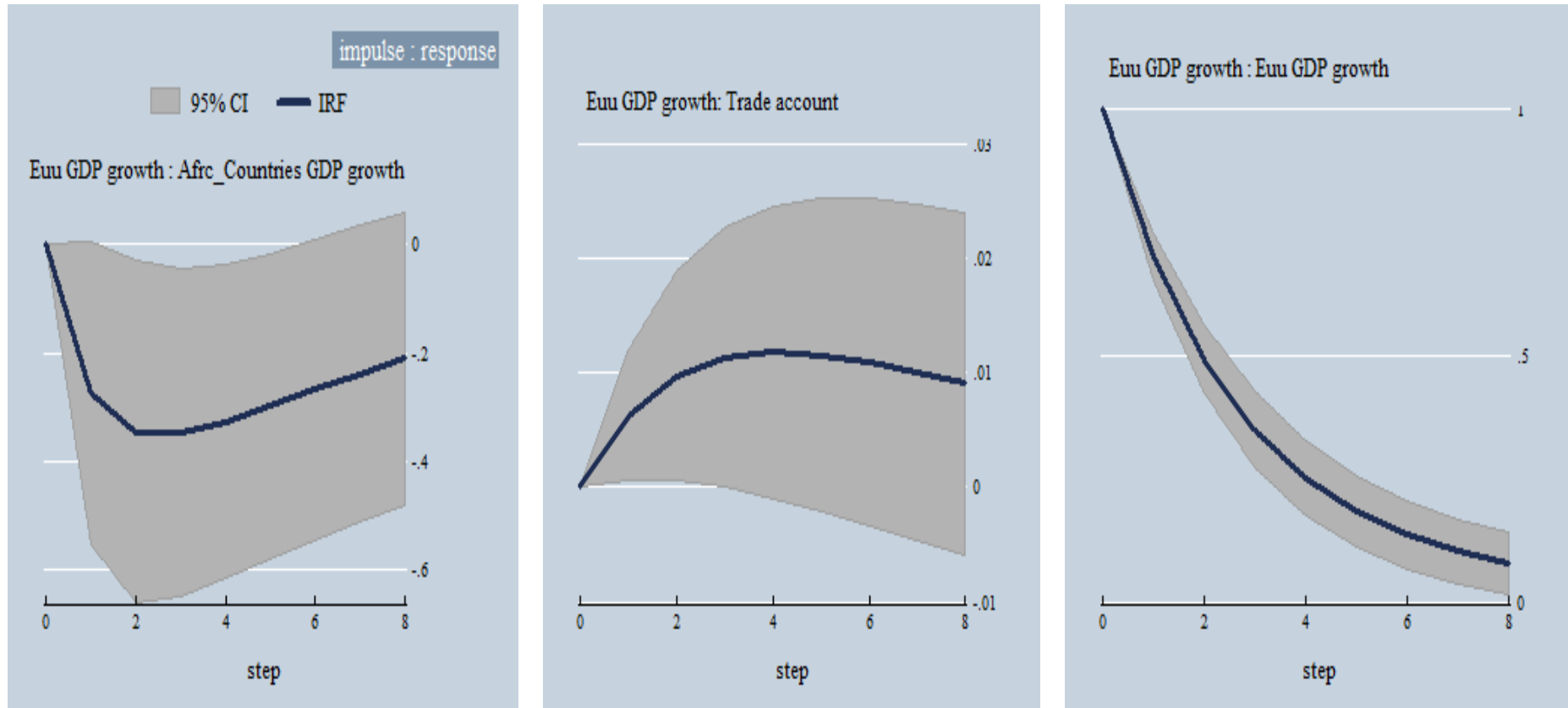


Table 10: Panel impulse response functions (3/3) . Improvement shock of European Union aggregate economy



Reference

- Akaike, H. (1969). Statistical predictor identification. *Annals of the Institute of Statistical mathematics*, 21:203–217.
- Andrews, D. and Lu, B. (2001). Consistent model and moment selection procedures for gmm estimation with application to dynamic panel data models. *Journal of Econometrics*, 101(1):123–164.
- Barro, J. and i Martin, S. (1995). Economic growth. *New York: McGraw Hill*.
- Boutbane, E., Coulibaly, D., and Rault, C. (2010). Immigration, growth and unemployment: Panel VAR evidence from OECD countries. *Manuscript*.
- Canova, F. and Ciccarelli, M. (2013). Panel vector autoregressive models. *ECB Working Paper N.1507*.
- Capolupo, R. and Celi, G. (2008). Openness and economic growth: A comparative study of alternative trading regimes. *Economie Internationale*, 4(116):5–35.
- Chandran, V. and Munusamy (2009). Trade openness and manufacturing growth in Malaysia. *Journal of Policy Modeling*, 31:637–647.
- Dumitrescu, E. I. and Hurlin, C. (2012). Testing for granger non-causality in heterogeneous panels. *Economic Modelling*, 29(4):1450–1460.
- Edwards, S. (1998). Openness, productivity and growth: What do we really know? *Economic Journal*, 18:383–398.
- Frankel, J. and Romer, D. (1999). Does trade cause growth? *American Economic Review*, 89:379–99.
- Granger, C. (1969). Investigating causal relations by econometric models and crossspectral methods. *Econometrica: Journal of the Econometric Society*, pages 424–438.
- Gries, T. and Redlin, M. (2012). Trade openness and economic growth: A panel causality analysis. *Center for international economics Working Paper No. 2011-06*.
- Grossman, G. and Helpman, E. (1990). Comparative advantage and long-run growth. *American Economic Review*, 80:796–815.
- Grossman, G. M. and Helpman, E. (1991). Innovation and growth in the global economy. *MIT Press, Cambridge, MA*.
- Hadri, K. (2000). Testing for stationarity in heterogeneous panel data. *Econometric Journal*, 3(2):148–61.
- Hamilton, D. J. (1994). Time series analysis. Princeton University Press.
- Hannan, E. and Quinn, B. (1979). The determination of the order of the an autoregression. *Journal of the Royal Statistical Sociaty, Serie B*, 41:190–191.
- Harrison, A. (1996). Openness and growth: A time-series, cross-country analysis for developing countries. *Journal of Development Economics*, 48:419–447.

- Im, K. S., Pesaran, M. H., and Shin, Y. (2003). Testing for unit roots in heterogeneous panels. *Journal of Econometrics*, 115:53–74.
- Irwin, D. and Tervio, M. (2002). Does trade raise income? Evidence from the twentieth century. *Journal of International Economics*, 58:1–18.
- Krugman, P. (1994). The myth of Asia's miracle. *Foreign Affairs*, 73(6):62–78.
- Lardic, S. and Mignon, V. (2002). Econométrie des séries temporelles macroéconomiques et financières. *Economica*.
- Levine, R. and Renelt, D. (1992). A sensitivity analysis of cross-country growth regressions. *American Economic Review*, 82(4):942–963.
- Love, I. and Zicchino, L. (2006). Financial development and dynamic investment behavior: evidence from a panel var. *The Quarterly Review of Economic and Finance*, 46:190–210.
- Lucas, R. E. J. (1988). On the mechanics of economic development. *Journal of Monetary Economics*, 22(1):3–42.
- Lutkepohl, H. (2005). New introduction to multiple time series analysis. New York: Springer.
- Nickell, S. J. (1981). Biases in dynamic models with fixed effects. *Econometrica*, 49:1417–1426.
- Rodríguez, F. and Rodrik, D. (2001). Trade policy and economic growth: A skeptic's guide to the cross-national evidence. In Bernanke, B. and Rogoff, K., editors, *NBER macroeconomics annual 2000*, page 261–325.
- Schwarz, G. (1978). Estimating the dimension of a model. *The Annals of Statistics*, 6:461–464.
- Sims, C. A. (1980). Macroeconomics and reality. *Econometrica*, 48:1–48.
- Wacziarg, R. and Welch, K. H. (2008). Trade liberalization and growth. *World Bank Economic Review*, 22(2):187–231.
- Yanikkaya, H. (2003). Trade openness and economic growth: a cross-country empirical investigation. *Journal of Development Economics*, 72:57–89.
- Young, A. (1991). Learning by doing and the dynamic effects of international trade. *Quarterly Journal of Economics*, 106(2):369–405.