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UMR 7522

Documents de travail

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Document de Travail n° 2018 – 09

Janvier 2018

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Théorique et Appliquée**
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Regional Integration: Do intra-African trade and migration improve income in Africa?*

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Abstract

Regional integration in Africa is a subject of great interest, but its impact on income has not been studied sufficiently. Using cross-sectional and panel estimations, this paper examines the impact of African integration on real per capita income in Africa. To do this, we consider intra-African trade and migration flows as quantitative measures reflecting the intensity of regional integration. In order to address the endogeneity concerns, we use a gravity-based IV strategy. Our results show that, from a long-term perspective, African integration has not been strong enough to generate a positive, significant and robust impact on real per capita income in Africa. However it appears to be significantly income-enhancing in the short term but only through inter-country migration. These results are robust to a wide range of specifications. Further analysis shows that economic diversification, financial development and the quality of transport and telecommunication infrastructure significantly affect the impact of intra-African trade on per capita income. Their improvement would make intra-African trade income-improving. Our policy recommendations have been formulated in this direction.

Keywords: Income per capita, Trade, International Migration, Economic Integration, Africa.

JEL classification: E64, F14, F22, F15, O55.

*This paper was produced as part of a research visit to the AfDB. I would like to thank AfDB and AERC for funding the research stay that led to this study. I would also like to thank John Anyanwu for his comments and suggestions that have enriched this paper. The presentation of the paper at the AfDB research seminar helped to improve the quality of the paper. I thank the economists of the BAD for their comments during this seminar (Amadou Boly, Anthony Simpasa, Thierry Kangoye, Linguère Mously Mbaye).

1 Introduction

Despite its strong economic growth since the beginning of the 21st century, Africa still faces the challenge of inclusive growth and poverty reduction.¹ The integration of African economies is seen by African leaders as well as African and international organizations as a powerful tool to promote inclusive growth and a significant reduction of poverty in Africa. For the African Development Bank (AfDB), regional integration is imperative for Africa. The “Integrate Africa” priority is one of the High Five priorities of the new AfDB President, Akinwumi Adesina.² As a result, the Bank has adopted a new Regional Integration Policy and Strategy for 2014-2023 (RIPoS) to help operationalize this commitment. Increased willingness to support the integration of African economies is also expressed by institutions such as the World Bank and the United Nations Economic Commission for Africa (UNECA), to name just a few. Similarly, African states themselves have formed several blocks of regional integration³ across the continent with the same intent to strengthen their economic ties, necessary for their economic development.

Although the interest in regional integration in Africa has increased in recent years, this ambition is not new because it is at the origin of the creation of most African institutions, many of them existing since the 60s. Despite the efforts made at various levels to achieve this goal, statistics on the current state of African integration are not sparkling. Intra-African trade, which is one of the main quantitative insights into this integration, remains very low at 15% of Africa’s total trade in 2015, far behind that of ASEAN (Association of Southeast Asian Nations) at 24% and the European Union (EU) at 61% as shown in Figure 1. Consequently, the intra-African trade openness rate is only 6.4% compared with 22% for ASEAN and 39.4% for the EU. Several reasons are often cited to explain this poor performance, including the striking lack of national and regional infrastructure, the still too high costs of intra-regional trade, and the strong specialization of African economies in the export of

¹Africa’s average economic growth has doubled since the turn of the century compared with the previous two decades (the 1980s and 1990s) and reached 4.5% (average over the period 2000-2015), thus exceeding global economic growth by two points. For sub-Saharan Africa, the average growth rate is 5% over the same period.

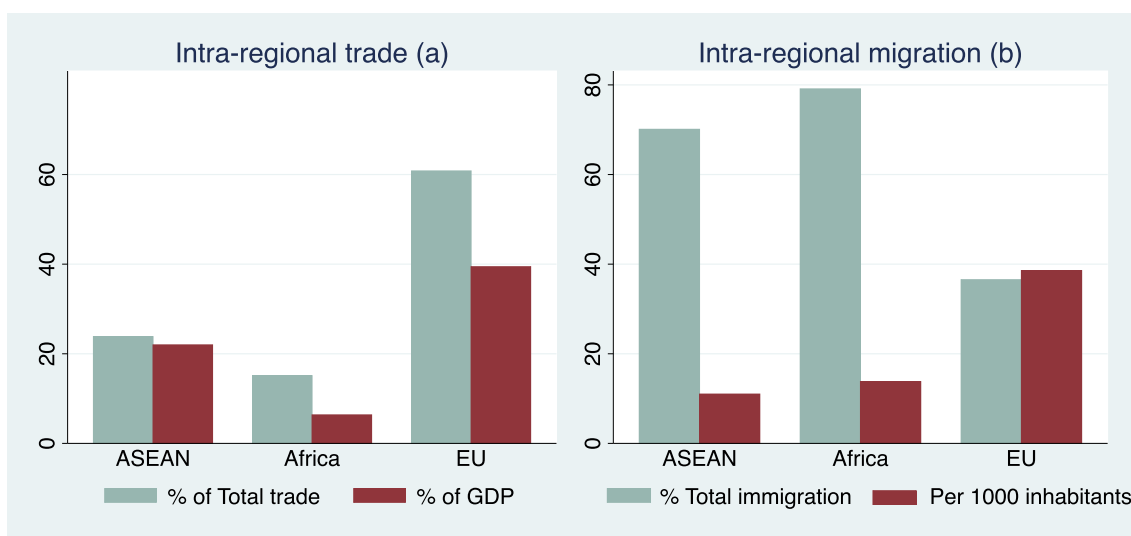
²This commitment was preceded by several other integration initiatives (among others, the Economic Cooperation and Regional Integration Policy in 2000; the Regional Integration Strategy (RIS) for 2009-2012, extended to 2013; a series of Regional Integration Strategy Papers (RISPs) to operationalize the RIS).

³Several regional economic communities exist: the Arab Monetary Union (UMA), the Common Market for Eastern and Southern Africa (COMESA), the Economic Community of Central African States (ECCAS), the Economic Community of West African States (ECOWAS) and the Southern African Development Community (SADC). Several regional trade integration agreements have been signed in these different blocs (see Table A-2 in the Appendix).

commodities (see [Limao and Venables, 2001](#); [Longo and Sekkat, 2004](#)).

In addition to intra-regional trade, the degree of mobility of people in a regional space (intra-regional migration) is also a quantitative reflection of integration. This dimension is often overlooked in studies, while people’s mobility is by definition one of the key foundations of regional integration. The record on intra-African migration is less dramatic, although improvement is needed. Indeed, nearly 80% of immigrants in Africa in 2015 are Africans, ahead of ASEAN with an intra-regional migration rate of 70% and the EU with a rate of 36.5%. However, in terms of the population ratio, Africa with an intra-regional migration of 14 per 1000 inhabitants in 2015 is far behind the EU at 39 per 1000 but ahead of ASEAN whose ratio is 11 per 1000 inhabitants (see Figure 1, b).

Figure 1: Intra-regional Trade and Migration in 2015



Notes: Data used to build these graphs are from the World Bank and United Nations for bilateral migration and the United Nations Conference on Trade and Development (UNCTAD) for bilateral trade.

The contrast between the long-standing political will to promote integration in Africa and the actual data reflecting the degree of integration of African economies raises several questions. Has regional integration in Africa really contributed to improved incomes in African countries? Is there a dominant channel between intra-African migration and trade? Can the impact of integration on income and growth in Africa be improved? By what mechanisms? These questions are the basis of this study. Indeed, although several studies have been devoted to regional integration in Africa, none of them provides answers to these questions to the best of our knowledge. Existing studies generally focus on intra-African trade or the impact of monetary unions (among others, [Limao and Venables, 2001](#); [Anyanwu, 2003](#); [Longo](#)

and Sekkat, 2004; Anyanwu, 2014) but do not address the issue of the impact of African integration in quantitative terms. Similarly, neither intra-African migration nor its impact on income and growth have been studied.

While the impact of openness, in particular trade openness, has been widely studied in the literature (among others Dollar, 1992; Edwards, 1992; Ben-David, 1993; Sachs and Warner, 1995; Frankel and Rose, 2002; Dollar and Kraay, 2003; Noguera and Siscart, 2005; Freund and Bolaky, 2008), very few studies exist on the impact of regional integration. Existing studies are more theoretical and the first empirical study on the impact of regional integration on growth dates back to Vamvakidis (1998). Looking more closely at the issue, the results of theoretical and empirical studies on regional integration are much more mixed than the general enthusiasm for the income-enhancing effect of regional integration. Several theoretical works predict that regional integration among developing countries, such as those in Africa, for example, is counterproductive for member countries (Grossman and Helpman, 1991a,b; Rivera-Batiz and Romer, 1991; Coe et al., 1997). According to these studies, integration is only beneficial to developing countries if it is carried out with larger, more open and more developed countries. The main argument is that a country with more advanced and bigger trading partners has greater technological spillover effects from them (Grossman and Helpman, 1991a,b). It seems therefore risky, without a serious empirical study, to conclude definitively on the impact of regional integration among developing countries, even though the overall opinion tends, a priori, to suggest a positive impact.

The main objective of this paper is to study the impact of regional openness – through intra-African migration and trade – on per capita income in Africa. Our starting assumption is that any regional integration process or agreement, including monetary unions, aims to increase trade in goods and services among member countries and the mobility of people and capital among them. This is the commonly accepted definition of regional integration.⁴ Given the low level of financial integration between African countries and the lack of bilateral data, we consider intra-African trade and migration as two important quantitative vehicles of African integration. It is now well known that when we study the impact of openness to trade and/or migration, an important problem to solve is that of reverse causality. Indeed, countries whose incomes are high for reasons other than trade and migration may trade and migrate more (see Frankel and Romer, 1999; Ortega and Peri, 2014). Thus, to take into account this potential problem of simultaneity bias, we

⁴The European Union, which is an example of regional integration, defines regional integration as “*The process of overcoming barriers that divide neighbouring countries, by common accord, and of jointly managing shared resources and assets. Essentially, it is a process by which groups of countries liberalise trade, creating a common market for goods, people, capital and services*”.

use two-stage least squares (2SLS) estimation strategy. Our 2SLS estimation approach follows recent developments in international trade and migration literature (Ortega and Peri, 2014; Alesina et al., 2016; Docquier et al., 2016) inspired from trade literature (Frankel and Romer, 1999).

Our paper contributes to the literature on several points. Firstly, it contributes to the empirical works on the impact of openness with the peculiarity of studying the impact of regional integration in Africa. Secondly, it provides additional insight into the impact channels by testing both the effect of intra-African trade and migration and distinguishing their respective impacts. Finally, our paper shows how improving certain structural characteristics of African countries such as low economic diversification, low levels of financial development and low quality of technological and transport infrastructure can help to improve the impact of regional integration on income in Africa.

The rest of the paper is organized as follows. Section 2 is devoted to the review of the literature. Section 3 describes our empirical strategy and presents the data. In Section 4, we present and discuss our main results, and provide some robustness checks. Section 5 is dedicated to examining how improving structural characteristics of African countries can help to improve the impact of regional integration. In Section 6, we deepen the discussion and propose policy recommendations. Finally, Section 7 concludes the paper.

2 From global openness to regional integration

Studies on the impact of regional integration on income are scarce. Those that exist are often inspired by the broader literature on international openness. In this section we present the most influential and recent theoretical and empirical studies on the impact of international openness that have inspired our study as well as the existing studies on the impact of regional integration on income.

2.1 The theoretical literature

The “income-enhancing” effect of international openness is well documented in economics. The new theory of international trade shows that openness to trade increases income through the exploitation of increasing returns to scale and the effects of networks (Helpman and Krugman, 1985; Grossman and Helpman, 1991a,b; Rivera-Batiz and Romer, 1991). This recent literature is essentially based on the

endogenous growth model of [Lucas \(1988\)](#), which considers human capital as the engine of growth and that analyzes the effects of learning by doing. According to this literature, by improving human capital, trade increases income. Indeed, trade increases innovation through economies of scale, technological spillovers, and elimination of the replication of research and development (*R&D*) in different countries (see [Vamvakidis, 1998](#)). [Grossman and Helpman \(1991a,b\)](#) consider the innovation of new products as a positive function of past innovations, which represent the stock of knowledge. Given that international trade provides access to a vast international market, to advanced technology, and, therefore, to a larger stock of knowledge, it promotes more innovation and faster growth. Therefore, it is more beneficial for a country to open up to free trade with large economies that have an advanced stock of knowledge. [Coe et al. \(1997\)](#) support this claim by showing that developing countries with limited *R&D* stocks can increase productivity by trading with a more developed country that has a wide range of knowledge from its cumulative *R&D* activities. Obviously, such results challenge the foundations of trade integration between developing countries such as African countries. However, the literature does not explicitly address the issue of regional integration.

Going further, [Ortega and Peri \(2014\)](#) developed a simple multi-country theoretical model to explain the joint impact of trade and migration on income. In this model, which is a minor extension of the model proposed by [Alesina et al. \(2000\)](#), total production is a function of intermediate goods and human capital, and each region is endowed with a differentiated good and a differentiated type of labor. Given the low mobility or high mobility costs of labor and intermediate goods between regions in different countries, this model defines income per worker as a function of the theoretical measures of trade and migration openness. The positive effect of openness to migration in this model operates through an increase in total factor productivity reflecting a greater diversity in productive skills caused by immigration. Like the studies on trade openness, [Ortega and Peri \(2014\)](#) address the issue of the impact of international migration indiscriminately and therefore do not address the impact of regional migration.

2.2 The empirical literature

This literature can be split into two. The earliest studies have focused more on the impact of openness policies (tariff and non-tariff barriers, trade agreements, protective measures, etc.). The most recent studies have relied more on quantitative variables of openness (generally the degree of openness, measured by the sum of exports and imports relative to GDP and/or the rate of international migration).

The first subgroup of studies generally show that free trade improves income and growth (Dollar, 1992; Edwards, 1992; Levine and Renelt, 1992; Barro and Sala-i-Martin, 1995; Sachs and Warner, 1995). Based on a cross-sectional study of 95 developing countries, Dollar (1992) shows that outward-oriented countries develop faster than inward-oriented countries. Edwards (1992) relies on nine opening indexes proposed in the literature to study the impact of openness and finds a positive correlation between trade openness and growth. In a study designed to identify the robust determinants of economic growth, Levine and Renelt (1992) find that free international trade indirectly affects growth through investment. Thus, countries with low trade barriers invest more and grow faster. Sachs and Warner (1995) construct a dummy variable of openness based on five protection dimensions find that open economies grow faster than closed economies. Similarly, Barro and Barro and Sala-i-Martin (1995) use tariffs on capital goods and intermediate inputs as a measure of protection and show that protection has a negative impact on growth and income.

The second subgroup, mainly inspired by Frankel and Romer (1999) , also find, for the most part, that openness is favorable to income (see among others Irwin and Terviö, 2002; Dollar and Kraay, 2003; Noguer and Siscart, 2005; Freund and Bolaky, 2008). Indeed, Frankel and Romer (1999) were the first to provide an original solution to the problem of bi-causality between trade and income. They use a gravity model to estimate bilateral trade on the basis of geographical factors, which they then use as an instrument to demonstrate a positive effect of trade on per capita income. However, the consensus is far from being established on this issue. Indeed, Rodriguez and Rodrik (2000) consider that these results are not robust since they lose all statistical power when the estimates are corrected for the bias of omitted variables taking into account variables such as distance from the equator or quality of institutions. More recently, Ortega and Peri (2014) goes further by pointing out that the geographical factors used by Frankel and Romer (1999) and taken up by other authors are also valid for bilateral migration, which is also a determinant of economic growth. Integrating openness to trade and openness to migration – both instrumented by the same geographical factors – in the real per capita income equation, the authors establish a positive and significant effect of immigration on Income per capita in the long term, but fail to do so for trade.

While most empirical studies treat indiscriminately the issue of the impact of openness on income, very few studies are devoted to the issue of the impact of regional integration. Among these are the works of Vamvakidis (1998, 1999). The author shows that regional integration between small economies has no positive impact on growth and that the latter would benefit more from trading with large economies. For Torstensson (1999), European integration has been favorable to growth, with the

main channels being the transfer of “know-how” and increased investment. [Spilimbergo et al. \(1999\)](#) show that regional trade agreements (RTAs) could inhibit growth by changing the composition of trade in favor of low-technological products or goods with less learning effect (“learning by doing”). This thesis is also the one developed by [Puga et Venables \(1998\)](#) and [Venables \(2003\)](#) which show that South-North trade agreements offer better income prospects for countries of the South.

These studies show that the channels theoretically envisaged seem to be inoperative for African countries. Indeed, the complementarity effect and technology transfer are unlikely due to the strong similarity in the pattern of trade between countries. Similarly, the migration channel presented above is not very relevant for Africa given the relative homogeneity of qualifications, techniques and institutions between countries. However, there are a number of reasons for the income-enhancing effect of regional integration. Indeed, the strengthening of intra-regional trade can generate a dynamic favorable to the creation of value added through processing, which is conducive to inclusive growth. Similarly, since regional immigration constitutes a productive and useful workforce for host countries in certain sectors such as agriculture (coffee and cocoa plantations in Ivory Coast for example), regional migration can improve income in Africa.

3 Empirical approach

The empirical approach is designed to assess the impact of African integration on per capita income in Africa. In this section we present our empirical model (Section [3.1](#)), discuss the estimation strategies (Section [3.2](#)) and describe the data sources used for the empirical analysis (Section [3.3](#)).

3.1 Model

Our empirical model is inspired by that of [Ortega and Peri \(2014\)](#), which is an extension of the model of [Frankel and Romer \(1999\)](#). It is a model designed to evaluate the impact of openness, initially openness to trade by [Frankel and Romer \(1999\)](#) and several other authors (among others [Dollar and Kraay, 2003](#); [Noguer and Siscart, 2005](#); [Freund and Bolaky, 2008](#)). Then, [Ortega and Peri \(2014\)](#) have extended this model to assess both the impact of openness to trade and migration on per capita income. Transposed to Africa alone, this model allows to assess the impact of the integration of African economies on per capita income, through intra-African trade (trade integration) and intra-African migration (integration or

mobility of people).⁵ Therefore, the specification of our model is given by:

$$\ln y = \alpha_0 + \alpha_1 TSH^{Afr} + \alpha_2 MSH^{Afr} + \alpha_3 \ln Size + \sum_k \delta^k X^k + \varepsilon \quad (1)$$

where y is the real GDP per capita at chained PPPs, TSH^{Afr} represents intra-African trade (import plus export) as a share of GDP, MSH^{Afr} is the intra-African migration share in the population, $Size$ controls for country size (population and area), X are control variables, and ε stands for the error term and accounts for unobserved determinants of log income per capita. The rationale behind this empirical model is given by the literature presented in Section 2. Roughly speaking, while the classical theory of international trade supports the income-enhancing effect of international trade through specialization based on comparative advantage, the new trade theory supports the same thesis by relying on the exploitation of increasing returns to scale and network effects (Grossman and Helpman, 1991a,b; Helpman and Krugman, 1985). The joint impact of trade and migration on income is explained by Ortega and Peri (2014) in a simple multi-country model which is an extension of Alesina et al. (2000).

In the intra-African context, the different channels (network effects, skills and technology transfers, etc.) assumed by these theoretical models are certainly not the most relevant to explain a possible income-enhancing effect of openness (regional integration). Strengthening intra-African trade could create regional value chains conducive to inclusive growth and increased per capita income. Given the relatively homogenous level of labor and income, the income-improving effect of intra-African migration could pass through the importance of labor as an adjustment factor of economic cycles, particularly in agriculture and services. For example, one frequently finds the Burkinabe and Malians in coffee and cocoa plantations in Ivory Coast. It is the same for the Beninese and Togolese who regularly work in cassava plantations in Nigeria. We could multiply these examples.

3.2 The estimation strategies

We use both cross-section and panel specifications of the model 1 to analyze respectively the long-term and short-term effects of integration on per capita income in Africa. We also discuss the identification strategy to address the problem of reverse causality.

⁵Our approach is thus different from those of previous studies on the impact of regional integration (Vamvakidis, 1998; Torstensson, 1999; Venables, 2003). Indeed, these studies typically assess the impact of integration through dummies variables that do not represent quantitative measures of integration. Moreover, the role of intra-regional migration is often ignored in these studies.

3.2.1 Cross-section OLS specification

This approach allows us to analyze the long-term impact of intra-African trade and migration (African integration) on per capita income in Africa. In other words, with the cross-sectional specification, one can check whether differences between African countries in terms of intra-African openness to trade and migration significantly explain their differences in terms of economic development (real income per capita). Estimates are made with the OLS estimator using the full-sample averages of the dependent and independent variables for each country:

$$\ln y_i = \alpha_0 + \alpha_1 TSH_i^{Afr} + \alpha_2 MSH_i^{Afr} + \alpha_3 \ln Size_i + \sum_k \delta^k X_i^k + \varepsilon_i \quad (2)$$

where i stands for country index. In this regression, the value of the variables is their simple average calculated over the period of the study (1990-2014).

3.2.2 Panel OLS specification

While the cross-sectional OLS approach is important for placing the relationship between regional integration and income per capita in a long-term perspective, it does not allow for analysis of the short-term effects of African integration. To account for this concern, we construct a panel that contains non-overlapping 5-year averages data for each country since the intra-African migration data are also available for each five-year period.

$$\ln y_{i,t} = \alpha_0 + \alpha_1 TSH_{i,t}^{Afr} + \alpha_2 MSH_{i,t}^{Afr} + \alpha_3 \ln Size_{i,t} + \sum_k \delta^k X_{i,t}^k + \varepsilon_{i,t} \quad (3)$$

where i and t stand for country and period indices, respectively. This specification also allows to take into account the possible heterogeneity between different sub-regions of Africa. Given the relatively small sample size of African countries, the panel specification has the advantage of providing more observations and variability, thus allowing for more robust estimates and certainly more accurate inferences.

3.2.3 The issue of endogeneity

By estimating equations (2) and (3) by OLS, it remains an important issue – that of endogeneity – that needs to be addressed. The main problem in using cross-sectional and pooled OLS regressions is the endogeneity of our main variable of interest – the African integration (intra-African trade and migration). If regional integration can improve the standard of living of the population, an increase in per capita income

resulting from an increase in production is itself conducive to integration (more trade, more migration). Thus, the relationship between regional integration and per capita income can be characterized by a reversal causality. Furthermore, unobserved characteristics of countries can jointly affect both variables. To account for these potential problems of simultaneity bias, we use a two-stage least squares (2SLS) estimation strategy based on gravity model.

Roughly speaking, the first step is to consists in constructing, on the basis of pseudo-gravity regressions, the geography-based prediction of integration (here bilateral trade and bilateral migration) between African countries. To do this, we consider the following pseudo-gravity model:

$$\begin{aligned} \ln WSH_{ij}^{Afr} = & \gamma_0 + \gamma_1 \ln Dist_{ij} + \gamma_2 \ln Pop_i + \gamma_3 \ln Pop_j + \gamma_4 \ln Area_i + \gamma_5 \ln Area_j \\ & + \gamma_6 \text{landlocked}_i + \gamma_7 \text{landlocked}_j + \gamma_8 \text{Border}_{ij} + \gamma_9 \text{ComLang}_{ij} \\ & + \sum_r \lambda^r RIA_{ij}^r + e_{ij} \end{aligned} \quad (4)$$

where WSH_{ij}^{Afr} is either, bilateral trade rate (the value of trade – exports + imports – between country i and j in Africa divided by the GDP of origin country i) or bilateral migration (the stock of migrants born in country i (j) and living in country j (i) in Africa as share of origin country i 's population), $Dist_{ij}$ is the distance between origin country i and destination country j , Pop denotes population, $Area$ is country area, $Landlocked$ is a dummy variable for landlocked countries, $ComLang$ is a dummy for sharing a common official language, $Border$ is a dummy variable to indicate that countries i and j share a common border. These different geographical regressors allow to estimate the “natural” or “potential” openness between countries. To these, we add the different Regional Integration Agreements (RIA_{ij}^r) established between the countries (see the list of agreements and their content in Table A-2 the Appendix). RIA_{ij}^r is a dummy variable that takes the value 1 if two African countries i and j have a regional integration agreement for a given year and 0 otherwise.

We rely on the Poisson Pseudo Maximum Likelihood (PPML) non-linear approach to estimate the gravity model. As argued by [Silva and Tenreyro \(2006\)](#), contrary to the log-linearized model estimation by OLS, PPML estimation allows to address issues related to observations of the dependent variable with zero value and to heteroskedasticity. We rely on the procedure of [Silva and Tenreyro \(2010\)](#) in order to deal with the identification problem of the (pseudo) maximum likelihood estimates of the Poisson regression models with non-negative values of the dependent variable (bilateral migration) and a large number of zeros on some regressors. Once the gravity regressions described by (4) are estimated, we sum up them over destination countries j to obtain the predicted trade and migration openness for each origin country i . More specifically, let Z_{ij} to be the vector of explanatory variables in-

cluded in Equation (4) and Γ_{tsh} to be the vector of coefficients in the bilateral trade regression, while Γ_{msh} being the corresponding for bilateral migration regression. The gravity-based predictor of intra-African trade openness for origin country i is then obtained by summing up bilateral trade over destination countries:

$$\widehat{TSH}^{Afr} = \sum_{j \neq i} \exp(\Gamma_{tsh} Z_{ij}) \quad (5)$$

Similarly, the gravity-based predictor of intra-African migration openness for origin country i is given by:

$$\widehat{MSH}^{Afr} = \sum_{j \neq i} \exp(\Gamma_{msh} Z_{ij}) \quad (6)$$

These two predicted values are used in the 2SLS procedure as instruments for intra-African trade and migration, respectively.

3.3 Data

Our data are taken from various sources. Our dependent variable is the real income per person (real PP P-adjusted GDP per person), collected from the Penn World Tables (PWT version 9.0). Our explanatory variables of interest are intra-African trade and migration. Data on bilateral trade are collected from the IMF's Direction of Trade Statistics (DOTS). The DOTS database contains data on the value of merchandise exports and imports between each country and all its trading partners. The period for which data are available depends on country but for most countries data extend from the 1980's to the present. The bilateral migration data are taken from the United Nations Global Migration Database (UNGMD). Data on bilateral migration are available for each five-year period starting in 1990. To estimate gravity models for both bilateral variables, we use geographic variables from the CEPII database described in [Head et al. \(2010\)](#) and from [Gallup et al. \(1999\)](#).

The control variables come largely from the World Bank's World Development Indicators (WDI) database. This is the case for the measure of financial development (domestic credit to private sector as share of GDP), inflation, population and area. We use the database from [Acemoglu et al. \(2001\)](#) for the historical (colonial origin and the European settlement in the colonies) and geographical (latitude and land-locked) variables. Data on real investment is from the PWT9.0 and for education, we use data on the expected years of schooling provided by the UNESCO Institute for Statistics.

Data on bilateral migration are available each five-year periods (1990-1995-2000-2005-2010). The other variables in the study are therefore all constructed on five-

year averages (1990-1994, 1995-1999, 2000-2004, 2005-2009 and 2010-2014). So we have a panel data structure with a time dimension of five and a country dimension that covers all African countries. Descriptive statistics on the main variables used for these variables are presented in Table 1.

Table 1: Descriptive statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Cross-sectional data					
Ln Income per capita	7.78	0.85	6.49	9.73	49
Intra-African Trade (% GDP)	8.35	7.7	0	35.72	49
Intra-African Migration (% Pop.)	2.29	3.04	0.05	13.09	49
Ln Population	15.56	1.62	11.26	18.61	49
Ln Area	11.99	2.13	6.13	14.7	49
Education	7.73	2.64	2.76	12.06	49
Financial development	20.66	18.32	4.28	112.86	49
Democracy	-0.9	3.98	-9.35	9.95	47
French colony	0.4	0.5	0	1	47
British colony	0.36	0.49	0	1	47
European settlers 1900	3.7	14.75	0	100	48
Dist. to equator	15.35	9.82	1.11	37.78	47
Inflation	0.45	1.87	0	12.69	49
Domest. Invest. rate (% GDP)	17.33	8.14	6.83	46.97	49
Landlocked	0.23	0.43	0	1	47
Panel data					
Ln Income per capita	7.75	0.94	5.54	10.62	245
Intra-African Trade (% GDP)	8.35	8.47	0	47.87	245
Intra-African Migration (% Pop.)	2.29	3.06	0.04	13.87	245
Ln Population	15.63	1.62	11.18	18.94	245
Ln Area	11.99	2.11	6.13	14.73	245
Education	8.18	3.01	2.05	14.6	243
Financial development	20.26	22.15	1.61	148.31	238
Democracy	0.52	5.26	-9.6	10	235
French colony	0.4	0.49	0	1	235
British colony	0.36	0.48	0	1	235
European settlers 1900	3.7	14.62	0	100	240
Dist. to equator	15.35	9.73	1.11	37.78	235
Inflation	0.58	5.72	0	86.03	233
Domest. Invest. rate (% GDP)	18.42	10.51	1.95	65.94	245
Landlocked	0.23	0.42	0	1	235

4 Empirical results

We begin by presenting the results of our model of gravity that are essential in our identification strategy. However, since the gravity model itself is not at the center of our study, the comments will be brief. Then we present and discuss the results on the impact of African integration, seen from the perspective of intra-African trade and migration. We then distinguish the long-term impact from the short- and medium-term impact.

4.1 Gravity Model Estimates

We estimated the gravity model (4) using both the OLS and PPML estimators even though we then prefer the results from the PPML approach for the reasons mentioned above. The results obtained for both intra-African trade and migration are presented in the table A-1 in the Appendix. The model is estimated for both cross-sectional (first four columns) and panel (last four columns) data. To account for time-varying dimension in panel setting, following [Docquier et al. \(2016\)](#) and [Feyrer \(2009\)](#), we include time fixed effects and interactions between geographic distance and time dummies. This allows the effect of geographic distance to be time-varying, and thus to capture reduction in trade and migration costs caused by improvements in transport technology ([Docquier et al., 2016](#)).

Several lessons can be drawn from these results. First, the results are consistent with the usual predictions of gravity models. Indeed, several expected results are obtained, such as the negative effect of distance on trade and migration, the positive effect of sharing the same border or a common language (official or local). We also find that landlocked countries are naturally much less open to trade and migration, which is an expected result. Moreover, we note that the intensity of trade and migration between two African countries increases with the size of the destination country. It should be added, however, that in terms of the effect of size (population, surface area), the results are in some cases different according to the estimator and between trade and migration. The literature itself has not established a clear and unambiguous relationship on this effect (see [Ortega and Peri, 2014](#)). Second, the results from the cross-sectional and panel-based approaches are consistent. The signs obtained for the different variables are generally the same. The results also show that the evolution of new transport technologies has not contributed to significantly reduce the impact of distance on intra-African migration and trade. Indeed, if the OLS estimator shows a downward trend in distance costs, this result disappears with the more robust PPML estimator. This result reflects the still too high costs

of trade and mobility between African countries, largely due to the impressive lack of transport infrastructure. Finally, with regard to regional integration agreements (mainly trade agreements), our results show that some have contributed to significantly improve trade and migration between member countries. This is the case for trade agreements between the member countries of ECA, COMESA, SADC, WAEMU and, to a lesser extent, of AGADIR.⁶ The PAFTA and AMU agreements do not appear to have had a significant and robust impact on trade and migration between member countries. The surprising result we get is that the SACU trade agreement seems to have had a significant negative impact on trade and migration between member countries. This surprising result must be interpreted with great caution because of the recent nature of this agreement, and above all because the countries involved in this agreement are also involved in the SADC agreement. In short, our model of gravity adapts well with some well-known stylized facts such as the effect of distance and shows that most regional integration agreements between African countries have been favorable for trade and migration between these countries.

4.2 Intra-African Openness and Income in Africa

We first present the results of the cross-sectional estimates in line with most of the previous studies (among others, [Frankel and Romer, 1999](#); [Dollar and Kraay, 2003](#); [Noguer and Siscart, 2005](#); [Freund and Bolaky, 2008](#); [Ortega and Peri, 2014](#); [Coulibaly et al., 2016](#); [Docquier et al., 2016](#)) in order to analyze the impact of integration in a long-term perspective. Then, we expose and discuss the results of the panel approach that introduces more variability and dynamics in the relationship between integration and income in Africa. These results show the short- and medium-term impact of regional integration in Africa. In both cases, we adopt the same format. We first present intra-African trade and migration results separately. Then we present the results of the joined impacts to take into account the criticism of [Ortega and Peri \(2014\)](#) on the omitted variable bias. This also makes it possible to see which of the two integration vectors is the most influential, if any. Since these results are based on the instrumental variables (IV) method, our results can be interpreted as measuring the causal effect of intra-African trade and migration if the instruments used are well identified. For this purpose, we use the [Sanderson and Windmeijer \(2016\)](#)'s test of weak identification for each endogenous regressor and the [Kleibergen and Paap \(2006\)](#)'s test of jointly weak identification.

⁶See more detail on the different agreements, their contents, the member countries and the definition of the different blocks in Table [A-2](#) in Appendix.

4.2.1 The long-term effects of intra-African trade and migration

Table 2 presents the baseline results of the long-term impact of regional integration in Africa. These results show that intra-African trade and migration, taken separately (columns CS-IV1 and CS-IV2), have a low significance impact on per capita income. This impact disappears when the two variables are considered simultaneously (Column CS-IV3) to avoid the omitted variable bias. Indeed, the geographical factors used to identify the causal impact of trade are also relevant for migration. The last three columns in Table 2 extend the baseline by introducing education, which is a key determinant of income, as a control variable. The results do not change significantly. Indeed, intra-African trade and migration have a positive impact on per capita income in the long term, but this impact disappears when the two variables are introduced jointly. As expected, education has a significant and positive impact on per capita income whatever the specification.

Table 2: The long-term effect of intra-African trade and migration

Variables	Baseline regression			Augmented-baseline regression		
	CS-IV1	CS-IV2	CS-IV3	CS-IV4	CS-IV5	CS-IV6
Intra-African Trade	0.026* (0.014)		0.014 (0.039)	0.035** (0.016)		0.026 (0.024)
Intra-African Migration		0.071* (0.042)	0.040 (0.119)		0.089** (0.039)	0.033 (0.067)
Ln Population	0.035 (0.130)	0.066 (0.111)	0.059 (0.118)	0.010 (0.094)	0.043 (0.084)	0.030 (0.095)
Ln Area	-0.099 (0.097)	-0.099 (0.089)	-0.103 (0.091)	-0.022 (0.078)	-0.020 (0.069)	-0.026 (0.073)
Dist. to equator	0.014 (0.018)	0.026* (0.016)	0.021 (0.024)	0.011 (0.015)	0.026** (0.012)	0.016 (0.017)
Education				0.165*** (0.033)	0.161*** (0.025)	0.164*** (0.028)
Constant	7.348*** (0.321)	7.190*** (0.339)	7.242*** (0.414)	5.911*** (0.317)	5.764*** (0.217)	5.837*** (0.337)
Observations	47	47	47	47	47	47
R-squared	0.441	0.533	0.503	0.615	0.723	0.668
Regional Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
K-P F-stat	40	22.50	2.409	34.62	22.34	2.474
SW F-stat Intra-Trade	40		11.46	34.62		11.34
SW F-stat Intra-Migration		22.50	4.750		22.34	5.050
SY 10% max IV size	16.38	16.38	7.030	16.38	16.38	7.030
SY 25% max IV size	5.530	5.530	3.630	5.530	5.530	3.630

Notes: Heteroskedasticity-robust standard errors are in parentheses. *, **, and *** denote significance at the 10%, 5% and 1% confidence level, respectively. K-P F-stat is the Kleibergen and Paap (2006) rk Wald F-stat test of jointly weak identification. SW F-stat is the Sanderson and Windmeijer (2016) F-stat test of weak identification for each endogenous regressor separately. In the case of a single endogenous regressor, the SW F-stat is identical to the K-P F-stat. SY 10% max IV size and SY 10% max IV size are the Stock and Yogo (2005) critical values under the i.i.d. assumption.

Table 3 extends the analysis by using a series of control variables to test the ro-

bustness of the relationship between regional integration and per capita income. Indeed, we introduced a set of geographic and historical control variables (landlocked dummy, former French colony, former English colony, European settlement) which are considered as exogenous sources of the quality of the current institutions as well as the current performances of the government (see [Hall and Jones, 1999](#); [La Porta et al., 1999, 2008](#); [Ortega and Peri, 2014](#)). The results still show that intra-African trade and migration do not have a significant impact on per capita income over the long term.

Table 3: The long-term effect of intra-African trade and migration – Controls

Variables	Historical and Geo. control variables			Political and eco. control variables		
	CS-IV1	CS-IV2	CS-IV3	CS-IV4	CS-IV5	CS-IV6
Intra-African Trade	0.022 (0.016)		0.015 (0.021)	0.031** (0.016)		0.021 (0.020)
Intra-African Migration		0.076* (0.045)	0.033 (0.060)		0.097** (0.045)	0.047 (0.059)
Ln Population	-0.003 (0.083)	0.025 (0.078)	0.017 (0.084)	0.005 (0.124)	0.074 (0.134)	0.058 (0.132)
Ln Area	-0.030 (0.072)	-0.019 (0.070)	-0.029 (0.069)	-0.033 (0.078)	-0.046 (0.082)	-0.048 (0.079)
Dist. to equator	0.011 (0.015)	0.025** (0.011)	0.016 (0.018)	-0.006 (0.012)	0.008 (0.012)	0.001 (0.014)
Education	0.136*** (0.032)	0.139*** (0.025)	0.139*** (0.029)	0.118*** (0.032)	0.110*** (0.021)	0.115*** (0.023)
British colony	0.271 (0.258)	0.197 (0.230)	0.225 (0.237)			
French colony	0.295 (0.225)	0.133 (0.218)	0.218 (0.211)			
Landlocked	-0.316** (0.146)	-0.225 (0.157)	-0.267 (0.164)			
European settlers 1900	-0.002 (0.003)	-0.000 (0.003)	-0.001 (0.003)			
Democracy				0.003 (0.028)	0.017 (0.032)	0.012 (0.031)
Inflation				-0.008 (0.024)	0.024 (0.018)	0.001 (0.024)
Financial development				1.063* (0.585)	0.810 (0.639)	0.866 (0.641)
Domest. Invest. rate				0.019** (0.009)	0.019** (0.009)	0.020** (0.009)
Constant	6.123*** (0.278)	5.902*** (0.265)	6.006*** (0.352)	6.073*** (0.371)	5.944*** (0.339)	5.957*** (0.391)
Observations	47	47	47	46	46	46
R-squared	0.683	0.740	0.714	0.692	0.773	0.740
Regional Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
K-P F-stat	31.92	15.77	2.589	28.04	11.59	2.773
SW F-stat Intra-Trade	31.92		10.49	28.04		14.51
SW F-stat Intra-Migration		15.77	5.38		11.59	5.60
SY 10% max IV size	16.38	16.38	7.030	16.38	16.38	7.030
SY 25% max IV size	5.530	5.530	3.630	5.530	5.530	3.630

Notes: see notes of Table 2.

In other words, countries that are more open to African trade and migration do not improve more their per capita income. The results are robust even when controlling for economic variables (such as inflation rates, financial development and investment rates) and institutional variables (such as the political regime) that are also major determinants of real income per capita. Of all these control variables, only the investment rate and education appear to have a significant positive impact in the long term on economic development in Africa. These results are fairly standard in the literature on the determinants of growth of African countries (see [Masanjala and Papageorgiou, 2008](#)).

To summarize, our empirical results do not allow us to establish a positive, significant and robust long-term impact of regional integration on the standard of living in Africa. This may be a reflection of the current low level of integration of African countries as outlined in the introduction. Indeed, the still too high costs of trade between countries, the sharp lack of inter-country connection infrastructure, the low level of diversification of African economies and the low level of financial development of the countries could explain this result. Does this mean that regional integration is not appropriate for African economies? Should we conclude, as in previous studies ([Vamvakidis, 1998](#); [Torstensson, 1999](#); [Venables, 2003](#)), that integration among developing countries is not beneficial to them? Certainly not, given the large potential for progression that exists for African economies. Moreover, it is possible that integration is most effective short and medium term than in the long term. Finally, given the relatively limited number of observations in cross-section, it is wise not to draw a definitive conclusion at this stage. What about the short- and medium-term impact of regional integration in Africa? The next section answers this question.

4.2.2 The short- and medium-term effect of African integration

As before, we begin by presenting the basic results (without control). These results, which appear in Table 4, show that, taken separately, only intra-African migration has a positive and significant impact on per capita income in Africa. Even considering the two regional integration vectors jointly, this result seems to be maintained. Intra-African migration therefore has a positive impact in the short and medium term on real per capita income in Africa. This result is not affected by the extension of the baseline model to control the effect of education. Intra-regional trade does not appear to have a significant impact on income in Africa. Education is highly correlated with income levels even in the short and medium term. Our identification

strategy confirms the exogenous nature of predictors from the gravity model.⁷ The instruments used are therefore well identified. However, as before, it is necessary to go further to see if these results resist the introduction of other important control variables to explain per capita income.

Table 4: The short- and medium-term of intra-African trade and migration

Variables	Baseline regression			Augmented-baseline regression		
	Panel-IV1	Panel-IV2	Panel-IV3	Panel-IV4	Panel-IV5	Panel-IV6
Intra-African Trade	0.011 (0.009)		-0.008 (0.012)	0.013 (0.009)		-0.009 (0.011)
Intra-African Migration		0.077*** (0.016)	0.090*** (0.025)		0.090*** (0.015)	0.105*** (0.022)
Ln Population	-0.015 (0.062)	0.059 (0.055)	0.057 (0.054)	-0.060 (0.054)	0.027 (0.051)	0.024 (0.049)
Ln Area	-0.080* (0.047)	-0.104** (0.044)	-0.099** (0.043)	0.001 (0.040)	-0.027 (0.037)	-0.022 (0.037)
Dist. to equator	0.019** (0.009)	0.029*** (0.008)	0.032*** (0.009)	0.016** (0.007)	0.028*** (0.006)	0.030*** (0.008)
Education				0.142*** (0.017)	0.140*** (0.013)	0.140*** (0.013)
Constant	7.260*** (0.169)	6.967*** (0.183)	6.935*** (0.190)	6.165*** (0.183)	5.839*** (0.163)	5.803*** (0.176)
Observations	235	235	235	235	235	235
R-squared	0.475	0.544	0.555	0.606	0.672	0.682
Regional Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
K-P F-stat	23.37	122.2	10.06	23.41	126.4	9.915
SW F-stat Intra-Trade	23.37		18.35	23.41		18.21
SW F-stat Intra-Migration		122.2	31.74		126.4	31.34
SY 10% max IV size	16.38	16.38	19.93	16.38	16.38	19.93
SY 25% max IV size	5.530	5.530	7.250	5.530	5.530	7.250

Notes: Heteroskedasticity-robust standard errors are in parentheses. *, **, and *** denote significance at the 10%, 5% and 1% confidence level, respectively. K-P F-stat is the [Kleibergen and Paap \(2006\)](#) rk Wald F-stat test of jointly weak identification. SW F-stat is the [Sanderson and Windmeijer \(2016\)](#) F-stat test of weak identification for each endogenous regressor separately. In the case of a single endogenous regressor, the SW F-stat is identical to the K-P F-stat. SY 10% max IV size and SY 10% max IV size are the [Stock and Yogo \(2005\)](#) critical values under the i.i.d. assumption.

The results in Table 5 thus go further by controlling the short- and medium-term impact of African integration by a set of control variables. The first three columns include geographic and historical controls. The previous results are not at all disturbed by these control variables. Intra-regional trade does not have a significant impact on per capita income. For its part, intra-regional migration still has a positive and significant impact at the 1% confidence level in Africa's standard of living. By controlling by economic and political variables (investment rate, financial development, inflation, democracy), intra-African trade seems to have a significant and

⁷The statistics from [Sanderson and Windmeijer \(2016\)](#)'s test of weak identification for each endogenous regressor and [Kleibergen and Paap \(2006\)](#)'s test of jointly weak identification are higher than the critical values of the [Stock and Yogo \(2005\)](#) at the usual confidence level.

positive impact when considered separately. However, this result does not resist the inclusion of intra-African migration. Once again, the positive and significant impact of intra-African migration is robust to the inclusion of these control variables. In an ultimate robustness check, we test the strength of our results by controlling the effect of regional integration by all of our control variables. The results are shown in the last three columns of Table 5. Our results remain unchanged. They confirm the income-enhancing effect of intra-African migration. The sensitivity of the results to the sample was also tested by making the same estimates for only sub-Saharan African countries. Intra-African migration remains the dominant and significant channel.⁸ Such a result was found by [Ortega and Peri \(2014\)](#) but in a cross-country analysis involving both developed and developing countries. Indeed, they show that the positive impact of international trade found by [Frankel and Romer \(1999\)](#) disappears when they control by international migration. For them, countries with a higher rate of immigration improve their per capita income more significantly.

While our short- and medium-term results do not contradict those of [Vamvakidis \(1998\)](#), [Torstensson \(1999\)](#) and [Venables \(2003\)](#) on trade, they do not confirm them either. According to our results, regional integration among developing countries like those in Africa can significantly improve their living standards, particularly through intra-African migration. One can not therefore look at the only channel of intra-regional trade to conclude on the impact of regional integration. We clearly show here that other channels count and in particular that of intra-African migration help to significantly improve per capita income in African countries, at least in the short to medium term. The result may be partly explained by the fact that intra-regional migration makes it possible to adjust production cycles in countries of immigration and, at the same time, income cycles for migrants themselves. This is particularly true in the construction sector but especially in the agricultural sector. For example, it is quite common to find Beninese and Togolese farmers who go to Nigeria to work in agricultural plantations when the agricultural season is not favorable for their own crops. Similarly the “housing boom” in some African countries such as Ivory Coast attracts many workers from neighboring countries. On the control variables, we note that they have the expected signs. Roughly speaking, education has a positive and significant impact on per capita income and this appears to be very robust. Investment contributes to a significant improvement in per capita income in Africa, while inflation contributes to its degradation. Financial development also has a positive and significant link with per capita income. The isolation reduces the per capita income. Finally, the African countries formerly colonized by the British seem to have a higher level of per capita income. All these results are consistent with the previous literature.

⁸To save space, the results of these estimates are not reported here, but are available upon request from the authors.

Table 5: The short- and medium-term of intra-African trade and migration – Controls

Variables	Historical and Geo. control variables			Political and eco. control variables			Robustness check		
	Panel-IV1	Panel-IV2	Panel-IV3	Panel-IV4	Panel-IV5	Panel-IV6	Panel-IV7	Panel-IV8	Panel-IV9
Intra-African Trade	0.001 (0.010)		-0.015 (0.011)	0.017** (0.007)		0.006 (0.010)	0.004 (0.008)		-0.007 (0.010)
Intra-African Migration		0.070*** (0.017)	0.099*** (0.025)		0.066*** (0.015)	0.056** (0.027)		0.055*** (0.017)	0.070*** (0.025)
Ln Population	-0.075 (0.047)	-0.002 (0.048)	-0.009 (0.044)	-0.090 (0.060)	-0.028 (0.060)	-0.030 (0.062)	-0.131** (0.053)	-0.065 (0.056)	-0.064 (0.055)
Ln Area	-0.008 (0.036)	-0.026 (0.038)	-0.011 (0.036)	0.008 (0.042)	-0.009 (0.041)	-0.011 (0.041)	0.016 (0.036)	-0.002 (0.038)	0.002 (0.037)
Dist. to equator	0.016** (0.007)	0.025*** (0.006)	0.032*** (0.009)	-0.005 (0.006)	0.005 (0.006)	0.003 (0.007)	-0.003 (0.006)	0.005 (0.006)	0.007 (0.007)
Education	0.112*** (0.016)	0.120*** (0.013)	0.119*** (0.012)	0.121*** (0.016)	0.117*** (0.013)	0.117*** (0.013)	0.088*** (0.016)	0.092*** (0.013)	0.092*** (0.013)
British colony	0.404*** (0.122)	0.253** (0.116)	0.256** (0.110)				0.462*** (0.106)	0.352*** (0.104)	0.346*** (0.101)
French colony	0.355*** (0.115)	0.168 (0.113)	0.120 (0.109)				0.266*** (0.100)	0.131 (0.098)	0.111 (0.095)
Landlocked	-0.382*** (0.077)	-0.246*** (0.072)	-0.231*** (0.070)				-0.249*** (0.072)	-0.159** (0.067)	-0.147** (0.064)
European settlers 1900	-0.002 (0.002)	-0.001 (0.002)	-0.000 (0.002)				0.009 (0.011)	0.006 (0.010)	0.007 (0.010)
Democracy				-0.007 (0.009)	0.003 (0.009)	0.002 (0.009)	-0.012 (0.008)	-0.001 (0.009)	0.000 (0.009)
Inflation				-0.011*** (0.003)	-0.004*** (0.001)	-0.006* (0.004)	-0.010*** (0.003)	-0.008*** (0.002)	-0.005 (0.003)
Financial development				1.009*** (0.204)	0.867*** (0.210)	0.872*** (0.215)	0.924*** (0.223)	0.828*** (0.231)	0.819*** (0.229)
Domest. Invest. rate				0.015*** (0.004)	0.016*** (0.004)	0.016*** (0.004)	0.018*** (0.004)	0.018*** (0.004)	0.018*** (0.003)
Constant	6.261*** (0.174)	5.969*** (0.174)	5.878*** (0.187)	6.219*** (0.196)	6.042*** (0.192)	6.065*** (0.201)	6.249*** (0.181)	6.082*** (0.181)	6.052*** (0.179)
Observations	235	235	235	214	214	214	214	214	214
R-squared	0.666	0.692	0.706	0.712	0.763	0.756	0.757	0.780	0.786
Regional / Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
K-P F-stat	19.68	126	8.452	17.89	94.70	7.782	14.73	90.77	6.520
SW F-stat Intra-Trade	19.68		16.27	17.89		14.41	14.73		12.70
SW F-stat Intra-Migration		126	26.37		94.70	19.66		90.77	17.46
SY 10% max IV size	16.38	16.38	19.93	16.38	16.38	19.93	16.38	16.38	19.93
SY 25% max IV size	5.530	5.530	7.250	5.530	5.530	7.250	5.530	5.530	7.250

Notes: See Table 4 (same notes).

5 How to boost regional trade and its impact?

Although our previous analysis shows a significant positive impact of intra-African migration on real per capita income in Africa, it reveals that regional trade has not contributed significantly to improving the standard of living on the continent. This section analyzes the influence of factors that may inhibit the development of intra-African trade and its impact on income. In other words, we want to investigate how the impact of trade on income may depend on factors such as diversification of economies, financial development and quality of transport and telecommunications infrastructure. These variables are obviously chosen on the basis of the fact that they do not satisfy the conditions of a real integration of the African countries but also taking into account the essential role that they can play in the strengthening of the regional integration and its impact on income.

We therefore empirically test the extent to which diversification of African economies, financial development, and improved infrastructure quality can contribute to making trade integration more conducive to improving the standard of living in Africa. To do this, we consider as before a per capita income equation in which, in addition to regional trade, we include successively the variables mentioned and their interaction with regional trade. Formally, we estimate the following equation:

$$\ln y_{i,t} = \alpha + \gamma TSH_{i,t}^{Afr} + \theta Z_{i,t} + \lambda(TSH_{i,t}^{Afr} \times Z_{i,t}) + \varepsilon_{i,t} \quad (7)$$

where $Z = (Div, FinDev, Infrac)$ refers respectively to the index of export diversification (Div), the level of financial development ($FinDev$) and the quality of infrastructure ($Infrac$). Equation 7 can be arranged so as to highlight the influence of the variable Z in the relationship that the regional trade has with per capita income (y).

$$\ln y_{i,t} = \alpha + (\gamma + \lambda Z_{i,t}) \times TSH_{i,t}^{Afr} + \theta Z_{i,t} + \varepsilon_{i,t} \quad (8)$$

Equation (8) thus shows that the impact of regional trade (TSH^{Afr}) in Africa depends on the value of the variable Z . Therefore, in Equation (7), we are interested in the λ coefficient associated with the interaction variable between the sub-African trade and the Z variables. A positive and significant value of the λ coefficient implies that an improvement of the Z variables leads to an increase in the impact of intra-African trade on per capita income. Descriptive statistics for these variables are presented in Table A-3 in the Appendix. It is important to indicate that in Equation 7, only our parameter of interest λ will be interpreted. Indeed, the γ and θ parameters can not be interpreted as being directly related to TSH^{Afr} and Z respectively, since they measure conditional effects. The new data collected in

this section are the export diversification index produced by the IMF, the index of the quality of the transport infrastructure produced by the World Economic Forum (WEF) and the rate of Internet penetration provided by UTI (International Telecommunication Union).

5.1 Does economic diversification really matter?

The vast majority of African countries are highly specialized in the production and export of commodities. Since most of these exported goods are not processed on a continent-wide basis, much of Africa's trade is therefore oriented outside the region. It is conceivable that diversifying the production and exports of African countries could promote intra-African trade and enhance its impact on the standard of living in Africa. Indeed, the diversification of African economies could provide more opportunities for complementarity and product transformation across Africa, making intra-African trade more conducive to improving per capita income. [Beine and Coulombe \(2007\)](#) show, for example, that there is a positive and significant empirical relationship between export diversification and regional trade integration. The theory also suggests that the diversification of economies enhances the benefits of regional integration. In the case of African countries, this would reduce their exposure to exogenous shocks in commodity prices that inhibit any prospect of major long-term investment projects.

Table 6 presents the results of Equation 7 when Z is replaced by the export diversification index (a proxy of economic diversification). The results are presented sequentially to test the strength of the influence of export diversification on the relationship between intra-African trade openness and per capita income. The estimated λ parameter is 0.02 and is statistically different from zero, implying that a diversification of African economies would significantly increase the impact of intra-regional trade on per capita income in Africa. This result is not sensitive to the inclusion of intra-African migration as a control variable or to the inclusion of education, both of which were very significant in our previous regressions. The last three columns complement the robustness analysis by including our historical and geographic controls (Panel-4), our economic and political controls (Panel-5) and all the controls (Panel-6). The initial result successfully passes all of these tests. It is clear, therefore, that in addition to limiting their exposure to terms-of-trade shocks, the diversification of African economies contributes to increasing the effect of intra-African trade by making it more significantly income-improving.

Table 6: The effect of economic diversification

Variables	Baseline regressions			Robustness checks		
	Panel-1	Panel-2	Panel-3	Panel-4	Panel-5	Panel-6
Intra-Afr. Trade x Diversif.	0.021*** (0.006)	0.014** (0.006)	0.026*** (0.006)	0.020*** (0.005)	0.018*** (0.004)	0.012** (0.005)
Intra-African Trade	0.048*** (0.017)	0.019 (0.017)	0.063*** (0.017)	0.043*** (0.015)	0.040*** (0.012)	0.013 (0.014)
Diversification	-0.140* (0.079)	-0.113 (0.079)	-0.277*** (0.072)	-0.150** (0.061)	-0.127** (0.058)	-0.040 (0.076)
Intra-African Migration		0.077*** (0.016)	0.056*** (0.014)	0.055*** (0.013)	0.089*** (0.012)	0.103*** (0.013)
Education			0.195*** (0.021)	0.145*** (0.017)	0.138*** (0.014)	0.089*** (0.018)
Ln Population					0.050 (0.070)	-0.007 (0.062)
Ln Area					-0.070 (0.049)	-0.063 (0.044)
Dist. to equator					0.024*** (0.007)	0.028*** (0.007)
British colony				0.261** (0.113)		0.438*** (0.118)
French colony				0.245** (0.114)		0.013 (0.116)
Landlocked				-0.311*** (0.086)		-0.219*** (0.084)
European settlers 1900				-0.001 (0.002)		0.028 (0.019)
Democracy					0.010 (0.011)	-0.000 (0.009)
Inflation					-0.008*** (0.002)	-0.010*** (0.003)
Domest. Invest. rate					0.014*** (0.005)	0.014*** (0.005)
Constant	7.983*** (0.287)	8.031*** (0.288)	5.998*** (0.347)	6.583*** (0.316)	5.762*** (0.282)	6.243*** (0.395)
Observations	205	205	203	195	181	181
R-squared	0.311	0.353	0.597	0.690	0.762	0.803
Regional Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Heteroskedasticity-robust standard errors are in parentheses. *, **, and *** denote significance at the 10%, 5% and 1% confidence level, respectively.

5.2 How important is financial development?

The level of financing of African economies by the financial sector is still low. Indeed, financial development, and in particular trade finance, appears to be a necessary condition for strengthening integration in Africa. Several empirical studies show the importance of financial development in improving long-term growth (see among others [Calderón and Liu, 2003](#) and [Levine, 1997](#) for a literature review). While enhanced financialization of the economy can be beneficial to the level of development, trade is certainly one of the channels through which its impact passes. Indeed, [Beck](#)

(2002) shows that financial development has a positive and significant impact on international trade in manufactures. Do and Levchenko (2004) also point to a positive relationship between financial development and trade in developing countries, although they argue that trade facilitates financial development. Moreover, Bojanic (2012) shows that financial development and trade both cause long-term economic growth. Therefore, the impact of trade on income is likely to depend on the level of financial development of countries and vice versa. Table 7 presents the results of the tests on this probable relationship. As expected, financial development contributes to increase the impact of intra-African trade on per capita income in Africa. This result succeeds as before all the tests of control, which demonstrates its robustness.

Table 7: The effect of financial development

Variables	Baseline regressions			Robustness checks		
	Panel-1	Panel-2	Panel-3	Panel-4	Panel-5	Panel-6
Intra-Afr. Trade x Finan. Dev.	0.129*** (0.041)	0.097** (0.040)	0.168*** (0.045)	0.142*** (0.041)	0.114*** (0.040)	0.103** (0.042)
Intra-African Trade	-0.035*** (0.010)	-0.039*** (0.009)	-0.046*** (0.009)	-0.043*** (0.009)	-0.036*** (0.009)	-0.036*** (0.009)
Financial development	0.688** (0.297)	0.875*** (0.283)	-0.227 (0.299)	0.117 (0.281)	0.191 (0.270)	0.198 (0.298)
Intra-African Migration		0.072*** (0.013)	0.060*** (0.011)	0.063*** (0.011)	0.075*** (0.010)	0.067*** (0.013)
Education			0.165*** (0.020)	0.121*** (0.015)	0.130*** (0.014)	0.100*** (0.015)
Ln Population					-0.043 (0.051)	-0.091* (0.053)
Ln Area					0.025 (0.034)	0.028 (0.037)
Dist. to equator					0.008 (0.006)	0.007 (0.006)
British colony				0.240** (0.094)		0.330*** (0.097)
French colony				0.154 (0.094)		0.071 (0.099)
Landlocked				-0.101 (0.070)		-0.140** (0.066)
European settlers 1900				-0.000 (0.002)		0.012 (0.010)
Democracy						0.000 (0.009)
Inflation					0.002 (0.002)	-0.001 (0.002)
Domest. Invest. rate					0.014*** (0.004)	0.016*** (0.004)
Constant	8.120*** (0.170)	8.052*** (0.170)	6.995*** (0.161)	7.104*** (0.172)	6.035*** (0.158)	6.190*** (0.188)
Observations	238	238	236	228	217	214
R-squared	0.447	0.489	0.644	0.747	0.781	0.800
Regional Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Heteroskedasticity-robust standard errors are in parentheses. *, **, and *** denote significance at the 10%, 5% and 1% confidence level, respectively.

5.3 Is infrastructure quality at stake?

The answer seems to be affirmative. Indeed, there is consensus that the development and improvement of the quality of infrastructure is essential for strengthening regional integration and its impact on the economic development of African countries. Indeed, in addition to being insufficient, transport infrastructure in African countries are characterized by their poor quality. In the Global Competitiveness Report 2016-2017 and in previous reports, most African countries rank lowest in the ranking of countries according to the quality of their infrastructure, including transport and telecommunications (IT) infrastructures. This situation exacerbates the cost of trade between countries and is not conducive to the integration and development of regional trade. The World Bank estimate that intra-African trade costs are around 50% higher than in East Asia, and are the highest of intra-regional costs in any developing region. The result of these high costs is that Africa has integrated with the rest of the world faster than with itself. Regional and international institutions (AfDB, AU, ECA, World Bank, among others) are aware that strengthening infrastructure in Africa is essential to boost intra-African trade potential and its impact on economic development and poverty reduction. The AfDB and the World Bank are making it a top priority. We therefore test the empirical link between the quality of transport and telecommunications infrastructure and regional trade in the relationship between trade and per capita income.

Table 8 presents the results on the impact of transport and telecommunications infrastructure (especially internet penetration) on the relationship between intra-African trade and per capita income. These results, while not surprising, are particularly edifying. They confirm the important role of infrastructure in boosting intra-African trade and its impact on the standard of living in Africa. Indeed, the overall quality of the infrastructures is decisive (the first two columns), since an improvement in the latter contributes significantly to improving the impact of regional integration. Looking more closely, the results show road infrastructure contribute more to enhance the impact of intra-African trade on per capita income. Port infrastructure seems to play an equally important role, followed by air transport infrastructure. Contrary to our expectations, the quality of rail transport infrastructure does not seem to play a very important role. Its impact, although positive, remains very low. With respect to telecommunications infrastructure, the results show that improved internet penetration contributes to enhancing the impact of intra-African trade on income in Africa. This result shows the growing role of new technologies and information and communication (ICT) in trade. Indeed, these ICTs help to reduce considerably the costs of transactions between countries. This can be seen as good news for African countries as these technologies have only spread to these African countries since the early 2000s and the trend is on the rise.

Table 8: The effect of the quality of infrastructure

Variables	Overall infrast.		Road infrast.		Railroad infrast.		Port infrast.		Air transp. infrast.		Internet penetration	
	All Infr.	All Infr.	Roads	Roads	Rails	Rails	Port	Port	Air	Air	Internet	Internet
Intra-AfrTrade x Infr	0.011*** (0.004)	0.010*** (0.003)	0.007*** (0.003)	0.007*** (0.002)	0.001 (0.003)	0.003* (0.002)	0.003 (0.003)	0.007*** (0.002)	0.004* (0.002)	0.004** (0.002)	0.084*** (0.027)	0.056*** (0.017)
Infrastructure	0.418*** (0.123)	-0.083 (0.076)	0.304** (0.119)	-0.074 (0.064)	0.763*** (0.084)	0.013 (0.072)	0.334** (0.134)	-0.049 (0.085)	0.355*** (0.087)	0.068 (0.058)	4.166*** (0.394)	1.531*** (0.442)
Intra-AfrTrade	-0.046*** (0.015)	-0.044*** (0.012)	-0.029*** (0.010)	-0.032*** (0.007)	-0.005 (0.009)	-0.008 (0.005)	-0.012 (0.011)	-0.035*** (0.009)	-0.005 (0.006)	-0.018*** (0.006)	-0.001 (0.003)	-0.010*** (0.003)
Ln Population		0.083 (0.070)		0.084 (0.067)		0.042 (0.053)		0.074 (0.075)		0.033 (0.080)		-0.063 (0.044)
Ln Area		-0.087* (0.050)		-0.085* (0.049)		0.128*** (0.036)		-0.082 (0.052)		-0.060 (0.052)		0.021 (0.034)
Dist. to equator		0.006 (0.008)		0.005 (0.008)		-0.020*** (0.007)		0.006 (0.009)		0.003 (0.008)		-0.003 (0.006)
Education		0.156*** (0.036)		0.149*** (0.036)		0.045 (0.032)		0.167*** (0.034)		0.158*** (0.035)		0.108*** (0.018)
British colony		0.742*** (0.112)		0.716*** (0.111)		0.874*** (0.128)		0.716*** (0.121)		0.702*** (0.110)		0.557*** (0.099)
French colony		0.397*** (0.148)		0.363** (0.151)		0.617*** (0.150)		0.365** (0.148)		0.382*** (0.142)		0.244*** (0.090)
Landlocked		-0.129 (0.081)		-0.133 (0.082)		-0.143* (0.083)		-0.061 (0.089)		-0.105 (0.078)		-0.312*** (0.076)
European settlers 1900		0.019* (0.011)		0.017* (0.010)		0.015* (0.008)		0.007 (0.011)		0.010 (0.011)		0.009 (0.009)
Democracy		-0.004 (0.008)		0.003 (0.009)		-0.013 (0.009)		-0.001 (0.008)		-0.005 (0.008)		-0.004 (0.007)
Inflation		-0.009 (0.007)		-0.010 (0.007)		0.003 (0.007)		-0.005 (0.007)		-0.004 (0.007)		-0.007 (0.006)
Domest. Invest. rate		0.028*** (0.004)		0.029*** (0.004)		0.018*** (0.003)		0.029*** (0.004)		0.027*** (0.004)		0.025*** (0.004)
Constant	6.633*** (0.436)	5.902*** (0.488)	7.044*** (0.402)	5.910*** (0.516)	6.361*** (0.213)	5.676*** (0.453)	6.804*** (0.501)	5.654*** (0.481)	6.536*** (0.336)	5.323*** (0.441)	7.335*** (0.077)	5.944*** (0.230)
Observations	186	178	186	178	147	142	186	178	186	178	258	228
R-squared	0.260	0.815	0.192	0.815	0.407	0.887	0.108	0.814	0.161	0.814	0.455	0.813
Regional Fixed Effect	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Time Fixed Effect	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes

Notes: The dependent variable is the real GDP per capita at chained PPPs. Heteroskedasticity-robust standard errors are in parentheses. *, **, and *** denote significance at the 10%, 5% and 1% confidence level, respectively.

6 Discussions and policy recommendations

Integration is undoubtedly a political and economic instrument necessary to promote political stability, growth, economic and social development and to tackle environmental challenges in a united framework. However, the success of a regional integration that satisfies both the general interest and the heterogeneous interests is an ongoing challenge. The international context gives us a masterful demonstration of this fact with the recent turmoil in Europe (with a “Grexit” narrowly avoided and where the “Brexit” marks an important turning point in the process of European integration). The challenges for African integration are immense because of a set of structural features of economies that inhibit the development of their natural integration potential.⁹ Regional and international institutions are aware of the urgency to develop this potential to strengthen regional integration and make it a real tool for inclusive growth. The integration of Africa is one of the “High Fives” priorities of the new AfDB administration.

Despite this commitment, which was preceded by a series of other initiatives, statistics on the state of integration of African economies are not flamboyant. Economists and political leaders must therefore make constant efforts to identify blocking factors and propose innovative solutions. This study on African integration was carried out in this spirit. It relies on two quantitative vectors of regional integration – intra-African migration and trade – to assess the impact of African integration on real per capita income. Appropriate technical tools have been used for this purpose. In doing so, our study gives itself the means to appreciate the impact of integration with respect to its past, to identify blocking factors and then to suggest future-oriented measures. To sum up quickly, the results of our empirical research are not very glorious about the current state of African integration. Indeed, our gravity model shows that despite the geographical proximity of countries, the cost of distance between these countries remains very high. This is undoubtedly the result of many non-tariff barriers that cause the costs of trade between countries to remain high. Our results also show that regional integration through intra-African trade and migration has not had a robust positive impact on per capita income in Africa when analyzed from a long-term perspective. However, seen in the short and medium term, African integration appears to be significantly income-enhancing but only through inter-country migration. The intra-African trade channel still fails to have a positive impact on the standard of living in Africa. These half-encouraging results, in light of the increased efforts to strengthen African integration, also show the extent of

⁹This potential can be assessed, among other things, through Africa’s significant natural resource endowment, its large young population, the availability of a large regional market and the relatively small geographical distance between countries.

the challenges still to be met. We have therefore gone further with the analysis to highlight how the improvement of certain economic fundamentals that are essential to the success of integration can enhance the impact of intra-African trade on real per capita income. This development thus shows that, in order to strengthen the impact of intra-regional trade on the standard of living in Africa, it is imperative to improve the diversification of African economies, strengthen financial development and improve the quality of transport and telecommunications infrastructure. Thus, it follows naturally from this research a series of recommendations that we formulate below.

Operate an ambitious plan to fill the gap in national and inter-country transport infrastructure. Our study shows the need to modernize road and port infrastructure to strengthen the role of intra-regional trade as a vehicle for inclusive growth in Africa. In concrete terms, we propose to create the **African Transport Infrastructure Fund (ATIF)**. Funding for this fund could be secured through a **special tax on vehicle imports**. There are several reasons for this. First, there is a close link between road infrastructure and the importation of vehicles. Vehicles contribute to the degradation of road infrastructure. But degraded infrastructure encourages the purchase/import of more powerful vehicles that can support these infrastructures, which contributes more to the degradation of infrastructures. So there is a vicious cycle of road infrastructure degradation. The tax can create a virtuous circle because it would help improve road infrastructure. Under these conditions, users will no longer feel the need to buy/import more powerful vehicles and therefore the road infrastructures will withstand longer. Secondly, we make the plausible assumption that the import of vehicles is weakly elastic or even inelastic to the tax. Indeed, a “middle class” emerges in Africa and imports of cars will continue to increase. In order for this measure to be more effective, it would be preferable for this tax to be homogeneous for all African countries. So their relative competitiveness will not be affected. This tax may also be proportional to the power of the imported vehicle. Concerning port infrastructures, it seems important to ensure the automation of port operations. The AfDB could provide technical and financial assistance to countries in this direction. At the level of the countries themselves, the administrative costs of customs operations must be reduced. Technical assistance from the Bank could be useful.

Strengthen the current role of new technologies and anticipate future impacts. Our results show that an improvement in the rate of Internet penetration helps to make intra-African trade income-enhancing. This reflects the decline in the costs of trade that implies the use of ICTs. However, the cost of accessibility to these technologies remains relatively high. Governments – through fiscal incentives and the removal of administrative barriers – must encourage private operators to make

investments for the renovation and expansion of telecommunication infrastructure that can reduce the cost of access to ICTs. International institutions, including the AfDB, must support this dynamic by helping these private operators to access long-term financing. The AfDB could support the development of the digital network by helping private operators access long-term financing at competitive rates. Moreover, the role of technology in international trade will certainly be increasingly important, including on the African continent. Online exchanges will develop. Regional institutions such as the AfDB should anticipate this dynamic to make it a real tool for boosting regional integration. To meet the challenges of economic and technological change, African countries must invest significantly in training and *R&D*.

Accelerate the diversification and transformation of African economies.

Given the comfort of habit and the cost of renouncing the rent provided by raw materials, many African countries fail to make a transition to diversification of their economy. In addition to the cost of exposure to the terms of trade shocks that it implies, the concentration of African economies on commodities inhibits intra-African trade as shown in our estimates. The diversification of African economies is therefore an imperative for African States and institutions. This diversification must be based on the transformation of economies for the creation of added value chains. Concretely this implies a transformation of raw materials on a regional scale. This requires well-studied industrialization plans. The Ivory Coast, for example, would create more value for its economy and participate more in regional trade by transforming its cocoa and cashew nuts. The AfDB should work with governments to identify their industrial potential. At the same time, the AfDB could put in place a financial incentive to support countries that are making more diversification efforts. To measure this effort, the Bank could **construct an economic diversification effort variable** (based, for example, on growth in the non-commodity sector).

Encourage financing for intra-African trade. Our results are robust on the development role in improving the impact of trade integration. Thus, access to finance for commercial activities on an African scale should be facilitated. This can be achieved through the establishment of a Bank for Regional Trade in Africa under the auspices of the AfDB. Another option would be to support commercial banks by granting them loans at competitive rates so that they facilitate access to commercial credit at lower rates.

Finally, other important findings emerge from our study even though they are not the main subject of our analysis. Indeed, education and domestic investment play a major role in improving income in the short and long term while inflation and development have a significant impact on income in the short and medium term. These results give rise to several policy implications. Given the importance of their role, improved education and domestic investment should be given prominence in

economic policy measures in Africa.

Regarding education, it is important to promote higher levels of education, including through vocational education. Considerable efforts must be made on the supply side as well as on the demand side. Supply-side policies could include increasing teachers' incentives, enhancing the basic quality of schools' physical infrastructure, and researching and implementing teaching methods to increase the learning performance of students who do not do well when left to their own devices. Demand-side policies could include scholarships conditional on attendance, bringing in excluded groups, and developing the accountability of schools and teachers to students, parents, and the broader society to help ensure effective service provider behavior.

For its current level of development, Africa has a low rate of domestic investment. Domestic investment needs to be strengthened, including in transport and telecommunications infrastructure. In order to do so, national governments (through taxation, streamlining of administrative procedures) and regional institutions (through assistance for low-cost capital mobilization and technical assistance) should encourage private companies to make long-term investments needed for sustainable and inclusive economic growth.

As expected, inflation contributes to depreciating real per capita income. As a result, policies aimed at limiting inflation (independent central banks, inflation targeting, etc.) will improve the average level of real income. Finally, as pointed out earlier, financial development needs to be strengthened in Africa so that finance is a driver of long-term growth.

7 Conclusion

Regional integration is seen as a powerful tool to promote inclusive growth and political stability, but also to address the challenges of global economic, technological and ecological change. On this basis, African leaders and institutions are making enormous efforts to promote regional integration. However, statistics on the state of African integration are not impressive. The challenges to be overcome are therefore still immense in order to strengthen this integration.

From the academic point of view, theoretical and empirical studies are, to say the least, very cautious about the income-enhancing effect of integration among developing countries. This paper aims to study the impact of African integration. To do this, it considers intra-African trade and migration as two quantitative measures of regional integration. To take into account the potential simultaneity bias issues, we

use two-stage least squares (2SLS) estimation method with an identification strategy based on the gravity models. Our results show that African integration has not been strong enough to drive a long-term improvement in real per capita income in Africa. In fact, although positive, the long-term impact of regional integration does not resist the robustness tests. However, African integration appears to be significantly income-enhancing in the short and medium term but only through inter-country migration. Intra-African trade, for its part, still fails to have a significant impact on per capita income. In further investigations, we find that the impact of intra-regional trade is conditioned by the diversification of African economies, their financial development and the quality of their transport and telecommunications infrastructures. A substantial improvement in these fundamentals would make intra-African trade significantly income-enhancing. Our recommendations above have been made to meet this challenge.

Appendix

Table A-1: Results of gravity model estimations

Variables	Cross-sectional gravity results				Panel gravity results			
	Trade		Migration		Trade		Migration	
	OLS	PPML	OLS	PPML	OLS	PPML	OLS	PPML
Ln distance	-1.32*** (0.10)	-0.69*** (0.15)	-1.83*** (0.10)	-0.85*** (0.16)				
Ln dist. 1990					-2.10*** (0.10)	-0.63*** (0.11)	-1.96*** (0.08)	-0.91*** (0.08)
Ln dist. 1995					-2.00*** (0.09)	-0.53*** (0.10)	-1.93*** (0.08)	-0.90*** (0.09)
Ln dist. 2000					-1.85*** (0.08)	-0.52*** (0.11)	-1.77*** (0.08)	-0.88*** (0.09)
Ln dist. 2005					-1.74*** (0.08)	-0.61*** (0.08)	-1.12*** (0.09)	-0.94*** (0.08)
Ln dist. 2010					-1.77*** (0.08)	-0.63*** (0.08)	-1.07*** (0.10)	-0.90*** (0.08)
Ln pop. origin	0.04 (0.07)	-0.12 (0.10)	-0.75*** (0.05)	-0.75*** (0.12)	0.06* (0.03)	-0.04 (0.06)	-0.65*** (0.02)	-0.68*** (0.05)
Ln pop. dest.	0.74*** (0.06)	0.75*** (0.13)	0.33*** (0.06)	0.20** (0.09)	2.14*** (0.52)	-1.26 (0.87)	-0.03 (0.58)	0.95 (0.90)
Ln area origin	-0.12** (0.06)	-0.07 (0.06)	0.21*** (0.04)	0.22** (0.08)	-0.11*** (0.03)	-0.08* (0.04)	0.12*** (0.02)	0.26*** (0.04)
Ln area dest.	-0.01 (0.05)	0.13 (0.11)	0.01 (0.04)	0.12 (0.12)	-1.66*** (0.51)	1.77** (0.85)	0.37 (0.52)	-0.15 (0.88)
Sum landlocked	-1.41*** (0.10)	-0.76*** (0.15)	-0.56*** (0.08)	-0.41*** (0.16)	-0.84*** (0.06)	-0.37*** (0.11)	-0.35*** (0.05)	-0.55*** (0.11)
Border	1.45*** (0.18)	1.32*** (0.32)	2.05*** (0.21)	2.35*** (0.34)	1.32*** (0.09)	1.36*** (0.14)	2.10*** (0.10)	2.18*** (0.13)
Com. language	0.61*** (0.17)	0.84*** (0.23)	0.20 (0.14)	0.61** (0.27)	0.31*** (0.08)	0.83*** (0.14)	0.37*** (0.08)	1.20*** (0.14)
Com. off. lang.	0.38** (0.18)	0.30 (0.20)	0.41*** (0.14)	0.48 (0.32)	0.63*** (0.07)	-0.09 (0.11)	0.48*** (0.07)	0.42*** (0.14)
RIA_AGADIR	2.69*** (0.92)	-0.59 (1.88)	1.40 (1.80)	-2.14 (2.67)	0.58** (0.27)	-0.53 (0.42)	0.15 (0.43)	-0.42 (0.79)
RIA_CEMAC	0.49 (0.49)	0.07 (0.82)	0.26 (0.53)	-1.17 (0.81)	-0.54** (0.21)	0.05 (0.41)	-0.14 (0.21)	0.43** (0.21)
RIA_COMESA	1.35*** (0.23)	0.26 (0.38)	0.56*** (0.21)	-0.03 (0.41)	0.88*** (0.10)	0.90*** (0.17)	0.47*** (0.10)	0.43** (0.21)
RIA_ECA	2.21*** (0.56)	0.54 (0.65)	2.50*** (0.52)	0.49 (0.71)	1.15*** (0.21)	0.69*** (0.19)	0.60*** (0.18)	0.30 (0.22)
RIA_ECOWAS	0.32 (0.21)	0.45 (0.38)	1.58*** (0.17)	0.58* (0.35)	0.20* (0.11)	0.94*** (0.18)	1.01*** (0.10)	0.26* (0.14)
RIA_PAFTA	0.09 (0.59)	-0.82 (0.87)	1.35 (1.04)	0.94 (0.94)	-0.36 (0.24)	-0.15 (0.22)	0.10 (0.34)	-0.47 (0.58)
RIA_SACU	-2.62** (1.29)	-12.74*** (2.22)	-1.97** (0.90)	-3.16*** (1.11)	0.25 (0.53)	-4.95*** (0.75)	-0.94*** (0.28)	-0.43 (0.33)
RIA_SADC	3.90*** (0.42)	3.06*** (0.59)	3.05*** (0.32)	0.79 (0.63)	1.40*** (0.12)	0.77*** (0.21)	0.92*** (0.14)	0.32* (0.17)
RIA_WAEMU	2.28*** (0.34)	0.91** (0.39)	0.73*** (0.28)	0.47 (0.50)	1.39*** (0.14)	0.63*** (0.18)	0.33** (0.14)	0.20 (0.22)
RIA_AMU	1.07** (0.43)	-0.12 (0.58)	-0.02 (0.49)	-1.63*** (0.50)	-0.01 (0.21)	0.13 (0.21)	-0.66** (0.27)	-0.09 (0.19)
Constant	4.50*** (0.89)	0.32 (1.01)	6.57*** (0.86)	0.86 (0.85)	11.46*** (0.98)	-1.67 (1.45)	1.33 (1.10)	-1.49 (1.50)
Observations	1,829	2,704	1,897	2,704	7,651	13,520	6,685	13,520
R-squared	0.45	0.28	0.57	0.34	0.56	0.32	0.61	0.55

Notes: Heteroskedasticity-robust standard errors are in parentheses. *, **, and *** denote significance at the 10%, 5% and 1% confidence level, respectively.

Table A-2: Regional Trade Agreements in Africa

Abbreviation	Name of RTA	Type of Agreement	Members	Year Originated	Year Agreement Signed	Objective
AMU (11.56)	Arab Maghreb Union	Free Trade Area	Algeria, Libya, Mauritania, Morocco, Tunisia	1988	1989	- Economic and political unity among Maghreb countries.
Agadir (21.66)	Agadir Agreement	Free Trade Area	Egypt, Jordan, Morocco, Tunisia	2001	2004	- Establish an FTA among members prior to a Euro-Mediterranean FTA as envisaged in The Barcelona Process. - Boost competitiveness of their products into European Union (EU) markets; expand co-operation, commercial exchange and free trade between members. - Agadir Agreement spectrum includes customs, services, certificates of origin, government purchases, financial dealings, preventive measures, intellectual property, standards and specifications, dumping and mechanisms to resolve conflicts.
EMCC/CEMAC (6.24)	Economic and Monetary Community of Central Africa	Customs & Monetary Union	Cameroon, Central African Republic (L), Chad (L), Congo, Equatorial Guinea, Gabon	1959 ¹	1994	- Create a common market based on the free movement of people, goods, capital and services. - Ensure a stable management of the common currency. - Secure environment for economic activities and business in general. - Harmonize regulations of national sectoral policies.
COMESA (8.04)	Common Market for Eastern and Southern Africa	Customs Union	Burundi (L), Comoros, DR Congo, Djibouti, Egypt, Eritrea, Ethiopia (L), Kenya, Libya, Madagascar, Malawi (L), Mauritius, Rwanda (L), Seychelles, Sudan, Swaziland (L), Uganda (L), Zambia (L), Zimbabwe (L)	1965 ²	1993	- Achieve sustainable economic and social progress in all Member States through increased co-operation and integration in all fields of development particularly in trade, customs and monetary affairs, transport, communication and information, technology, industry and energy, gender, agriculture, environment and natural resources.
EAC (12.07)	East Africa Community	Customs Union	Burundi (L), Kenya, Rwanda (L), Tanzania, Uganda (L)		1999	- Widen and deepen co-operation among Partner States in, among others, political, economic and social fields for their mutual benefit. To this extent the EAC countries established a Customs Union in 2005 and a Common Market in 2010. Enter into a Monetary Union and ultimately become a Political Federation of the East African States.
ECOWAS (7.23)	Economic Community of West African States	Trade, Currency, Political Union	Benin, Burkina Faso (L), Cape Verde, Cote d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali (L), Niger (L), Nigeria, Senegal, Sierra Leone, Togo	1965 ³	1975/1993	- Achieve a common market and a single currency. Provide for a West African parliament, an economic and social council and an ECOWAS court of justice to replace the existing Tribunal and enforce Community decisions. The treaty also formally assigned the Community with the responsibility of preventing and settling regional conflicts.
PAFTA (9.45)	Pan-Arab Free Trade Area	Free Trade Area	Bahrain, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, United Arab Emirates, Yemen		1997	- Elimination of customs duties and other fees and duties having similar effects. - Eliminate all non tariff barriers, including Administrative, Monetary, Financial and Technical barriers. - Preferential treatment for least developed member states.
SACU (21.07)	Southern African Customs Union	Customs & Monetary Union	Botswana (L), Lesotho (L), Namibia, South Africa, Swaziland (L)	1910 ³	2002	- Facilitate the cross-border movement of goods between the territories of the Member States. - Create effective, transparent and democratic institutions to ensure equitable trade benefits to Member States. - Promote conditions of fair competition in the Common Customs Area and investment opportunities.
SADC (11.45)	Southern African Development Community	Free Trade Area	Angola, Botswana (L), Lesotho (L), Malawi (L), Mauritius, Mozambique, Namibia, South Africa, Swaziland (L), Tanzania, Zambia (L), Zimbabwe (L)	1980 ⁴	1996	- Enhance growth and poverty alleviation: support the socially disadvantaged through Regional Integration. - Evolve common political values, systems and institutions: Promote and defend peace and security. - Promote self-sustaining development on the basis of collective self-reliance and the inter-dependence of Member States. - Achieve complementarity between national and regional strategies and programmes. - Achieve sustainable utilisation of natural resources and effective protection of the environment. - Strengthen and consolidate historical, social and cultural affinities.
WAEMU /UEMOA (10.33)	West African Economic and Monetary Union	Customs & Monetary Union	Benin, Burkina Faso (L), Côte d'Ivoire, Guinea-Bissau, Mali (L), Niger (L), Senegal, Togo		1994	- Increase competitiveness through open markets: rationalize and harmonize the legal environment. - Convergence of macro-economic policies and coordination of sectoral policies; create a Common Market. - The coordination of sectoral policies.

Notes: De Melo and Tsikata (2015).

Table A-3: Additional descriptive statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Quality of overall infrastructure, 1-7 (best)	3.55	0.76	1.85	5.62	190
Quality of roads, 1-7 (best)	3.45	0.83	1.91	5.83	190
Quality of railroad infrastructure, 1-7 (best)	2.32	0.74	1.24	4.15	147
Quality of port infrastructure, 1-7 (best)	3.74	0.75	1.77	5.64	190
Quality of air transport infrastructure, 1-7 (best)	3.92	0.91	2.11	6.14	190
Percentage of Individuals using the Internet	12.93	13.38	0.58	56.8	271
Export diversification index	-3.22	1.02	-5.34	-0.8	205

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