The Effect of Intra-African Immigration on Productivity in Africa

By

Blaise Gnimassoun

Research Paper 535

AFRICAN ECONOMIC RESEARCH CONSORTIUM
CONSORTIUM POUR LA RECHERCHE ÉCONOMIQUE EN AFRIQUE

Bringing Rigour and Evidence to Economic Policy Making in Africa

The Effect of Intra-African Immigration on Productivity in Africa

By

Blaise Gnimassoun
University of Lorraine, BETA-CNRS
Nancy, France

AERC Research Paper 535
African Economic Research Consortium
August 2023

THIS RESEARCH STUDY was supported by a grant from the African Economic Research Consortium. The findings, opinions and recommendations are those of the author, however, and do not necessarily reflect the views of the Consortium, its individual members or the AERC Secretariat.

Published by: The African Economic Research Consortium
P.O. Box 62882 - City Square
Nairobi 00200, Kenya

ISBN 978-9966-61-238-0

Contents

List of tables

List of figures

List of abbreviations and acronyms

2SLS	Two-Step Least Squares
AU	African Union
CEPII	Centre d'Études Prospectives et d'Informations Internationales (Center for International Prospective Research and Data)
GDP	Gross Domestic Product
IFS	International Financial Statistics
IMF	International Monetary Fund
MPFA	Migration Policy Framework for Africa
OLS	Ordinary Least Squares
PPML	Poisson Pseudo Maximum Likelihood
PPPs	Purchasing Power Parities
PWT	Penn World Table
UNCTAD	United Nations Conference on Trade and Development
WDI	World Development Indicators

Acknowledgements

I would like to sincerely thank the Africa Economic Research Consortium (AERC) resource persons (Carol Newman, Remco Oostendorp, and Måns Söderbom) as well as the reviewer, Exley Silumbu, for their excellent comments and advice which greatly contributed to improving the quality of this paper.

Abstract

Contrary to popular belief, the majority of Africans who migrate stay in Africa. In a context of low trade openness between African countries and high differences in the prices of goods and factors, intra-African immigration could theoretically play an important role. This paper aims to study the impact of intra-African immigration on labour productivity in Africa, as well as its macroeconomic and sectoral components. Empirically, I rely on a panel of 187 countries, including 53 African countries, over the period 1990–2019, and a gravity-based 2SLS approach to deal with endogeneity. The results show that intra-African immigration has a positive, significant, and robust impact on labour productivity in Africa. This impact is greater than the effect of immigration in a global sample, and essentially passes through the improvement in total factor productivity and capital efficiency. While immigration tends to deteriorate capital productivity in the world sample, intra-African immigration improves capital productivity in Africa. Furthermore, the results reveal that the service sector is the one that benefits from the positive effect of intra-African immigration in Africa.

Key words: Integration; Labour productivity; Immigration; Africa.
JEL classification codes: F02; J24; J61; O55.

1. Introduction

The continued rise in international migration following the acceleration of globalization that has taken place since the early 1990s has led to increased interest in studying the impact of migration on economies. However, research has mostly focused on developed economies for which migration flows from developing countries are perceived as a supply shock on the labour market, requiring adjustments in the economy (see, among others, Coleman & Rowthorn, 2004; Card, 2005; Bentolila et al., 2008; Peri, 2012; Akay et al., 2014; Ottaviano et al., 2018). Studies of the consequences of this dynamic of migration for sending countries are less numerous and have mainly focused on the impact of migrant remittances (see, among others, Adams & Page, 2005; Combes & Ebeke, 2011; Adams & Cuecuecha, 2013; Konte, 2016; Asatryan et al., 2017). This abundant literature is also silent on the impact of migration between developing countries, despite the importance of the latter in the structure of international migration. Gnimassoun (2020) addressed this question for African countries by studying the impact of intra-African immigration on incomes in Africa, and showed that, although intra-African integration positively impacts per capita income, the effect passes only through intra-African migration, with intra-African trade having no significant impact.

In this study, I go further by analysing the impact of intra-African immigration on labour productivity and its macroeconomic and sectoral components in Africa. The reasons underlying this investigation are threefold. First, the architecture of international migration clearly shows that it is dominated by greater mobility of the working-age population. Consequently, the labour market is supposed to be directly impacted by immigration, hence the relevance of this study to an analysis of the impact of migration on labour productivity. Second, intra-African migration may have a different effect on productivity compared with developed countries because of its different composition. Indeed, this migration is, above all, linked to the structure of African economies and is largely agricultural or related to the tertiary sector. Thus, intra-African migration involves less highly qualified people given the small size of the industrial sector and the low economic complexity in most African countries. Third, the Heckscher-Ohlin theory (see Leamer, 1995) suggests that, with free trade there is no incentive to migrate due to the equalization of factor prices, including wages, and that migration will have no impact on labour productivity. In a context where trade is far from free, such as within Africa, immigration could have a positive impact on income

per worker. Moreover, considering the relatively lower level of intra-African trade, one can expect that intra-African immigration will have a relatively greater impact on income per worker. Fourth, following the neoclassical theory of international factor mobility, labour tends to move from low real wage/productivity countries to higher wage/productivity countries. Although the theory predicts the equalization of factor returns/productivities in the very long run, it predicts, during adjustment or in the medium term, rising returns in the origin/emigration countries and decline of returns in the destination/immigration countries. However, real national and per capita incomes rise in both countries. On this basis, a positive impact of immigration on productivity can be expected in the medium term.

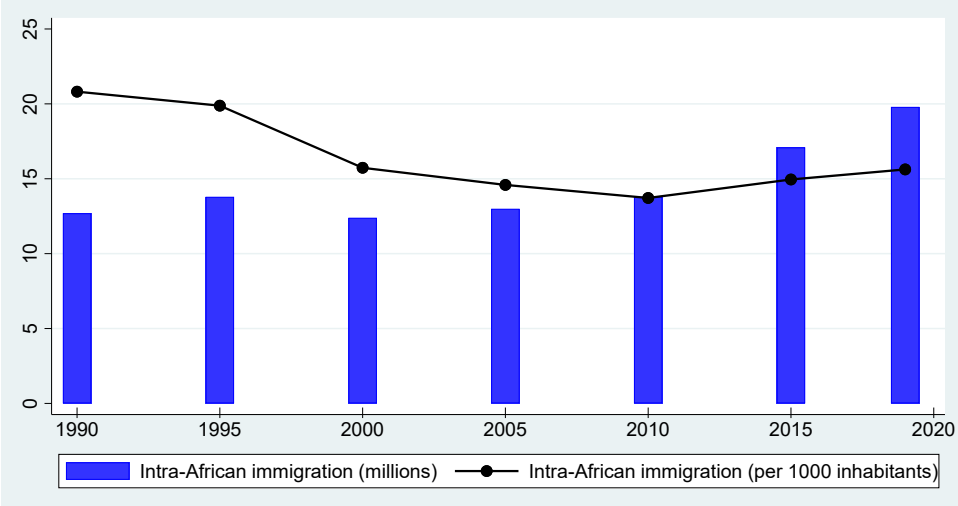
The study of the impact of intra-African migration is also of interest from a political point of view. African policy makers and institutions see intra-African migration as an opportunity for Africa, but they are also concerned about the challenges posed by certain forms of migration. For countries facing unexpected waves of migration, managing these flows can pose some challenges, or even difficulties, in making them mutually beneficial. However, when immigration meets a need in the host country, it can be beneficial for both immigrants and the host country. In the early 2000s, the Organization of the Council of Ministers of the African Union (AU) considered that it was necessary to develop a migration policy framework given the challenges posed by cross-border migration. This resulted in the development of the first African Union Migration Policy Framework for Africa (MPFA) in 2006 and then a revised version in 2016, supplemented by an action plan (2018–2030). The revised MPFA blends AU priorities, sustainable development goals, and international migration management policies and standards.

In addition, the statistics of intra-African immigration reinforces the rationale for this study. Indeed, if Africa is often distinguished by a strong emigration of its talents to developed countries (called the *brain drain phenomenon*) then, contrary to popular belief, intra-African migration remains the most important component of African migration. According to United Nations migration data, African immigrants accounted for 78% of immigrants in Africa in 2015, although this proportion is lower than it was in 1990. Moreover, as Figure 1 shows, intra-African immigration has increased significantly since the early 2000s. Nevertheless, intra-African immigration remains relatively low compared with the African population. Indeed, for every 1,000 Africans in 2015, only 15 were African immigrants, although this rate is very heterogeneous between African regions and countries (see Table A2 in the appendix). Indeed, if West Africa has the highest intra-community immigration rate (more than 88%, because of an old and very proactive immigration policy), the regional immigration rate is 40% in Central Africa and less than 20% in Southern Africa.

Given Africa's development potential, intra-African immigration could be an alternative to emigration to developed countries. For this to occur, it must contribute to the emergence of this potential and allow Africans to have a better quality of life on the continent. Thus, a study of the impact of intra-African migration has important implications in terms of short-, medium-, and long-term economic policy strategy

for policy makers. Moreover, to my knowledge, no study yet has been devoted to an examination of the effect of intra-African immigration on productivity and its components in African countries.

Figure 1: Dynamics of intra-African immigration



Note: Data come from the United Nations database. They are available by country pair from 1990 every five years.

The approach I use in this study is based on major contributions from the literature devoted to an examination of the factors that explain differences in productivity between nations (Hall & Jones, 1999; Caselli, 2005; Hsieh & Klenow, 2010; Peri, 2012; Ortega & Peri, 2014). The analytical approach relies on a conventional production function and its decomposition. It provides an adequate framework for studying the effect of intra-African migration on productivity and each of its main components, namely, human capital, total factor productivity, and capital intensity. Furthermore, I examine the impact of intra-African immigration on labour productivity by sector (agriculture, industry, and service). To properly assess the effect of immigration on the economy, it is essential to consider the possibility of a reverse causality between immigration and productivity. Indeed, migrants choose to settle in countries that have higher productivity and better employment opportunities. I, therefore, use a gravity-based two-step least squares (2SLS) approach to deal with this issue of endogeneity.

The rest of the paper is structured as follows. Section 2 briefly reviews the empirical literature. The empirical method proposed for this study is set out in Section 3. Section 4 presents and discusses the results. Section 5 concludes the study.

2. Empirical literature review

Empirical studies aimed at studying the effect of immigration on the economy of host countries are numerous. In this section, I focus only on those that have dealt with the impact of immigration on productivity or, more broadly, on the labour market. Studies of the effects of regional immigration are rare. The literature mostly deals with the effects of immigration regardless of the origin of the migrants and focuses mainly on developed countries. The empirical literature I present here is not exhaustive and focuses more on a few influential studies since the 2000s.

Several empirical studies rely on the so-called 'national approach', which focuses on immigration as a factor affecting the relative supply of skills in the labour markets (Borjas 2003; Ottaviano & Peri 2012; Ortega & Peri, 2014; among others). This approach focuses mainly on analyses of complementarity between skills and ignores other considerations (margins change in the supply/specialization of indigenous and technological adjustment). Borjas (2003) assessed the effect of immigration on the U.S. labour market on the basis that immigration is not balanced between groups of workers who have the same education but who differ in their work experience. For him, workers of the same level, with different levels of experience, participate in the labour market and are not perfectly substitutable for one another. His results indicate that immigration reduces the wages of competing workers: A 10% increase in supply reduces wages by 3–4%. Ottaviano and Peri (2012) calculated the effects of immigration on the wages of native U.S. workers of various skill levels. A novel aspect of their study is that they assessed the degree of substitutability between nationals and immigrants with the same level of education and experience. They found that, in the data-driven model, there was a small but significant degree of imperfect substitutability between natives and immigrants. By combining this result with other estimated elasticities, the authors indicated that, over the period 1990–2006, the impact of immigration on the wages of native workers without a high school diploma was limited (between 0.6% and +1.7%). The effect on the average wages of native-born was positive but weak (+0.6%), and the long-term effect on the wages of former immigrants was negative and significant (-6.7%). Ortega and Peri (2014) adopted a more macroeconomic approach and explored the relationship among trade openness, immigration, and income per person across countries. To solve endogeneity problems, they relied on a gravity-based 2SLS strategy and found a positive and robust effect of openness to immigration on long-term per capita income. They also showed that the effect of immigration operates through an increase in total factor productivity.

Some studies have used area-level analyses to examine adjustment margins other than just wages. They have pointed out that indigenous workers are not fully mobile and that part of the effect of immigrants on productivity is more local (Ottaviano & Peri, 2006; Peri & Sparber, 2009; Lewis, 2011; Peri, 2012). In this empirical literature, the instrumental variable method is often used to control for changes in local labour market demand. The so-called "shift-share" (or enclave) instrument is commonly adopted in this strategy, which attempts to isolate supply-driven changes of immigrants in local areas (for more details on this approach, see Card, 2001). Using this strategy, Ottaviano and Peri (2006) showed that immigration has a significant positive effect on labour productivity, especially when immigrants come from diverse origin countries. Peri and Sparber (2009) indicated that, for U.S. states, high immigration has induced a significant movement of native workers without qualifications toward non-manual jobs, complementary to the specialization of immigrants, with slightly positive effects on their wages. Lewis (2011) and Peri (2012) indicated that large inflows of immigrants influence the political choices of the state or the metropolitan region in terms of production technology. The latter tend to choose production techniques that are more intensive in unskilled and poorly educated labour when immigrants have a low level of education. They, therefore, found that a larger supply of immigrants has not greatly affected the local wages of non-university natives. More recently, Ottaviano et al. (2018) studied the effect of immigrants on trade and the productivity of firms specializing in the production of services in the United Kingdom. They found that immigration contributes to an increase in the overall productivity of these firms, which is an indication of a cost-reduction effect. In their view, immigrants also contribute to reducing the scale of country-specific relocations, in accordance with a reallocation of tasks, and they induce an increase in the country's exports.

Although this is a controversial conclusion, the literature generally shows that immigration has an overall negligible effect on wages and the unemployment rate. Through a review of the literature, Edo (2019) showed, for example, that the impact of immigration on the average wage and employment of native workers is null or slightly positive. However, because of the adjustment time required, the immediate effects on the labour market of unexpected migration episodes can be detrimental. Moreover, the skill composition of immigrants matters insofar as an influx of immigrants tends to lower the wages of competing native workers and raise those of complementary workers. In the same vein, Aubry et al. (2022), through a meta-analysis on about 60 articles found that, on average, the literature reports a negative and near-zero effect of immigration on the wages of natives regardless of the qualification level of the immigrants. These conclusions differ from those of Edo (2019), although the two studies agree on the generally low quantitative impact of immigration on the wages and employment rate of natives.

Most of the empirical studies presented in this section have relied on detailed migration data. Such data are unfortunately not available for African countries, which forces my analysis to be more macroeconomic in its focus, leaving aside skills and wage considerations.

3. Methodology

Regional (or continental) studies of the impact of intercountry migration on productivity are scarce. They are often based on an analytical accounting framework and a conventional production function. In this section, I present the analytical framework underlying my study as well as the empirical strategy I used to assess the effect of migration (especially immigration) on productivity.

Analytical framework

To study the factors explaining differences in productivity between nations, an often-used analytical framework includes a reliance on the conventional Cobb–Douglas production function and its accounting decomposition. Hall and Jones (1999) were the first to propose this approach. It was then adopted and developed in several more recent studies (Caselli, 2005; Hsieh & Klenow, 2010; Peri, 2012; Ortega & Peri, 2014; Hendricks & Schoellman, 2017). I am, therefore, closely following this analytical framework because it is appropriate for studying the impact of intra-African migration on productivity. Specifically, I consider the following production function:

$$Y_{it} = K_{it}^{\rho}(A_{it}H_{it})^{1-\rho} \quad (1)$$

Where: Y_{it} stands for country *i*'s PPP-adjusted gross domestic product (GDP) for period *t*; K_{it} is its physical capital stock for the same period; *A* is its total factor productivity; and $H_{it} \equiv h_{it}L_{it}$ denotes the total labour factor, which is made up of human capital per worker (h_{it}) and the number of workers (L_{it}). A rewrite of this production function in terms of output per worker gives:

$$y_{it} = \left(\frac{K_{it}}{Y_{it}}\right)^{\frac{\rho}{(1-\rho)}} A_{it}h_{it} \quad (2)$$

Where: $y_{it} = Y_{it}/L_{it}$ denotes output per worker. Applying the logarithm to the two sides of Equation 2 gives:

$$\ln(Y_{it}) = \ln(y_{it}) + \ln(L_{it}) = \ln(L_{it}) + \frac{\rho}{(1-\rho)} ln\left(\frac{K_{it}}{Y_{it}}\right) + \ln(A_{it}) + \ln(h_{it}) \quad (3)$$

In accordance with the standard neoclassical approach, total factor productivity is calculated as the Solow residual from the production function with an estimated rho (ρ) value for African countries of 0.72 over the study period. Moreover, I follow Hall and Jones (1999) in considering human capital per worker as a function of return to education ($h = e^{\phi(E)}$); ϕ is a function expressing the efficiency of a unit of work with *E* years of education.

My empirical development is based on this decomposition. Indeed, according to Equation 3, the increase in employment (L_{it}) and the increase in production per worker (y_{it}) induce the increase in total production in a state. In turn, output per worker increases because of the effect of three factors: (1) capital intensity (K_{it}/Y_{it}), (2) total factor productivity (A_{it}), and (3) human capital per worker (h_{it}).

On the basis of Equation 3, I can study the effect of intra-African immigration on output per worker (labour productivity) and on each of its components. A priori, the net effect of immigration on output per worker is not easy to predict. Indeed, neoclassical growth models consider that, in the long run, only the increase in total factor productivity improves output per worker. Therefore, an exogenous increase in employment due to immigration (as is often assumed) would only increase L_{it} without having a long-term effect on any other variable or on y_{it}. However, as Peri (2012) pointed out, immigration can be more than a simple inflow of people. On the one hand, when it brings different and complementary skills, changes in the specialization of natives, increased competition, and directed technical changes, immigration is likely to increase productivity and capital intensity. On the other hand, the crowding of fixed factors and incomplete capital adjustment can produce decreases in productivity and capital intensity (Peri, 2012). Through this study, I can examine the effect of intra-African immigration on each of the four terms on the right-hand side of Equation 3. In addition, the study will also examine disaggregated results such as the effect of immigration on real value-added per worker in each sector (agriculture, industry, and services).

Model

The empirical model is based on the analytical framework. The specification adopted is common in the literature on the impact of openness. More precisely, the model used is inspired by that of Ortega and Peri (2014), who proposed an extension of the model of Frankel and Romer (1999), which was originally designed to study the impact of openness to trade. With their extension, Ortega and Peri studied the effect of openness to trade and immigration on per capita income and productivity by adopting the accounting framework of the production function presented above.

Transposed only to Africa, the same specification can be used to assess the impact of intra-African immigration on productivity and its components in Africa. Therefore, the specification of my model is given by:

$$lnz_{it} = \alpha_0 + \delta_t + \vartheta_{reg} + \alpha_1 IMMIG_{it-1}^{Afr} + \sum_k \delta^k X_{it}^k + \varepsilon_{i,t} \quad (4)$$

Where: $z_{it} = \{y_{it}; K_{it}/Y_{it}; A_{it}; h_{it}; y_{it}^A; y_{it}^I; y_{it}^S\}$ is the dependent variable, which is, alternately, labour productivity, capital intensity, total factor productivity, human capital, labour productivity (value-added per worker) in the agriculture sector, labour productivity in the industrial sector, and labour productivity in the services sector. $IMMIG^{Afr}$ MSH^{Afr} is the intra-African immigrants' proportion of the population, *X* represents control variables, and $\varepsilon_{i,t}$ represents the error term and captures unobserved determinants of productivity. The control variables are the trade openness rate, the investment rate, the level of financial development, the degree of financial openness, the natural resource rent rate, and the level of democracy, as well as geographical and historical variables (percentage of tropical climate, distance to the Equator, colonial origin, and percentage of settlers in 1900). In the specification, the variable of interest is lagged by one period (five years) to account for the lagged effect of immigration on productivity. This specification controls for potential heterogeneity between different subregions of Africa; δ_t and ϑ_{reg} are, respectively, unobserved period effects and unobserved region effects that are constant over time; *i* and *t* stand for country and period, respectively.

Turning now to the estimation strategy, I first use the ordinary least squares (OLS) estimator to study the link between intra-African immigration and dependent variables. With the relatively small sample size, the study relies on a non-overlapping panel data approach. This approach has the advantage of providing more observations and variability, which allows for more accurate and robust estimates. The panel specification accounts for heterogeneity across subregions in Africa as well as time fixed effects.

Gravity-based 2SLS approach

The OLS regression of Equation 4 ignores the endogeneity problem that needs to be addressed. To identify the causal effect of immigrants on an economy, it is important to consider the possibility of reverse causality. Indeed, migrants choose to settle in countries that have higher productivity and better employment opportunities. Thus, the relationship between intra-African immigration and productivity may be marked by reverse causality. Moreover, immigration and productivity are likely to be jointly affected by the same unobserved characteristics. The use of the 2SLS estimation strategy overcomes these potential simultaneity bias issues.

The first step of this strategy consists of building predictions of intra-African bilateral immigration on the basis of explanatory geographical factors. For this purpose, the following pseudo-gravity model is considered:

$$lnIMMIG_{ij,t}^{Afr} = \gamma_0 + \gamma_1 lnDist_{ij} + \gamma_2 lnIMMIG_{ij,1990}^{Afr} + \gamma_3 lnPop_{jt} + \gamma_4 lnArea_j + \gamma_5 Conflict_{jt} + \gamma_6 Landlocked_i + \gamma_7 Landlocked_j + \gamma_8 Border_{ij} + \gamma_9 ComLang_{ij} + \gamma_{10} heg_j + \gamma_{11} Colony_{ij} + e_{ij,t}, \quad (5)$$

Where: $IMMIG_{ij}^{Afr}$ is the bilateral immigration rate (the stock of migrants born in country *j* of Africa and living in country *i* of Africa as a percentage of the population of host country *i*), $Dist_{ij}$ measures the distance between country *i* (departure country) and *i* (host country), Pop_j is the population of country *j*, and $Area_j$ is the measured area of country *j*. Several dummy variables are included in this model: *Landlocked*, to take into account landlocked countries; *ComLang*, for countries that share a common official language; *Border*, to indicate whether countries *i* and *j* share a common border; and *Colony*. to indicate whether two African countries, *i* and *j,* share colonial ties. In addition, heg_j is the variable used to capture past or current hegemonic relationships, as in Ortega and Peri's (2014) paper. It should be noted, however, that in the intra-African context, hegemonic relations are rare. They only existed between Ethiopia and Eritrea, South Africa and Namibia, and Egypt and Sudan. $IMMIG_{ij,1990}^{Afr}$ is the immigration rate at the start of the period, used to capture the attraction exerted by former migrants in the host country on new ones (see Coulibaly & Gnimassoun, 2023). $Conflict_{jt}$ is a variable based on data from the Center for Systemic Peace, which measures all types of major episodes of armed conflict. This is a conflict and war index coded from 1 (lowest) to 20 (highest), 0 denoting no episode of conflict or war. Since the gravity model is the first stage in the identification strategy, the focus is mainly on the country of origin variables to satisfy the exclusion restrictions. Indeed, if the variables of the country of origin directly influence the rate of immigration in the host country, then they do not have a direct impact on GDP per worker in the destination country. In other words, relying essentially on the variables relating to the partner countries, the immigration rates estimated from the gravity model appear to be appropriate instruments in the regressions of GDP per worker on the immigration rate. Furthermore, although the emphasis is on Africa in Equation 5, the latter is also estimated for the whole sample. In this case, the dependent variable is the total immigration rate regardless of country of origin. The descriptive statistics on all the variables used in the gravity models are presented in Table A1.

To estimate this gravity model, I rely on the nonlinear Poisson pseudo maximum likelihood (PPML) approach used by Silva and Tenreyro (2006). For these authors, unlike the estimation of the log-linearized model by OLS, the PPML approach has the merit of taking into account the observations of the dependent variable with zero values as well as heteroscedasticity; specifically, I use Silva and Tenreyro's (2010) procedure. It overcomes the problem of identifying (pseudo) maximum likelihood estimates of Poisson regression models with nonnegative values of the dependent variable (bilateral migration) and a large number of 0s on some regressors. It is important to point out that, given the propensity for time-invariant variables in the gravity model, the use of country fixed effects is not practical. As soon as Equation 5

is estimated, the sum of the estimated migration data for the countries of origin *j* provides the openness to immigration estimated for each destination country *i*. Assuming that Z_{ijt} is the vector of the explanatory variables of Equation 5 and Γ_{immig} Γ_{immig} is the vector of estimated coefficients, openness to intra-African immigration for a country *i* and at time *t* is given by:

$$\widehat{IMMIG}_{it}^{Afr} = \sum_{i \neq j} exp(\Gamma_{immg} Z_{ijt}) \quad (6)$$

These estimated values are used as external instruments for intra-African immigration in the 2SLS procedure.

Data

The data used in this study come from various sources. In this section, I present the set of data used and their source, distinguishing the dependent variables and the explanatory variables. Considering the objective of the paper and the empirical strategy, several variables are used as dependent variables according to the equation. The main dependent variable is labour productivity measured by GDP per worker at purchasing power parities (PPPs) from the Penn World Table (PWT, Version 10.0). Then, from the production decomposition equation, there are four dependent variables: (1) employment and the components of output per worker (i.e., (2) human capital per worker, (3) capital intensity, and (4) total factor productivity). The PWT10.0 contains data on real GDP for purchasing power parity, human capital, capital stock, and number of workers. This makes it possible to calculate all these dependent variables except the total factor productivity. As soon as the other variables are known, the total factor productivity is calculated directly from the production function as indicated previously. All these variables are useful for achieving the objective set out in this paper because they make it possible to determine the impact of (intra-African) immigration on labour productivity and to identify, where appropriate, the main transmission channels. The sectoral productivity variables come from the World Bank's World Development Indicators (WDI) database.

The most important explanatory variable in this study is the (intra-African) immigration rate, which for a given country is measured by the stock of (African) migrants divided by the population. Migrants are assimilated to the foreign-born population, including refugees. Data on the stock of (intra-African) migrants come from the United Nations International Migration Database.[1] Table A2 (in the appendix) shows the average rate of (intra-African) immigration by country over the period 1990–2019. Data are available every five years and date back to 1990. In addition to the explanatory variable of interest, several control variables are introduced into the main model in accordance with the literature. These variables include openness to

1 Refer to United Nations (2020) for more information on the methodology for estimating the migrant stock.

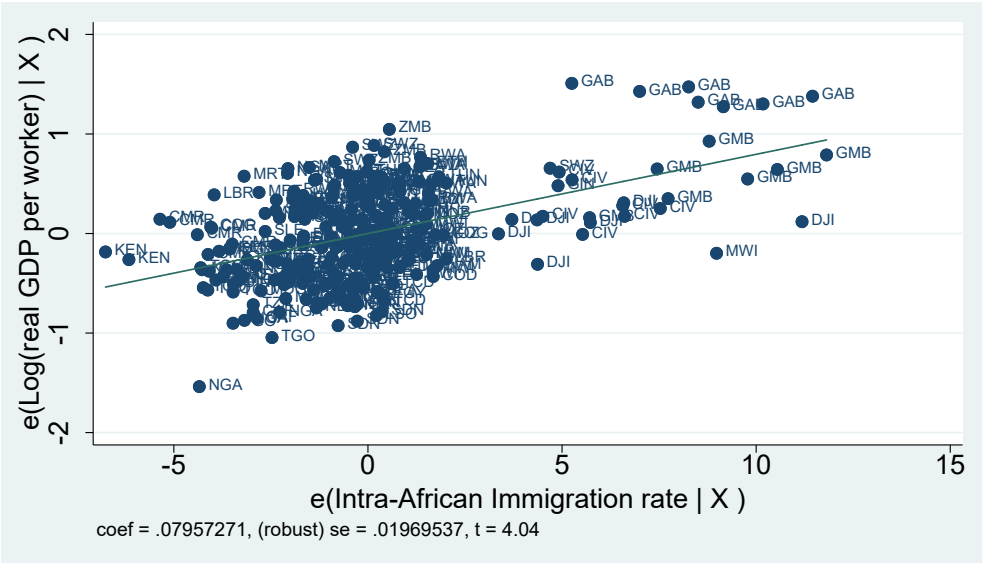
trade, level of financial development, rate of investment, level of democracy, natural resource rents, and rate of financial openness, as well as historical and geographical factors. All of these variables are likely to influence the level of productivity at the country level. Data on trade openness, measured as the sum of imports and exports as a percentage of GDP, come from the CEPII database on the gravity model. Financial development is a composite index summarizing how developed financial institutions and financial markets are in terms of depth, access, and efficiency. This index comes from the International Financial Statistics (IFS) database of the International Monetary Fund (IMF). Data on total natural resource rents as a percentage of GDP are from the World Bank's WDI database. The historical control variables are dummy variables related to the colonial past of the countries, and the geography variables are related to the latitude of the country, the share of tropical lands, and the dummy variables for landlocked countries. All these data are taken from Acemoglu et al. (2001). Data on the investment rate come from the IMF's World Economic Outlook. The democracy variable is an average of the Freedom House civil liberties and political rights indices. This variable was based on data from the Quality of Government Institute's Quality of Government database.

As indicated above, data on international migration are available for every 5-year period (1990–1995–2000–2005–2010–2015–2019). Therefore, the panel consists of a temporal dimension of seven five-year periods and a cross-sectional dimension that covers a set of 187 countries in the world, including 53 African countries. Taking a global sample into account makes it possible to reproduce known results, such as Ortega and Peri's (2014), and to examine any specificities linked to Africa. Descriptive statistics for the main variables targeted in this study are presented in Table A3 (in the appendix). In addition to the explanatory variables mentioned above, dummy variables are introduced into the regressions to control for unobserved regional heterogeneity. For the global sample, these variables relate to sub-Saharan Africa, East Asia, and Latin America. For the African sample, they concern the different regions of the continent (north, south, centre, west, and east).

4. Empirical results

Before presenting the results of the regression, it is important to graphically examine the relationship between the main variables of interest to see whether a visual trend emerges. Figure 2 shows the link between the intra-African immigration rate and the logarithm of real GDP per worker, which is the measure of aggregate labour productivity. This figure highlights an overall positive relationship between the immigration rate and labour productivity. The statistics (coefficient, standard deviation, t-stat) associated with this relationship confirm a significant positive link. The results of the regressions, in particular of the 2SLS regressions, will be more informative on the quality of the link between these two variables.

Figure 2: Immigration and labour productivity in Africa



Note: This graph is a residual scatterplot of real GDP per worker versus intra-African immigration based on a panel OLS regression of Equation 4.

Aggregate labour productivity

Table 1 presents the results of the OLS and 2SLS regressions[2] on the effect of (intra-African) immigration on overall labour productivity for both the global and African sample. These results are consistent with expectations; for example, the negative effect of distance is a standard result in the literature. Similarly, the results show that the larger the population of origin, the higher the immigration rate of the host country (see Ortega & Peri, 2014). Moreover, isolation reduces the rate of immigration, whereas colonial ties increase it. As expected, conflicts and wars in the country of origin are associated with more immigration, and former migrants exert a pull effect on new ones. In addition to the consistency of the results with the literature, Figure A1 (in the appendix) shows that the graph model adequately reproduces the immigration rate. This is important for the identification strategy, which requires a strong correlation between the endogenous variable and the instrument.

The results of the OLS regressions show that the total immigration rate, as well as the intra-African immigration rate, is positively associated with labour productivity measured by real GDP per worker. The results of the 2SLS regressions based on the gravity model point in the same direction and show that (intra-African) immigration has a positive and significant impact on labour productivity. This impact does not differ qualitatively depending on the estimator (OLS or 2SLS), but the coefficients associated with the 2SLS estimator are quantitatively lower than that of the OLS estimator. Furthermore, the quantitative impact of immigration differs depending on the sample. Indeed, this impact is four times greater for intra-African immigration compared with the impact of immigration in the world when considering the OLS estimator and more than twice as large with the 2SLS estimator. More specifically, the results show that a 10% increase in the immigration rate leads to an increase in labour productivity of 0.18% for the whole sample, whereas an equivalent increase in the immigration rate between African countries leads to an increase in labour productivity of 0.42% according to the 2SLS estimator. These results are significant at the 1% confidence level and are consistent with those of Ortega and Peri (2014), although there is a quantitative difference in the impact of immigration. The impact of immigration, when considering the full sample, is quantitatively lower than that in Ortega and Peri's study, which reached 0.85. However, it should be noted that these authors performed cross-sectional regressions instead, whereas in this study panel data regressions are performed. Moreover, the variables explained are not exactly the same insofar as Ortega and Peri considered real income per capita and not per worker. On the African sample, however, the impact of intra-African immigration on labour productivity is quantitatively closer to, although lower than, that found by Gnimassoun (2020) on the level of per capita income, between 0.5% and 1.1% according to the specification.

2 The results of the preliminary gravity model regressions are presented in Table A4 (in the appendix).

With regard to the 2SLS approach I used to deal with endogeneity, it is important to note that the gravity model provides instruments that are a priori decorrelated from the productivity of the immigration countries. Indeed, in the gravity model, the emphasis was placed primarily on the variables of the country of origin such as population and conflicts/wars. The effects of these variables on productivity in the destination country essentially pass through migration, which is in line with the exclusion restrictions. A thorough analysis of the power of the instruments confirms this intuition. Indeed, I carried out the test of low identification of the parameters of interest, and the results on the performance of the instrumental variables used are reported at the bottom of Table 1. The Kleibergen–Paap (KP) *F* test is used to test the weak instrument null hypothesis. The results show that, regardless of the specification, the null hypothesis is rejected since the KP *F* test is significantly higher than the Stock and Yogo critical values, including the most demanding (16.38). In sum, the positive effect of (intra-African) immigration on labour productivity highlighted in this paper is consistent with the results of Ottaviano and Peri (2006) and Ottaviano et al. (2018), although these studies focused on developed countries with more detailed data.

Table 1: Immigration and aggregate productivity

	OLS regressions		2SLS regressions	
VARIABLES	World	Africa	World	Africa
Immigration rate	0.020***	0.080***	0.018***	0.042***
	(0.004)	(0.020)	(0.004)	(0.009)
Trade openness	-0.020	-0.026	-0.016	-0.004
	(0.094)	(0.041)	(0.049)	(0.036)
Investment rate	0.012***	0.006	0.012***	0.005
	(0.004)	(0.005)	(0.003)	(0.003)
Financial openness	-0.001	-0.150**	-0.001	-0.129***
	(0.001)	(0.063)	(0.000)	(0.032)
Financial development	0.016***	0.004	0.017***	0.006
	(0.002)	(0.008)	(0.001)	(0.004)
Level of democracy	0.038	-0.000	0.036***	-0.016
	(0.023)	(0.031)	(0.011)	(0.016)
Natural resource rents	0.014***	0.014**	0.015***	0.014***
	(0.006)	(0.006)	(0.003)	(0.004)
Constant	8.726***	9.445***	8.726***	9.562***
	(0.270)	(0.659)	(0.131)	(0.310)
Observations	911	299	911	299
R-squared	0.793	0.804	0.793	0.790
Region FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes

Geographic controls	Yes	Yes	Yes	Yes
K-P F-stat			399.5	265.3
SY 10% max IV size			16.38	16.38
SY 25% max IV size			5.530	5.530

Notes: Heteroscedasticity-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 weak identification. SY 10% max IV size and SY 25% max IV size are the Stock and Yogo (2005) critical values under the i.i.d. assumption. Historical controls are dummy variables related to colonial origin (British, French, Portuguese, and Other European) and percentage of population of European descent in 1900. Geographic controls are distance to equator, share of tropical land, and dummy variables for landlocked countries. For the African sample, the explanatory variable of interest is the intra-African immigration rate, while for the whole sample it is the total immigration rate

With regard to the control variables, the results show that an increase in the rate of investment, financial development, and level of democracy induce a significant improvement in labour productivity for the full sample. These variables do not have a significant impact in the African sample. However, financial openness has a significant negative impact on labour productivity in Africa. This last result contrasts with others in the literature that show that financial openness increases productivity (Bonfiglioli, 2008; Bekaert et al., 2011). It should be noted that these studies are generally based on a set of countries selected throughout the world, which is therefore different from the sample considered here. Moreover, the negative effect of financial openness could be explained by the low level of financial development in most African countries, as well as by the potential Dutch disease effect that could result from financial openness in developing countries (see Lartey, 2011). The natural resource endowment, measured by the ratio of total natural resource rents as a percentage of GDP, has a positive and significant impact on income per worker regardless of the sample.

Transmission channels

To identify the channels through which the effect of immigration on productivity passes, I carried out regressions relating to Equation 3 and highlighting the components of income per worker. The results of the 2SLS regressions on the impact of immigration on the components of productivity (capital intensity, human capital, and total factor productivity) are presented in Table 2. These results show that the transmission channels differ according to the sample. For the whole sample, the impact of immigration on labour productivity significantly goes through the improvement of total factor productivity (at 1%) and, to a lesser extent, human capital per worker and capital intensity (at 10%). For Africa, the positive impact of intra-African immigration on labour productivity essentially involves improving total factor

productivity and capital intensity. Indeed, capital intensity (K/Y) being the inverse of capital productivity (Y/K), the negative and significant coefficient associated with intra-African immigration means that the latter improves the productivity of capital in Africa. The effect of immigration on total factor productivity appears to be five times higher for Africa than for the entire sample. Concerning the control variables, the increase in the rate of investment increases the capital intensity regardless of the sample, as one might expect. Investment also contributes significantly to the improvement of human capital regardless of the sample. Trade openness positively and significantly affects human capital and capital intensity in both samples, but its impact is negative on total factor productivity. The negative impact of financial openness on labour productivity in Africa passes more through total factor productivity and human capital. As in previous regressions, the null hypothesis of weak identification is strongly rejected, which confirms the performance of the instrumental variables used.

Labour productivity by sector of activity

One way to further analyse the impact of immigration on productivity is to study this impact by institutional sector of activity. The results of the impact of (intra-African) immigration on labour productivity by activity sector (agriculture, industry, and services) are reported in Table 3. According to these results, immigration has a positive and significant impact on labour productivity only in the services sector. This result could be explained by the fact that the tertiary sector is the one that has created the most opportunities for migrants. Indeed, across Africa, this sector is the only one that saw its share of GDP increase between 1990 and 2019 by 10%, while the other sectors saw their share drop in the same proportions. At the global level, the agriculture and industry sectors have seen their share of GDP drop by 18 and 14% respectively, while the share of services has increased by 9%. As before, the impact of intra-African immigration is quantitatively much greater than for the sample as a whole (more than three times). The results also show that trade openness exerts a negative effect on labour productivity in the services and industry sectors for the entire sample, but has no significant impact for the sample of African countries. Investment positively and significantly affects labour productivity in the industry and services sectors regardless of the sample. Financial development and natural resource endowment have positive and significant impacts on labour productivity in all sectors regardless of the sample.

Table 2: Impact of immigration on the components of productivity – 2SLS regression results

VARIABLES	World sample				Africa sample			
	ln(Y/L)	$\frac{\rho}{(1-\rho)} ln(\frac{K}{Y})$	ln(H/L)	Ln(A)	ln(Y/L)	$\frac{\rho}{(1-\rho)} \ln(\frac{K}{Y})$	ln(H/L)	Ln(A)
Immigration rate	0.018***	0.001*	0.001*	0.016***	0.042***	-0.036***	-0.001	0.086***
	(0.004)	(0.001)	(0.001)	(0.004)	(0.009)	(0.005)	(0.003)	(0.016)
Trade openness	-0.016	0.021**	0.036**	-0.082**	-0.004	0.030**	0.065***	-0.077*
	(0.049)	(0.010)	(0.015)	(0.036)	(0.036)	(0.013)	(0.013)	(0.040)
Investment rate	0.012***	0.007***	0.003***	0.004	0.005	0.007***	0.003***	-0.003
	(0.003)	(0.001)	(0.001)	(0.003)	(0.003)	(0.001)	(0.001)	(0.003)
Financial openness	-0.001	-0.000	-0.001***	-0.000	-0.129***	0.066***	-0.027**	-0.175***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.032)	(0.024)	(0.011)	(0.036)
Financial development	0.017***	-0.001	0.003***	0.014***	0.006	0.003*	0.003***	-0.002
	(0.001)	(0.000)	(0.000)	(0.001)	(0.004)	(0.002)	(0.001)	(0.004)
Level of democracy	0.036***	0.008**	0.017***	0.016	-0.016	-0.013*	0.010**	-0.008
	(0.011)	(0.004)	(0.003)	(0.013)	(0.016)	(0.007)	(0.005)	(0.018)
Natural resource rents	0.015***	0.003**	0.002*	0.010***	0.014***	0.004**	0.003***	0.004
	(0.003)	(0.001)	(0.001)	(0.003)	(0.004)	(0.002)	(0.001)	(0.004)
Constant	8.726***	0.350***	0.272***	8.114***	9.562***	0.273**	0.081	9.207***
	(0.131)	(0.059)	(0.045)	(0.149)	(0.310)	(0.106)	(0.085)	(0.283)
Observations	911	904	839	832	299	299	271	271
R-squared	0.793	0.309	0.780	0.643	0.790	0.339	0.725	0.751
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
K-P F-stat	399.5	399.3	420.8	420.8	265.3	265.3	319.8	319.8
SY 10% max IV size	16.38	16.38	16.38	16.38	16.38	16.38	16.38	16.38
SY 25% max IV size	5.530	5.530	5.530	5.530	5.530	5.530	5.530	5.530

Notes: Heteroscedasticity-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 weak identification. SY 10% max IV size and SY 25% max IV size are the Stock and Yogo (2005) critical values under the i.i.d. assumption. Historical controls are dummy variables related to colonial origin (British, French, Portuguese, and Other European) and percentage of population of European descent in 1900. Geographic controls are distance to equator, share of tropical land, and dummy variables for landlocked countries. For the African sample, the explanatory variable of interest is the intra-African immigration rate, while for the whole sample it is the total immigration rate.

Table 3: Immigration and labour productivity by sector – 2SLS regression results

	Agriculture		Industry		Services	
VARIABLES	World	Africa	World	Africa	World	Africa
Immigration rate	0.002	-0.040	0.004	0.005	0.014***	0.048***
	(0.004)	(0.029)	(0.003)	(0.027)	(0.003)	(0.014)
Trade openness	0.100*	-0.068	-0.235***	-0.020	-0.119***	0.000
	(0.052)	(0.044)	(0.053)	(0.052)	(0.036)	(0.039)
Investment rate	0.005	-0.012**	0.025***	0.020***	0.016***	0.007**
	(0.005)	(0.005)	(0.004)	(0.006)	(0.003)	(0.003)
Financial openness	0.003***	-0.076	0.003***	-0.354***	0.002***	-0.203***
	(0.001)	(0.063)	(0.001)	(0.072)	(0.001)	(0.043)
Financial development	0.032***	0.018**	0.028***	0.022***	0.026***	0.022***
	(0.002)	(0.007)	(0.001)	(0.005)	(0.001)	(0.004)
Level of democracy	0.028*	-0.090***	0.030**	-0.026	0.050***	0.007
	(0.016)	(0.029)	(0.014)	(0.023)	(0.011)	(0.018)
Natural resource rents	0.024***	0.016**	0.045***	0.036***	0.012***	0.011***
	(0.004)	(0.006)	(0.005)	(0.008)	(0.003)	(0.004)
Constant	6.066***	9.399***	7.567***	8.707***	7.897***	8.418***
	(0.220)	(0.378)	(0.191)	(0.436)	(0.132)	(0.284)
Observations	753	237	736	235	725	230

R-squared	0.741	0.652	0.708	0.678	0.846	0.743
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes
K-P F-stat	242.4	78.06	242.6	66.62	364.6	78.96
SY 10% max IV size	16.38	16.38	16.38	16.38	16.38	16.38
SY 25% max IV size	5.530	5.530	5.530	5.530	5.530	5.530

Notes: Heteroscedasticity-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 weak identification. SY 10% max IV size and SY 25% max IV size are the Stock and Yogo (2005) critical values under the i.i.d. assumption. Historical controls are dummy variables related to colonial origin (British, French, Portuguese, and Other European) and percentage of population of European descent in 1900. Geographic controls are distance to equator, share of tropical land, and dummy variables for landlocked countries. For the African sample, the explanatory variable of interest is the intra-African immigration rate, while for the whole sample it is the total immigration rate.

5. Robustness check

Insofar as the variables explaining bilateral migration could also explain bilateral trade, the identification strategy based on the gravity model could turn out to be incomplete if it does not deal with the case of trade openness. Moreover, if immigration has a positive impact on GDP per worker, is this effect not counterbalanced by the potentially negative impact of emigration? In other words, wouldn't the effect of net migration be zero? This question and the issue of outlier bias are addressed in the subsections hereunder.

Dealing with trade endogeneity

In this subsection, I reproduce the previous 2SLS regressions by considering both the immigration rate and the trade openness rate as endogenous variables. To deal with the endogeneity relating to these two variables, I use the same instruments from the gravity model, as Ortega and Peri (2014) did. The results of the gravity model on trade are presented in Table A5 (in the appendix). These results are consistent with expectations. For example, conflicts and wars are harmful to trade, including intra-African trade. The standard results of gravity models are also found in the form of a negative effect of distance and isolation against the positive effect of border, language, and colonial ties.

The results of the regressions on the impact of immigration and trade on labour productivity and its components (capital intensity, human capital, and total factor productivity) are reported in Table 4. These results concerning the explanatory variable of interest are broadly the same as those in Table 2. Indeed, an increase in the immigration rate has a positive and significant impact on labour productivity regardless of the sample, and this impact is quantitatively about four times greater for intra-African immigration. As before, the impact of immigration essentially goes through the improvement of total factor productivity and, to a lesser extent, human capital for the entire sample, whereas for Africa the positive impact of intra-African immigration essentially involves improving total factor productivity.

However, as in Ortega and Peri (2014), trade does not have a significant positive impact on aggregate labour productivity. For the sample of African countries, the impact of trade openness even seems weakly negative on labour productivity through the channel of total factor productivity and human capital. For all the regressions, I

have reported at the bottom of the tables KP *F*-statistic, which tests the null hypothesis of jointly weak instruments, as well as the *F* test of Sanderson and Windmeijer (2015), which assesses whether each individual endogenous regressor is well identified separately after the other endogenous regressor has been removed. In almost all cases, the null hypothesis of jointly weak instruments as well as the null hypotheses of weak identification for each regressor is strongly rejected. However, for the regressions with the Africa sample, the null hypothesis of jointly weak instruments is rejected only when considering the less demanding critical values (3.53) of Stock and Yogo.

Table 4: Impact of immigration on the components of labour productivity — trade endogeneity

VARIABLES	World sample				Africa sample			
	ln(Y/L)	$\frac{\rho}{(1-\rho)} ln(\frac{K}{Y})$	ln(H/L)	Ln(A)	ln(Y/L)	$\frac{\rho}{(1-\rho)} \ln(\frac{K}{Y})$	ln(H/L)	Ln(A)
Immigration rate	0.015***	0.002	0.002*	0.012***	0.058***	-0.036***	0.001	0.091***
	(0.005)	(0.001)	(0.001)	(0.005)	(0.017)	(0.006)	(0.005)	(0.017)
Trade openness	0.002	-0.000	-0.000	0.002	-0.035*	0.006	-0.012*	-0.029*
	(0.002)	(0.001)	(0.001)	(0.002)	(0.020)	(0.007)	(0.007)	(0.018)
Investment rate	0.011***	0.007***	0.003***	0.004	0.008*	0.006***	0.004**	-0.001
	(0.003)	(0.001)	(0.001)	(0.003)	(0.005)	(0.001)	(0.002)	(0.005)
Financial openness	-0.001	-0.000	-0.001***	0.000	-0.022	0.056	0.030	-0.101
	(0.000)	(0.000)	(0.000)	(0.000)	(0.082)	(0.035)	(0.035)	(0.069)
Financial development	0.018***	-0.001	0.003***	0.015***	0.005	0.003	0.003*	-0.002
	(0.002)	(0.001)	(0.000)	(0.001)	(0.006)	(0.002)	(0.002)	(0.006)
Level of democracy	0.029**	0.009**	0.019***	0.007	-0.028	-0.009	0.006	-0.024
	(0.012)	(0.004)	(0.004)	(0.014)	(0.023)	(0.007)	(0.008)	(0.023)
Natural resource rents	0.015***	0.003**	0.002*	0.009**	0.014***	0.005**	0.005***	0.005
	(0.003)	(0.001)	(0.001)	(0.004)	(0.004)	(0.002)	(0.002)	(0.004)
Constant	8.663***	0.359***	0.278***	8.067***	8.818***	0.432**	-0.106	8.446***
	(0.146)	(0.062)	(0.047)	(0.156)	(0.602)	(0.191)	(0.221)	(0.522)
Observations	911	904	839	832	299	299	271	271
R-squared	0.782	0.303	0.773	0.611	0.655	0.313	0.365	0.638
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
K-P F-stat	13.73	11.39	12.35	9.789	4.588	4.588	4.215	4.215
SW F-stat for Immigration	58.83	44.26	61.50	45.30	18.87	18.87	90.37	90.37
SW F-stat for Trade	27.60	22.86	24.87	19.61	9.190	9.190	8.430	8.430
SY 10% max IV size	7.030	7.030	7.030	7.030	7.030	7.030	7.030	7.030
SY 25% max IV size	3.630	3.630	3.630	3.630	3.630	3.630	3.630	3.630

Notes: Heteroscedasticity-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. SY 10% max IV size and SY 25% max IV size are the Stock and Yogo (2005) critical values under the i.i.d. assumption. SW F-stat is the Sanderson and Windmeijer (2015) F-stat test of weak identification for each endogenous regressor separately. Historical controls are dummy variables related to colonial origin (British, French, Portuguese, and Other European) and percentage of population of European descent in 1900. Geographic controls are distance to equator, share of tropical land, and dummy variables for landlocked countries. For the African sample, the explanatory variable of interest is the intra-African immigration rate, while for the whole sample it is the total immigration rate.

In the same vein, the results of the 2SLS regressions of the impact of immigration and trade on sectoral productivities are presented in Table 5. They confirm the previous results that immigration has a positive impact on labour productivity only in the tertiary sector. Once again, the impact is almost five times greater for intra-African immigration. The larger positive effect of intra-African immigration evidenced in the various regressions is consistent with the Heckscher-Ohlin theory. The latter implies that the low degree of trade openness between African countries increases incentives for migration and induces a positive impact of immigration on GDP per worker.

Table 5: Impact of immigration on overall and sectoral labour productivity - trade endogeneity

	Agriculture		Industry		Services	
VARIABLES	World	Africa	World	Africa	World	Africa
Immigration rate	0.002	-0.063	0.003	-0.003	0.009**	0.043***
	(0.005)	(0.046)	(0.004)	(0.030)	(0.003)	(0.016)
Trade openness	0.001	-0.095**	-0.001	-0.033	0.002	-0.045*
	(0.003)	(0.047)	(0.003)	(0.029)	(0.002)	(0.026)
Investment rate	0.005	-0.005	0.024***	0.022***	0.014***	0.011*
	(0.005)	(0.012)	(0.004)	(0.008)	(0.003)	(0.006)
Financial openness	0.003***	0.408	0.003***	-0.186	0.002***	0.044
	(0.001)	(0.299)	(0.001)	(0.186)	(0.001)	(0.164)
Financial development	0.032***	0.011	0.029***	0.020***	0.028***	0.018**
	(0.002)	(0.017)	(0.002)	(0.007)	(0.001)	(0.008)
Level of democracy	0.028	-0.158**	0.026	-0.049	0.038***	-0.024
	(0.019)	(0.065)	(0.016)	(0.033)	(0.012)	(0.034)
Natural resource rents	0.024***	0.023**	0.045***	0.038***	0.010***	0.016***
	(0.005)	(0.011)	(0.005)	(0.009)	(0.003)	(0.006)
Constant	6.062***	7.054***	7.543***	7.913***	7.834***	7.173***
	(0.229)	(1.375)	(0.190)	(0.887)	(0.137)	(0.850)
Observations	753	237	736	235	725	230
R-squared	0.741	0.346	0.704	0.571	0.815	0.369
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes
K-P F-stat	16.72	2.707	14.46	2.762	15.59	2.523
SW F-stat for Immigration	73.87	70.08	62.53	65.63	71.82	82.27
SW F-stat for Trade	33.48	5.410	28.94	5.530	31.19	5.050
SY 10% max IV size	7.030	7.030	7.030	7.030	7.030	7.030
SY 25% max IV size	3.630	3.630	3.630	3.630	3.630	3.630

Notes: Heteroscedasticity-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 weak identification. SY 10% max IV size and SY 25% max IV size are the Stock and Yogo (2005) critical values under the i.i.d. assumption. SW F-stat is the Sanderson and Windmeijer (2015) F-stat test of weak identification for each endogenous regressor separately. Historical controls are dummy variables related to colonial origin (British, French, Portuguese, and Other European) and percentage of population of European descent in 1900. Geographic controls are distance to equator, share of tropical land, and dummy variables for landlocked countries. For the African sample, the explanatory variable of interest is the intra-African immigration rate, while for the whole sample it is the total immigration rate.

Net migration impact

Insofar as the potentially negative effect of emigration could counterbalance the positive one of immigration, it seems interesting to examine the impact of net immigration. Like Ortega and Peri (2014), I examined whether the effect of the gross immigration rate is different from that of net immigration measured, for a given country, by the stock of immigration minus the stock of emigration divided by the total population of the country. For the sake of methodological consistency, the instrument used is the estimated net immigration rate (estimated immigration rate minus estimated emigration rate). Table A6 (in the appendix) presents the results of the gravity model for emigration with symmetrically more emphasis on destination country variables. The results of the impact of net immigration are shown in Table 6. These results show that net intra-African immigration has a positive and significant impact on real GDP per worker, confirming the previous results. However, for the whole sample, the impact is less significant (at 10%) with the 2SLS approach, although it remains positive. The positive and significant impact of net intra-African immigration on labour productivity in Africa shows that migration is not a zero-sum game for the continent. The impact of net immigration is comparable to that of gross immigration, suggesting that the negative effect of emigration is limited and weaker than the positive effect of immigration.

Table 6: Net immigration and labour productivity

	OLS regressions		2SLS regressions	
VARIABLES	World	Africa	World	Africa
Net migration rate	0.010***	0.055***	0.006*	0.043***
	(0.004)	(0.014)	(0.003)	(0.011)
Trade openness	0.019	0.029	0.003	-0.034
	(0.107)	(0.038)	(0.002)	(0.021)
Investment rate	0.013***	0.004	0.011***	0.007
	(0.004)	(0.005)	(0.003)	(0.004)
Financial openness	0.000	-0.118*	0.001	0.009
	(0.001)	(0.060)	(0.000)	(0.095)
Financial development	0.017***	0.006	0.019***	0.006
	(0.002)	(0.007)	(0.002)	(0.006)
Level of democracy	0.029	-0.024	0.020*	-0.044*
	(0.024)	(0.027)	(0.012)	(0.025)
Natural resource rents	0.019***	0.015**	0.018***	0.016***
	(0.006)	(0.006)	(0.004)	(0.004)
Constant	8.717***	9.398***	8.646***	8.853***
	(0.285)	(0.629)	(0.152)	(0.561)
Observations	911	299	911	299
R-squared	0.781	0.804	0.764	0.642
Region FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes
Geographic controls	Yes	Yes	Yes	Yes
K-P F-stat			15.48	4.307
SW F-stat for Net immig.			129.9	30.96

SW F-stat for Trade	30.97	8.760
SY 10% max IV size	7.030	7.030
SY 25% max IV size	3.630	3.630

Notes: Heteroscedasticity-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 weak identification. SY 10% max IV size and SY 25% max IV size are the Stock and Yogo (2005) critical values under the i.i.d. assumption. SW F-stat is the Sanderson and Windmeijer (2015) F-stat test of weak identification for each endogenous regressor separately. Historical controls are dummy variables related to colonial origin (British, French, Portuguese, and Other European) and percentage of population of European descent in 1900. Geographic controls are distance to equator, share of tropical land, and dummy variables for landlocked countries. For the African sample, the explanatory variable of interest is the intra-African immigration rate, while for the whole sample it is the total immigration rate.

Potential outliers

Figure 2 reveals that one group of countries stands out from the others to the right of the horizontal axis due to their relatively higher rate of intra-African immigration. These countries include Gabon, Gambia, Djibouti, Côte d'Ivoire, Malawi, Guinea, and Eswatini. The question, therefore, arises as to whether the main results are drawn by these countries. To avoid potential outlier bias, new regressions were performed excluding these seven countries from the sample. It appears that the main previous results are robust to the exclusion of these countries. They are even reinforced qualitatively and quantitatively. The results are also robust with net immigration. For the sake of the number of pages and the already large number of tables, these results are not presented here. However, they are available from the author on request.

6. Conclusion and policy implications

With the increase of globalization, migratory flows have been accentuated since the beginning of the 1990s. Thus, a strong emigration from developing countries to industrialized countries has been observed. This global trend sometimes hides the dynamics of regional migrations, which are often more structural and motivated by geographical, cultural, linguistic, or economic proximity. Africa is often singled out for the flight of its talents to Western countries, but the largest component of African migration is intra-African. The latter represents an important pillar of regional integration that is advocated on the continent for its economic and social development. Despite the interest shown by African authorities and institutions in strengthening African integration, including through the establishment of a regional migration policy framework, few studies have focused on the impact of intra-African migration.

Studies of the impact of immigration on productivity or on the unemployment rate and wages mostly have focused on developed countries, which are considered as the countries that experience the most immigration. In this paper, I studied the impact of intra-African immigration on labour productivity in Africa. To analyse the transmission channels, labour productivity is disaggregated into human capital, capital intensity, and total factor productivity. Furthermore, I examined the impact of (intra-African) immigration on labour productivity in the agricultural, industrial, and services sectors. In doing so, the contribution of this paper to the literature is threefold. First, it fills a gap in the literature on the impact of regional immigration in Africa, a particularly edifying contribution in a context of promoting African integration where migration is a key driver. Second, knowing the low level of intra-African trade, this paper considers a global sample of countries and examines whether the impact of intra-African immigration is relatively greater in line with the Heckscher-Ohlin theory of factor price equalization with free trade. Finally, more than previous studies on the impact of intra-African immigration on per capita income, this paper goes further by examining the impact of immigration on labour productivity as well as its macroeconomic and sectoral components.

Empirically, the study is based on a sample of 187 countries, including 53 African countries, covering the period 1990–2019. Distinguishing Africa from the whole sample enabled me to examine whether the impact of intra-African immigration is different. To deal with the endogeneity problem raised by the relationship between

productivity and immigration, I used a gravity-based 2SLS approach. The empirical results show that intra-African immigration has a positive and significant impact on labour productivity in Africa, which is consistent with the international factor mobility approach. The larger effect of intra-African immigration than that of immigration for the entire sample seems consistent with the Heckscher-Ohlin theory of factor price equalization with free trade. The results also show that the positive effect of intra-African immigration passes through the improvement of total factor productivity and the efficiency of physical capital. Moreover, at the sectoral level, intra-African immigration positively and significantly affects labour productivity only in the services sector. The robustness analyses I carried out confirm all of these results. Thus, it appears that intra-African immigration has played an important role in the relative development of the tertiary sector in Africa. Indeed, while the share of the added value of this sector in Africa's GDP was 46% on average in the 1970s, it rose to 53% in the 2010s, i.e., seven percentage points more according to United Nations Conference on Trade and Development (UNCTAD) data. Meanwhile, the share of the agricultural and industrial sectors declined by three percentage points each, to 15% and 32%, respectively, in the 2010s.

Altogether, the results of this paper have several policy implications. First, intra-African immigration is clearly emerging as a key driver of regional integration and economic prosperity in Africa. Therefore, immigration policies between African countries must be strengthened by removing the barriers that hinder the mobility of people. In this perspective, the establishment of a single African passport would be a good regional integration policy. Second, while the African Agenda 2063 emphasizes industrialization as the main driver of Africa's development and as a vehicle for African integration, the lack of significant effect of immigration on agricultural and industrial sectors raises some thoughts. Indeed, industrial policies in Africa should be thought out in a more inclusive manner for both national and foreign workers. To achieve this, Africa's industrial development should gradually shift away from the extractive sectors to embrace other areas of Africa's comparative advantage, particularly in a context where green transition is an absolute necessity. The promotion of small and medium-sized enterprises in the manufacturing, assembly, technology and digital sectors could be a promising path. Moreover, in a context where climatic shocks are likely to cause growing migratory movements across the continent, agricultural policies must also be designed for a more resilient and inclusive agriculture, taking advantage of technological and digital advances as well as natural resources such as solar energy. The African Union Migration Policy Framework for Africa (MPFA) should therefore build on this reflection by ensuring that Africa's migration policy is coherent with its agricultural and industrial development in a context of green transition.

References

Acemoglu, D., S. Johnson and J. Robinson. 2001. "The colonial origins of comparative development: An empirical investigation". *American Economic Review,* 91(5): 1369–1401.

Adams Jr, R.H. and J. Page. 2005. "Do international migration and remittances reduce poverty in developing countries?" *World Development*, 33(10): 1645–69.

Adams Jr, R.H. and A. Cuecuecha. 2013. "The impact of remittances on investment and poverty in Ghana". *World Development*, 50: 24–40.

Akay, A., A. Constant and C. Giulietti. 2014. "The impact of immigration on the well-being of natives". *Journal of Economic Behavior & Organization*, 103: 72–92.

Asatryan, Z., B. Bittschi and P. Doerrenberg. 2017. "Remittances and public finances: Evidence from oil-price shocks". *Journal of Public Economics*, 155: 122–37.

Aubry, A., J. Héricourt, L. Marchal and C. Nedoncelle. 2022. "Does immigration affect wages? A meta-analysis". Working Papers hal-03579606, HAL.

Bekaert, G., C.R. Harvey and C. Lundblad. 2011. "Financial openness and productivity". *World Development*, 39(1): 1–19.

Bentolila, S., J.J. Dolado and J.F. Jimeno. 2008. "Does immigration affect the Phillips curve? Some evidence for Spain". *European Economic Review*, 52(8): 1398–1423.

Bonfiglioli, A. 2008. "Financial integration, productivity and capital accumulation". *Journal of International Economics*, 76(2): 337–55.

Borjas, G.J. 2003. "The labor demand curve is downward sloping: Reexamining the impact of immigration on the labor market". *The Quarterly Journal of Economics,* 118(4): 1335–74.

Card, D. 2001. "Immigrant inflows, native outflows, and the local labor market impacts of higher immigration". *Journal of Labor Economics,* 19(1): 22–64.

Card, D. 2005. "Is the new immigration really so bad?" *The Economic Journal*, 115(507): F300–F323.

Caselli, F. 2005. "Accounting for cross-country income differences". In P. Aghion and S. Durlauf, eds., *Handbook of Economic Growth*, vol. 1A, pp. 679-741. Amsterdam: Elsevier.

Coleman, D. and R. Rowthorn. 2004. "The economic effects of immigration into the United Kingdom". *Population and Development Review*, 30(4): 579–624.

Combes, J.L. and C. Ebeke. 2011. "Remittances and household consumption instability in developing countries". *World Development*, 39(7): 1076–89.

Coulibaly, D. and B. Gnimassoun. 2023. "Emigration and external imbalances in sub-Saharan Africa: Do migrants' skills matter?" *Journal of African Economies*, forthcoming.

Edo, A. 2019. "The impact of immigration on the labor market". *Journal of Economic Surveys*, 33(3): 922–48.

Frankel, J.A. and D. Romer. 1999. "Does trade cause growth?" *American Economic Review,* 89(3): 379–99.

Gnimassoun, B. 2020. "Regional integration: Do intra-African trade and migration improve income in Africa?" *International Regional Science Review*, 43(6): 587–631.

Hall, R.E. and C.I. Jones. 1999. "Why do some countries produce so much more output per worker than others?" *The Quarterly Journal of Economics,* 114(1): 83–116.

Hendricks, L. and T. Schoellman. 2017. "Human capital and development accounting: New evidence from wage gains at migration". *The Quarterly Journal of Economics*, 133(2): 665–700.

Hsieh, C.T. and P.J. Klenow. 2010. "Development accounting". *American Economic Journal: Macroeconomics*, 2(1): 207–23.

Kleibergen, F., and R. Paap. 2006. "Generalized Reduced Rank Tests Using the Singular Value Decomposition". *Journal of Econometrics*, 133(1):97–126.

Konte, M. 2016. "The effects of remittances on support for democracy in Africa: Are remittances a curse or a blessing?" *Journal of Comparative Economics*, 44(4): 1002–1022.

Lartey, E.K. 2011. "Financial openness and the Dutch disease". *Review of Development Economics*, 15(3): 556–68.

Leamer, Edward E. 1995. "The Heckscher-Ohlin Model in Theory and Practice". Princeton Studies in International Finance, Working Paper no. 77 (February), Princeton Univ.

Lewis, E. 2011. "Immigration, skill mix, and capital skill complementarity". *The Quarterly Journal of Economics*, 126(2): 1029–69.

Ortega, F. and G. Peri. 2014. "Openness and income: The roles of trade and migration". *Journal of International Economics,* 92(2): 213–51.

Ottaviano, G.I. and G. Peri. 2006. "The economic value of cultural diversity: Evidence from US cities". *Journal of Economic geography*, 6(1): 9–44.

Ottaviano, G.I. and G. Peri. 2012. "Rethinking the effect of immigration on wages". *Journal of the European Economic Association,* 10(1): 152–97.

Ottaviano, G.I., G. Peri and G.C. Wright. 2018. "Immigration, trade and productivity in services: Evidence from UK firms". *Journal of International Economics*, 112: 88–108.

Peri, G. and C. Sparber. 2009. "Task specialization, immigration, and wages". *American Economic Journal: Applied Economics*, 1(3): 135–69.

Peri, G. and C. Sparber. 2011. "Assessing inherent model bias: An application to native displacement in response to immigration". *Journal of Urban Economics*, 69(1): 82–91.

Peri, G. 2012. "The effect of immigration on productivity: Evidence from US states". *Review of Economics and Statistics*, 94(1): 348–58.

Sanderson, E., and F. Windmeijer. 2016. "A Weak Instrument F-test in Linear IV Models with Multiple Endogenous Variables". *Journal of Econometrics*, 190(2):212–21.

Silva, J.M.C.S. and S. Tenreyro. 2006. "The log of gravity". *The Review of Economics and Statistics,* 88(4): 641–58.

Silva, J.M.C.S. and S. Tenreyro. 2010. "On the existence of the maximum likelihood estimates in Poisson regression". *Economic Letters,* 107(2): 310–12.

Stock, J. and M. Yogo. 2005. "Testing for weak instruments in linear IV regression". In D.W.K. Andrews, *Identification and Inference for Econometric Models*, pp. 80–108. New York: Cambridge University Press.

United Nations, Department of Economic and Social Affairs, Population Division. 2020. *International Migrant Stock 2020*. United Nations Database, POP/DB/MIG/Stock/Rev.2020.

Appendixes

Table A1: Descriptive statistics on the gravity model

VARIABLES	N	Mean	Std. Dev.	Min.	Max.
World sample					
Immigration rate (%)	279,600	0.043	0.603	0.000	50.127
Immigration rate in 1990	280,000	0.040	0.599	0.000	50.127
Trade openness rate (%)	265,400	0.354	5.269	0.000	1,501.933
Emigration rate (%)	279,600	0.054	0.787	0.000	103.592
Emigration rate in 1990	280,000	0.048	0.844	0.000	103.592
Ln Distance	269,067	8.767	0.810	-0.005	9.890
Ln Population, origin	279,600	1.435	2.329	-4.721	7.250
Ln Population, destination	279,600	1.435	2.329	-4.721	7.250
Ln Area in sq. km, origin	280,000	4.162	2.943	-4.962	9.745
Ln Area in sq. km, destination	280,000	4.162	2.943	-4.962	9.745
Sum Landlocked dummy	280,000	0.360	0.543	0.000	2.000
Border dummy	271,816	0.015	0.120	0.000	1.000
Common official language	271,816	0.169	0.374	0.000	1.000
Common language	271,816	0.157	0.364	0.000	1.000
Colonial ties	280,000	0.010	0.101	0.000	1.000
Origin hegemon	275,586	0.005	0.068	0.000	1.000
Destination hegemon	275,586	0.005	0.068	0.000	1.000
Conflicts/wars, origin	219,000	0.656	1.630	0.000	13.000
Conflicts/wars, destination	219,000	0.656	1.630	0.000	13.000
African sample					
Immigration rate (%)	19,557	0.052	0.397	0.000	17.144
Immigration rate in 1990	19,663	0.065	0.550	0.000	17.144
Trade openness rate (%)	18,974	0.189	1.770	0.000	106.268
Emigration rate (%)	19,557	0.067	0.603	0.000	21.988
Emigration rate in 1990	19,663	0.072	0.607	0.000	16.508
Ln Distance	19,558	7.975	0.765	2.944	9.187
Ln Population, origin	19,557	1.916	1.597	-2.666	5.303
Ln Population, destination	19,557	1.916	1.597	-2.666	5.303
Ln Area in sq. km, origin	19,663	5.209	2.096	-0.787	7.826
Ln Area in sq. km, destination	19,663	5.209	2.096	-0.787	7.826
Sum Landlocked dummy	19,663	0.566	0.637	0.000	2.000
Border dummy	19,558	0.072	0.258	0.000	1.000
Common official language	19,558	0.429	0.495	0.000	1.000
Common language	19,558	0.315	0.465	0.000	1.000
Colonial ties	19,663	0.001	0.038	0.000	1.000
Origin hegemon	19,610	0.001	0.033	0.000	1.000
Destination hegemon	19,610	0.001	0.033	0.000	1.000
Conflicts/wars, origin	18,762	0.734	1.613	0.000	7.000
Conflicts/wars, destination	18,762	0.734	1.613	0.000	7.000

Table A2: Rate of African immigrants by country, average 1990-2019

Country	African Immigrants	Country	African Immigrants
Gabon	156.53	Senegal	19.20
Djibouti	131.99	Zambia	18.83
Cote d'Ivoire	121.94	Kenya	18.25
Gambia, The	111.16	Tanzania	18.18
Congo, Rep.	75.35	Cabo Verde	18.10
Namibia	43.04	Comoros	17.93
Guinea	40.30	Mali	17.00
Burkina Faso	39.06	Congo, Dem. Rep.	15.75
Rwanda	38.51	Cameroon	15.45
Liberia	35.04	Guinea-Bissau	14.71
Eswatini	32.89	Central African Republic	14.65
Sudan	30.65	Ghana	11.85
Mauritania	29.63	Ethiopia	11.32
Zimbabwe	29.05	Niger	10.99
Botswana	29.01	Mozambique	10.42
Burundi	28.59	Somalia	10.10
Togo	28.58	Nigeria	4.79
Malawi	28.15	Eritrea	4.50
South Sudan	26.14	Angola	2.67
Uganda	25.63	Tunisia	2.47
South Africa	25.58	Equatorial Guinea	2.20
Chad	23.69	Lesotho	1.67
Libya	23.27	Mauritius	1.40
Sao Tome and Principe	23.23	Egypt, Arab Rep.	0.73
Benin	23.19	Morocco	0.64
Sierra Leone	20.53	Madagascar	0.51
Seychelles	19.40	Algeria	0.42

Notes: Data on international migration comes from the United Nations database. They are available by country pair from 1990 every five years. The values in the table represent the number of African immigrants per 1,000 nationals.

Table A3: Descriptive statistics on the main model (productivity model)

VARIABLES	N	Mean	Std. Dev.	Min.	Max.
World sample					
Log Output per worker, PPP	1,163	9.98	1.13	6.42	12.54
Immigration rate	1,307	7.36	11.67	0.01	84.63
Physical capital intensity	1,169	0.55	0.24	-0.35	1.59
Human capital per worker	987	0.83	0.32	0.03	1.47
Total factor productivity	980	8.61	0.93	4.03	11.13
Ln labour productivity, agriculture	931	8.49	1.49	5.34	14.83
Ln labour productivity, industry	905	9.66	1.23	5.94	12.73
Ln labour productivity, services	894	9.46	1.17	6.59	12.25
Trade openness	1,309	68.59	160.88	0.00	5,229.31
Net intra-African immigration rate	369	-0.73	5.73	-31.66	19.10
Investment rate	1,176	21.49	9.49	0.53	84.03
Financial openness	1,229	4.21	19.65	0.08	394.37
Financial development	1,225	27.71	21.73	0.00	98.54
Level of democracy	1,282	6.29	3.25	0.00	10.00
Natural resource rents	1,275	7.07	10.70	0.00	64.85
% Tropical climate	1,309	41.99	45.77	0.00	100.00
Distance to equator	1,099	27.09	17.51	0.42	67.47
Landlocked country	1,309	0.19	0.39	0.00	1.00
Pct. Euro. descent in 1900	1,099	29.54	41.59	0.00	100.00
Colonial origin indicator: British	1,309	0.35	0.48	0.00	1.00
Colonial origin indicator: French	1,309	0.14	0.35	0.00	1.00
Colonial origin indicator: Portuguese	1,309	0.03	0.18	0.00	1.00
Colonial origin indicator: Other European	1,309	0.04	0.19	0.00	1.00
Latin America dummy	1,309	0.16	0.36	0.00	1.00
East Asia dummy	1,309	0.12	0.32	0.00	1.00
Sub-Sahara Africa dummy	1,309	0.25	0.43	0.00	1.00
African sample					
Log Output per worker, PPP	349	9.05	0.99	6.79	11.59
Intra-African Immigration rate	369	2.80	3.50	0.01	19.41
Physical capital intensity	350	0.42	0.26	-0.33	1.51
Human capital per worker	287	0.51	0.25	0.03	1.08
Total factor productivity	287	8.05	0.88	5.21	9.86
Ln labour productivity, agriculture	267	7.24	1.04	5.34	9.87
Ln labour productivity, industry	265	8.83	1.09	5.94	12.73
Ln labour productivity, services	260	8.49	0.78	6.59	10.41
Intra-African trade openness	371	9.66	13.64	0.00	111.15
Net intra-African immigration rate	369	-0.73	5.73	-31.66	19.10
Investment rate	350	18.31	11.02	1.94	84.03
Financial openness	370	2.01	6.51	0.31	77.01
Financial development	357	13.62	10.11	0.00	64.18
Level of democracy	370	4.54	2.62	0.44	10.00
Natural resource rents	362	11.52	11.29	0.00	61.22
% Tropical climate	371	51.94	43.21	0.00	100.00
Distance to equator	336	13.56	9.02	0.42	34.09
Landlocked country	371	0.28	0.45	0.00	1.00
% Euro. descent in 1900	364	3.57	14.08	0.00	100.00
Colonial origin indicator: British	371	0.38	0.49	0.00	1.00
Colonial origin indicator: French	371	0.38	0.49	0.00	1.00
Colonial origin indicator: Portuguese	371	0.09	0.29	0.00	1.00
Colonial origin indicator: Other European	371	0.09	0.29	0.00	1.00
East Africa dummy	371	0.32	0.47	0.00	1.00
Middle Africa dummy	371	0.17	0.38	0.00	1.00
Western Africa dummy	371	0.30	0.46	0.00	1.00
South Africa dummy	371	0.09	0.29	0.00	1.00
Log output per worker, PPP	349	9.05	0.99	6.79	11.59

Table A4: Results of the gravity model for immigration

	World sample		African sample	
VARIABLES	PPML1	PPML2	PPML1	PPML2
Ln Distance	-0.898***	-0.963***	-0.962***	-0.931***
	(0.018)	(0.018)	(0.040)	(0.039)
Immigration rate in 1990	0.109***	0.221***	0.202***	0.292***
	(0.006)	(0.007)	(0.011)	(0.026)
Ln Population, origin	0.617***	-0.316**	0.215***	-0.619
	(0.024)	(0.156)	(0.033)	(0.477)
Ln Area in sq. km, origin	-0.130***	0.473***	0.018	0.934**
	(0.019)	(0.059)	(0.035)	(0.419)
Sum Landlocked dummy	-0.574***	-0.413***	-0.265***	-0.524***
	(0.040)	(0.048)	(0.052)	(0.065)
Common official language	0.883***	1.275***	0.554***	1.028***
	(0.050)	(0.040)	(0.088)	(0.087)
Colonial ties	1.480***	1.210***	-0.225	-0.161
	(0.064)	(0.076)	(0.286)	(0.393)
Origin hegemon	0.076	-0.213	-0.539	-0.129
	(0.112)	(0.132)	(0.361)	(0.419)
Conflicts/wars, origin	0.106***	0.052***	0.107***	0.178***
	(0.011)	(0.015)	(0.024)	(0.025)
Border dummy	0.850***	0.571***	1.968***	1.809***
	(0.056)	(0.053)	(0.097)	(0.101)
Constant	2.722***	2.446***	2.699***	-0.457
	(0.172)	(0.343)	(0.244)	(0.797)
Observations	214,192	214,192	18,508	18,508
R-squared	0.213	0.522	0.567	0.751
Origin FE	No	Yes	No	Yes
Time FE	Yes	Yes	Yes	Yes

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

Table A5: Results of the gravity model for trade

	World sample		African sample	
VARIABLES	PPML1	PPML2	PPML1	PPML2
Ln Distance	-0.564***	-0.568***	-0.942***	-0.860***
	(0.031)	(0.030)	(0.070)	(0.049)
Ln Population, origin	0.998***	0.899***	0.681***	-2.379***
	(0.043)	(0.269)	(0.056)	(0.652)
Ln Area in sq. km, origin	-0.266***	-0.754***	0.327***	2.926***
	(0.059)	(0.124)	(0.072)	(0.568)
Sum Landlocked dummy	-0.700***	-0.464***	-0.358***	-0.273***
	(0.036)	(0.042)	(0.071)	(0.086)
Common official language	0.683***	0.743***	0.729***	0.525***
	(0.079)	(0.073)	(0.139)	(0.157)
Colonial ties	0.752***	0.492***	1.258***	0.742**
	(0.090)	(0.077)	(0.325)	(0.315)
Origin hegemon	0.335***	0.218**	-0.514	-0.681*
	(0.111)	(0.093)	(0.425)	(0.360)
Conflicts/wars, origin	-0.339***	-0.057***	-0.296***	-0.167***
	(0.015)	(0.021)	(0.045)	(0.042)
Border dummy	0.748***	0.782***	1.293***	1.312***
	(0.057)	(0.057)	(0.102)	(0.097)
Constant	2.515***	3.777***	0.819	-3.965***
	(0.139)	(0.375)	(0.574)	(1.033)
Observations	204,655	203,509	18,001	18,001
R-squared	0.025	0.041	0.167	0.498
Origin FE	No	Yes	No	Yes
Time FE	Yes	Yes	Yes	Yes

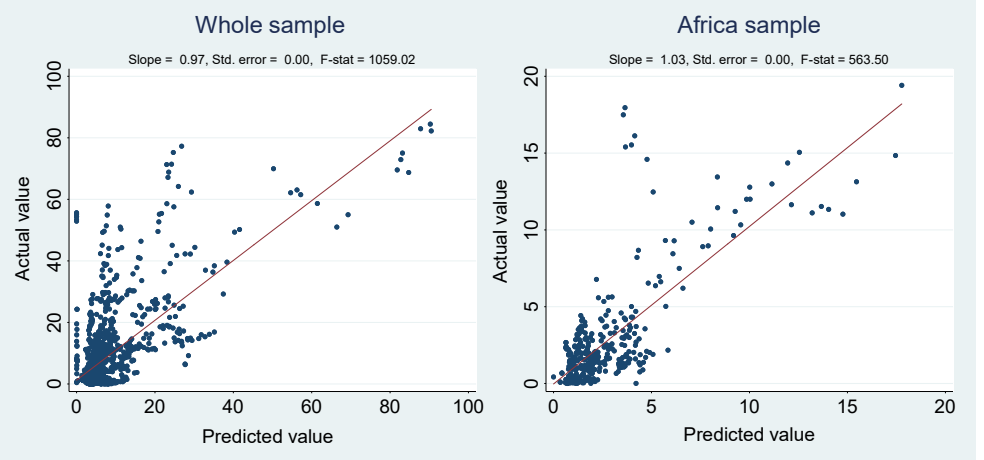
Notes: Heteroscedasticity-robust standard errors are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% confidence level, respectively.

Table A6: Results of the gravity model for emigration

	World sample		African sample	
VARIABLES	PPML1	PPML2	PPML1	PPML2
Ln Distance	-0.592***	-0.998***	-0.470***	-0.911***
	(0.018)	(0.021)	(0.071)	(0.058)
Emigration rate in 1990	0.158***	0.184***	0.195***	0.178***
	(0.006)	(0.005)	(0.015)	(0.018)
Ln Population, destination	-0.147***	-0.233***	-0.252***	-0.344***
	(0.033)	(0.019)	(0.059)	(0.055)
Ln Area in sq. km, destination	-0.141***	-0.051***	-0.193***	-0.108**
	(0.024)	(0.014)	(0.054)	(0.050)
Sum Landlocked dummy	-0.310***	-0.084*	-0.054	-0.087
	(0.048)	(0.045)	(0.050)	(0.108)
Common official language	0.532***	0.358***	0.514***	0.705***
	(0.061)	(0.047)	(0.116)	(0.098)
Colonial ties	1.634***	1.316***	1.624***	1.552***
	(0.140)	(0.066)	(0.357)	(0.314)
Destination hegemon	-1.433***	-0.377***	-3.705***	-3.658***
	(0.195)	(0.146)	(0.351)	(0.444)
Conflicts/wars, destination	0.072***	0.148***	0.217***	0.329***
	(0.016)	(0.012)	(0.036)	(0.028)
Border dummy	1.636***	0.935***	3.137***	2.423***
	(0.079)	(0.063)	(0.190)	(0.105)
Constant	1.919***	2.390***	0.119	1.684***
	(0.181)	(0.414)	(0.466)	(0.459)
Observations	214,508	214,508	18,606	18,606
R-squared	0.227	0.571	0.456	0.672
Destination FE	No	Yes	No	Yes
Time FE	Yes	Yes	Yes	Yes

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

Figure A1: Observed immigration rate and predicted immigration rate



Note: This figure presents the scatter plots of the relationship between the actual and predicted values of the overall and intra-African immigration rates.

Mission

To strengthen local capacity for conducting independent, rigorous inquiry into the problems facing the management of economies in sub-Saharan Africa.

The mission rests on two basic premises: that development is more likely to occur where there is sustained sound management of the economy, and that such management is more likely to happen where there is an active, well-informed group of locally based professional economists to conduct policy-relevant research.

www.aercafrica.org

Learn More

www.facebook.com/aercafrica

www.instagram.com/aercafrica_official/

twitter.com/aercafrica

www.linkedin.com/school/aercafrica/

Contact Us
African Economic Research Consortium
Consortium pour la Recherche Economique en Afrique
Middle East Bank Towers,
3rd Floor, Jakaya Kikwete Road
Nairobi 00200, Kenya
Tel: +254 (0) 20 273 4150
communications@aercafrica.org