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ORIGINAL PAPER

The impact of health worker migration on development dynamics: evidence of wealth effects from Africa

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Abstract This article examines three relevant hypotheses on the effect of health worker migration on human development and economic prosperity (at the macro- and micro-levels) in Africa. Owing to the lack of relevant data on health human resource (HHR) migration for the continent, the subject matter has remained empirically void over the last decades despite the acute concern about health professional emigration. Using quantile regression, the following findings have been established. (1) The effect of HHR emigration is positive (negative) at low (high) levels of economic growth. (2) HHR emigration improves (mitigates) human development (GDP per capita growth) in low (high) quantiles of the distribution. (3) Specific differences in effects are found in top quantiles of human development and low quantiles of GDP per capita growth where the physician (nurse) emigration elasticities of development are positive (negative) and negative (positive), respectively. As a policy implication, blanket health-worker emigration control policies are unlikely to succeed across countries with different levels of human development and economic prosperity. Hence, the policies should be contingent on the prevailing levels of development and tailored differently across the most and least developed African countries.

Keywords Welfare · Health · Human capital · Migration

JEL Classification D60 · F22 · I10 · J24 · O15

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Introduction

International migration of labor is an important component of globalization and economic development in many developing and less developed countries (hence LDCs). The number of international migrants residing in a country other than their country of birth has soared more or less linearly over the past 40 years, from an estimated 76 million in 1965 to 188 million in 2005 [34]. International migration represents important challenges for LDCs from which international migrants originate. These (migrants) include millions of highly educated people from countries in which human capital is relatively scarce. This significant flow is also due to relatively low skilled workers whose productivity and wages are far higher abroad than at home.

Despite the acute concern about the health worker crisis in the African continent owing to emigration, lack of relevant data has made the subject matter empirically void over the last decades. There is little information on the available weight of health human resource (HHR) emigration on the development of source countries. Researchers used to ask whether migration has a positive or negative effect on development [34]. Today they are more likely to ask: "Why does international migration seem to promote economic development in some cases and not others?" [2, 34]. This question could be paraphrased into the following concerns in light of the dire development needs of the continent. (1) Do existing human development and economic prosperity levels affect the impact of HHR emigration on development? (2) Are blanket common policies relevant irrespective of specific development characteristics? (3) To be effective, should immigration policies be contingent on the prevailing levels of development dynamics and tailored differently across countries with the best and worst development records? This article seeks to address the above concerns in a bid to give

policy makers guidance on how health worker emigration shapes development when existing levels of development dynamics matter. Borrowing from Bueno de Mesquita and Gordon [12], this is particularly relevant given the threats to the millennium development goals (MDGs). Within this framework, the empirical relationship between HHR emigration and development dynamics is less a concern than the obligation or duty of all nations to manage migration flows in a way that does not compromise their legal or normative commitments under human rights treaties (for example, the right to health) or development (notably the MDGs).

In this article, we examine how human and economic prosperity levels of source countries play out in how HHR emigration affects development. In plainer terms, the work explores whether HHR outward migration plays out differently in the least developed African countries in comparison to their most developed counterparts. The choice of the African continent is most relevant given the dire HHR crisis it is facing in the health sector. Whereas medical tourism in Asia and Latin America is seriously deterring HHR emigration (as patients from developed countries move there for more readily and affordable treatments), African health system infrastructures are not solid enough to attract foreign patients. Over the past 2 decades, the African population has substantially increased, with a significant surge in disease burden due to HIV/AIDS and recurrent communicable diseases as well as an increased incidence in noncommunicable diseases. This soaring demand for health services has been met with a rather low supply of health workers. HHR emigration is severely infringing on the African health care system. To put this concern into perspective, Africa has a 25 % share of the global diseases burden, a population share of 13.76 %, but only a 1.3 % share of health services [31].

The rest of the article is organized as follows: The "Existing literature" section examines the related literature. Data and methodology are discussed and outlined respectively in the "Data and methodology" section. Empirical analysis and discussion of results are covered in the "Empirical analysis" section. The "Conclusion" section concludes.

Existing literature

Globalization and cross-border care of patients

Globalization is to a substantial extent responsible in various ways for causing the 'push' and 'pull' conditions that have contributed to chronic problems in HHRs. Deteriorating socioeconomic and environmental conditions (partly attributable to liberalization and other forms of global market integration) are pushing health workers away from their countries. Conditions linked to loans or debt relief from international financial institutions might limit governments' ability to pay adequate salaries or provide incentives in a bid to retain health workers. As a result, physicians and nurses are being pushed out, and governments are hard-pressed to implement effective remedies to curb the soaring exodus. The movement of HHRs is asymmetrical and tilted toward developed (rich) countries, with the poorest countries unable to attract replacement workers (professionals). For countries unable to draw in new health workers to replace those who have left for greener pastures, the inevitable effect is reduced healthcare access and service.

Globalization is making it easier for rich countries to attract HHRs. Border barriers in rich countries are being actively lowered for skilled professionals. The principal destination countries of HHRs are five English-speaking OECD countries for the most part: the UK, the US, Canada, Australia and New Zealand. These countries deficient in HHRs are increasingly relying on the immigration of foreign-trained health workers to relieve them in exchange for higher pay, greater opportunities and better working conditions. In addition to these push-and-pull factors are a number of other features linked to globalization that further foster HHR migration, notably the internationalization of professional credentials, citizenship and remittances. Therefore, professional credentials in health and other fields are increasingly recognized across borders, particularly where free trade zones have been established. Professional credentials are now serving as passports ('laissez-passer') and other factors that ease migration (multilingualism, post-colonial ties, common academic curricula, etc.) and mobility (cheaper, faster and easier travel) have contributed to a veritable sense of global belonging (citizenship). The opportunity to accumulate savings and remit portions to family and communities back home is a significant attraction for HHR migration. Hence, remittances represent important private welfare gains and seriously influence the HHR migration decision [31].

Cross-border importing (exporting) of health workers and exporting (importing) of patients is becoming a real industry and flourishing worldwide. A decade past, the medical tourism industry was hardly on the horizon. A great bulk of literature has emphasized the substantial nature of this industry: in 2002, whereas the number of foreign patients traveling to India for medical care was 150,000, it increased in 2005 to almost half a million [22, 33]; by 2007, 250,000 patients were visiting Singapore alone on a yearly basis, with half of them from the Middle East [31], etc. A number of reasons elucidate the boom of this medical industry. Patients confronted with significant waiting lists for medical care or high costs of treatment

seek care in other countries where treatment is readily available and/or affordably priced.[1]

India is the leading country promoting medical tourism, and it is estimated that tourism of this kind is growing by 20 % per annum [31]. In a declaration by India's National Health Policy, the treatment of foreign patients is legally an "export" and "eligible for all fiscal incentives extended to export income." Government and private sector studies in the country estimate that medical tourism could generate as much as between US$1 billion and $2 billion for the country by 2012. The country is also moving into a new dimension of medical outsourcing where subcontractors provide services to overburdened medical care systems in developed countries [28].

Thailand is also seriously committed to entertaining this industry, with the Thai Consulate General in Canada for example advertising medical tourism in Thailand for Canadians by listing prices in US dollars for various surgeries on its website. According to Packer et al. [31], 600,000 foreign patients in 2005 sought treatment in Thailand. This figure was expected to grow by 66 % toward the end of 2006, and projections (by the country's ambitious national health plan of action) hold that the country will become an excellent medical hub by 2020 with an estimated number of foreign patients increasing to 10 million that year. This ambitious plan also engenders negative consequences for Thai citizens as the Ministry of Health is noting a substantial shift in HHRs (to the private sector) from the public sector on which about 90 % of the Thai population depends. Though steps to mitigate the within-country HHR migration are yet unclear, it is nonetheless anticipated that fewer health workers will seek to leave the country to work abroad.

Whereas some analysts are of the opinion that this cross-border treatment of patients could be an answer to unethical waiting lists for patients and structural (temporal) shortages in domestic HHRs [35], critics of cross-border care point to a number of major flaws. First, patients receiving treatment abroad may be awarded lower quality care, therefore putting their health at risk. Patients may also be treated by foreign HHRs in a language they do not understand. Second, cross-border health care discriminates in favor of rich patients (able to pay for the services), therefore rendering access to health-care increasingly unequal. Third, in countries with insufficient HHRs, promoting medical tourism discriminates in favor of wealthy foreigners. Finally, income accruing from health tourism typically (but not always) enters into the coffers of private clinics, implying the revenues end up in private pockets (accounts) and are not reinvested in the public health system.

A stance in favor of or against cross-border care is not very clear cut as there are shifting costs and benefits to the countries involved. The cross-border health care supply is for the most part organized as a private system (with private providers, private insurance or co-payments and private facilities) and rewards only those who can afford it. However, from a heath equity basis public systems allow access to services (though they may be imperfect on the basis of need rather than ability to pay) with costs being met through cross-subsidization. Borrowing from Packer et al. [31], policy measures governments are facing are whether to value equity in health-care access or simply to augment aggregate access without regard to who benefits. Thus, for effective management with insurance of equitable access and HHR flows, the prevailing system in the European Union (EU) could be suitable for a global model. Nonetheless, a large number of countries must agree to some form of supranational regulatory framework for such flows based on equity in health service access. In the meantime, the inevitable cross-border care as a backup to domestic health-care systems will continue [32], with insurance companies in particular increasingly gauging out-of-country treatments as a low-cost alternative (solution).

Health human resource crisis in Africa

HHR migration is severely deteriorating the African health-care system. Physicians and nurses based in rural and poor areas move to cities for better working conditions and environments. Urban-based physicians and nurses migrate from the critically under-funded and under-equipped public sector to the private sector [20]. In addition, these professionals and their colleagues in the public sector leave to work in more developed countries in order to obtain greater pay, better working conditions, improved quality of life and better opportunities for their families.

Borrowing from Dovlo [16], the need for medical professionals is arguably most felt in sub-Saharan Africa (SSA). Still a significant number of African-trained health workers are migrating to developed countries to work on a yearly basis. Mullan [29] established that 6 of the 20 countries with the highest physician emigration factors (arrived at by measuring the loss of physicians from countries as a proportion of the physicians left to offer their services in health care) are in SSA. It is estimated that more or less 11,000 SSAfrican-trained health workers are licensed and practicing in the UK, US and Canada alone [21]. In Africa the public health sector is arguably the most seriously affected by inadequate HHRs, and it is this sector

[1] According to Packer et al. [31], in one study, the waiting time for a heart bypass in the UK could last up to 6 months and cost the NHS between 15,000 and 19,000 pounds, whereas a large pool of well-qualified doctors in India will readily perform the surgery at a cost of 4,800 pounds. For clinics and hospitals in developing countries receiving these patients, their treatment brings in important revenue and desirable foreign exchange.

that serves a great chunk of the population. The greatest burden of disease globally is endured by the poorer strata in African countries, which constitute a great proportion of the population.[2] These health professionals leave behind severely crippled health systems in a region where life expectancy is only in the neighborhood of 50 years. On the continent, 16 % of children die before their fifth birthday, and the HIV/AIDS crisis continues to gain ground. The population of SSA is around 660 million with a ratio of fewer than 13 physicians per 100,000 [31]. Under-staffing leads to stress and increased workload [17] and poses a significant threat to the Millennium Development Goals [12]. A great bulk of the remaining health professionals is poorly motivated, not only because of their workload and poor pay, but also because of poor equipment and limited career opportunities. These conditions in turn lead to a downward spiral in which workers migrate, further crippling the system and placing greater strain on the remaining workers who also start entertaining ambitions of quitting poor working conditions [17]. Eventually, this cycle leads to a catastrophic crisis in HHRs.

The article's contribution to the literature is threefold. (1) Despite the abundant theoretical literature on the subject matter, lack of relevant data on health professional migration has rendered it empirically void over the last decades. Therefore, we complement the existing theoretical literature by providing some empirical dimension to the migration-development nexus of the African health sector. (2) Assessing the impact of HHR emigration from a plethora of development dynamics (economic and human prosperity) could be crucial in understanding some trends in the MDGs. (3) Examining the impact of HHR migration throughout the conditional distributions of development dynamics elucidates the three main hypotheses highlighted in the introduction of this article.[3]

Data and methodology

Data

We examine a sample of 24 countries with data from the African Development Indicators (ADI) of the World Bank (WB) and Clemens and Pettersson's [15] new database on HHR migration in Africa.[4] The data structure is cross-sectional for the year 2000 because HHR emigration data are only available for this year. Development dependent variables include: the Inequality-adjusted Human Development Index (IHDI), economic prosperity (GDP growth) and per capita economic prosperity (GDP per capita growth).[5] Independent variables of interest are the physician and nurse emigration rates. Control variables include: economic considerations (inflation, population growth and foreign-aid), globalization (trade openness and financial liberalization), political considerations (level of democracy) and the quality of government (government effectiveness). It has been substantially documented that development (both in human and economic terms) depends on the existing economic atmosphere, globalization, the quality of government and the state of democratic institutions [9, 11, 18, 26]. Summary statistics ("Appendix 1"), correlation analysis with presentation of countries ("Appendix 2") and variable definitions ("Appendix 3") are presented in the appendices.

Methodology

To determine if existing development levels matter in how HHR emigration affects development dynamics (human and economic), we borrow from Billger and Goel [10] and recent African development literature by using quantile regression [3–5]. This technique enables us to investigate whether the relationship between development dynamics and the exogenous emigration variables differ throughout the distribution of the dependent variable [25]. Some studies on the migration-development nexus based on ordinary least squares (OLS) estimation report parameter estimates at the conditional mean of the development indicator. While mean effects are certainly important, this study expands such findings by using quantile regression (QR). In addition, one of the underlying assumptions of OLS regression is that the error term and the dependent variable are normally distributed. However QR does not require a normally distributed error term. Thus, based on this technique, we are able to carefully assess how HHR

[2] Refer to Figure 2, page 18, of [31]. Africa has 25 % of the global disease burden with a share in the population of 13.76 %, but has only a 1.3 % share of health workers.

[3] (1) Do existing human development and economic prosperity levels matter in the impact of HHR emigration on development? (2) Are blanket common policies relevant irrespective of specific development characteristics? (3) To be effective, should immigration policies be contingent on the prevailing levels of development dynamics and tailored differently across countries with the best and worst development records?

[4] The data are collected from census offices of destination countries of African physicians and professional nurses working abroad, that is, those that practice abroad. Health professionals that emigrated from Africa but did not practice abroad are not considered.

[5] We believe presenting both cases of GDP growth is relevant on two counts. (1) The effect of physician emigration (exogenous variable of interest) in the analysis may be different across GDP growth and GDP per capita growth distributions. (2) We expect the elasticities of the control variables to be similar; hence using both measures is a means of robustness check.

migration affects development throughout the conditional distribution with particular emphasis on the least and most developed African countries. QR yields parameters estimated at multiple points in the conditional distribution of the dependent variable [24] and has gained attention in recent development literature [3–5, 10, 30].

The θth quantile estimator of the dependent variable is obtained by solving for the following optimization problem.

$$\min_{\beta \in R^k} \left[\sum_{i \in \{i: y_i \geq x_i' \beta\}} \theta \left| y_i - x_i' \beta \right| + \sum_{i \in \{i: y_i \geq x_i' \beta\}} (1-\theta) \left| y_i - x_i' \beta \right| \right] \quad (1)$$

where $\theta \in (0,1)$. Contrary to OLS, which is based on minimizing the sum of squared residuals, with QR we minimize the weighted sum of absolute deviations, for instance, the 75th or 90th quantiles (with $\theta = 0.75$ or 0.90 respectively) by approximately weighing the residuals. The conditional quantile of y_i given as x_i is:

$$Q_y(\theta / x_i) = x_i' \beta_\theta \quad (2)$$

where unique slope parameters are estimated for each θth quantile of interest. This formulation is analogous to $E(y/x) = x_i'\beta$ in the OLS slope, although the parameters are estimated only at the mean of the conditional distribution of the dependent variable. For the model in Eq. (2), the dependent variable y_i is a development dynamic (human development and economic prosperity at macro- and micro-levels), while x_i contains a constant term, HHR emigration rate (physicians or nurses), foreign direct investment, trade, democracy, inflation, development assistance, population growth and government effectiveness. The quantile estimation technique is more robust than the OLS approach in the presence of outliers when the distribution of the dependent variable is a highly non-normal pattern [3, 30].[6] We also report estimates for least absolute deviations (LAD), which should correspond to those of the 0.5th quantile.

Empirical analysis

Summary of results

The results presented in Tables 2 and 3 include OLS, LAD and QR estimates. OLS estimates provide a baseline of mean effects, and we compare these to estimates of LAD and separate quantiles in the conditional distributions of HHR emigration. The results of Tables 2, 3 and 4 are summarized in Table 1 below, which focuses on top and bottom quantiles of HHR emigration elasticities of development dynamics. Hence, we report the incidence of HHR outward migration on development with particular emphasis on the least and most developed African countries. While panel A summarizes the effect of physician emigration on existing development levels, panel B synthesizes the impact of nurse emigration on prevailing development thresholds. From a horizontal comparative standpoint, the following conclusions could be established. (1) While physician emigration leads to human development and decreases GDP per capita growth, its effect on overall economic growth is contingent on existing levels of economic prosperity, with a positive (negative) effect in low (high) growth countries. (2) Nurse emigration exerts a positive (negative) effect on development dynamics only when existing development levels are low (high). Looking at the emigration elasticities of development from a vertical prism, the following conclusions could be drawn. (1) The effect of HHR emigration is positive (negative) at low (high) levels of economic growth. (2) HHR emigration improves (mitigates) human development (GDP per capita growth) when existing levels of development are low (high). (3) Differences in effects are found in top quantiles of human development and low quantiles of GDP per capita growth where the physician (nurse) emigration elasticities of development are positive (negative) and negative (positive) respectively.

Most control variables are significant with the right signs. Thus, the following complementary findings have been established. (1) Stable and slow population growth significantly improves economic prosperity [6]. The population growth rate of 2.6 % in the mean (see "Appendix 1") provides summary justification of this explanation.[7] (2) Development assistance is perilous to human development

[6] There are other justifications for the use of quantile regression. (1) It is rare to find normal distributions of variables in the real world, so the use of quantile regression merely provides a different algorithm for estimating the conditional mean. It should be kept in mind that, if the distribution of y for a fixed x is symmetric, then the conditional mean and the conditional median are the same thing. (2) Upper and lower quantiles could have significant policy implications. In other words, existing levels of development may respond differently to health worker migration, implying blanket immigration control policies may not be effective unless they are contingent on existing levels of development and tailored differently across the least and most developed countries. (3) The inherent variability in the data is worth studying, too.

[7] See Fernández-Villaverde [19] for a broad explanation. "This paper studies the relationship between population dynamics and economic growth. Prior to the Industrial Revolution increases in total output were roughly matched by increases in population. In contrast, during the last 150 years, increments in per capita income have coexisted with slow population growth. Why are income and population growth no longer positively correlated? This paper presents a new answer, based on the role of capital-specific technological change, that provides a unifying account of lower population growth and sustained economic growth" (p.1).

Table 1 Summary of results

	Human development		Economic growth		GDPpc growth	
	BQ	TQ	BQ	TQ	BQ	TQ
Panel A: impact of physician emigration						
HHR						
Physician	**+**	**+**	**+**	**−**	**−**	**−**
Economic considerations						
Inflation	+	+	−	+	−	+
Population growth	+	na	+	+	+	+
Development assistance	−	−	+	−	+	−
Political considerations						
Democracy	+	+	−	+	−	+
Governance						
Government effectiveness	+	+	+	−	+	−
Globalization						
Financial openness	+	na	−	+	−	+
Trade openness	+	na	+	+	+	+
Panel B: impact of nurse emigration						
HHR						
Nurse	**+**	**−**	**+**	**−**	**+**	**−**
Economic considerations						
Inflation	+	+	−	+	−	+
Population growth	+	+	+	+	+	+
Development assistance	−	−	−	−	+	−
Political considerations						
Democracy	+	+	−	+	−	+
Governance						
Government effectiveness	+	+	+	−	+	−
Globalization						
Financial openness	+	+	+	+	+	+
Trade openness	+	−	+	+	+	+
Panel C: impacts of physician and nurse emigration						
HHRs						
Physician	+	+	+	−	+	−
Nurse	+	−	+	−	+	na
Economic considerations						
Inflation	+	+	−	+	−	+
Population growth	+	+	+	+	+	+
Development assistance	−	−	−	−	−	−
Political considerations						
Democracy	na	+	−	+	−	+
Governance						
Government effectiveness	na	+	+	−	+	na
Globalization						
Financial openness	na	+	−	+	+	+
Trade openness	+	−	−	+	−	na

na not applicable because of insignificance of estimated coefficients, *TQ* top quantiles, *BQ* bottom quantiles, *GDPpc* GDP per capita

and macro-economic prosperity [7] and could be more or less positive to GDP per capita growth depending on the effectiveness of donor agencies or international organizations in their targeted micro-interest [14]. (3) Democracy improves human development but could be detrimental to economic prosperity when existing levels of growth are low. (4) Government effectiveness generally improves development dynamics. (5) Globalization dynamics

Table 2 Impact of HHR emigration on human development

	OLS	LAD	Q 0.1	Q 0.25	Q 0.50	Q 0.75	Q 0.90
Panel A: impact of physician emigration							
Constant	7.708	0.381	**0.336*****	**0.255*****	**0.381*****	**0.403****	5.721
	(0.573)	(0.980)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.011)**	(0.671)
Physician emigration	−1.098	0.184	**0.241*****	**0.248*****	**0.184*****	**0.384****	24.305
	(0.938)	(0.989)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.019)**	(0.101)
Trade	−0.093	0.0004	**0.0006****	**0.0004*****	**0.0004*****	0.000	−0.096
	(0.297)	(0.996)	**(0.014)**	**(0.000)**	**(0.000)**	(0.986)	(0.275)
Democracy	0.464	0.004	**0.004***	**0.010*****	**0.004*****	0.006	**2.258****
	(0.616)	(0.995)	**(0.080)**	**(0.000)**	**(0.000)**	(0.533)	**(0.024)**
Inflation	0.293	0.003	**0.002*****	**0.002*****	**0.003*****	0.004	**0.692***
	(0.402)	(0.990)	**(0.005)**	**(0.000)**	**(0.000)**	(0.210)	**(0.057)**
Foreign direct invt.	0.537	0.0003	0.003	**0.010*****	**0.0003*****	0.0008	1.155
	(0.701)	(0.999)	(0.336)	**(0.000)**	**(0.000)**	(0.956)	(0.408)
Gov't effectiveness	5.464	0.079	0.018	**0.0007*****	**0.079*****	0.073	**11.002****
	(0.256)	(0.990)	(0.161)	**(0.000)**	**(0.000)**	(0.152)	**(0.029)**
Population growth	1.915	0.031	0.002	**0.024*****	**0.031*****	0.019	3.495
	(0.538)	(0.991)	(0.734)	**(0.000)**	**(0.000)**	(0.550)	(0.262)
Foreign aid	−0.676	−0.015	**−0.016*****	**−0.016*****	**−0.015*****	**−0.016****	**−1.658*****
	(0.240)	(0.974)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.011)**	**(0.008)**
Observations	1–24	1–24	1–24	1–24	1–24	1–24	1–24
Panel B: impact of nurse emigration							
Constant	8.493	0.364	**0.329*****	**0.395*****	**0.364*****	**0.542*****	15.549
	(0.512)	(0.985)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	(0.262)
Nurse emigration	−9.203	−0.089	**0.186*****	−0.006	**−0.089*****	**−0.053*****	**−26.338****
	(0.442)	(0.997)	**(0.000)**	(0.948)	**(0.000)**	**(0.000)**	**(0.049)**
Trade	−0.106	0.0004	**0.0001*****	−0.000	**0.0004*****	**0.0007*****	**−0.293*****
	(0.213)	(0.997)	**(0.000)**	(0.950)	**(0.000)**	**(0.000)**	**(0.004)**
Democracy	0.686	0.005	**0.007*****	0.012	**0.005*****	**0.008*****	**3.225*****
	(0.468)	(0.995)	**(0.000)**	(0.156)	**(0.000)**	**(0.000)**	**(0.004)**
Inflation	0.359	0.007	**0.005*****	**0.005***	**0.007*****	**0.0004*****	**0.983****
	(0.311)	(0.988)	**(0.000)**	**(0.081)**	**(0.000)**	**(0.000)**	**(0.015)**
Foreign direct invt.	0.741	0.003	**0.010*****	0.012	**0.003*****	**−0.004*****	**3.071****
	(0.593)	(0.999)	**(0.000)**	(0.309)	**(0.000)**	**(0.000)**	**(0.048)**
Gov't effectiveness	4.581	0.069	**0.099*****	0.056	**0.069*****	**0.105*****	−1.832
	(0.338)	(0.991)	**(0.000)**	(0.186)	**(0.000)**	**(0.000)**	(0.712)
Population growth	1.665	0.034	**0.053*****	0.017	**0.034*****	**0.001*****	4.846
	(0.583)	(0.995)	**(0.000)**	(0.521)	**(0.000)**	**(0.000)**	(0.142)
Foreign aid	−0.722	−0.012	**−0.022*****	**−0.016*****	**−0.012*****	**−0.007*****	**−2.188*****
	(0.153)	(0.986)	**(0.000)**	**(0.001)**	**(0.000)**	**(0.000)**	**(0.000)**
Observations	1–24	1–24	1–24	1–24	1–24	1–24	1–24

Dependent variable is the Human Development Index

Lower quantiles (e.g., Q 0.10) signify nations where human development is least

Bold refers to significant estimates and their corresponding *p*-values

OLS ordinary least squares, *LAD* least absolute deviations, *Invt* investment, *Gov't* government

*, **, *** Significance levels of 10, 5 and 1 %, respectively

broadly improve human development [7, 23] and deteriorate economic prosperity in low income (growth) countries [2]. (6) Inflation decreases (increases) economic prosperity in low (high) quantiles of growth distributions, at micro- and macro-levels. Low and stable inflation is conducive for economic growth. Also, while low inflation may mitigate

Table 3 Impact of HHR emigration on economic prosperity

	OLS	LAD	Q 0.1	Q 0.25	Q 0.50	Q 0.75	Q 0.90
Panel A: impact of physician emigration							
Constant	−0.879	−2.406	**−0.505*** **	7.472	−2.406	−2.923	**−2.816*** **
	(0.871)	(0.814)	**(0.000)**	(0.176)	(0.339)	(0.479)	**(0.000)**
Physician emigration	2.752	−0.646	**2.232*** **	−0.180	−0.646	−1.740	**−0.931*** **
	(0.629)	(0.952)	**(0.000)**	(0.974)	(0.803)	(0.686)	**(0.000)**
Trade	0.026	0.058	**0.009*** **	0.016	**0.058*** **	0.003	**0.004*** **
	(0.448)	(0.491)	**(0.000)**	(0.625)	**(0.002)**	(0.899)	**(0.000)**
Democracy	−0.009	−0.0009	**−0.513*** **	−0.232	−0.0009	0.209	**0.232*** **
	(0.978)	(0.998)	**(0.000)**	(0.525)	(0.995)	(0.454)	**(0.000)**
Inflation	0.035	−0.038	**−0.015*** **	−0.086	−0.038	**0.180***	**0.171*** **
	(0.798)	(0.856)	**(0.000)**	(0.529)	(0.548)	**(0.097)**	**(0.000)**
Foreign direct invt.	0.203	−0.101	**−0.110*** **	−0.189	−0.101	**1.313*** **	**1.200*** **
	(0.714)	(0.945)	**(0.000)**	(0.730)	(0.691)	**(0.006)**	**(0.000)**
Gov't effectiveness	1.036	−0.351	**5.858*** **	**3.813***	−0.351	−0.383	**−0.697*** **
	(0.581)	(0.927)	**(0.000)**	**(0.053)**	(0.682)	(0.786)	**(0.000)**
Population growth	1.160	1.669	**1.753*** **	−1.524	**1.669*** **	**2.652** **	**2.569*** **
	(0.352)	(0.528)	**(0.000)**	(0.220)	**(0.008)**	**(0.010)**	**(0.000)**
Foreign aid	−0.187	−0.132	**0.010*** **	0.136	−0.132	**−0.415** **	**−0.421*** **
	(0.407)	(0.705)	**(0.000)**	(0.538)	(0.207)	**(0.024)**	**(0.000)**
Observations	1–24	1–24	1–24	1–24	1–24	1–24	1–24
Panel B: impact of nurse emigration							
Constant	−0.295	−3.735	**−0.184*** **	**−0.802*** **	**−3.735*** **	**−3.189** **	**−3.189*** **
	(0.955)	(0.674)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.048)**	**(0.000)**
Nurse emigration	1.453	4.043	**11.092*** **	**6.650*** **	**4.043*** **	−0.898	**−0.898*** **
	(0.764)	(0.708)	**(0.000)**	**(0.000)**	**(0.000)**	(0.521)	**(0.000)**
Trade	0.033	0.082	−0.0009	**0.002*** **	**0.082*** **	0.002	**0.002*** **
	(0.336)	(0.265)	(0.000)	**(0.000)**	**(0.000)**	(0.765)	**(0.000)**
Democracy	−0.067	−0.049	**−0.479*** **	**−0.275*** **	**−0.049*** **	**0.256** **	**0.256*** **
	(0.860)	(0.928)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.031)**	**(0.000)**
Inflation	0.020	−0.100	**−0.063*** **	**−0.032*** **	**−0.100*** **	**0.174*** **	**0.174*** **
	(0.883)	(0.661)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Foreign direct invt.	0.138	−0.252	**0.027*** **	**0.124*** **	**−0.252*** **	**1.270*** **	**1.270*** **
	(0.805)	(0.848)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Gov't effectiveness	1.274	0.822	**6.924*** **	**4.608*** **	**0.822*** **	−0.626	**−0.626*** **
	(0.509)	(0.809)	**(0.000)**	**(0.000)**	**(0.000)**	(0.266)	**(0.000)**
Population growth	1.117	1.611	**1.799*** **	**1.783*** **	**1.611*** **	**2.655*** **	**2.655*** **
	(0.370)	(0.580)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Foreign aid	−0.132	−0.065	**0.013*** **	**−0.024*** **	**−0.065*** **	**−0.443*** **	**−0.443*** **
	(0.508)	(0.843)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Observations	1–24	1–24	1–24	1–24	1–24	1–24	1–24

Dependent variable is the GDP growth rate

Lower quantiles (e.g., Q 0.10) signify nations where GDP growth is least

Bold refers to significant estimates and their corresponding *p*-values

OLS ordinary least squares, *LAD* least absolute deviations. *Invt* investment, *Gov't* government

*, **, *** Significance levels of 10, 5 and 1 %, respectively

inequality [13, 27], high inflation has been documented to have a negative income redistributive effect [1] in recent African inequality literature [8]. The average inflation rate around the region of 8 % with a corresponding standard deviation (inflation uncertainty or risk) of about 9 % (see "Appendix 1") supports this explanation.

Table 4 Impact of HHR emigration on per capita economic prosperity

	OLS	LAD	Q 0.1	Q 0.25	Q 0.50	Q 0.75	Q 0.90
Panel A: impact of physician emigration							
Constant	−0.777	−2.334	−0.384	**7.285*** **	−2.334	−2.755	**−2.654*** **
	(0.882)	(0.813)	(0.795)	**(0.000)**	(0.179)	(0.495)	**(0.000)**
Physician emigration	2.667	−0.621	2.146	**−0.265*** **	−0.621	−1.646	**−0.858*** **
	(0.631)	(0.951)	(0.181)	**(0.000)**	(0.726)	(0.696)	**(0.000)**
Trade	0.026	0.057	0.009	**0.017*** **	**0.057*** **	0.003	**0.004*** **
	(0.440)	(0.453)	(0.310)	**(0.000)**	**(0.000)**	(0.900)	**(0.000)**
Democracy	−0.007	0.0007	**−0.511*** **	**−0.225*** **	0.0007	0.202	**0.222*** **
	(0.982)	(0.999)	**(0.000)**	**(0.000)**	(0.994)	(0.460)	**(0.000)**
Inflation	0.033	−0.036	−0.014	**−0.084*** **	−0.036	**0.176***	**0.167*** **
	(0.803)	(0.851)	(0.702)	**(0.000)**	(0.394)	**(0.098)**	**(0.000)**
Foreign direct invt.	0.198	−0.101	−0.117	**−0.184*** **	−0.101	**1.291*** **	**1.185*** **
	(0.714)	(0.942)	(0.446)	**(0.000)**	(0.559)	**(0.006)**	**(0.000)**
Gov't effectiveness	1.007	−0.326	**5.616*** **	**3.706*** **	−0.326	−0.350	**−0.637*** **
	(0.582)	(0.923)	**(0.000)**	**(0.000)**	(0.577)	(0.800)	**(0.000)**
Population growth	0.104	0.602	**0.652***	**−2.479*** **	0.602	1.559	**1.483*** **
	(0.930)	(0.836)	**(0.067)**	**(0.000)**	(0.130)	(0.101)	**(0.000)**
Foreign aid	−0.181	−0.127	0.014	**0.133*** **	**−0.127***	**−0.407** **	**−0.413*** **
	(0.409)	(0.713)	(0.808)	**(0.000)**	**(0.081)**	**(0.024)**	**(0.000)**
Observations	1–24	1–24	1–24	1–24	1–24	1–24	1–24
Panel B: impact of nurse emigration							
Constant	−0.208	−3.576	**−0.028*** **	**−0.646*** **	**−3.576*** **	**−3.005***	**−3.005*** **
	(0.967)	(0.666)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.056)**	**(0.000)**
Nurse emigration	1.385	3.780	**10.653*** **	**6.356*** **	**3.780*** **	−0.847	**−0.847*** **
	(0.769)	(0.682)	**(0.000)**	**(0.000)**	**(0.000)**	(0.536)	**(0.000)**
Trade	0.032	0.080	**−0.0003*** **	**0.002*** **	**0.080*** **	0.002	**0.002*** **
	(0.330)	(0.283)	**(0.000)**	**(0.000)**	**(0.000)**	(0.765)	**(0.000)**
Democracy	−0.063	−0.044	**−0.467*** **	**−0.267*** **	**−0.044*** **	**0.246** **	**0.246*** **
	(0.865)	(0.933)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.034)**	**(0.000)**
Inflation	0.019	−0.095	**−0.062*** **	**−0.032*** **	**−0.095*** **	**0.170*** **	**0.170*** **
	(0.888)	(0.657)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Foreign direct invt.	0.135	−0.242	**0.020*** **	**0.119*** **	**−0.242*** **	**1.250*** **	**1.250*** **
	(0.804)	(0.862)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Gov't effectiveness	1.236	0.771	**6.712*** **	**4.486*** **	**0.771*** **	−0.580	**−0.580*** **
	(0.511)	(0.807)	**(0.000)**	**(0.000)**	**(0.000)**	(0.293)	**(0.000)**
Population growth	0.062	0.548	**0.711*** **	**0.696*** **	**0.548*** **	**1.562*** **	**1.562*** **
	(0.958)	(0.843)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.0004)**	**(0.000)**
Foreign aid	−0.129	−0.064	**0.014*** **	**−0.020*** **	**−0.064*** **	**−0.432*** **	**−0.432*** **
	(0.509)	(0.838)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Observations	1–24	1–24	1–24	1–24	1–24	1–24	1–24

Dependent variable is the GDP per capita growth rate

Lower quantiles (e.g., Q 0.10) signify nations where GDP per capita growth is least

Bold refers to significant estimates and their corresponding *p*-values

OLS ordinary least squares, *LAD* least absolute deviations, *Invt* investment, *Gov't* government

*, **, *** Significance levels of 10, 5 and 1 %, respectively

Table 5 The effects of HHR emigration in a single equation (for further robustness checks)

	OLS	LAD	Q 0.1	Q 0.25	Q 0.50	Q 0.75	Q 0.90
Panel A: impact on human development							
Constant	7.551	0.393	**0.268*****	0.233	**0.393*****	**0.419*****	**15.647*****
	(0.586)	(0.986)	**(0.000)**	(0.120)	**(0.000)**	**(0.000)**	**(0.001)**
Physician emigration	4.029	0.235	**0.224*****	0.226	**0.235*****	**0.513*****	**10.147****
	(0.800)	(0.992)	**(0.000)**	(0.185)	**(0.000)**	**(0.000)**	**(0.044)**
Nurse emigration	−10.598	−0.069	**0.072****	−0.054	**−0.069*****	−0.145	**−29.823*****
	(0.435)	(0.998)	**(0.047)**	(0.696)	**(0.000)**	(0.116)	**(0.000)**
Trade	−0.115	0.0002	**0.0007*****	0.0003	**0.0002*****	−0.0002	**−0.318*****
	(0.227)	(0.999)	**(0.006)**	(0.695)	**(0.000)**	(0.696)	**(0.000)**
Democracy	0.754	0.004	0.004	0.010	**0.004*****	0.009	**2.881*****
	(0.458)	(0.997)	(0.109)	(0.322)	**(0.000)**	(0.185)	**(0.000)**
Inflation	0.375	0.004	**0.003*****	0.004	**0.004*****	**0.005****	**1.190*****
	(0.314)	(0.994)	**(0.003)**	(0.287)	**(0.000)**	**(0.035)**	**(0.000)**
Foreign direct invt.	0.821	0.0008	0.004	0.011	**0.0008*****	0.001	**2.895*****
	(0.576)	(0.999)	(0.193)	(0.437)	**(0.000)**	(0.875)	**(0.000)**
Gov't effectiveness	4.300	0.073	0.019	−0.019	**0.073*****	**0.097*****	−0.973
	(0.395)	(0.993)	(0.135)	(0.707)	**(0.000)**	**(0.009)**	(0.511)
Population growth	1.751	0.027	**0.030*****	0.028	**0.027*****	0.018	**5.248*****
	(0.579)	(0.996)	**(0.001)**	(0.386)	**(0.000)**	(0.365)	**(0.000)**
Foreign aid	−0.800	−0.015	**−0.019*****	**−0.015****	**−0.015*****	**−0.018*****	**−2.504*****
	(−0.800)	(0.988)	**(0.000)**	**(0.022)**	**(0.000)**	**(0.000)**	**(0.000)**
Panel B: impact on economic prosperity							
Constant	−0.870	−3.870'	−0.537	**5.307*****	−3.870	**−2.991*****	**−2.923***
	(0.876)	(0.716)	(0.601)	**(0.000)**	(0.624)	**(0.000)**	**(0.052)**
Physician emigration	2.461	0.287	**4.192*****	**−1.482*****	0.287	**−1.436*****	−0.551
	(0.703)	(0.982)	**(0.002)**	**(0.000)**	(0.974)	**(0.000)**	(0.733)
Nurse emigration	0.601	4.481	**11.882*****	**3.041*****	4.481	**−0.913*****	−0.238
	(0.912)	(0.800)	**(0.000)**	**(0.000)**	(0.560)	**(0.000)**	(0.861)
Trade	0.027	0.084	**−0.014***	**0.030*****	0.084	**0.002*****	0.003
	(0.465)	(0.335)	**(0.056)**	**(0.000)**	(0.129)	**(0.000)**	(0.692)
Democracy	−0.026	−0.052	**−0.551*****	**−0.269*****	−0.052	**0.215*****	**0.230****
	(0.949)	(0.938)	**(0.000)**	**(0.000)**	(0.927)	**(0.000)**	**(0.037)**
Inflation	0.030	−0.108	−0.045	**−0.096*****	−0.108	**0.146*****	**0.177*****
	(0.837)	(0.717)	(0.111)	**(0.000)**	(0.603)	**(0.000)**	**(0.000)**
Foreign direct invt.	0.187	−0.260	0.053	**−0.225*****	−0.260	**1.400*****	**1.225*****
	(0.752)	(0.860)	(0.623)	**(0.000)**	(0.754)	**(0.000)**	**(0.000)**
Gov't effectiveness	1.102	0.956	**7.317*****	**3.809*****	0.956	**−0.249*****	−0.611
	(0.589)	(0.805)	**(0.000)**	**(0.000)**	(0.737)	**(0.000)**	(0.240)
Population growth	1.169	1.599	**1.998*****	**−0.719*****	1.599	**2.762*****	**2.608*****
	(0.366)	(0.605)	**(0.000)**	**(0.000)**	(0.377)	**(0.000)**	**(0.000)**
Foreign aid	−0.180	−0.058	**−0.105****	**0.063*****	−0.058	**−0.440*****	**−0.433*****
	(0.457)	(0.886)	**(0.027)**	**(0.000)**	(0.862)	**(0.000)**	**(0.000)**
Panel C: impact on per capita economic prosperity							
Constant	−0.769	−3.756	**−0.390*****	**5.224*****	−3.756	**−2.807*****	**−2.744****
	(0.888)	(0.720)	**(0.000)**	**(0.000)**	(0.620)	**(0.000)**	**(0.026)**
Physician emigration	2.398	0.385	**4.294*****	**−1.476*****	0.385	**−1.372***	−0.541
	(0.703)	(0.976)	**(0.000)**	**(0.000)**	(0.964)	**(0.085)**	(0.677)

Table 5 continued

	OLS	LAD	Q 0.1	Q 0.25	Q 0.50	Q 0.75	Q 0.90
Nurse emigration	0.555	4.367	**11.462*** **	**2.878*** **	4.367	−0.834	−0.198
	(0.917)	(0.796)	**(0.000)**	**(0.000)**	(0.555)	(0.204)	(0.856)
Trade	0.027	0.082	**−0.013*** **	**0.030*** **	0.082	0.002	0.003
	(0.459)	(0.358)	**(0.000)**	**(0.000)**	(0.122)	(0.515)	(0.631)
Democracy	−0.022	−0.048	**−0.541*** **	**−0.260*** **	−0.048	**0.206*** **	**0.221** **
	(0.954)	(0.941)	**(0.000)**	**(0.000)**	(0.930)	**(0.000)**	**(0.016)**
Inflation	0.029	−0.106	**−0.044*** **	**−0.094*** **	−0.106	**0.144*** **	**0.173*** **
	(0.841)	(0.678)	**(0.000)**	**(0.000)**	(0.596)	**(0.000)**	**(0.000)**
Foreign direct invt.	0.183	−0.253	**0.047*** **	**−0.218*** **	−0.253	**1.370*** **	**1.206*** **
	(0.751)	(0.859)	**(0.000)**	**(0.000)**	(0.751)	**(0.000)**	**(0.000)**
Gov't effectiveness	1.068	0.950	**7.115*** **	**3.689*** **	0.950	−0.225	−0.566
	(0.591)	(0.806)	**(0.000)**	**(0.000)**	(0.728)	(0.349)	(0.179)
Population growth	0.113	0.531	**0.915*** **	**−1.715*** **	0.531	**1.660*** **	**1.516*** **
	(0.927)	(0.857)	**(0.000)**	**(0.000)**	(0.757)	**(0.000)**	**(0.000)**
Foreign aid	−0.175	−0.056	**−0.108*** **	**0.062*** **	−0.056	**−0.430*** **	**−0.423*** **
	(0.458)	(0.885)	**(0.000)**	**(0.000)**	(0.862)	**(0.000)**	**(0.000)**

Dependent variables are development dynamics. Lower quantiles (e.g., Q 0.10) signify nations where development is least

Bold refers to significant estimates and their corresponding *p*-values

OLS ordinary least squares, *LAD* least absolute deviations, *Invt* investment, *Gov't* government. There are 24 cross sections

*, **, *** Significance levels of 10, 5 and 1 %, respectively

Robustness checks

As of now, two types of robustness checks have been performed: (1) the use of LAD specifications to check the consistency of 0.5th quantile estimates and (2) the employment of economic prosperity at macro and per capita income levels. Regarding the former, although not in the significance but in the magnitude of estimated values, the estimates in LAD are consistent with those of the 0.5th quantile across the distributions and specifications. With respect to the latter, except for a slight difference in the impact of physician emigration, GDP growth estimations are robust to those of GDP per capita growth.[8] For further robustness checks, we examine the consistency of the findings by assessing the effects of nurse and physician emigration in the same equation. Corresponding results are presented in Table 5 above and summarized in panel C of Table 1. Accordingly, these new findings are consistent with those in Tables 2, 3 and 4.

Discussion and policy implications

Before delving into the discussion, it is imperative to outline the intuition motivating this article. Despite the acute concern about HHR emigration from the African continent, lack of relevant data has made the subject matter empirically void over the last decades. Hence, there is little information on the weight HHR emigration might exert on the development of source countries. Researchers used to ask if HHR emigration has a positive or negative effect on development [34]. Today, they are more likely to ask the following questions. (1) At what development thresholds does HHR emigration have positive or negative effects on development dynamics? (2) Do existing development levels (human and economic) affect the impact of HHR emigration on development dynamics? (3) To be effective, should immigration policies be commonly a blanket (irrespective of development characteristics) or contingent on the prevailing levels of development dynamics and tailored differently across countries with the best and worst development records? We have examined these concerns in a bid to give policy makers guidance on the hypotheses. The relevance of this analysis is particularly substantial given the apparent threats to the MDGs [12]. In addition, it is the obligation or duty of all nations to manage migrant flows in a way that does not compromise their legal or normative commitments under human rights treaties (e.g., right to health) and development (notably the MDGs).

As we have observed from horizontal comparative analysis, while physician emigration leads to human development and decreases GDP per capita growth, its effect on overall economic growth is contingent on the existing level of economic prosperity with a positive (negative) effect for low (high) growth countries. Given the negative (positive) incidence of physician emigration on GDP per capita (human

[8] See the signs in panel A and panel B in Table 1.

development), since GDP per capita growth is a constituent of human development, it follows that life expectancy and 'years of schooling' are the most likely components of the HDI that are positively affected by HHR emigration. How these factors play out (come about) could be the focus of other research in which other components of human development not captured by the HDI are decomposed to specifically analyze the constituents that matter most in the positive physician (emigration)-human development nexus.

Our findings have also shown, from a horizontal comparative standpoint, that nurse emigration exerts a positive (negative) effect on development dynamics only when existing development levels are low (high). Thus, there is evidence of a decreasing magnitude in the positive impact of nurse emigration across the development distributions. It follows that the development gains of nurse outward migration (remittances for the most part) decrease with the level of economic prosperity and human development. This implies that wealthier African nations should suffer while their poor counterparts gain with the unfolding of the phenomenon. A possible explanation to this finding could be that the benefits in remittances contingent on nurse emigration could be greater than the domestic gains in nurse services when economic prosperity and human development are low. However, as the nation develops, the domestic need for nurses outweighs the economic and human development appeals of remittances resulting from their (nurses) emigration. Hence, sampled countries stand to benefit less from nurse emigration as they develop. This interpretation is consistent only with the economic prosperity dimension of development dynamics.

Now observing the emigration elasticities of development from a vertical prism, we have established three main findings. (1) The effect of HHR emigration is positive (negative) at low (high) levels of economic growth. The analytical elucidation of this finding has already been covered in the preceding paragraph. (2) HHR emigration improves (mitigates) human development (GDP per capita growth) when existing levels of development are low (high). This interpretation is also consistent with the elucidation in the above paragraph. (3) Differences in effects are found in top quantiles of human development and low quantiles of GDP per capita growth where the physician (nurse) emigration elasticities of development are positive (negative) and negative (positive) respectively. What do these differences imply? It follows that nurses are more useful domestically for human development when existing human development levels are high than physicians, implying physician emigration will improve the HDI while nurse emigration will decrease it. However, when existing GDP per capita income growth levels are low, physician emigration is detrimental to GDP per capita growth, whereas nurse emigration has the opposite effect.

As a policy implication, blanket health-worker emigration control policies are unlikely to succeed across countries with different levels of human development and economic prosperity. Hence, the policies should be contingent on the prevailing levels of development and tailored differently across the most and least developed African countries. HHR emigration could be beneficial in certain development circumstances. Also, the benefits of physicians differ substantially from those of nurses in certain development thresholds. Hence, it is necessary to distinguish these HHR categories in policy making.

Conclusion

Owing to the lack of relevant data on health worker migration for Africa, the subject matter has remained empirically void over the last decades despite the acute concern about health professional emigration in the continent. Researchers used to ask whether migration has a positive or negative effect on development [34]. In this article we have assessed three main questions researchers might ask today. (1) Do existing human development and economic prosperity levels matter in the impact of HHR emigration on development? (2) Are blanket common policies relevant irrespective of specific development characteristics? (3) To be effective, should immigration policies be contingent on the prevailing levels of development dynamics and tailored differently across countries with the best and worst development records?

From a horizontal comparative standpoint, the following findings have been established. (1) While physician emigration leads to human development and decreases GDP per capita growth, its effect on overall economic growth is contingent on existing levels of economic prosperity, with a positive (negative) effect in low (high) growth countries. (2) Nurse emigration exerts a positive (negative) effect on development dynamics only when existing development levels are low (high). Looking at the emigration elasticities of development from a vertical prism, the following conclusions could be drawn. (1) The effect of HHR emigration is positive (negative) at low (high) levels of economic growth. (2) HHR emigration improves (mitigates) human development (GDP per capita growth) when existing levels of are low (high). (3) Differences in effects are found in top quantiles of human development and low quantiles of GDP per capita growth where the physician (nurse) emigration elasticities of development are positive (negative) and negative (positive) respectively.

As a policy implication, blanket health-worker emigration control policies are unlikely to succeed across countries with different levels of human development and economic prosperity. Hence, the policies should be contingent on the prevailing levels of development and tailored differently across the most and least developed countries.

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Appendices

Appendix 1

See Table 6.

Appendix 2

See Table 7.

Table 6 Summary statistics

Variables	Mean	SD	Min.	Max.	Observations
Dependent variables					
Human development	2.270	9.055	0.219	44.783	24
Economic prosperity	3.701	3.532	−3.700	10.073	24
Per capita economic prosperity	1.037	3.701	−6.097	8.290	24
Independent variables of interest					
Physician emigration	0.376	0.174	0.090	0.750	24
Nurse emigration	0.166	0.185	0.010	0.780	24
Control variables					
Trade	70.732	37.665	27.688	166.14	24
Democracy	3.291	4.069	−8.000	10.000	24
Inflation	8.458	9.090	−0.881	29.581	24
Foreign direct investment	2.951	3.102	0.479	15.792	24
Government effectiveness	−0.550	0.573	−1.491	0.578	24
Population growth	2.610	1.070	0.982	6.686	24
Development assistance	8.905	7.655	0.366	25.587	24

SD standard deviation, *Min* minimum, *Max* maximum

Table 7 Correlation analysis and presentation of countries

Dependent variables			Independent variables		Control variables							
IHDI	GDPg	GDPpcg	Physicians	Nurses	Trade	Democracy	Inflation	FDI	GE	Popg	NODA	
Panel A: correlation analysis												
1.000	0.034	0.040	−0.203	−0.131	−0.093	0.300	−0.073	−0.163	0.424	−0.031	−0.244	IHDI
	1.000	0.954	0.025	−0.066	0.437	−0.110	−0.104	0.309	0.250	−0.077	−0.286	GDPg
		1.000	−0.002	0.016	0.557	−0.080	−0.067	0.410	0.286	−0.370	−0.406	GDPpcg
			1.000	0.332	0.075	−0.031	0.409	0.087	0.003	0.085	0.530	Physicians
				1.000	−0.030	0.231	0.285	−0.037	−0.025	−0.267	0.100	Nurses
					1.000	−0.139	0.054	0.635	0.240	−0.494	−0.385	Trade
						1.000	0.027	−0.561	0.480	−0.072	0.031	Democracy
							1.000	−0.016	0.010	−0.104	0.561	Inflation
								1.000	0.065	−0.409	−0.161	FDI
									1.000	−0.173	−0.166	GE
										1.000	0.465	Popg
											1.000	NODA

Panel B: presentation of countries (24)

Benin, Burkina Faso, Burundi, Congo Republic, Ghana, Kenya, Madagascar, Malawi, Mali, Mozambique, Niger, Rwanda, Togo, Uganda, Zambia, Botswana, Cameroon, Ivory Coast, Lesotho, Mauritius, Senegal, South Africa, Sudan, Swaziland

IHDI Inequality-adjusted Human Development Index, *GDPg* gross domestic product growth rate. *GDPpcg* GDP per capita growth rate, *FDI* foreign direct investment, *GE* government effectiveness, *Popg* population growth rate, *NODA* net official development assistance

Appendix 3

See Table 8.

Table 8 Variable definitions

Factors	Variables	Definitions	Sources
Panel A: independent variables (health human resource emigration)			
Health worker emigration	Physicians	Physician emigration rate (% of total physicians)	Clemens and Pettersson [15]
	Nurses	Nurse emigration rate (% of total nurses)	Clemens and Pettersson [15]
Panel B: dependent variables			
Development dynamic variables	Human development	Inequality adjusted HDI	World Bank (WDI)
	Economic prosperity	GDP growth rate (annual %)	World Bank (WDI)
	Per capita economic prosperity	GDP per capita growth rate (annual %)	World Bank (WDI)
Panel C: control variables			
Economic considerations	Inflation	Consumer price index (annual %)	World Bank (WDI)
	Population growth	Population growth rate (annual %)	World Bank (WDI)
	Development assistance	Net Official development assistance (% of GDP)	World Bank (WDI)
Political considerations	Democracy	Level of institutionalized democracy	World Bank (WDI)
Governance	Government effectiveness	Government effectiveness (estimate)	World Bank (WDI)
Globalization	Foreign investment	Foreign direct investment (% of GDP)	World Bank (WDI)
	Trade openness	Exports plus imports (% of GDP)	World Bank (WDI)

WDI world development indicators, *IHDI* inequality-adjusted Human Development Index, *GDP* gross domestic product

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