Research Article

# The “Africa Rising”: An Empirical Analysis of the Determinants of Per-Capita Growth

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**In developing economies, the race toward inclusive development has prompted researchers to reconsider the drivers of growth in view of achieving the Sustainable Development Goals (SDGs). This study aims to explore the determinants of African growth after analysing reference literature to select the explanatory variables.**

**The paper aims to identify the robust drivers of growth of 54 African countries over the period 2010-2019, where the data source is more complete. As a data source, the main international organisations (UN, WB, IMF) have been considered.**

**We employ a fixed-effects (FE) estimator and primarily a system dynamic panel estimator (GMM-sys) without and with added exogenous regressors, the latter as a robustness check. As far as we know, we have not found any studies analysing the determinants of growth in a panel of 54 African countries using GMM estimators with data referring to the last decade. We have used the real per-capita GDP as a dependent variable.**

**Our findings indicate that in addition to the initial conditions of the per-capita GDP, the natural resource rent with one order of lags has emerged as significant and with a negative sign, crowding out the per-capita GDP. On the other hand, the government expenditure with one order of lags is also confirmed as significant with a positive sign, while the terms-of-trade has emerged as not significant, after the robustness check with the instrumental variables. We conclude that institutional and business environments are particularly important in explaining African growth.**

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## 1. Introduction

Since the new millennium, Africa has had considerable GDP growth that has more than doubled. Over the last decade, six of the fastest-growing economies in the world were in Africa. “Africa rising” has prompted academics and analysts to reconsider the issue of African economic potential. This is affecting firms’ strategies, and those from developed countries are seeking to enter these emerging markets[1][2][3][4].

African countries that gained independence from colonial rule in the sixties experienced their own model of cultural, social, and economic development[5][6]. According to the theory of development, all societies advance through similar stages of development, and this means that underdeveloped countries today are in the same condition as developed countries were in the past[7][8][9]. In other words, underdeveloped countries are not merely a primitive version of developed countries, but they are unique in their features and structures[10][11].

Underdeveloped countries can accelerate their development, for instance, by implementing structural reforms, by attracting capital flows, and by enhancing technology transfers, as well as, they have increased the integration along the global value chains (GVCs)[12].

Although the political and macroeconomic framework of African countries can be unstable, nonetheless, these emerging markets are often considered an opportunity, anyway with a given operative risk. In other words, labour markets may be inadequately regulated, the rule of law may be poor, and corruption may be high, logistical difficulties may depend on infrastructural deficiencies, or trade may be difficult due to the absence of codes of conduct and best practices.

Can African markets grow and break with their colonial trading past? On the other hand, can Africa successfully integrate into the global economy as other areas of the world have experienced?

Despite the difficulties, many African countries are encouraging drawing up action agendas and implementing structural reforms[13][14][15][16][17][18][19][20].

In the last decade, Africa has experimented with high levels of growth, but there are still governance weaknesses[21]. Historically, African countries have experienced conflicts, structural upgrade programmes, weak institutions and unsound governance, high levels of international aid, low levels of foreign investment, dependence on natural resources, limited economic freedom and private sector[22][23].

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This means that debate on the determinants of African growth is central for economists and scholars. Economies in transition, such as emerging and developing, are experiencing an evident socio-economic dynamism, and soon, they will have to face the challenge of change, as much as developed countries will have to do[24]. Globalisation has broken the consolidated production paradigms, and new business opportunities have emerged around the world.

This has increased competition between firms to enter GVCs, and the pressure on emerging markets[25]. African ones primarily trade raw materials and commodities with developed countries, but when these are traded with developing countries, it exists a higher likelihood that they are dutiable.

The state of crisis that began in 2008 has never stopped. Former, the sovereign debt crisis in the Eurozone, then, the uprisings in the Middle East and North Africa, and now, the global pandemic caused by Covid-19, the imbalances in the US-China relationship, and the Russia-Ukraine war are seriously damaging the world economy. Advanced economies are growing slowly, or risk a new recession, as they have begun to suffer from growing internal imbalances and income disparity risking compromising the long-run economic and social stability[26][27][28].

In conclusion, interest in African emerging markets is growing at least for three reasons: (i) governance in developed and developing countries, especially in Eastern and Southern Asia, is concerned about ensuring the supply of strategic raw materials to manufacturing industries; (ii) the so-called "African lions" – Ethiopia, Ghana, Kenya, Mozambique, Nigeria, and South Africa – have experienced fast growth[29]; (iii) it expects that the African Continental Free Trade Area Agreement (AfCFTA) will increase income in countries by at least 9% by 2035[30][31]. The multilateral, and free trade agreements are important for the success of African countries, as a consequence of the economic and geopolitical processes that are affecting the globalised world. In fact, AfCFTA will help investors mitigate operational risks, overcome market barriers, and address compliance issues arising from non-harmonised trade standards, therefore enabling them to effectively grow their businesses while supporting inclusive and sustainable development at both the regional and local levels[32].

In Figure 1, the average levels of real per capita GDP over the periods 2010-2019 (benchmark) and 1990-1999 for the 54 African countries are shown in comparison.

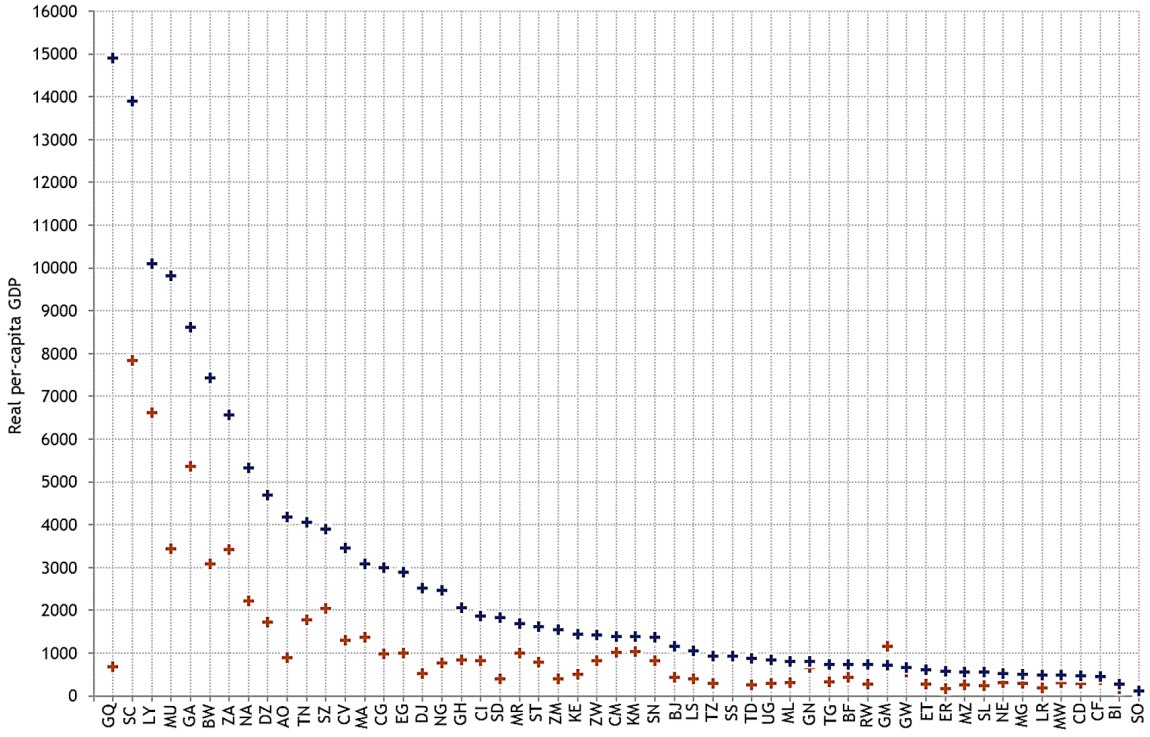


**Figure 1.** Average levels of real per-capita GDP for the 54 African countries, 2010-2019 and 1990-1999, USD. *Note: data for South-Sudan are missing before 2010. Source: our elaboration.*

Figure 1 shows that African counties recorded growth in real per capita GDP on average between the two periods considered. Numerous countries fall within the range of less than $1,000 to around $2,000 yearly. However, wide disparities between countries are evident. At the bottom of the income pyramid are two of the poorest countries in the world, Somalia and Burundi, with just over $100 and $200 yearly, respectively. While Equatorial Guinea – an oil-rich country – and

the Seychelles – a financial and offshore centre – stand out, with almost $15,000 and $14,000 yearly, respectively. The “African lions” – South Africa ($6,500), Nigeria ($2,500), Ghana ($2,000), Kenya ($1,500), Ethiopia ($600), and Mozambique ($550) – are quite vary. Finally, the other countries in the $6,000-$10,000 yearly range are: Libya ($10,000), Mauritius ($9,800), Gabon ($8,500), and Botswana ($7,500).

At the Figure A.1 in the Appendix A, the long-term average growth of Africa and its sub-regions is shown since 1990. The greatest growth rates are evident starting in the 2000s. In terms of growth achieved, Northern-Africa is the leader thanks to its more diversified economies. Southern-Africa follows, supported by the mining industry and relatively advanced infrastructure, but penalized by internal inequalities and recurring crises. Eastern-Africa follows, its growth has accelerated driven by targeted economic reforms. Western-Africa is subject to political instability and volatility in commodity prices, and it is at the bottom. Central-Africa is the last due to internal conflicts and a lack of infrastructure.

The last decade, then, is the period showing the most uneven trends, where growth has suffered setbacks or slowed, and has generally become more instable, primarily due to commodity price shocks and various socio-political tensions across subregions[29][30][31]. Northern- and Eastern- Africa remained the area with the highest income levels, while the Central-, Western-, and Southern- Africa struggled the most. Therefore, these trends make the last decade worthy of further investigation and a deeper understanding of the drivers of African growth.

This study aims to explore the determinants of African growth in a panel of 54 counties[1] after analysing reference literature to select the explanatory variables. Therefore, our research question (*RQ*) is the following: *what macroeconomic, institutional, and international openness factors drove GDP per-capita growth in the sample of 54 African countries over the decade 2010-2019?*

Although many studies analyse growth with the generalised method of moment (GMM), however, as far as we know, there are no studies analysing growth with a panel of 54 African countries using GMM estimators over the period 2010-2019.

The remaining paper has been structured as follows: (i) related literature and explanatory variables, (ii) data collection, materials, and methods, (iii) empirical analysis, (iv) conclusions.

## 2. Related literature and explanatory variables

We have found the reference literature to select the explanatory variables of African growth from the online search engine *discovered.ed.ac.uk* developed by the University of Edinburgh, by inserting the following keywords in the title: *Africa growth*; filters: *gross domestic product*; time-frame: *2011-2025*; discipline: *business and economics*. Clustering was performed for 75 peer-reviewed research articles selected based on topics and relevance (see Table A.1 in the Appendix A).

Development economists have produced many empirical studies about the drivers of growth, however, their findings can change over time and based on the considered countries. As a result, authors can differently explain growth, based on the specific research questions or analysis methods they adopt. From the reference literature, it emerges that differences in economic policy among countries can explain their gaps in economic growth.

Many empirical studies on growth have been influenced by the neoclassical model. These studies start from the initial income level and extend their analysis to include factors such as government policies related to human capital formation, technology diffusion, population growth, and the geographical location of countries. Despite the vast literature on growth, the mechanics of development remain central in the economic debate. While empirical works have identified a number of variables correlated with development, an important issue that remains open is the lack of an unequivocal theoretical framework about what the determinants of growth are with reasonable certainty. Starting from the model by Solow[33][34] various reasons have emerged. These variables are not necessarily mutually exclusive and have not an order of importance. Therefore, given the existence of multiple and possible repressors, a specific approach to analyse the growth determinants could be to research robust empirical relations for African growth over the last decade.

Recently, the debate on the primacy of human development is increase, however, empirical works focus on explaining why some countries have experienced rapid long-term growth rates in per-capita income, while others have not achieved the same performance. In the economic growth theory, relatively small differences in cross-country growth rates, when cumulated over one or more generations, can have significant consequences on countries’ living standards, thus, the role of governance and institutional environment on development is a widely debated research topic.

The relationship between the geographical localisation of countries and growth is also wide. The geographical factors can have little effect on growth after controlling for the country’s institutional framework. In other words, these effects can be indirectly grasped by the institutional and business environment variables. The experience of countries where institutional and business environment is weak, or where governance has collapsed, has shown that growth is significantly lower than otherwise.

In sum, the neoclassical economic theory considers capital accumulation as a driver of growth, but endogenous growth models have also highlighted the key role of employment, productivity, human capital formation, and technology, as a result, unemployment, and low knowledge capital cause slow growth[35][36][37][38][39][40]. Development can depend on public and private investments, foreign direct investments, and international aid. The latter, if granted based on the

level of development reached by the recipient countries, has proven to be better. Moreover, in a globalised world, a part of the trade is along the GVCs. For example, African trade with China has intensified as a consequence of the diplomatic action in countries rich in natural resources.

The neoclassical economic models consist of a set of assumptions useful for analysing market behaviour with an adequate mathematical formalisation. Under its assumptions, the appropriate unit of analysis is the individual consumer or firm rationally choosing among available alternatives according to preferences, by maximizing the utility function or profit respectively. Preferences are exogenous to models, transaction costs are null, and information is perfectly available as the theorem by Coase[41] implies. However, this can be deceptive as people and firms do not have perfect information about the markets. Despite this, the neoclassical theoretical framework remains a fundament in modern economic analysis.

Two main theories of economic development emerged in the second half of the XX century[42][43]. On the one hand, there is the "modernisation theory" grasping from the cultural and technological differences among countries the explanation of their underdevelopment[42]. The capitalistic way should be a solution for underdeveloped economies and technology is the most important factor in the development analysis, while cultural differences and traditionalist behaviours can be an obstacle to progress and innovation. On the other hand, there is the "dependency theory", suggesting that underdevelopment can be explained in part by the exploitation of poor countries by the rich ones, due to the globalisation that privileges some countries at the expense of others[43]. South countries rich in natural resources remain underdeveloped to the advantage of developed ones exporting cheaply raw materials, which are then processed in developed countries, and then sold in developing countries as manufacturing goods with a higher value-added. In most ex-colonised countries exists a dependency on trade with ex-colonising countries, properly traced to this experience shaped the economic relations. In the past, import substitution policies with locally manufactured products and inter- and intra-regional trade agreements were adopted as solutions to this order of issues.

In conclusion, from our clustering over the reference literature, the most questioned variable in empirical studies is the governance climate. The institutional level reached by countries affects their business environment. In other words, there is a positive nexus between the quality of the institutional and business environment with growth, but it requires sound governance[44][45][46][47][48][49][50]. Indeed, studies suggest that productivity, innovation, and a stable macroeconomic framework can affect growth based on the quality of the institutional and business environment in the country.

A clustering on the reference literature has been useful to determine which explanatory variables to include in econometric models. We develop our models starting from the macroeconomic determinants of growth most frequently used in empirical studies, such as openness, inflation, unemployment, external debt, net-ODA, FDI inflows, received remittances, natural resource rent, urbanisation, public expenditure, fixed and human capital formation, innovation, productivity, and last but not least the governance climate. Additionally, we want to consider how the global interdependencies across markets can contribute to explaining African growth[51]. In other words, growth can create the conditions for a country to have a competitive advantage in trade with other countries. Trade and growth can be dependent or independent, otherwise, if there is a negative relationship between them, this can depend on the imports being higher than exports.

As a result, it seems to us necessary to include in our framework of analysis proxy variables for African countries' merchandise trade across clusters of developed and developing countries as World Bank Group researchers have classified them.

Finally, the academic and political debate on the possible trade-off between efficiency in resource allocation and public interventionism in the economy led us to separately consider in our models the explicative variables. The expected signs and economic motivations for the inclusion of the variables of interest were reported in the following Table 1.

| Variables | Expected Signs | Economic Motivations |
|---|---|---|
| Real per-capita GDP | + | Growth persistence and conditional convergence (lags) |
| FDI Inflows | + | Technology transfer and capital accumulation |
| Inflation | – | Macroeconomic and monetary instability |
| Openness | ± | Productivity spillovers, or infant industry crowd-out |
| Natural Resource Rent | – | Resource curse |
| Government Expenditure | ± | Stabilizing role, infrastructure, or fiscal constraints |
| Productivity | + | Manufacturing efficiency |
| External Debt | ± | Debt-overhang effects, or financing |
| Unemployment | – | Unproductive labour force |
| Military Expenditure | ± | Political stability, or opportunity costs |
| Health Expenditure | + | Improvement of human capital and productivity |
| Received Remittances | + | Keynesian demand-driven multiplier effect |
| Net-ODA | ± | Effective aid, or crowd-out and governance lacks |
| Urban Population | ± | Urban-scale benefits, or infrastructural congestion |
| Human Capital Formation | + | High skills, innovation, and productivity |
| Gross Fixed Capital Formation | + | Physical capital accumulation |
| ICT-diffusion | + | Greater connectivity, technology diffusion and spillovers |
| Governance Climate | + | Sound governance reduces country risk and attracts capital flows |
| Terms-of-trade (import-export) | ± | Participation in GVC, or structural dependence |

**Table 1.** Economic variables, expected signs, and economic motivations.

*Source: our elaboration.*

## 3. Data collection, materials, and methods

We have used a set of explanatory variables extracted from the UN-dataset (UNCTAD and UNDP), and the WB-dataset (World Development Indicators-WDI and World Governance Indicators-WGI) over the period 2010-2019 for all 54 African countries. Time-series have been integrated, when necessary, for a few missing values (2%) with data from the IMF (World Economic Outlook-WEO), otherwise from secondary sources (CIA-World Factbook's country surveys). A panel-dataset allows us to explore not only the cross-sectional dimension but also the time-variant one. As a result, the reliability of our panel-dataset based on its completeness is at 98%. At Table A.2 in the Appendix A, we show the main descriptive statistics and proxies for the variables used. An acceptable level of variability over the time dimension exists, while the cross-sectional dimension shows a higher level of this for some variables.

In the Appendix A at the Table A.3, we show the statistical associations between variables that are non-excessive for the dependent variable, particularly, and among the regressors, generally. Referring only to the dependent variable, the stronger correlations were found for the variables: ICT-diffusion, Urban Population, Openness, and Net-ODA.

With panel data, unobserved heterogeneity needs to be addressed by applying the within transformation – or demeaning process – as in fixed-effects (FE) models, otherwise by taking first differences, if the second dimension of the panel is a proper time-series. The ability of first differencing to remove unobserved heterogeneity also underlies the family of estimators that have been developed for dynamic panel data models. These models contain one or more lagged dependent variables allowing for the modelling of a partial adjustment mechanism.

A serious difficulty arises with the FE model when implementing a dynamic model for panel data with "small T and large N"[52]. This occurs because the demeaning process, which subtracts the individual's mean value of *y* and each *x* from the respective variable, creates a correlation between regressor and error.

Therefore, the first difference transformation removes both the constant term and the individual effect. First-differencing the equation removes the unobserved individual effect and its associated omitted-variable bias. However, an estimate of the FE model without a dynamic term and lagged regressors to mitigate multicollinearity bias was shown at the Table A.4 in the Appendix A. These estimates are affected by heteroskedasticity and autocorrelation, but not by cross-sectional dependence, therefore Arellano's[53] clustered-by-unit robust standard errors were implemented. The magnitude and sign of significant coefficients are stable in the fitted models, but the estimator is inconsistent[54]. However, R-squared values above 50% indicate that the modelling is quite good.

Alternatively, to simultaneously address both omitted variable bias and issues of endogeneity, we have used the GMM estimator for panel data. Using a GMM to estimate growth models is certainly nothing new. Nevertheless, firstly, it corrects for the omitted variable bias, eliminating the need to make any probabilistic assumptions on the country effect, Secondly, it eliminates the inconsistency arising from the potential endogeneity of the regressors. Indeed, the GMM estimator addresses both estimation problems under the assumption that the lagged values of the regressors are valid instruments.

Finally, the GMM-system (GMM-sys) estimator exploiting additional moment restrictions has better properties in finite samples than the GMM-difference (GMM-dif) estimator[55][56]. In other words, the GMM estimator can provide consistent results in the presence of different sources of endogeneity, such as unobserved heterogeneity, simultaneity, dynamic endogeneity, and in finite samples. We have computed over the time-series 2010-2019 the average value every two years, thus having in mean-stationary time-series of five time-units.

The "two-step" GMM applies forward orthogonal deviations, which means that instead of subtracting the previous observations of a variable from its current value, it subtracts the average of all future available observations of a particular variable[57]. By using a "two-step" GMM, researchers can prevent unnecessary data information loss. In the case of a balanced panel dataset, this estimator provides more efficient and consistent estimates for the involved coefficients[58]. In other words, the estimator allows to correct endogeneity when using a panel-dataset with variables that are potentially endogenously determined[59]. Generally, using the orthogonality conditions, the GMM estimators allow efficient estimation even in the presence of heteroscedasticity of unknown form.

Therefore, we have adopted the "two-step" GMM-sys estimator, as this procedure is more efficient than the differencing, especially for a panel dataset like ours, where N is greater than T. The GMM-sys extended the difference model by adding equations in levels to the regressions run in the first differences, and this allows the introduction of additional instruments. Specifically, by using lagged levels as instruments for first difference equations and the lagged first differences as instruments for level equations.

In other words, for endogenous variables in levels, their own lagged differences serve as instruments, thus the additional moment conditions efficiency is increased. This means the modelling also takes care of finite sample bias, and if it exists an inverse causality issue, the variables are highly persistent and are used as weak instruments for the first differences. We have also used the finite sample bias correction by Windmeijer[60] for robust standard errors in the models.

Finally, an unbiased GMM estimator depends on the validity of the instruments and maintaining the number of this below the number of groups is a good rule of thumb[61]. Instruments should be correlated with endogenous instrumented variables while conforming to the orthogonality condition to prevent errors[62]. A higher p-value for Sargan and Hansen is a confirmation of the correct specification of models under the null hypothesis of non-overidentification and instrumental validity. On the one hand, Sargan relies on the assumption of homoscedastic errors, but this puts limitations on the strength of the test when the assumption is weak. On the other hand, this test is not exposed to the same instrumental proliferation weaknesses as the Hansen test. The Sargan test is associated with not robust estimates, but is not weakened by many instruments, while, the Hansen test is associated with robust estimates, but can be weakened by the instrument proliferations. Therefore, the Hansen test seems to us more adequate.

Based on our heterogeneous dataset, there is a high probability of idiosyncratic shocks in each country, and there is a potential violation of the homoscedasticity assumption. Therefore, computing the Sargan test alone may be misleading, while computing both tests can be more convenient.

To account for a possible bias effect due to modelling uncertainty, a univariate approach has been adopted to have regressions with strictly exogenous regressors ($x_i$). Modelling uncertainty bias arises when the lack of clear theoretical guidance on the choice of likely regressors results in a wide set of possible model specifications. As a result, will be a high risk of incurring arbitrary model selection and eventually incorrect inference.

Finally, as a robustness check, the instrumental approach with exogenous regressors ($z_i$) is also shown. As instruments and proxy variables of the institutional and business environment, the governance climate, ICT-diffusion, and squared urban population were used. We have considered governance climate and ICT-diffusion as proxies for the medium- and long-term changes that occurred within the institutional and business environments. While urban population at square captures the non-linear effects of the population growth, resulting from infrastructural policies, labour policies, and household wealth.

Furthermore, these variables were also considered for their non-negligible correlations with the others (see Table A.3 in the Appendix A). As a theoretical justification, these variables catch macroeconomic conditions that required slower institutional, technological, and demographic adjustments, impacting

countries' development and potentially remaining exogenous to the error terms.

Finally, to address potential endogeneity issues due to reverse causality, omitted variables, or misspecification errors, we chose an approach for instrumental variables to complement GMM-sys models.

The difference-in-Sargan or -Hansen statistic for controlling the validity of a subset of instruments has been implemented. The test is computed as the difference between two Sargan or Hansen tests. The first is computed from the full regression model using the entire subset of overidentifying restrictions, while the second is that of the restricted regression model using a smaller subset of instruments in which some are removed. The null hypothesis is that the specified variables are proper instruments, and it is $\chi^2$-distributed with degrees of freedom equal to the loss of overidentifying restrictions, hence equal to the number of suspect instruments being tested.

Sometimes the test may generate a negative result in finite samples, although to solve this issue, it is sufficient to use the same matrix from the first model to compute both tests[63]. We show only one of the difference-in-Sargan and -Hansen tests for instrument subsets for which the difference is positive, because both statistics are equally informative in testing the exogeneity of instruments. While, if both statistics return a positive result, the difference-in-Hansen test is preferred because it is more appropriate as specified above, instead, if both statistics fail, the results are omitted.

The dependent variable in the models is real per-capita GDP, and the dynamic specification is given by the presence of the dependent variable with one order of lags in the right side of equation. We have estimated models with regressors at time t, and t-1 to consider the eventual lagged effect of macroeconomic policies on variables, or the persistent effect on trade. The models have been estimated with the open-source statistical software gretl, as below [1]:

$$y_{i,t} = \alpha y_{i,t-1} + \beta x_{i,t} + \delta x_{i,t-1} + \theta_i + \lambda_t + \varepsilon_{i,t}; \quad (1)$$

where, $y_{i,t}$ is the dependent variable; $y_{i,t-1}$ is the dependent variable with one order of lags on the right side of the equation; $x_{i,t}$ and $x_{i,t-1}$ are time-variant explanatory variables; $\theta_i$ is the constant in the equation grasping the fixed effects; $\lambda_t$ is the idiosyncratic unobserved time-specific effects to prevent a contemporaneous correlation due to time-related shocks; finally, $\alpha, \beta$, and $\delta$ are the coefficients that want to be estimated, $\varepsilon_{i,t}$ is the idiosyncratic individual and time-specific error terms in the regressions.

## 4. Empirical analysis

### *4.1. Outcomes and discussion*

Estimated models with the significant variables are shown in Table 2 (a, b) in the Appendix A, as well as models for the robustness check (Table A.5 a, b). The real per-capita GDP with one order of lags is the significant variable with the highest magnitude in all models. It is expected of us coherently to the literature on growth. This is clear confirmation that the dynamic approach is suitable for capturing the effects of past policies on growth.

Inflation could be expected to negatively impact growth. In fact, it is not uncommon to find it associated with a more unstable economic system[64][65][66][67]. However, its significance and positive magnitude for the variable with one order of lags can be affected by competitive devaluations in the related foreign exchange markets implemented by policymakers to encourage import-export, otherwise, it can be related to short-term assessments of labour market efficiency.

As well, external debt has been found to be significant, which means that African countries have had a need to finance their growth recurring to founds of international organisation financing development[68][69][70][71][72][73][74][75][76][77][78].

By finding it significant, it may be a confirmation of debt overhang theories according to larger levels of accumulated debt stocks initially leading to lower growth, as captured by the variable with one order of lags. However, it should be highlighted that only in the neoclassical models, allowing for perfect capital mobility and the ability to borrow and lend capital without constraint, an excess of debt can lead to a positive effect on growth, but this may also be unrealistic due to several macroeconomic backlash effects[79].

Openness is significant and it is not uncommon for more liberalised economies to be better positioned along the GVCs, for instance, benefiting from positive externalities on productivity by learning-by-doing in trade, or by collaborations and competition on international markets[80][81][82][83][84][85][86]. However, a rapid openness can also damage development, if it does not occur in the appropriate way and at the right time, especially in developing countries, where they tend to specialise in traditional productions or in industries where innovation is not the core, thus, by becoming more vulnerable to external negative shocks[87]. This means the openness effect on growth can be ambiguous in developing countries, and more openness can have a crowding-out effect on domestic growth and investments[88]. Nonetheless, more openness can increase productivity, facilitate the manufacturing industry's upgrading, promote technological and institutional advancement, and finally, increase capital accumulation, as a result, intermediate manufacturing imports and goods exports rise[89][90].

Therefore, in line with our expectations, the gross fixed investments and unemployment rate have been found significant[91][92][93]. Gross fixed investment has been found with a positive magnitude, while the unemployment rate and it with one order of lags have been found with a negative and positive magnitude, respectively. Gross fixed investment and unemployment rate are variables related to income equation and labour market efficiency.

Remittances can influence the economy to which they are directed through the Keynesian multiplier. Even if all the income is consumed by the households that received the remittances, this would indirectly stimulate the exogenous component of demand, as there will be a general increase in aggregate income. This suggests that migrant workers' earnings proxied by received remittance with one order of lags are positively contributing to African growth[94][95][96]. Institutional quality and stability positively influence the countries' growth. Improvements in the institutional and business environment can produce spillover effects on growth. As a result, the governance climate is an important indicator of the level of development reached by a country, and it has been found significant and with a positive sign.

The macroeconomic variables related to public spending, such as government, health and military expenditure have been also found significant[91][97].

Government expenditure is a proxy for the governance's bureaucratic size, and it is often associated with a negative impact on growth due to the issue of available resource allocation[98].

The health expenditure and military one with one order of lags have been found significant and positively and negatively impacting growth, respectively, although the second without the lag has had a positive impact[99][100][101][102]. However, assessing these impacts should be difficult, especially in economies with a permanent or semipermanent war and riots, or because they could be related to other unconsidered exogenous variables[103][104][92][105].

Finally, growth can be associated, among other determinants, with geographical and cultural factors, or with ethnic fragmentation grasped by constant in the equations. However, after controlling for instrumental variables, we have found less and non-significant direct effects of fixed effects in the sample of African countries. If we do not consider this approach, instead, it exists a significant relationship between country fixed effects and growth in the African sample. This result shows that geographical factors can have little effect on growth after controlling for other country factors.

In Table 2b, we show models with the proxy variables for African countries' merchandise trade across clusters of developed and developing countries as classified by World Bank Group researchers. The significant proxy variables of the African merchandise trade are the imports and exports from or to the cluster of HDCs lead by US economy, as well as the exports to the cluster of developing economies in Europe or Central-Asia, and Eastern-Asia or Pacific where the Russian and Chinese economy lead, respectively. In general, Russian, and especially Chinese economic influence in Africa has increased over the past decade[106][107]. Additionally, imports from developing economies in Southern Asia led by India, have been found significant. Other significant evidence has not been found for the remaining clusters. In fact, the weak complementarity between African countries' trade specialisations – linked also to the weight of primary natural resources in their exports – may constitute an obstacle to trade across African countries[108][109].

Furthermore, low countries' integration along the GVCs may be another obstacle to adding value to their productions. This means that, it is more likely that countries' trade in general focus on processed goods, while agricultural products and raw materials may mostly be exported outside the African continent[110][111][112].

We also point out that among the macroeconomic variables (Table 2a), natural resource rent, productivity, FDI inflows, human capital formation, urban population, net-ODA, and ICT-diffusion have not been found significant.

Countries rich in natural resources are usually characterised by their high dependency on them, their low economic diversification, and the volatility of their commodity prices and revenues[113][114]. As a result, a negative sign for the variable with one order of lags refers to a crowding-out effect, i.e., the Dutch disease due to an abundance of natural resources and raw materials[115].

Productivity reflects the manufacturing industry's ability to add value to production inputs. The higher this is, the broader the implications for growth[116]. This variable shows a negative relationship, which may depend on the positioning of the African countries' manufacturing system along the GVCs, but it is not significant[117][21][118].

In developing and emerging economies, FDI inflows can contribute to growth in a different way, but proofs of their effect can be contrasting[94][119][120][93] (Hagan and Amoah, 2020). We have found evidence that FDI inflows with one order of lags positively affect growth. Nevertheless, the magnitude of the estimated coefficients is very low. It can depend on the complementarity degree, or the substitution effect between FDIs and the other foreign capital – such as net-ODA and received remittance, or the countries' domestic policies on physical investments and human capital formation. Otherwise, it can be caused by increased competition in markets. As a result, their net effect can be positive even if the substitution effect has crowded-out domestic fixed investment.

Human capital formation is a proxy for more training, or a higher educational level usually associated with higher growth[64][121][122][123][124]. Nonetheless, their effects can have a direct and indirect impact on growth and can be positive, negative, or neutral based on the level of disaggregation of the indicators[125].

The urban population growth may be related to the extension of urban areas, and the development of global cities following an increase in income[126][127][19]. The non-significance found for the urban population growth can be due to the neo-Malthusian theory suggesting that population growth can hinder development, as larger households must spend more on public utilities, by eroding their savings or limiting investments[102]. However, the impacts of demographic growth on development can vary considerably by country based on economic and institutional policies.

The effect of net-ODA comes with a negative sign. International aid can crowd-out growth if it is not effectively directed by governance toward social and economic progress or poverty reduction[128][94][129]. In other words, democracy and political rights promote growth, while the protectionism of the elite's interests depresses it[130][131][132][133][134][135][136][137][138][139].

Although the use of new technologies such as the internet and mobile devices has been found significant in previous studies, this may depend on the variable used as a proxy[140][141][142][143][144][145][146]. According to Haftu[147], African societies still lag in the adoption of new information and communication technologies, however, we have found ICT-diffusion with a positive sign.

The Sargan and Hansen tests, Wald tests on regressors and time-dummies, as well as respecting the rule of thumb to maintain the number of instruments less than the number of cross-sectional units, demonstrate the reliability of our estimations in models.

After the robustness check shown in the Appendix A at the Table A.5 (a, b), our findings indicate that, in addition to the initial conditions of the per-capita GDP, the natural resource rent with one order of lags has emerged as significant and with a negative sign, crowding out the per-capita GDP. On the other hand, the government expenditure with one order of lags is confirmed as significant with a positive sign, while the terms-of-trade have emerged as not significant. Finally, the null hypothesis for exogeneity and validity of instrument subsets cannot be widely rejected, confirming the validity of the instrumental approach implemented and the robustness of the results (see Table A.6 in the Appendix A). In Table 2, the main outcomes of the robustness check were shown.

| Variables | Baseline Model (GMM-sys) | | Robust Model (GMM-sys with Exogenous Instruments) | |
|---|---|---|---|---|
| | *Coeff.* | *Std. Err.* | *Coeff.* | *Std. Err.* |
| Openness (t-1) | 0.245*** | 0.074 | -0.020 | 0.222 |
| Natural Resources Rent (t-1) | -0.072 | 0.047 | -0.149* | 0.078 |
| Government Expenditure (t-1) | 0.115* | 0.062 | 0.259* | 0.141 |

**Table 2.** Outcomes after the robustness check.

*Note: *** significance for $\alpha$ = 0.01 ** significance for $\alpha$ = 0.05 * significance for $\alpha$ = 0.10. Source: our elaboration.*

As expected, the coefficient of the lagged per-capita GDP is positive and highly significant. This outcome points out the dynamic and persistent nature of economic growth in the countries' development-path[51]. Especially, the coefficient of the lagged trade openness – encompassing all terms-of-trade – is not significant, suggesting that more international involvement in trading may not be an uncritical driver of African growth[148][120][149], as is also supported by the non-significance found for all terms-of-trade after the robustness check. The coefficient of the lagged natural resources rent is negative and statistically significant, and this result is in line with the "resource curse" theory[150][151]. Also, the coefficient of the lagged government expenditure is positive and significant – more than doubled – pointing out the proactive and stabilising role of the governments[152]. Finally, our robustness check has pointed out that initial growth conditions, natural resources endowment, and government spending were the main drivers of African growth over the period considered.

The negative impact of natural resource endowment on per-capita GDP growth may indicate the need for economic diversification policies aimed at reducing the commodity-export dependency[153][154]. However, sound management of funds and resources can result in long-term growth, provided that investments in infrastructure and human capital formation are prioritized; monetary-financial and trade shocks are prevented[152][155][156].

In other words, governments could act as "growth accelerators" if they were more efficient[157][158]. For instance, public spending could be channelled toward societal well-being through investments in healthcare, education, infrastructure, and through the integration of marginalized groups, such as women, into economic processes, enhancing productivity and acting as a driver for the African countries' development[159][160][161]. As a result, the effectiveness of

government policies is contingent on a sound institutional and business environment[162][163]. In other words, improving the African countries' governance climate may represent a necessary, though not sufficient, condition for sustainable and inclusive economic growth[164][165].

### *4.2. Summary of results*

Our GMM-sys model results, after robustness checks, indicate that over the period considered African per-capita GDP growth was primarily driven by its past level and government spending, while significantly hindered by natural resource endowment. Growth persistence was confirmed by the strong positive effect of the lagged Real Per-capita GDP[51], while Government Expenditure showed a positive effect, suggesting a stabilising role for public policy[152]. On the contrary, Natural Resource Rent had a significant negative impact, consistent with the "resource curse" theory[150][151]. Trade Openness showed mixed results and, after robustness checks, appeared to crowd-out growth in Africa[148][120][149].

The other resulting significant variables are indicative of complex interlinkages existing between macroeconomic frameworks and growth dynamics in African countries. In particular, the Governance Climate emerged as a significant positive determinant, highlighting a pivotal role of institutional quality and sound governance in fostering growth performance[166][74].

Finally, the terms-of-trade suggested Africa's trade-dependency on specific global regions, but these relationships were not confirmed after robustness checks[148][120][149]. However, the non-significance of these and other macroeconomic variables suggests their effects may perhaps be better analysed and understood at the country-level[119][167][70][168][169].

| | Real per-capita GDP | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (a) | *Coeff.* | *Std. Err.* | | Constant | Time Dummies | Standard Error | Regressors Wald-Test p-value | Time Dummies Wald-Test p-value | AR (2) Test p-value | Non-Observations (%) | Observations (%) | Sargan Test p-value | Hansen Test p-value | Instruments |
| Real per-capita GDP (t-1) | 0.917 | 0.064 | *** | | | | | | | | | | | |
| FDI Inflows | -0.001 | 0.008 | | | | | | | | | | | | |
| FDI Inflows (t-1) | 0.006 | 0.010 | | | | | | | | | | | | |
| | | | | yes | yes | 0.107 | 0.000 | 0.000 | 0.489 | 54 (20) | 216 (80) | 0.149 | 0.336 | 15 |
| Real per-capita GDP (t-1) | 0.890 | 0.057 | *** | | | | | | | | | | | |
| Inflation | -0.230 | 0.027 | *** | | | | | | | | | | | |
| Inflation (t-1) | 0.340 | 0.042 | *** | | | | | | | | | | | |
| | | | | yes | yes | 0.099 | 0.000 | 0.000 | 0.175 | 54 (20) | 216 (80) | 0.191 | 0.626 | 15 |
| Real per-capita GDP (t-1) | 0.878 | 0.078 | *** | | | | | | | | | | | |
| Openness | -0.148 | 0.076 | * | | | | | | | | | | | |
| Openness (t-1) | 0.245 | 0.074 | *** | | | | | | | | | | | |
| | | | | yes | yes | 0.101 | 0.000 | 0.000 | 0.164 | 54 (20) | 216 (80) | 0.029 | 0.444 | 15 |
| Real per-capita GDP (t-1) | 0.948 | 0.041 | *** | | | | | | | | | | | |
| Natural Resources Rent | 0.053 | 0.048 | | | | | | | | | | | | |
| Natural Resources Rent (t-1) | -0.072 | 0.047 | | | | | | | | | | | | |
| | | | | yes | yes | 0.106 | 0.000 | 0.000 | 0.611 | 54 (20) | 216 (80) | 0.264 | 0.301 | 15 |
| Real per-capita GDP (t-1) | 0.911 | 0.054 | *** | | | | | | | | | | | |
| Government Expenditure | -0.055 | 0.063 | | | | | | | | | | | | |
| Government Expenditure (t-1) | 0.115 | 0.062 | * | | | | | | | | | | | |
| | | | | yes | yes | 0.106 | 0.000 | 0.000 | 0.562 | 54 (20) | 216 (80) | 0.179 | 0.495 | 15 |
| Real per-capita GDP (t-1) | 0.925 | 0.057 | *** | | | | | | | | | | | |
| Productivity | -0.348 | 0.265 | | | | | | | | | | | | |
| Productivity (t-1) | -0.225 | 0.254 | | | | | | | | | | | | |
| | | | | yes | yes | 0.105 | 0.000 | 0.000 | 0.781 | 54 (20) | 216 (80) | 0.107 | 0.361 | 15 |


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| | Real per-capita GDP | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (a) | *Coeff.* | *Std. Err.* | | Constant | Time Dummies | Standard Error | Regressors Wald-Test p-value | Time Dummies Wald-Test p-value | AR (2) Test p-value | Non-Observations (%) | Observations (%) | Sargan Test p-value | Hansen Test p-value | Instruments |
| Real per-capita GDP (t-1) | 0.879 | 0.055 | *** | | | | | | | | | | | |
| External Debt | -0.192 | 0.059 | *** | | | | | | | | | | | |
| External Debt (t-1) | 0.179 | 0.056 | *** | | | | | | | | | | | |
| | | | | yes | yes | 0.094 | 0.000 | 0.000 | 0.698 | 54 (20) | 216 (80) | 0.070 | 0.325 | 15 |
| Real per-capita GDP (t-1) | 0.824 | 0.149 | *** | | | | | | | | | | | |
| Unemployment | -0.059 | 0.092 | | | | | | | | | | | | |
| Unemployment (t-1) | 0.148 | 0.058 | ** | | | | | | | | | | | |
| | | | | yes | yes | 0.102 | 0.000 | 0.000 | 0.397 | 54 (20) | 216 (80) | 0.102 | 0.517 | 15 |
| Real per-capita GDP (t-1) | 0.874 | 0.075 | *** | | | | | | | | | | | |
| Military Expenditure | 0.135 | 0.093 | | | | | | | | | | | | |
| Military Expenditure (t-1) | -0.179 | 0.100 | * | | | | | | | | | | | |
| | | | | yes | yes | 0.104 | 0.000 | 0.000 | 0.186 | 54 (20) | 216 (80) | 0.054 | 0.374 | 15 |
| Real per-capita GDP (t-1) | 0.918 | 0.044 | *** | | | | | | | | | | | |
| Health Expenditure | 0.065 | 0.039 | * | | | | | | | | | | | |
| Health Expenditure (t-1) | 0.008 | 0.049 | | | | | | | | | | | | |
| | | | | yes | yes | 0.106 | 0.000 | 0.000 | 0.524 | 54 (20) | 216 (80) | 0.083 | 0.359 | 15 |
| Real per-capita GDP (t-1) | 0.959 | 0.049 | *** | | | | | | | | | | | |
| Received Remittance | -0.010 | 0.006 | * | | | | | | | | | | | |
| Received Remittance (t-1) | 0.021 | 0.007 | *** | | | | | | | | | | | |
| | | | | yes | yes | 0.109 | 0.000 | 0.000 | 0.402 | 54 (20) | 216 (80) | 0.167 | 0.614 | 15 |
| Real per-capita GDP (t-1) | 0.920 | 0.058 | *** | | | | | | | | | | | |
| Net-ODA | -0.033 | 0.046 | | | | | | | | | | | | |
| Net-ODA (t-1) | -0.001 | 0.044 | | | | | | | | | | | | |


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| | Real per-capita GDP | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (a) | *Coeff.* | *Std. Err.* | | Constant | Time Dummies | Standard Error | Regressors Wald-Test p-value | Time Dummies Wald-Test p-value | AR (2) Test p-value | Non-Observations (%) | Observations (%) | Sargan Test p-value | Hansen Test p-value | Instruments |
| | | | | yes | yes | 0.108 | 0.000 | 0.000 | 0.557 | 54 (20) | 216 (80) | 0.132 | 0.321 | 15 |
| Real per-capita GDP (t-1) | 0.861 | 0.157 | *** | | | | | | | | | | | |
| Urban Population$^2$ | -0.114 | 0.123 | | | | | | | | | | | | |
| Urban Population$^2$ (t-1) | 0.136 | 0.151 | | | | | | | | | | | | |
| | | | | yes | yes | 0.104 | 0.000 | 0.000 | 0.492 | 54 (20) | 216 (80) | 0.044 | 0.104 | 15 |
| Real per-capita GDP (t-1) | 0.898 | 0.054 | *** | | | | | | | | | | | |
| Human Capital Formation | -0.019 | 0.034 | | | | | | | | | | | | |
| Human Capital Formation (t-1) | -0.004 | 0.039 | | | | | | | | | | | | |
| | | | | yes | yes | 0.106 | 0.000 | 0.000 | 0.488 | 54 (20) | 216 (80) | 0.127 | 0.398 | 15 |
| Real per-capita GDP (t-1) | 0.895 | 0.069 | *** | | | | | | | | | | | |
| Gross Fixed Investment | -0.039 | 0.047 | | | | | | | | | | | | |
| Gross Fixed Investment (t-1) | 0.107 | 0.051 | ** | | | | | | | | | | | |
| | | | | yes | yes | 0.105 | 0.000 | 0.000 | 0.493 | 54 (20) | 216 (80) | 0.081 | 0.296 | 15 |
| Real per-capita GDP (t-1) | 0.909 | 0.090 | *** | | | | | | | | | | | |
| ICT-diffusion | 0.095 | 0.092 | | | | | | | | | | | | |
| ICT-diffusion (t-1) | -0.001 | 0.123 | | | | | | | | | | | | |
| | | | | yes | yes | 0.108 | 0.000 | 0.000 | 0.558 | 54 (20) | 216 (80) | 0.056 | 0.084 | 15 |
| Real per-capita GDP (t-1) | 0.942 | 0.040 | *** | | | | | | | | | | | |
| Governance Climate | 0.172 | 0.085 | ** | | | | | | | | | | | |
| Governance Climate (t-1) | -0.104 | 0.100 | | | | | | | | | | | | |
| | | | | yes | yes | 0.109 | 0.000 | 0.000 | 0.553 | 54 (20) | 216 (80) | 0.103 | 0.347 | 15 |
| Real per-capita GDP (t-1) | 0.901 | 0.057 | *** | | | | | | | | | | | |
| Constant | 0.804 | 0.410 | ** | | | | | | | | | | | |


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| | Real per-capita GDP | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (a) | *Coeff.* | *Std. Err.* | | Constant | Time Dummies | Standard Error | Regressors Wald-Test p-value | Time Dummies Wald-Test p-value | AR (2) Test p-value | Non-Observations (%) | Observations (%) | Sargan Test p-value | Hansen Test p-value | Instruments |
| | | | | - | yes | 0.106 | 0.000 | 0.000 | 0.492 | 54 (20) | 216 (80) | 0.135 | 0.385 | 13 |

**Table 2a.** GMM-sys with $x_i$ strictly exogenous regressor.


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| | Real per-capita GDP | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (b) | *Coeff.* | *Std. Err.* | | Constant | Time Dummies | Standard Error | Regressors Wald-Test p-value | Time Dummies Wald-Test p-value | AR (2) Test p-value | Non-Observations (%) | Observations (%) | Sargan Test p-value | Hansen Test p-value | Instruments |
| Real per-capita GDP (t-1) | 0.899 | 0.062 | *** | | | | | | | | | | | |
| Imports from HDCs | 0.235 | 0.114 | ** | | | | | | | | | | | |
| Imports from HDCs (t-1) | -0.209 | 0.113 | * | | | | | | | | | | | |
| | | | | yes | yes | 0.104 | 0.000 | 0.000 | 0.142 | 54 (20) | 216 (80) | 0.064 | 0.283 | 15 |
| Real per-capita GDP (t-1) | 0.901 | 0.065 | *** | | | | | | | | | | | |
| Exports to HDCs | -0.034 | 0.023 | | | | | | | | | | | | |
| Exports to HDCs (t-1) | 0.056 | 0.019 | *** | | | | | | | | | | | |
| | | | | yes | yes | 0.103 | 0.000 | 0.000 | 0.451 | 54 (20) | 216 (80) | 0.080 | 0.332 | 15 |
| Real per-capita GDP (t-1) | 0.901 | 0.066 | *** | | | | | | | | | | | |
| Imports from LMDCs in Latin America or Caribbean | 0.005 | 0.014 | | | | | | | | | | | | |
| Imports from LMDCs in Latin America or Caribbean (t-1) | -0.004 | 0.011 | | | | | | | | | | | | |
| | | | | yes | yes | 0.106 | 0.000 | 0.000 | 0.523 | 54 (20) | 216 (80) | 0.146 | 0.397 | 15 |
| Real per-capita GDP (t-1) | 0.919 | 0.049 | *** | | | | | | | | | | | |
| Exports to LMDCs in Latin America or Caribbean | 0.006 | 0.012 | | | | | | | | | | | | |


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| | Real per-capita GDP | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (b) | *Coeff.* | *Std. Err.* | | Constant | Time Dummies | Standard Error | Regressors Wald-Test p-value | Time Dummies Wald-Test p-value | AR (2) Test p-value | Non-Observations (%) | Observations (%) | Sargan Test p-value | Hansen Test p-value | Instruments |
| Exports to LMDCs in Latin America or Caribbean (t-1) | 0.011 | 0.011 | | | | | | | | | | | | |
| | | | | yes | yes | 0.106 | 0.000 | 0.000 | 0.497 | 54 (20) | 216 (80) | 0.176 | 0.438 | 15 |
| Real per-capita GDP (t-1) | 0.895 | 0.058 | *** | | | | | | | | | | | |
| Imports from LMDCs in Europe or Central-Asia | 0.011 | 0.016 | | | | | | | | | | | | |
| Imports from LMDCs in Europe or Central-Asia (t-1) | -0.019 | 0.017 | | | | | | | | | | | | |
| | | | | yes | yes | 0.105 | 0.000 | 0.000 | 0.426 | 54 (20) | 216 (80) | 0.100 | 0.363 | 15 |
| Real per-capita GDP (t-1) | 0.909 | 0.057 | *** | | | | | | | | | | | |
| Exports to LMDCs in Europe or Central-Asia | -0.010 | 0.006 | * | | | | | | | | | | | |
| Exports to LMDCs in Europe or Central-Asia (t-1) | 0.008 | 0.007 | | | | | | | | | | | | |
| | | | | yes | yes | 0.106 | 0.000 | 0.000 | 0.5125 | 54 (20) | 216 (80) | 0.129 | 0.396 | 15 |
| Real per-capita GDP (t-1) | 0.896 | 0.057 | *** | | | | | | | | | | | |
| Imports from LMDCs in Eastern- | 0.024 | 0.056 | | | | | | | | | | | | |


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| | Real per-capita GDP | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (b) | *Coeff.* | *Std. Err.* | | Constant | Time Dummies | Standard Error | Regressors Wald-Test p-value | Time Dummies Wald-Test p-value | AR (2) Test p-value | Non-Observations (%) | Observations (%) | Sargan Test p-value | Hansen Test p-value | Instruments |
| Asia or Pacific | | | | | | | | | | | | | | |
| Imports from LMDCs in Eastern-Asia or Pacific (t-1) | -0.089 | 0.059 | | | | | | | | | | | | |
| | | | | yes | yes | 0.106 | 0.000 | 0.000 | 0.384 | 54 (20) | 216 (80) | 0.114 | 0.507 | 15 |
| Real per-capita GDP (t-1) | 0.924 | 0.053 | *** | | | | | | | | | | | |
| Exports to LMDCs in Eastern-Asia or Pacific | 0.012 | 0.012 | | | | | | | | | | | | |
| Exports to LMDCs in Eastern-Asia or Pacific (t-1) | -0.025 | 0.013 | * | | | | | | | | | | | |
| | | | | yes | yes | 0.105 | 0.000 | 0.000 | 0.629 | 54 (20) | 216 (80) | 0.072 | 0.337 | 15 |
| Real per-capita GDP (t-1) | 0.839 | 0.107 | *** | | | | | | | | | | | |
| Imports from LMDCs in Southern-Asia | -0.053 | 0.028 | * | | | | | | | | | | | |
| Imports from LMDCs in Southern-Asia (t-1) | -0.008 | 0.030 | | | | | | | | | | | | |
| | | | | yes | yes | 0.102 | 0.000 | 0.000 | 0.361 | 54 (20) | 216 (80) | 0.124 | 0.394 | 15 |
| Real per-capita GDP (t-1) | 0.898 | 0.060 | *** | | | | | | | | | | | |
| Exports to LMDCs in Southern-Asia | 0.004 | 0.015 | | | | | | | | | | | | |


doi.org/10.32388/2U1RS5.13

| | Real per-capita GDP | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (b) | *Coeff.* | *Std. Err.* | | Constant | Time Dummies | Standard Error | Regressors Wald-Test p-value | Time Dummies Wald-Test p-value | AR (2) Test p-value | Non-Observations (%) | Observations (%) | Sargan Test p-value | Hansen Test p-value | Instruments |
| Exports to LMDCs in Southern-Asia (t-1) | -0.009 | 0.017 | | | | | | | | | | | | |
| | | | | yes | yes | 0.106 | 0.000 | 0.000 | 0.603 | 54 (20) | 216 (80) | 0.125 | 0.413 | 15 |
| Real per-capita GDP (t-1) | 0.899 | 0.059 | *** | | | | | | | | | | | |
| Imports from LMDCs in North Africa or Middle East | -0.019 | 0.022 | | | | | | | | | | | | |
| Imports from LMDCs in North Africa or Middle East (t-1) | 0.006 | 0.022 | | | | | | | | | | | | |
| | | | | yes | yes | 0.106 | 0.000 | 0.000 | 0.485 | 54 (20) | 216 (80) | 0.093 | 0.361 | 15 |
| Real per-capita GDP (t-1) | 0.913 | 0.061 | *** | | | | | | | | | | | |
| Exports to LMDCs in North Africa or Middle East | -0.002 | 0.007 | | | | | | | | | | | | |
| Exports to LMDCs in North Africa or Middle East (t-1) | 0.003 | 0.008 | | | | | | | | | | | | |
| | | | | yes | yes | 0.107 | 0.000 | 0.000 | 0.505 | 54 (20) | 216 (80) | 0.118 | 0.354 | 15 |
| Real per-capita GDP (t-1) | 0.889 | 0.073 | *** | | | | | | | | | | | |
| Imports from LMDCs in Sub- | -0.016 | 0.037 | | | | | | | | | | | | |


doi.org/10.32388/2U1RS5.13

| | Real per-capita GDP | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (b) | *Coeff.* | *Std. Err.* | | Constant | Time Dummies | Standard Error | Regressors Wald-Test p-value | Time Dummies Wald-Test p-value | AR (2) Test p-value | Non-Observations (%) | Observations (%) | Sargan Test p-value | Hansen Test p-value | Instruments |
| Saharan Africa | | | | | | | | | | | | | | |
| Imports from LMDCs in Sub-Saharan Africa (t-1) | 0.002 | 0.037 | | | | | | | | | | | | |
| | | | | yes | yes | 0.106 | 0.000 | 0.000 | 0.485 | 54 (20) | 216 (80) | 0.134 | 0.331 | 15 |
| Real per-capita GDP (t-1) | 0.895 | 0.069 | *** | | | | | | | | | | | |
| Exports to LMDCs in Sub-Saharan Africa | -0.006 | 0.019 | | | | | | | | | | | | |
| Exports to LMDCs in Sub-Saharan Africa (t-1) | 0.004 | 0.020 | | | | | | | | | | | | |
| | | | | yes | yes | 0.106 | 0.000 | 0.000 | 0.497 | 54 (20) | 216 (80) | 0.125 | 0.350 | 15 |

**Table 2b.** GMM-sys with $x_i$ strictly exogenous regressor.

*Note: *** significance for $\alpha$ = 0.01 ** significance for $\alpha$ = 0.05 * significance for $\alpha$ = 0.10. Source: our elaboration.*

## 5. Conclusions

### *5.1. Contribution and concluding remarks*

African growth has benefited from particularly favourable external factors over the last decades[29][30][31]. For instance, recent Chinese economic expansionism has fuelled African exports of natural resources and increased foreign capital flows have supplemented international aid. Finally, commodity prices have been high, interest rates have been low, and economic global crisis had limited impacts as African countries have weak or underdeveloped financial markets.

Since the FE estimator may be inconsistent in a multivariate approach[54], this study analysed growth in a panel of 54 African countries over the period 2010-2019 using the GMM-sys estimators[56][59], following a univariate approach to reduce endogeneity bias and avoid instrument proliferation and collapse[61], finally improving the robustness of the estimates. As far as we know, we have not found studies analysing growth with a panel of 54 African countries using the GMM-estimator over the period considered.

Moreover, we introduce a novelty element in the analysis, by considering African growth in relation to specific openness degrees as proxied by merchandise imports and exports for the clusters of developed and developing countries such as defined by the World Bank Group researchers. Therefore, based on the time-series data collected, and the estimation methodology used, our results show the determinants of African growth over the period 2010-2019.

After the robustness check with the instrumental variables, our findings indicate that in addition to the initial conditions of the per-capita GDP, the natural resource rent with one order of lags has emerged as significant and with a negative sign, crowding out the per-capita GDP. On the other hand, the government expenditure with one order of lags is confirmed as significant with a positive sign, while the terms-of-trade have emerged as not significant.

Finally, over the question that we have highlighted in the introduction, where it asks whether Africa can break with its colonial commercial past, we have found proof of the existence of a trade dependency added to that with the cluster of developed countries, in which certainly the ex-colonising countries are situated. In fact, we have found evidence of a trade dependency with the cluster of developing countries in Southern Asia led by India.

A more developed institutional and business environment should lead to sustainable long-run African growth, but this depends on sound governance. Indeed, the governance climate has been found to be significant in models. Therefore, economic growth should be appropriately driven where countries have a strong comparative advantage deriving from the natural resource rent, especially[21].

Additionally, if countries are more open, they are also more vulnerable to exogenous shocks, for instance due to possible shifts in their terms-of-trade, then countries will need wider government expenditure to stabilise the institutional and business environment[170][171][117]. In other words, one explanation could be that government expenditure plays an external shock-reducing and internal-stabilising role in emerging economies particularly exposed to significant macroeconomic imbalances.

Generally, the significance found in import and export from or to LMDCs can depend on favourable linkages between developing economies that, for instance, have a similar institutional and business environment, or a similar technological gap with respect to developed countries. However, the significance found in the trade with HDCs highlights the linkage along the GVCs between African markets and developed ones.

Therefore, both statistical significances can depend on the linkages found by the growth studies analysing the development in the North-South and South-South frameworks. This can explain the trade relationship existing along the GVCs between African markets and developed and developing countries[25].

The GVCs have expanded in the new millennium, and low transport costs, low trade barriers, few embargoes, as well as technological and financial spillovers, have made this possible, but this has also meant greater uncertainty in the markets, which are then closely interconnected with each other[29][30][31]. This means that economies in transition have to face negative aspects related to globalisation. As a result, there is a trade-off between the lowering of trade barriers, and technological advancements deriving from the international specialisation of production, and the exposure of countries and their firms to economic and political unbalances and shocks[172].

Especially, in developing countries, trade in semi-finished products has intensified firms' activities along the GVCs, however, these goods may escape from national accounting due to the absence of international accounting harmonisation[173][174]. It should be considered that the system of harmonisation of national accounts developed by the UN statistical commission is stuck in the fifth version since 2008 as an upgrade of the previous one released in the early Nineties. Therefore, causing trade intensification along the GVCs, products can transit from one developing country to another after they have had an increase in value at least equal to the labour cost, and in turn, they can return to developed countries, but without having been properly accounted for. This means that a "country-factory" can show macroeconomic structures characterised by only consumed income, for instance, as small economies focusing on import-export activities with a dominant manufacturing production.

The fragmentation of production along GVCs involves both trade and foreign direct investment and may have had different impacts on the African countries' economic growth[175].

Trading tasks and unbundling foster capital mobility more than labour one, a relatively less mobile input. Therefore, the international fragmentation of production can pose a credible threat for workers, weakening their bargaining power, reducing the wage share, and increasing inequality in both developed and underdeveloped countries[176][177].

The internationally fragmented production requires more skill- and capital-intensive activities than domestic production and international trade because a higher level of knowledge, capabilities and competencies are required for internationalized firms and their workers to operate along GVCs than domestic firms[178], as well as to perform specific and geographically dispersed value-adding activities[179][180]. The offshoring of low-skill tasks to underdeveloped countries may entail a higher (lower) remuneration of high-skilled workers in developed (underdeveloped) countries, increasing (reducing) income inequality within (across) developed (and underdeveloped) countries[181][182]. Furthermore, the offshoring of labour-intensive activities from capital-abundant countries to labour-abundant ones may involve a higher capital-output ratio in the former, reducing the wage share in developed countries to the extent that capital acts as a gross substitute for labour[183]. Nevertheless, to the extent that underdeveloped countries are marked by a lower level of education and capital endowment than developed countries, the value chain functions offshored by the latter to the former may involve high-skill and capital-intensive activities, therefore increasing income inequality in both developed and underdeveloped countries[184][185][186].

In conclusion, trading tasks and unbundling may foster countries' hyper-specialization in selected value-chain activities[187][188][189][190][191].

### *5.2. Policy implications*

In the future, African growth could depend more on sound governance, but countries should improve their institutional and business environments to achieve more inclusive and sustainable growth[45][49]. African governance could lead the growth, both by pursuing incentive policies on exports rather than imports or by improving the opportunities for firms[48]. Therefore, sound institutions and forward-looking policies can lead firms toward progress, technological specialisation, and wellbeing[192][193][194][195][196][46].

With particular emphasis, African policymakers should focus on: (i) efficient management of natural resources; (ii) targeted public spending on infrastructural investments and human capital formation; and (iii) improving the countries' governance climate. In pursuit of these goals, for instance, Italy's "Mattei Recovery Plan for Africa" and, more generally, the EU's "Global Gateway" program – both aim for Africa's sustainable development – following an equal and non-predatory approach, in contrast to traditional models constrained by the donor-recipient logic. By promoting co-designed partnerships and leveraging local potential, the two projects aim to develop sound synergies in key sectors, such as agriculture, energy, education, and infrastructure. For instance, the practice of participatory budgeting could contribute to enhancing local governance, providing a voice to the citizens, increasing public transparency, and controlling corruption[197][198][199][200]. This best practice for sound governance could lead to a broader accountability of the African policymakers, establishing a mutual trust among the societal and economic stakeholders[201][202][203][204].

However, institutional and business changes are generally burdened: (i) by a heavy inertial mass to change in defence of the elites' interests; and (ii) by the slowness of adaptive responses typified by many societies. As a result, the acceptance of a new techno-economic paradigm as well as a new socio-institutional system is a difficult process, as the country will have to bear a greater sunk-cost due to the specificity of its historical development path and the variety characterising the capitalistic system as an expression of the institutional and business environment[205][44][206][207][208][209]. As a result, the socio-economic and institutional transition processes will inevitably lead to internal contradictions within capitalism and to paradigmatic fluctuations[210][211][212][213].

Recurring crises are showing that the governance of globalisation is an important issue related to capitalism[24]. In the capitalist system, there will be a certain selfish impulse to capital accumulation, such that intrinsic instability is not its failure, but constitutes its vital impulse[50]. Therefore, capitalism is changing by its nature, and its ability to self-production does not contribute to making the socio-economic system stable for too long.

In other words, it is the choices made by individuals and the occurrence of endogenous shocks to the socioeconomic system determining social progress and triggering a dynamic change process[214]. Change occurs for incremental improvements, and the proximity of the socioeconomic system to the Pareto-optimal points' frontier is the reason to innovate[215][216][47][217][218].

The global pandemic and war in Eastern Europe are showing that global governance is an important issue at the current stage of globalisation[219][220][221][222][223][224]. The evolution of the world economy has for too long been left solely to the regulatory automatisms of the markets, and this has increased social inequalities[225][226][227].

The trajectory followed by globalisation is progressively abrading the stability and social cohesion in the advanced and emerging economies, as it is not consciously governed. Globalisation, on the other hand, can foster convergence between countries while also increasing economic and political competition between them by causing a disruption in global balances[228][229][230][231].

For instance, difficulties in multilateral trade negotiations within the World Trade Organisation-WTO have resulted in a generalised focus shift toward regional agreements, which have grown in number and complexity over the last decade. African countries' signatories to the AfCFTA agreement have accepted to limit their governance's unilateral action to jointly improve their attractiveness. The AfCFTA agreement may be the biggest trade area in the world, with which the African countries could enhance the position of their manufacturing systems along the GVCs and reach sustainable development in the direction of the SDGs[232], nonetheless, the AfCFTA agreement is burdened by significant lags in its agenda[233][234][235][236].

African countries, such as Rwanda, Ethiopia, and Botswana, have demonstrated how targeted reforms and infrastructural investments can generate important socioeconomic impacts[29][30][31]. For instance, in Rwanda, partnerships between statal and private actors have enabled of implementing numerous projects in strategic sectors, such as energy, transport, and communication. In Ethiopia, the expansion of the roads and railways has strongly reduced inter-urban travel time and promoted intra-regional trade. The government of Botswana has also invested more in improving roads, railways, and facilities. These structural interventions are transforming Botswana into a major regional logistics hub and supporting a new process of economic diversification. Therefore, all these cases are exemplary of how infrastructural investments can accelerate economic growth and promote wider trade integration.

Finally, greater attention has then been given to the growth-wellbeing relationship in recent years[237][238][239][240][241][242]. Two commonly adopted indicators are per-capita GDP and the Human Development Index-HDI by the United Nations. The first is widely used, and it is annually available for all countries, although it measures only the economic dimension of development and suffers from some methodological issues, it remains a reliable growth index. The second is better, but data may not be available for all countries.

In other words, HDI is a composite and synthetic indicator measuring, on average, the country's performance based on three aspects: life expectancy at birth, schooling, and income. However, another indicator that considers the social impacts also is the Social Progress Index-SPI, developed by Porter et al. [243] starting from the works by Sen, North, and Stiglitz. This index measures society's ability to satisfy basic human needs and improve people's quality of life, so that everyone can aspire to achieve the best possible personal fulfilment. Therefore, the HDI, SPI, and other similar indexes (e.g., Global Impact Inequality index, Gross National Happiness, Governance-adjusted Sustainable Development Index) are well-being indicators prioritising social progress over economic progress and could be used as an alternative for the GDP.

### *5.3. Limitations and suggestions*

One limitation of our analysis is that African countries cannot share the same growth functions, which can also be unstable over time. Growth can be the result of a different resource endowment and distinct stages of progress that could be separately considered[7][8][9]. For instance, the resource-debt nexus in Africa was found to be negative at the aggregate level and positive at the disaggregated level, implying that an aggregation bias may exist in the analyses. Therefore, this relationship could be further explored at the country level[244].

In other words, it can be more convenient to singularly deal with the specificities of each African country's development path[245]. Failure to account for this heterogeneity can result in incorrect model specifications or misguided policy implications, as analyses may suffer from misleading inferences. For instance, it is important to recognise that a higher positive effect observed in one country can offset smaller negative effects in other countries within the panel. Nevertheless, a panel data analysis provides the advantage of constructing well-fitting models that may not be identifiable using cross-sectional or time-series data alone. Therefore, a general-to-particular approach can be recommended in the presence of competing explanatory theories.

The non-significance of some explanatory variables could arise from econometric specification or a combination of methodological factors and structural specificities of models. For instance, some variables may suffer from mismeasurement. In particular, FDIs not disaggregated by sector or technology intensity may not fully reflect the true impact on countries' growth, especially if their intent is extractive or non-inclusive. Other indicators, such as human capital formation, if measured through an aggregate proxy, may not capture the true quality of skills or their compatibility with the African labour market.

Another issue is related to the time-frame adopted, which may not be sufficient to observe the effects of structural reforms, especially in emerging and transitional economies where technology adoption and institutional change require a long adjustment period. Finally, some variables may be affected by low intra-country variability, which limits the informativeness of panel data. In this case, non-linear effects models could be used to detect possible latent relationships.

Furthermore, it is known in the economic literature that structural reforms in a country need more time to manifest their effects on the socioeconomic system. As a result, this may explain why some lagged variables have not been found to be significant in this study. Moreover, it could be a need to include other explicative variables in models, for instance, related to demographic characteristics, such as fertility rate and life expectancy, or, related to the quality of the institutional and business environment, which literature has shown to be significant for growth. As a result, it has greater data completeness. In addition, starting a backward time-series reconstruction project to extend the time dimension can be necessary.

Finally, a clustering based on the country's level of income could also be necessary to have control in models with reference to it. Four clusters could be used: low-income, lower middle-income, upper middle-income, and high-income countries, as provided by World Bank Group researchers. For instance, the gross national income-GNI with Atlas correction to reduce the impact of exchange rate fluctuations in the cross-country comparison, and the Gini coefficient for the income inequality could be used in addition to GDP.

## Appendix A

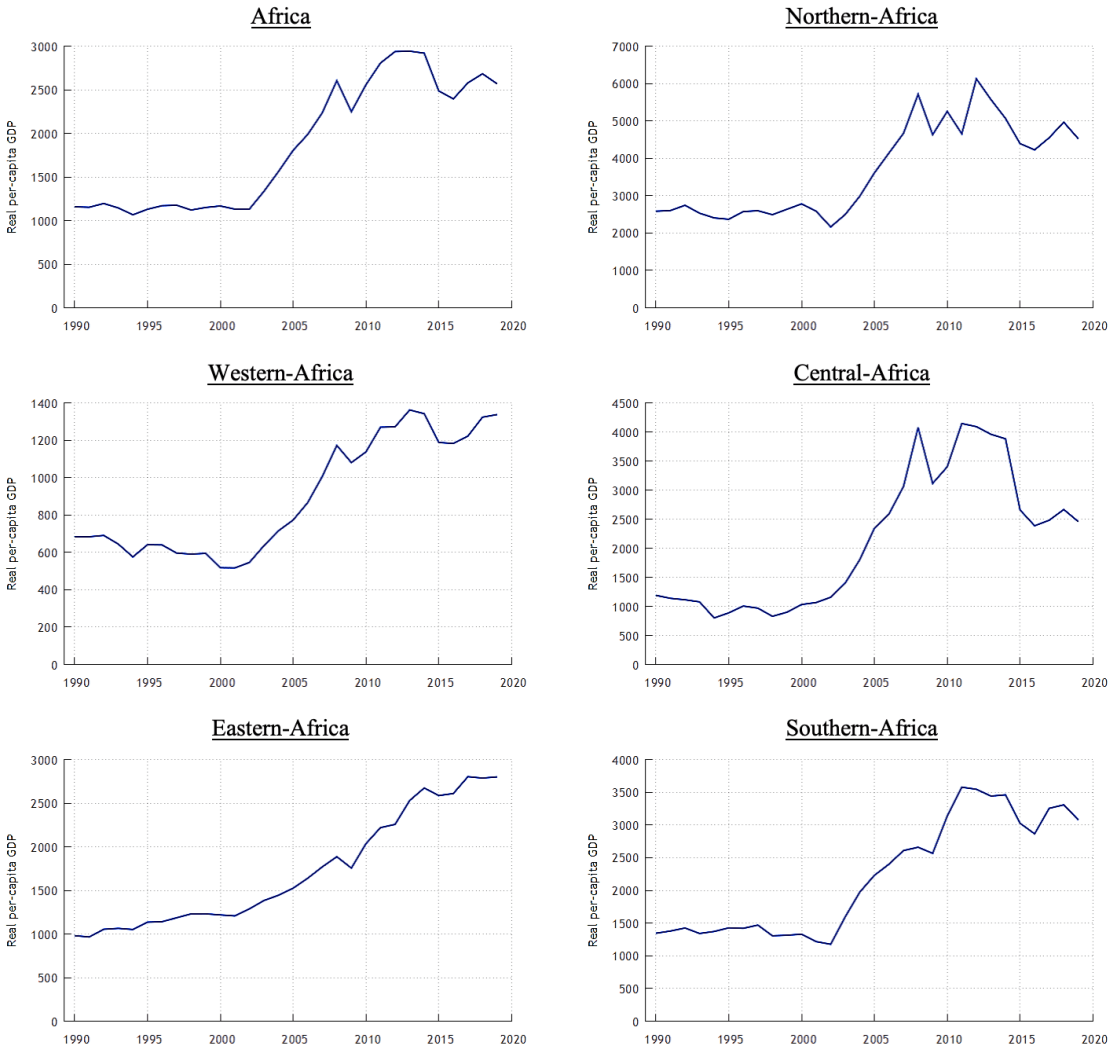


**Figure A.1.** The long-term average growth of Africa and its sub-regions, 1990-2019. *Note: data for South-Sudan are missing before 2010. Source: our elaboration.*

| Clusters | Authors | Summary |
|---|---|---|
| GOVERNANCE CLIMATE | Gaibulloev and Sandler[130] | They have found the effects of domestic and transnational terrorism on the per-capita income growth of 51 African countries from 1970 to 2007 by accounting for the cross-sectional spatial dependence of conflicts. The findings suggest that transnational terrorism has a modest marginal impact on per-capita income growth and that domestic terrorist events, surprisingly, do not affect it. According to the authors, the modest impact of transnational terrorism on African growth indicates that developing economies are more resilient to terrorism than is commonly assumed. |
| | Narayan et al. [131] | They examine the relationship between democracy and economic growth in 30 SSA countries, finding mixed support for the Lipset theory in the long run. |
| | Bertocchi and Guerzoni[132] | They explore the empirical determinants of fragility in SSA over the period 1992-2007 by using a battery of development indicators and finding that institutions are the main cause of the fragility. The probability that a country will be fragile increases with the restrictions on civil liberties and with the increase in revolutions. In fact, the per-capita GDP growth and investments are significant explanatory variables, but the economic growth has an uncertain net impact as it reduces the country's fragility, while the investments increase it. |
| | Jaunky[133] | He studies the linkage between democracy and economic development in 28 SSA countries over the period 1980–2005 using the GMM model. He has found that economic growth precedes democracy in the short run, while bi-directional causality is found in the long run. At last, the effects on growth are positive. |
| | Fayissa and Nsiah[134] | They use fixed and random effects models, and GMM models for investigating the governance effect on African growth. They have found that governance contributes to the growth gap of African countries, which depends on the countries' income. |
| | Ahlerup et al. [135] | They examine how an impartial government toward ethnic groups can improve the growth of 20 SSA countries beginning in the late Nineties. They have found that countries with a governance perceived as impartial have a better chance of growth. |
| | Akobeng[246] | He investigates whether the linkage between growth and poverty reduction can be strengthened across the institutions in 41 SSA countries over the period 1981-2010 by using the GMM estimator. He finds that improvements in governance are significant for supporting the link between growth and poverty reduction in SSA. |
| | Toh[136] | He investigates the long-run growth drivers of a group of SSA emerging economies. His findings indicate that the economies diverge more on economic characteristics, institutional quality, and governance than the slow-growth group. |
| | Epaphra and Kombe[137] | They examine the impact of institutions on African growth using the GMM, fixed- and random-effects models over a sample of 48 countries from 1996 to 2016, discovering that political stability is the most important factor in explaining African per-capita GDP growth. Other significant explanatory variables are openness, gross fixed investments, human capital formation, and foreign direct investments. |
| | Ogbuabor et al. [138] | They examine the impact of governance on economic growth in Western Africa after the global economic recession using a panel of 13 countries and find a negative relationship between governance and growth. Specifically, corruption, government ineffectiveness, political instability, the weakness of the rule of law, and the absence of accountability are the main obstacles to growth, while the per-capita GDP, gross fixed investments, employment, and foreign direct investment are the other significant drivers of growth in the region. |
| | Chomen[247] | He investigates the causal relationship between institutions and economic growth in 43 SSA countries over 13 years using system-GMM. He reports no significant causal link between institutions and growth and suggests that their impact may depend on omitted variables and institutional thresholds. |
| | Hussen[139] | He investigates how different dimensions of institutional quality affect economic growth in 31 SSA countries between 1991 and 2015. Using PCA and system-GMM, he finds that investment-promoting, democratic, and regulatory institutions significantly enhance growth, while conflict-preventing institutions have limited effect. |
| FINANCIAL DEVELOPMENT, DEBT AND PUBLIC EXPENDITURE | Ahmed[99] | He explores the relationship between military expenditure, external debts, and growth in a sample of 25 SSA countries over the period 1988–2007, by finding that military expenditure has a positive impact on the external debt of African countries, and GDP growth negatively affects their total debt stock. |
| | Kagochi et al.[64] | They investigate the relationship between financial development and growth in a sample of SSA countries and find that stock-market development has a positive effect on growth. Instead, the other financial development indicators have an uncertain impact on the growth, while the control variables such as capital formation, schooling, and life expectancy have a positive effect on the growth. |

| Clusters | Authors | Summary |
|---|---|---|
| | Mbate[68] | He investigates the impact of the domestic debt on growth and the private sector in 21 SSA countries over the period 1985-2010 by using GMM models. He has found that domestic debt crowds out the private sector and deters capital accumulation. |
| | Asongu[65] | He uses a VAR approach to examine the effects of monetary policy on African growth from 1987 to 2010, testing whether monetary policy variables affect growth in the short and long run, but with inconclusive results. |
| | Walle[66] | He examines the long-run relationship between the financial development and growth in 17 SSA countries over the period 1975-2005 by applying an error correction term based on the co-integration tests for considering the cross-sectional dependence between the countries. He has found that there is a long-run relationship between financial development and growth, although there is a weak reverse causal impact. |
| | Shaaba and Ngepah[101] | On a panel of 35 African countries from 1990 to 2015, they analyse the relationship between military expenditure, industrialization, and growth, by finding that industrialisation and growth precede military expenditure in the short- and long run, but that military power can be used to achieve industrialisation and growth under given conditions. |
| | Mensah et al.[70] | They used ADL models to exaggerate the impact of public debt on growth in 38 African countries from 1970 to 2015, discovering that public debt stifles growth when it exceeds 50% of the country's GDP. |
| | Arizala et al.[98] | They investigate the effects of government expenditures and revenues on growth in SSA from 1990 to 2016. They discovered that cutting off public investments has a greater impact on growth than cutting off public consumption or increasing revenues. Attempts to consolidate public finances, on the other hand, have had a negative impact on short- and medium-term growth, which has been mitigated by financial adjustments. |
| | Ehigiamusoe and Lean[71] | They examine the effects of public debt and deficit on growth in Western Africa by implementing empirical strategies that account for various econometric issues. They find that the impact of financial development on growth depends on the levels of debt and deficit. When debt and deficit levels exceed a certain threshold, the marginal effects of financial development on growth are negative. |
| | Idun[72] | He believes that the use of technology in financial systems can contribute to African growth in the long run, provided that other growth drivers such as human capital formation, openness, and infrastructural capital are present in the countries. However, financial development produces divergent responses to growth within African country clusters. Financial innovation in COMESA and ECCAS causes growth, while that in ECOWAS and ARABMAG has been found to be dangerous to growth. |
| | Olaoye[73] | He evaluates the sustainability and inclusiveness of debt-financed growth in 44 SSA countries over 38 years. By using nonlinear fiscal reaction functions and panel threshold models, he finds that economic growth becomes less inclusive when public debt exceeds 34% of GDP, thereby questioning the long-term viability of debt-driven development. |
| | Asante et al.[74] | They examine the relationship between financial development and economic growth in 29 SSA countries from 2000 to 2019, incorporating institutional quality as a mediating factor. Using system-GMM, they find that institutional features such as rule of law and regulatory quality amplify the positive effect of financial development on growth. |
| | Jima and Makoni[75] | They explore the causal relationships between financial inclusion, financial stability, and economic growth in 26 SSA countries. Using PCA and ARDL cointegration with Granger causality tests, they find short- and long-term linkages, as well as bi-directional and unidirectional causality, supporting a complementary policy framework. |
| | Mazorodze[76] | He evaluates the interplay between exports, government debt, and growth in 44 SSA countries from 2004 to 2023. He finds that export-led growth is weaker in countries with high debt burdens. Simulated fiscal adjustments indicate that reducing public expenditure is more effective than raising revenue to achieve debt sustainability. |
| | Sore et al.[77] | They assess the short- and long-term effects of fiscal deficits on growth in 42 SSA countries between 2011 and 2021 using a two-step GMM approach. They report that fiscal deficits have a positive short-run but a negative long-run impact on growth. They also find capital formation and real interest rates to be key growth drivers, whereas inflation and exchange rates hinder short-term growth. |
| | Diop et al.[78] | They investigate the relationship between bank-based and market-based financial systems and their effects on economic growth in Sub-Saharan Africa. Using a dynamic panel model, they disentangle the roles of banks and stock markets. Their findings show a negative impact from banking development and a positive contribution from stock markets, suggesting that policy should favour capital market expansion. |
| **ICT ADVANCEMENT** | Batuo[141] | He finds that ICT infrastructures are positively related to the growth of a panel of 44 African countries over the period 1990-2010. A dynamic panel data approach has been employed. Findings show that additional ICT investments have a positive impact on |

| Clusters | Authors | Summary |
|---|---|---|
| | | growth. |
| | Donou-Adonsou et al.[142] | They examine the impact of the ICT infrastructures on the growth of 47 SSA countries over the period 1993-2012, by finding the positive impact of internet adoption and mobile technology. |
| | David[143] | Over the period 2000-2015, he investigated the impact of ICT infrastructure on growth as measured by the GDP and HDI index in 46 African countries. He uses a composite index as a proxy for the ICT depth finding and finds that it contributes to the growth. |
| | Haftu[147] | Using GMM models with internet and mobile telephone penetration rates as proxies for ICT depth, he discovered that an increase in mobile telephone penetration rate contributes to growth while an increase in internet penetration rate does not, as the countries remain in a relatively immature state in terms of technology use. |
| | David and Grobler[144] | They investigate the impact of ICT infrastructure on growth in African countries. They discovered that the depth of ICT has a positive impact on growth. |
| | Ngameni et al. [145] | They study the impact of the ICT infrastructure on the growth-gap between China and 30 African countries over the period 2000-2016, by using internet penetration and ICT good exports as proxies. Their results suggest that the technological gap has a positive impact on African growth. The increase in Chinese ICT investments could benefit African economies through the positive externalities induced. |
| | Ahodode[146] | He explores how triple to quintuple innovation systems affect GDP per capita growth in 27 African countries between 2007 and 2019. Using panel VAR and causality tests, he identifies coevolution dynamics between innovation, institutions, and competitiveness. The study suggests that policy should support system openness and resource-driven innovation for sustained growth. |
| | Ibrahim et al. [125] | They assess the impact of financial development, macroeconomic volatility, digital economy, and domestic investment on sustainable growth in African countries from 1995 to 2021. Disaggregating finance indicators, they find long- and short-run benefits for financial institutions, human capital, and digital tools, but negative effects from trade openness and volatility. The study informs sustainability-focused financial policies. |
| **FOREIGN CAPITAL INFLOWS** | Alemu and Lee[128] | For a panel of 20 middle-income economies and one for 19 low-income economies over the period 1995-2010, they used GMM models that found a positive relationship between foreign aid and growth only in the low-income countries, while the growth is subordinated to foreign investments and oil-export revenues in the middle-income countries. |
| | Adusah-Poku[94] | He investigates the impact of foreign capital inflows – foreign aid, foreign direct investments, and personal remittances – on SSA growth from 1990 to 2010, concluding that all three inflows have a positive and significant impact on growth in the long run, while personal remittances are significant only in the short run. |
| | Cai et al.[129] | They investigate the effects of aid on African growth using panel data from 47 African countries from 1980 to 2013, discovering that international aid promotes growth, but its effectiveness is dependent on governance. |
| | Hagan and Amoah[248] | Using an instrumental variable approach to panel data, they investigate whether the effect of foreign investments on African growth is dependent on the resilience of the financial system. They have found that when the financial markets are fragile, as they are in some African countries, the foreign investment inflows can have a small positive effect on growth. |
| | Kumar and Saleh[249] | They use co-integrated vector autoregressive analysis to examine the output and prices of tradable and non-tradable sectors in SSA countries. They find that aids have a heterogeneous effect on sectoral output and prices. |
| | Amir and Amir[96] | They evaluate the relationship between remittances and economic growth in 42 African countries from 2001 to 2020 using fixed-effects and GMM. They find a significant positive effect of remittances on GDP growth. The use of unemployment as an instrument addresses endogeneity, strengthening the case for remittance-driven development policies. |
| **HUMAN CAPITAL FORMATION** | Anoruo and Elike[250] | They analyse the causal relationship between human capital formation and growth in a panel of 29 African countries. The results show a bidirectional causality between the two variables and reinforce the nexus between education and growth. |
| | Kayaoglu and Naval[121] | They simulate the trend for the formation of human capital, the urbanisation rate, and the per-capita GDP in African countries. They contend that in the short run, a low, or negative return on education investments can be attributed to systemic transitory adjustment or urbanisation costs. |
| | Ibrahim[122] | He examines the effect of human capital formation on the financial depth and growth in 29 SSA countries over the period 1980-2014 by using GMM models. They discovered that human capital formation and financial depth both promote growth in the short and long run, with financial depth stimulating human capital formation. |

| Clusters | Authors | Summary |
|---|---|---|
| | Anetor[123] | He analyses the impact of human capital formation on foreign direct investment and growth in 28 SSA countries over the period 1999-2017. He finds that SSA countries do not have a sufficient, skilled workers for absorbing and transforming the FDI's spillover toward growth. |
| | Nwani[124] | He examines the role of human capital formation in relation to foreign aid and growth in SSA countries from 1985 to 2019. He has found that foreign aid and human capital formation have a negative impact on growth, nevertheless, this impact is mitigated by the interaction between human capital formation and foreign aid, which reduces the negative effect of foreign aid on growth. |
| OPENNESS | Chang and Mendy[80] | They examine the effects of openness on growth in 36 African countries over the period 1980-2009, by using fixed-effects models. Their results show that openness and investments positively impact growth, with North Africa being the best, while foreign aid, domestic savings, and gross fixed investments show a negative impact. |
| | Brueckner and Lederman[82] | They use the instrumental variables approach to estimate the reciprocal effects of openness and growth in SSA discovering that growth has a negative effect on openness while having a positive effect on growth. |
| | Osei et al.[84] | They compare the influencing factors of openness in low- and low-middle-income African countries using the GMM approach. They have found that growth robustly enhances openness in low-income countries, while the impact is not robust and is largely negative in low-income countries. This suggests to them that higher growth is associated with less openness. Furthermore, the growth-openness relationship is non-linear and has an inverted U-shape in low-income countries. This means that an increase in the per-capita GDP improves openness, but beyond a given threshold, further increases penalise openness. |
| | Udeagha and Ngepah[85] | They use a non-linear ARDL approach for exploiting the relationship between openness and growth in South Africa over the period 1960-2016, by finding that there is a short- and long-run causality from the openness to the growth. |
| | Kiiza et al.[87] | They study the effect of export quality and public institutions on income convergence between SSA and developed countries. Using system-GMM, they find that both manufactured and food exports increase convergence, and this effect is strengthened by good institutions, anti-corruption efforts, and public investment. |
| | Epaphra and Amin[90] | They analyse the relationship between trade liberalization, economic growth, and balance of payments in 37 SSA countries from 1996 to 2019. Using GMM regressions, they find that trade openness, measured via trade-to-GDP ratio, significantly enhances growth, and improves both the trade and current account balances. |
| | Namahoro et al.[115] | They analyse how natural resource rents and trade openness affect growth across African regions and income levels from 1980 to 2018. Using CS-DL and variance decomposition, they find that resource rents negatively impact long-run growth, while trade openness through exports has a more positive and strong effect. The study highlights regional disparities and calls for tailored policymaking to promote sustainable growth. |
| | Musila and Yiheyis[109] | They examine the effects of intra-African trade, extra-African trade, and overall trade openness on economic growth using panel data from 42 African countries. They find that both intra- and extra-regional trade openness positively and significantly influence long-run real GDP per capita. However, this effect is limited to more integrated regional blocs. Short-run effects are mostly positive but not statistically significant. In addition, they emphasize the importance of human and physical capital accumulation in driving growth. |
| CHINESE INFLUENCE | Doku et al.[106] | They use fixed-effect models and Granger causality tests to examine the effects and causal nexus of Chinese FDIs on African growth over a sample of 20 countries from 2003 to 2012. They have found that Chinese FDIs increase the GDP growth rate in Africa, and all other things being equal, they have found that there is a unidirectional causality between GDP growth and Chinese FDIs in Africa. |
| | Koomson-Abekah and Nwaba[83] | They primarily examine the effects of Chinese FDIs on African growth using ADL models and Granger causality tests on data dating back to the millennium. They discovered that Chinese FDIs have a negative impact on African growth in both the short and long run because their inflows are directed toward capital-intensive activities with a lower impact on employment. They also discovered that FDIs from the United States and Chinese trade had little impact on African growth. The Granger-causality test has confirmed that there is a unidirectional relationship between growth and the other variables, except for human capital formation, which does not show causality. More FDI inflows to labour-intensive activities will, according to the authors, boost African growth by lowering unemployment. |
| | Kodzi-Jr[107] | He investigates whether Chinese FDI contributes to inclusive growth in Africa by assessing local industry participation across BRI-linked African countries. Using principal components and regression analysis, he finds that while Chinese FDI reduces |

| Clusters | Authors | Summary |
|---|---|---|
| | | unemployment, it does not support local industry linkages. He warns that special economic zones may foster isolationism and advocates for strategic interconnectivity improvements to realize mutual benefits. |
| URBANISATION | Bruckner[126] | He analyses the effects of the value-added growth in the agricultural sector and per-capita GDP growth on the urbanisation rate in African countries over the period 1960-2007. He has found that an increase in the urbanisation rate has a negative effect on the per-capita GDP growth on average, but this does not affect the urbanisation rate. At last, he has found that a decrease in the value-added in agriculture leads to an increase in urbanisation. |
| | Onjala and K'Akumu[127] | They found that the relationship between GDP and urbanisation in sub-Saharan African countries differs from that in developed economies. Their results indicate that the traditional thesis is still valid in the SSA countries, in fact, they urbanise without growth. However, new trends emerge when urbanization coexists with growth. |
| OTHER ADDITIONAL VARIABLES | Seetanah and Rojid[91] | They analyse the drivers of growth in the selected African COMESA member countries and find that gross fixed investments, openness, and human capital formation are the most important drivers of growth, as well as governance, financial depth, international aid, and spillover effects from foreign capital inflows. |
| | Mijiyawa[103] | He explores the drivers of African growth over the period 1995-2005, by finding that investments, access to finance, governance improvements, exports, and the share of value-added from agriculture have positively contributed to the growth. |
| | Akhmat et al. [100] | They investigate the relationship between the public health indicators and growth in Africa from 1975 to 2011, by establishing that there exists a moderately bidirectional causality between the variables. |
| | Elhiraika et al. [81] | They investigate the role of manufacturing transformations along the GVCs in 50 growing African countries. By using GMM models, they find that GDP increases when human capital formation drives the output growth in manufacturing, at last, this has a positive impact on the GDP growth rate, reducing the volatility. |
| | Pinkovskiy and Sala-i-Martin[97] | They look at the recent growth in Africa in relation to poverty. They estimate the income distribution, the poverty rate, and the inequality index in African countries over the period 1990-2011. They show that African poverty is falling rapidly, and the growth that began in the second half of the Nineties has decreased income inequality, even in countries with geographical or historical disadvantages. |
| | Addison et al. [251] | They investigate the commodity price shocks in SSA countries dependent on agricultural commodities, by finding that there are inconclusive proofs of unanticipated price variations as responses to variations in per-capita GDP. |
| | Calderon and Boreux[92] | They investigate if African growth was accompanied by improved structural and macroeconomic indicators, if African countries had liquidity, and if governments implemented countercyclical policies following the global economic crisis between 1995 and 2008. They have found that improvements in the macroeconomic framework have allowed some African countries to better resist the global crisis. |
| | Nsiah et al.[104] | They examine the determinants of growth in 48 African countries from 1980 to 2011, by taking into account the economic impacts of neighbouring countries. They control for some drivers of growth, such as the gross fixed capital investment, openness, aids, and inflation, by finding a significant level for the gross fixed investments and education, as well as, for the spatial linkages across countries. When recessions occur, neighbouring SSA countries with similar growth compete for resources. |
| | Kedir et al.[69] | They estimate the additional investments required to achieve the SDGs and reduce poverty in Africa by 2030. They have found that estimates of the required growth rates vary widely across African subregions and countries. Countries and subregions with low initial poverty levels and higher responsiveness to the poverty contrast will need less development assistance. |
| | Oluwatayo and Ojo[19] | They examine growth drivers and poverty reduction in African countries, by finding that African development is advancing inequality and poverty. In other words, this is manifested through persistent inequality, poverty, armed conflict, and indiscriminate young people's migration toward developed countries in search of better living conditions. |
| | Shittu et al.[93] | They study the impacts of FDIs, globalisation, and governance on the growth of Western Africa over the period of 1996-2016 using ADL models. They discover a positive relationship between globalization, governance, and growth. Even if the findings on the relationship between FDI and growth are inconclusive, governance has a positive impact on FDIs and growth. The other considered drivers of growth are employment, gross fixed capital investment, and government expenditure, whose effects on growth are negative on the first two and positive on the last. |
| | Franses and Welz[105] | They propose a forecasting model with a single equation for estimating the GDP growth rate in 52 African countries starting from 1960 and by including lagged growth rates from the other countries. Furthermore, co-integration relationships have been computed to capture potential common stochastic trends. |

| Clusters | Authors | Summary |
|---|---|---|
| | Bouvet et al.[67] | They evaluate the 1994 CFA franc devaluation's impact on GDP per capita across CFA-zone countries using synthetic control methods. Except for Mali, the devaluation did not result in higher GDP levels compared to the counterfactual. Negative outcomes are linked to weak institutions and external shocks, casting doubt on currency devaluation as a growth strategy. |
| | Ajayi[102] | He explores the impact of mineral rents, conflict, and population growth on GDP in 13 SSA countries from 1980 to 2022. Using pooled OLS, fixed-effects, and GMM, he finds that mineral rents boost short-run growth, while civil conflict and high population growth rates negatively affect long-term growth. The study highlights the mediating role of institutional quality. |
| | Yeboua[118] | He investigates how growth in specific economic sectors affects income inequality in 21 African countries from 1990 to 2018. Using FE and FE-IV estimations, he finds that agriculture and manufacturing reduce inequality, while mining and finance increase it. These results stress the need for sub-sectoral analysis in designing inclusive growth policies. |

**Table A.1.** The clustering of the reference literature (2011-2025), authors, and summary.

*Source: our elaboration.*

| Variables | Mean | Standard Deviation | | Proxy and source |
|---|---|---|---|---|
| | | Within | Between | |
| **Real per-capita GDP** | 2,687 | 963.0 | 3,330 | Middle income per-capita as a proxy of economic growth<br>UNCTAD (USD) |
| **FDI Inflows** | 4.985 | 4.606 | 5.729 | FDI inflows as a proxy of activities of international investors<br>UNCTAD (% of GDP) |
| **Inflation** | 189.7 | 603.4 | 372.7 | Consumer price index as a proxy of monetary stability<br>UNCTAD (trend % with the annual average growth rate) |
| **Openness** | 75.96 | 19.48 | 41.60 | Openness degree by country as a proxy of international integration<br>UNCTAD (% of GDP) |
| **Natural Resources Rent** | 10.59 | 5.323 | 9.637 | Available resources rent as a proxy of revenues from raw materials<br>WB-WDI (% of GDP) |
| **Government Expenditure** | 16.66 | 4.166 | 7.443 | General government consumption as a proxy of the bureaucracy<br>WB-WDI (% of GDP) |
| **Productivity** | 91.55 | 4.312 | 4.475 | Gross value added at factors cost as a proxy of productivity<br>WB-WDI (% of GDP) |
| **External Debt** | 40.15 | 13.12 | 27.04 | External debt stock as a proxy of the creditworthiness of the country<br>WB-WDI (% of GNI) |
| **Unemployment** | 9.149 | 0.922 | 7.285 | Labour market efficiency<br>WB-WDI (% of labour force) |
| **Military Expenditure** | 3.395 | 16.18 | 10.51 | Expenditures for keeping the armed forces<br>WB-WDI (% of GDP) |
| **Health Expenditure** | 6.504 | 1.403 | 3.144 | Domestic general health expenditure as a proxy of public health care<br>WB-WDI (% of general government expenditure) |
| **Received Remittances** | 3.591 | 2.103 | 4.407 | Transfers from the migrant labour force as a proxy of foreign incomes<br>WB-WDI (% of GDP) |
| **Net-ODA** | 8.225 | 6.361 | 9.972 | Net official development assistance as a proxy of the international aid<br>WB-WDI (% of GNI) |
| **Urban Population** | 44.77 | 4.138 | 18.52 | Urban population level as a proxy of urbanisation<br>WB-WDI (% of total population) |
| **Human Capital Formation** | 39.70 | 12.89 | 6.808 | Human capital formation as a proxy of the educational level<br>UNDP (%) |
| **Gross Fixed Investments** | 23.62 | 5.454 | 8.258 | Internal structural investments as a proxy of infrastructural capital<br>WB-WDI (% of GDP) |
| **ICT-diffusion** | 77.91 | 15.47 | 35.60 | Mobile cellular subscriptions as a proxy of ICT-diffusion<br>WB-WDI (per 100 people) |
| **Governance Climate** | 35.62 | 2.363 | 12.72 | Composite index as a proxy for the governance by Scalamonti[252] our elaboration from WB-WGI (%) |

| Variables | Mean | Standard Deviation | | Proxy and source |
|---|---|---|---|---|
| | | Within | Between | |
| **Imports [Exports] from [to] HDCs** | 46.78 [52.12] | 6.338 [10.84] | 16.77 [23.34] | Merchandise imports [exports] from [to] high-developed countries (HDCs) WB-WDI (% of total merchandise imports [exports]) |
| **Imports [Exports] from [to] LMDCs in Latin America or Caribbean** | 2.092 [1.136] | 0.868 [1.372] | 1.928 [2.210] | Merchandise imports [exports] from [to] low- and middle-developed countries (LMDCs) in Latin America or Caribbean WB-WDI (% of total merchandise imports [exports]) |
| **Imports [Exports] from [to] LMDCs in Europe or Central-Asia** | 3.429 [1.347] | 1.424 [1.792] | 3.068 [1.533] | Merchandise imports [exports] from [to] low- and middle-developed countries (LMDCs) in Europe or Central-Asia WB-WDI (% of total merchandise imports [exports]) |
| **Imports [Exports] from [to] LMDCs in Eastern-Asia or Pacific** | 15.40 [11.85] | 4.141 [10.26] | 7.087 [14.14] | Merchandise imports [exports] from [to] low- and middle-developed countries (LMDCs) in Eastern-Asia or Pacific WB-WDI (% of total merchandise imports [exports]) |
| **Imports [Exports] from [to] LMDCs in Southern-Asia** | 6.607 [6.655] | 4.345 [5.026] | 5.896 [10.58] | Merchandise imports [exports] from [to] low- and middle-developed countries (LMDCs) in Southern-Asia WB-WDI (% of total merchandise imports [exports]) |
| **Imports [Exports] from [to] LMDCs in North Africa or Middle East** | 2.380 [2.098] | 1.102 [1.941] | 2.291 [3.559] | Merchandise imports [exports] from [to] low- and middle-developed countries (LMDCs) in North Africa or Middle East WB-WDI (% of total merchandise imports [exports]) |
| **Imports [Exports] from [to] LMDCs in Sub-Saharan Africa** | 21.41 [22.80] | 7.088 [7.955] | 21.24 [21.02] | Merchandise imports [exports] from [to] low- and middle-developed countries (LMDCs) in Sub-Saharan Africa WB-WDI (% of total merchandise imports [exports]) |

**Table A.2**. Main statistics and description of the used variables, 2010-2019.

*Source: our elaboration.*

| | Real per-capita GDP | FDI Inflows | Inflation | Openness | Natural Resources Rent | Government Expenditure | Productivity | External Debt | Unemployment | Military Expenditure | Health Expenditure | Received Remittances | Net-ODA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Real per-capita GDP** | 1.000 | | | | | | | | | | | | |
| **FDI Inflows** | -0.030 | 1.000 | | | | | | | | | | | |
| **Inflation** | -0.059 | -0.060 | 1.000 | | | | | | | | | | |
| **Openness** | 0.349 | 0.405 | -0.066 | 1.000 | | | | | | | | | |
| **Natural Resources Rent** | 0.217 | 0.097 | -0.039 | -0.049 | 1.000 | | | | | | | | |
| **Government Expenditure** | 0.113 | 0.161 | -0.003 | 0.271 | -0.094 | 1.000 | | | | | | | |
| **Productivity** | 0.042 | -0.082 | 0.075 | -0.099 | 0.330 | -0.065 | 1.000 | | | | | | |
| **External Debt** | 0.205 | 0.301 | -0.016 | 0.492 | -0.285 | 0.150 | -0.225 | 1.000 | | | | | |
| **Unemployment** | 0.329 | -0.027 | 0.035 | 0.413 | 0.003 | 0.358 | 0.126 | 0.071 | 1.000 | | | | |
| **Military Expenditure** | 0.144 | -0.056 | 0.009 | 0.010 | 0.221 | 0.058 | 0.051 | -0.080 | 0.130 | 1.000 | | | |
| **Health Expenditure** | 0.210 | -0.174 | -0.090 | -0.034 | -0.311 | 0.203 | -0.228 | 0.110 | 0.257 | -0.087 | 1.000 | | |
| **Received Remittances** | -0.237 | 0.139 | 0.016 | 0.095 | -0.207 | 0.228 | -0.183 | 0.025 | 0.044 | -0.074 | -0.019 | 1.000 | |
| **Net-ODA** | -0.353 | 0.198 | 0.217 | 0.004 | -0.095 | 0.221 | 0.032 | 0.071 | -0.173 | -0.009 | -0.293 | 0.101 | 1.000 |
| **Urban Population** | 0.508 | 0.076 | -0.109 | 0.318 | 0.163 | 0.124 | 0.104 | 0.131 | 0.468 | 0.155 | 0.024 | -0.099 | -0.10 |
| **Human Capital Formation** | -0.046 | 0.103 | -0.039 | 0.015 | -0.082 | -0.007 | -0.080 | 0.137 | -0.038 | 0.049 | 0.070 | 0.004 | -0.03 |
| **Gross Fixed Investments** | 0.177 | 0.414 | -0.147 | 0.267 | 0.112 | 0.113 | -0.001 | 0.182 | 0.071 | -0.063 | 0.056 | -0.021 | -0.21 |
| **ICT-diffusion** | 0.526 | -0.049 | -0.112 | 0.134 | -0.101 | 0.042 | -0.158 | 0.206 | 0.347 | 0.022 | 0.416 | 0.064 | -0.45 |
| **Governance Climate** | 0.303 | 0.020 | -0.180 | 0.116 | -0.397 | 0.168 | -0.262 | 0.250 | 0.098 | -0.190 | 0.573 | 0.080 | -0.31 |
| **Imports from HDCs** | 0.271 | 0.045 | -0.137 | 0.082 | 0.155 | -0.067 | 0.037 | 0.256 | -0.032 | 0.039 | -0.030 | -0.199 | -0.10 |
| **Imports from LMDCs in Latin America or Caribbean** | 0.092 | -0.066 | -0.080 | -0.091 | 0.085 | -0.209 | 0.076 | -0.068 | 0.004 | 0.004 | -0.052 | 0.060 | -0.11 |
| **Imports from LMDCs in** | 0.041 | -0.026 | -0.023 | -0.072 | 0.143 | -0.043 | 0.019 | -0.060 | 0.050 | 0.299 | -0.135 | 0.085 | 0.03 |


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| | Real per-capita GDP | FDI Inflows | Inflation | Openness | Natural Resources Rent | Government Expenditure | Productivity | External Debt | Unemployment | Military Expenditure | Health Expenditure | Received Remittances | Net-ODA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Europe or Central-Asia | | | | | | | | | | | | | |
| Imports from LMDCs in Eastern-Asia or Pacific | -0.201 | 0.082 | -0.013 | -0.205 | 0.070 | -0.230 | -0.048 | -0.156 | -0.428 | -0.002 | -0.222 | -0.043 | 0.129 |
| Imports from LMDCs in Southern-Asia | -0.186 | -0.010 | -0.018 | -0.009 | -0.069 | -0.187 | -0.108 | 0.149 | -0.172 | -0.057 | -0.140 | -0.026 | 0.065 |
| Imports from LMDCs in North Africa or Middle East | 0.052 | -0.078 | -0.047 | 0.078 | 0.114 | -0.135 | -0.057 | 0.015 | 0.170 | 0.257 | -0.112 | -0.168 | 0.001 |
| Imports from LMDCs in Sub-Saharan Africa | -0.091 | -0.051 | 0.144 | 0.045 | -0.154 | 0.283 | 0.017 | -0.134 | 0.243 | -0.075 | 0.188 | 0.174 | 0.035 |
| Exports to HDCs | 0.311 | 0.197 | -0.133 | 0.187 | 0.055 | 0.125 | -0.156 | 0.182 | 0.033 | 0.076 | 0.179 | -0.053 | -0.02 |
| Exports to LMDCs in Latin America or Caribbean | 0.123 | -0.035 | -0.041 | 0.226 | -0.045 | 0.124 | 0.131 | -0.045 | 0.188 | -0.025 | -0.045 | -0.043 | -0.06 |
| Exports to LMDCs in Europe or Central-Asia | -0.127 | -0.027 | -0.029 | -0.158 | -0.065 | -0.067 | 0.045 | -0.059 | -0.102 | 0.005 | -0.057 | -0.066 | 0.059 |
| Exports to LMDCs in Eastern-Asia or Pacific | -0.032 | -0.018 | 0.347 | -0.108 | 0.252 | -0.043 | 0.296 | -0.044 | -0.044 | 0.056 | -0.301 | -0.208 | 0.186 |
| Exports to LMDCs in Southern-Asia | -0.135 | -0.110 | -0.021 | -0.193 | -0.011 | -0.208 | 0.089 | -0.079 | -0.201 | -0.044 | -0.228 | 0.062 | 0.015 |
| Exports to LMDCs in North Africa or Middle East | -0.064 | -0.019 | -0.013 | 0.206 | -0.187 | 0.042 | -0.007 | 0.101 | 0.265 | -0.010 | 0.013 | 0.033 | -0.01 |
| Exports to LMDCs in Sub-Saharan Africa | -0.236 | -0.121 | -0.085 | -0.065 | -0.265 | 0.007 | -0.121 | -0.157 | 0.034 | -0.097 | 0.157 | 0.201 | -0.09 |


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**Table A.3.** The correlation matrix, 2010-2019

*Source: our elaboration.*

| | Full Models | | | | Fitted Models[(a)] | | | |
|---|---|---|---|---|---|---|---|---|
| | Real per-capita GDP | | | | | | | |
| | Africa | | SSA | | Africa | | SSA | |
| | *Coeff.* | *Std. Err.* | *Coeff.* | *Std. Err.* | *Coeff.* | *Std. Err.* | *Coeff.* | *Std. Err.* |
| **FDI Inflows** | -0.010 | 0.010 | -0.010 | 0.010 | | | | |
| **Inflation** | -0.014 | 0.048 | -0.039 | 0.052 | | | | |
| **Openness** | -0.080 | 0.100 | -0.041 | 0.098 | | | | |
| **Natural Resources Rent** | 0.031 | 0.043 | 0.010 | 0.045 | | | | |
| **Government Expenditure** | -0.036 | 0.088 | -0.051 | 0.091 | | | | |
| **Productivity** | 0.058 | 0.124 | 0.022 | 0.118 | | | | |
| **External Debt** | -0.209*** | 0.041 | -0.180*** | 0.046 | -0.199*** | 0.039 | -0.186*** | 0.041 |
| **Unemployment** | 0.009 | 0.062 | -0.014 | 0.067 | | | | |
| **Military Expenditure** | -0.026 | 0.039 | -0.057 | 0.090 | | | | |
| **Health Expenditure** | -0.046 | 0.052 | -0.024 | 0.050 | | | | |
| **Received Remittance** | -0.035*** | 0.012 | -0.029*** | 0.010 | -0.035*** | 0.010 | -0.027*** | 0.007 |
| **Net-ODA** | -0.096*** | 0.035 | -0.124*** | 0.027 | -0.092*** | 0.031 | -0.124*** | 0.021 |
| **Urban Population$^2$** | -0.046** | 0.019 | -0.034 | 0.022 | -0.046*** | 0.015 | -0.029** | 0.012 |
| **Human Capital Formation** | -0.046 | 0.030 | -0.043* | 0.024 | -0.053* | 0.031 | -0.057* | 0.029 |
| **Gross Fixed Investments** | 0.187** | 0.084 | 0.194** | 0.082 | 0.156** | 0.072 | 0.165* | 0.083 |
| **ICT-diffusion** | 0.215*** | 0.060 | 0.229*** | 0.054 | 0.222*** | 0.061 | 0.212*** | 0.055 |
| **Governance Climate** | 0.111 | 0.125 | 0.183 | 0.124 | 0.163*** | 0.083 | 0.242** | 0.092 |
| **Imports from HDCs** | -0.138 | 0.084 | -0.105 | 0.080 | | | | |
| **Exports to HDCs** | -0.040 | 0.032 | -0.035 | 0.031 | | | | |
| **Imports from LMDCs in Latin America or Caribbean** | 0.012 | 0.023 | 0.014 | 0.022 | | | | |
| **Exports to LMDCs in Latin America or Caribbean** | 0.004 | 0.010 | -0.001 | 0.010 | | | | |
| **Imports from LMDCs in Europe or Central-Asia** | -0.017 | 0.025 | -0.033 | 0.024 | | | -0.038* | 0.020 |
| **Exports to LMDCs in Europe or Central-Asia** | -0.012 | 0.010 | -0.012 | 0.009 | | | | |
| **Imports from LMDCs in Eastern-Asia or Pacific** | -0.019 | 0.034 | -0.013 | 0.032 | | | | |
| **Exports to LMDCs in Eastern-Asia or Pacific** | -0.017 | 0.011 | -0.020* | 0.011 | | | | |
| **Imports from LMDCs in Southern-Asia** | -0.089*** | 0.032 | -0.072** | 0.033 | -0.078** | 0.030 | -0.072** | 0.033 |
| **Exports to LMDCs in Southern-Asia** | -0.015 | 0.012 | -0.011 | 0.013 | -0.019* | 0.011 | | |
| **Imports from LMDCs in North Africa or Middle East** | 0.040 | 0.024 | 0.052** | 0.024 | 0.043* | 0.025 | 0.053** | 0.026 |
| **Exports to LMDCs in North Africa or Middle East** | 0.006 | 0.011 | 0.007 | 0.011 | | | | |
| **Imports from LMDCs in Sub-Saharan Africa** | -0.059 | 0.038 | 0.001 | 0.049 | | | | |
| **Exports to LMDCs in Sub-Saharan Africa** | 0.001 | 0.025 | 0.002 | 0.023 | | | | |
| **Fixed-Effects** | 8.722*** | 1.030 | 7.690*** | 1.113 | 6.825*** | 0.553 | 6.460*** | 0.592 |
| **Time-Dummies** | Yes | | Yes | | Yes | | Yes | |
| **Standard Error** | 0.113 | | 0.111 | | 0.112 | | 0.110 | |
| **Log-likelihood** | 258.8 | | 243.3 | | 248.1 | | 230.9 | |


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| | Full Models | | | | Fitted Models[(a)] | | | |
|---|---|---|---|---|---|---|---|---|
| | Real per-capita GDP | | | | | | | |
| | Africa | | SSA | | Africa | | SSA | |
| | *Coeff.* | *Std. Err.* | *Coeff.* | *Std. Err.* | *Coeff.* | *Std. Err.* | *Coeff.* | *Std. Err.* |
| **Regressors F-Test p-value** | 0.000 | | 0.000 | | 0.000 | | 0.000 | |
| **Time-Dummies Wald F-Test p-value** | 0.000 | | 0.000 | | 0.000 | | 0.000 | |
| **Welch F-Test p-value** | 0.000 | | 0.000 | | 0.000 | | 0.000 | |
| **Heteroskedasticity Test p-value** | 0.000 | | 0.000 | | 0.000 | | 0.000 | |
| **Autocorrelation Test p-value** | 0.000 | | 0.000 | | 0.000 | | 0.000 | |
| **Normality Test p-value** | 0.008 | | 0.001 | | 0.065 | | 0.027 | |
| **Pesaran CD-Test p-value** | 0.201 | | 0.221 | | 0.231 | | 0.178 | |
| **Observations (%)** | 270 (100) | | 245 (91) | | 270 (100) | | 245 (91) | |
| **Non-Observations (%)** | - | | 25 (9) | | - | | 25 (9) | |
| **Within R-squared** | 0.547 | | 0.591 | | 0.510 | | 0.547 | |

**Table A.4.** Fixed-effects, full and fitted models.

*Note: *** significance for $\alpha$ = 0.01 ** significance for $\alpha$ = 0.05 * significance for $\alpha$ = 0.10. (a) Both backward and forward selection of regressors was used. Source: our elaboration.*

| (a) | Real per-capita GDP | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Instruments: Governance Climate, ICT-diffusion, Urban Population*[2] | | | | | | | | | | | | | |
| | *Coeff.* | *Std. Err.* | | Constant | Time Dummies | Standard Error | Regressors Wald-Test p-value | Time Dummies Wald-Test p-value | AR (2) Test p-value | Non-Observations (%) | Observations (%) | Sargan Test p-value | Hansen Test p-value | Instruments |
| Real per-capita GDP (t-1) | 0.979 | 0.016 | *** | | | | | | | | | | | |
| FDI Inflows | 0.046 | 0.030 | | | | | | | | | | | | |
| FDI Inflows (t-1) | -0.004 | 0.025 | | | | | | | | | | | | |
| | | | | yes | yes | 0.118 | 0.000 | 0.002 | 0.546 | 54 (20) | 216 (80) | 0.298 | 0.370 | 16 |
| Real per-capita GDP (t-1) | 0.988 | 0.023 | *** | | | | | | | | | | | |
| Inflation | -0.161 | 0.212 | | | | | | | | | | | | |
| Inflation (t-1) | 0.267 | 0.272 | | | | | | | | | | | | |
| | | | | yes | yes | 0.105 | 0.000 | 0.000 | 0.198 | 54 (20) | 216 (80) | 0.053 | 0.429 | 16 |
| Real per-capita GDP (t-1) | 1.002 | 0.023 | *** | | | | | | | | | | | |
| Openness | -0.023 | 0.226 | | | | | | | | | | | | |
| Openness (t-1) | -0.020 | 0.222 | | | | | | | | | | | | |
| | | | | yes | yes | 0.112 | 0.000 | 0.000 | 0.556 | 54 (20) | 216 (80) | 0.030 | 0.447 | 16 |
| Real per-capita GDP (t-1) | 0.972 | 0.019 | *** | | | | | | | | | | | |
| Natural Resources Rent | 0.089 | 0.060 | | | | | | | | | | | | |
| Natural Resources Rent (t-1) | -0.149 | 0.078 | * | | | | | | | | | | | |
| | | | | yes | yes | 0.108 | 0.000 | 0.000 | 0.725 | 54 (20) | 216 (80) | 0.363 | 0.315 | 16 |
| Real per-capita GDP (t-1) | 0.986 | 0.015 | *** | | | | | | | | | | | |
| Government Expenditure | -0.225 | 0.153 | | | | | | | | | | | | |
| Government Expenditure (t-1) | 0.259 | 0.141 | * | | | | | | | | | | | |
| | | | | yes | yes | 0.112 | 0.000 | 0.000 | 0.865 | 54 (20) | 216 (80) | 0.059 | 0.635 | 16 |
| Real per-capita GDP (t-1) | 0.989 | 0.014 | *** | | | | | | | | | | | |
| Productivity | -0.495 | 0.939 | | | | | | | | | | | | |
| Productivity (t-1) | -0.393 | 0.894 | | | | | | | | | | | | |
| | | | | yes | yes | 0.108 | 0.000 | 0.000 | 0.963 | 54 (20) | 216 (80) | 0.094 | 0.245 | 16 |
| Real per-capita GDP (t-1) | 0.981 | 0.022 | *** | | | | | | | | | | | |


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| | Real per-capita GDP | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (a) | *Instruments: Governance Climate, ICT-diffusion, Urban Population*[2] | | | | | | | | | | | | | |
| | *Coeff.* | *Std. Err.* | | Constant | Time Dummies | Standard Error | Regressors Wald-Test p-value | Time Dummies Wald-Test p-value | AR (2) Test p-value | Non-Observations (%) | Observations (%) | Sargan Test p-value | Hansen Test p-value | Instruments |
| **External Debt** | 0.071 | 0.111 | | | | | | | | | | | | |
| **External Debt (t-1)** | 0.011 | 0.170 | | | | | | | | | | | | |
| | | | | yes | yes | 0.114 | 0.000 | 0.000 | 0.491 | 54 (20) | 216 (80) | 0.060 | 0.276 | 16 |
| **Real per-capita GDP (t-1)** | 0.986 | 0.013 | *** | | | | | | | | | | | |
| **Unemployment** | -0.608 | 0.481 | | | | | | | | | | | | |
| **Unemployment (t-1)** | 0.614 | 0.483 | | | | | | | | | | | | |
| | | | | yes | yes | 0.124 | 0.000 | 0.000 | 0.244 | 54 (20) | 216 (80) | 0.074 | 0.665 | 16 |
| **Real per-capita GDP (t-1)** | 1.001 | 0.017 | *** | | | | | | | | | | | |
| **Military Expenditure** | -0.120 | 0.133 | | | | | | | | | | | | |
| **Military Expenditure (t-1)** | 0.116 | 0.160 | | | | | | | | | | | | |
| | | | | yes | yes | 0.115 | 0.000 | 0.000 | 0.723 | 54 (20) | 216 (80) | 0.127 | 0.436 | 16 |
| **Real per-capita GDP (t-1)** | 0.983 | 0.016 | *** | | | | | | | | | | | |
| **Health Expenditure** | -0.045 | 0.511 | | | | | | | | | | | | |
| **Health Expenditure (t-1)** | 0.069 | 0.523 | | | | | | | | | | | | |
| | | | | yes | yes | 0.112 | 0.000 | 0.000 | 0.533 | 54 (20) | 216 (80) | 0.057 | 0.395 | 16 |
| **Real per-capita GDP (t-1)** | 0.988 | 0.012 | *** | | | | | | | | | | | |
| **Received Remittance** | -0.024 | 0.027 | | | | | | | | | | | | |
| **Received Remittance (t-1)** | 0.031 | 0.026 | | | | | | | | | | | | |
| | | | | yes | yes | 0.111 | 0.000 | 0.000 | 0.300 | 54 (20) | 216 (80) | 0.311 | 0.755 | 16 |
| **Real per-capita GDP (t-1)** | 1.020 | 0.046 | *** | | | | | | | | | | | |
| **Net-ODA** | -0.009 | 0.121 | | | | | | | | | | | | |
| **Net-ODA (t-1)** | 0.036 | 0.098 | | | | | | | | | | | | |
| | | | | yes | yes | 0.111 | 0.000 | 0.000 | 0.529 | 54 (20) | 216 (80) | 0.105 | 0.539 | 16 |
| **Real per-capita GDP (t-1)** | 0.990 | 0.019 | *** | | | | | | | | | | | |

| | Real per-capita GDP | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (a) | *Instruments: Governance Climate, ICT-diffusion, Urban Population*[2] | | | | | | | | | | | | | |
| | *Coeff.* | *Std. Err.* | | Constant | Time Dummies | Standard Error | Regressors Wald-Test p-value | Time Dummies Wald-Test p-value | AR (2) Test p-value | Non-Observations (%) | Observations (%) | Sargan Test p-value | Hansen Test p-value | Instruments |
| **Human Capital Formation** | 0.210 | 0.560 | | | | | | | | | | | | |
| **Human Capital Formation (t-1)** | -0.038 | 0.219 | | | | | | | | | | | | |
| | | | | yes | yes | 0.122 | 0.000 | 0.000 | 0.700 | 54 (20) | 216 (80) | 0.171 | 0.445 | 16 |
| **Real per-capita GDP (t-1)** | 0.983 | 0.027 | *** | | | | | | | | | | | |
| **Gross Fixed Investment** | 0.088 | 0.454 | | | | | | | | | | | | |
| **Gross Fixed Investment (t-1)** | -0.046 | 0.529 | | | | | | | | | | | | |
| | | | | yes | yes | 0.113 | 0.000 | 0.000 | 0.541 | 54 (20) | 216 (80) | 0.058 | 0.323 | 16 |
| **Real per-capita GDP (t-1)** | 0.992 | 0.015 | *** | | | | | | | | | | | |
| **Constant** | 0.150 | 0.108 | | | | | | | | | | | | |
| | | | | - | yes | 0.112 | 0.000 | 0.000 | 0.522 | 54 (20) | 216 (80) | 0.038 | 0.414 | 16 |

**Table A.5(a)**. GMM-sys with $x_i$ endogenous regressor and $z_i$ exogenous instruments.


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| | Real per-capita GDP | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (b) | *Instruments: Governance Climate, ICT-diffusion, Urban Population*[2] | | | | | | | | | | | | | |
| | *Coeff.* | *Std. Err.* | | Constant | Time Dummies | Standard Error | Regressors Wald-Test p-value | Time Dummies Wald-Test p-value | AR (2) Test p-value | Non-Observations (%) | Observations (%) | Sargan Test p-value | Hansen Test p-value | Instruments |
| Real per-capita GDP (t-1) | 0.998 | 0.020 | *** | | | | | | | | | | | |
| Imports from HDCs | 0.171 | 0.412 | | | | | | | | | | | | |
| Imports from HDCs (t-1) | -0.216 | 0.389 | | | | | | | | | | | | |
| | | | | yes | yes | 0.109 | 0.000 | 0.000 | 0.237 | 54 (20) | 216 (80) | 0.012 | 0.313 | 16 |
| Real per-capita GDP (t-1) | 0.991 | 0.022 | *** | | | | | | | | | | | |
| Exports to HDCs | 0.105 | 0.101 | | | | | | | | | | | | |
| Exports to HDCs (t-1) | -0.107 | 0.096 | | | | | | | | | | | | |
| | | | | yes | yes | 0.127 | 0.000 | 0.000 | 0.498 | 54 (20) | 216 (80) | 0.029 | 0.417 | 16 |
| Real per-capita GDP (t-1) | 1.011 | 0.024 | *** | | | | | | | | | | | |
| Imports from LMDCs in Latin America or Caribbean | -0.014 | 0.071 | | | | | | | | | | | | |
| Imports from LMDCs in Latin America or Caribbean (t-1) | -0.015 | 0.066 | | | | | | | | | | | | |
| | | | | yes | yes | 0.112 | 0.000 | 0.000 | 0.563 | 54 (20) | 216 (80) | 0.038 | 0.470 | 16 |
| Real per-capita GDP (t-1) | 0.989 | 0.019 | *** | | | | | | | | | | | |
| Exports to LMDCs in Latin America or Caribbean | -0.011 | 0.042 | | | | | | | | | | | | |
| Exports to LMDCs in Latin America or Caribbean (t-1) | 0.022 | 0.037 | | | | | | | | | | | | |
| | | | | yes | yes | 0.110 | 0.000 | 0.000 | 0.551 | 54 (20) | 216 (80) | 0.037 | 0.287 | 16 |
| Real per-capita GDP (t-1) | 0.997 | 0.015 | *** | | | | | | | | | | | |


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| | Real per-capita GDP | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (b) | *Instruments: Governance Climate, ICT-diffusion, Urban Population*$^2$ | | | | | | | | | | | | | |
| | *Coeff.* | *Std. Err.* | | Constant | Time Dummies | Standard Error | Regressors Wald-Test p-value | Time Dummies Wald-Test p-value | AR (2) Test p-value | Non-Observations (%) | Observations (%) | Sargan Test p-value | Hansen Test p-value | Instruments |
| **Imports from LMDCs in Europe or Central-Asia** | -0.138 | 0.119 | | | | | | | | | | | | |
| **Imports from LMDCs in Europe or Central-Asia (t-1)** | 0.104 | 0.113 | | | | | | | | | | | | |
| | | | | yes | yes | 0.131 | 0.000 | 0.000 | 0.839 | 54 (20) | 216 (80) | 0.080 | 0.683 | 16 |
| **Real per-capita GDP (t-1)** | 0.987 | 0.028 | *** | | | | | | | | | | | |
| **Exports to LMDCs in Europe or Central-Asia** | -0.019 | 0.071 | | | | | | | | | | | | |
| **Exports to LMDCs in Europe or Central-Asia (t-1)** | 0.026 | 0.077 | | | | | | | | | | | | |
| | | | | yes | yes | 0.111 | 0.000 | 0.000 | 0.602 | 54 (20) | 216 (80) | 0.087 | 0.402 | 16 |
| **Real per-capita GDP (t-1)** | 0.957 | 0.031 | *** | | | | | | | | | | | |
| **Imports from LMDCs in Eastern-Asia or Pacific** | 0.068 | 0.425 | | | | | | | | | | | | |
| **Imports from LMDCs in Eastern-Asia or Pacific (t-1)** | -0.213 | 0.470 | | | | | | | | | | | | |
| | | | | yes | yes | 0.113 | 0.000 | 0.000 | 0.439 | 54 (20) | 216 (80) | 0.018 | 0.396 | 16 |
| **Real per-capita GDP (t-1)** | 0.985 | 0.017 | *** | | | | | | | | | | | |
| **Exports to LMDCs in Eastern-Asia or Pacific** | -0.045 | 0.053 | | | | | | | | | | | | |
| **Exports to LMDCs in** | 0.031 | 0.052 | | | | | | | | | | | | |


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| | Real per-capita GDP | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (b) | *Instruments: Governance Climate, ICT-diffusion, Urban Population*$^2$ | | | | | | | | | | | | | |
| | *Coeff.* | *Std. Err.* | | Constant | Time Dummies | Standard Error | Regressors Wald-Test p-value | Time Dummies Wald-Test p-value | AR (2) Test p-value | Non-Observations (%) | Observations (%) | Sargan Test p-value | Hansen Test p-value | Instruments |
| **Eastern-Asia or Pacific (t-1)** | | | | | | | | | | | | | | |
| | | | | yes | yes | 0.120 | 0.000 | 0.000 | 0.443 | 54 (20) | 216 (80) | 0.052 | 0.418 | 16 |
| **Real per-capita GDP (t-1)** | 1.023 | 0.025 | *** | | | | | | | | | | | |
| **Imports from LMDCs in Southern-Asia** | -0.079 | 0.095 | | | | | | | | | | | | |
| **Imports from LMDCs in Southern-Asia (t-1)** | 0.109 | 0.080 | | | | | | | | | | | | |
| | | | | yes | yes | 0.115 | 0.000 | 0.000 | 0.746 | 54 (20) | 216 (80) | 0.029 | 0.440 | 16 |
| **Real per-capita GDP (t-1)** | 0.986 | 0.019 | *** | | | | | | | | | | | |
| **Exports to LMDCs in Southern-Asia** | 0.089 | 0.068 | | | | | | | | | | | | |
| **Exports to LMDCs in Southern-Asia (t-1)** | -0.060 | 0.047 | | | | | | | | | | | | |
| | | | | yes | yes | 0.131 | 0.000 | 0.000 | 0.622 | 54 (20) | 216 (80) | 0.220 | 0.644 | 16 |
| **Real per-capita GDP (t-1)** | 0.986 | 0.014 | *** | | | | | | | | | | | |
| **Imports from LMDCs in North Africa or Middle East** | 0.148 | 0.116 | | | | | | | | | | | | |
| **Imports from LMDCs in North Africa or Middle East (t-1)** | -0.165 | 0.114 | | | | | | | | | | | | |
| | | | | yes | yes | 0.129 | 0.000 | 0.000 | 0.573 | 54 (20) | 216 (80) | 0.657 | 0.891 | 16 |
| **Real per-capita GDP (t-1)** | 0.991 | 0.014 | *** | | | | | | | | | | | |
| **Exports to LMDCs in North Africa or Middle East** | -0.013 | 0.025 | | | | | | | | | | | | |

| | Real per-capita GDP | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (b) | *Instruments: Governance Climate, ICT-diffusion, Urban Population*$^2$ | | | | | | | | | | | | | |
| | *Coeff.* | *Std. Err.* | | Constant | Time Dummies | Standard Error | Regressors Wald-Test p-value | Time Dummies Wald-Test p-value | AR (2) Test p-value | Non-Observations (%) | Observations (%) | Sargan Test p-value | Hansen Test p-value | Instruments |
| **Exports to LMDCs in North Africa or Middle East (t-1)** | 0.008 | 0.021 | | | | | | | | | | | | |
| | | | | yes | yes | 0.111 | 0.000 | 0.000 | 0.580 | 54 (20) | 216 (80) | 0.027 | 0.293 | 16 |
| **Real per-capita GDP (t-1)** | 1.003 | 0.016 | *** | | | | | | | | | | | |
| **Imports from LMDCs in Sub-Saharan Africa** | −0.051 | 0.096 | | | | | | | | | | | | |
| **Imports from LMDCs in Sub-Saharan Africa (t-1)** | 0.080 | 0.101 | | | | | | | | | | | | |
| | | | | yes | yes | 0.114 | 0.000 | 0.000 | 0.307 | 54 (20) | 216 (80) | 0.148 | 0.639 | 16 |
| **Real per-capita GDP (t-1)** | 0.995 | 0.013 | *** | | | | | | | | | | | |
| **Exports to LMDCs in Sub-Saharan Africa** | 0.026 | 0.052 | | | | | | | | | | | | |
| **Exports to LMDCs in Sub-Saharan Africa (t-1)** | −0.017 | 0.047 | | | | | | | | | | | | |
| | | | | yes | yes | 0.113 | 0.000 | 0.000 | 0.498 | 54 (20) | 216 (80) | 0.064 | 0.203 | 16 |

**Table A.5(b)**. GMM-sys with $x_i$ endogenous regressor and $z_i$ exogenous instruments.

*Note: *** significance for $\alpha$ = 0.01 ** significance for $\alpha$ = 0.05 * significance for $\alpha$ = 0.10. Source: our elaboration.*


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| | | Model | | | |
|---|---|---|---|---|---|
| **Model with:** | **Test** | **Full** | **Restricted** | **Difference-in-Test** | **p-value [$\chi^2_{(3)}$]** |
| **FDI Inflows** | Hansen | 9.763 | 9.079 | 0.684 | 0.877 |
| **Inflation** | Hansen | 9.091 | 6.190 | 2.901 | 0.407 |
| **Openness** | Hansen | 8.893 | 7.897 | 0.997 | 0.802 |
| **Natural Resources Rent** | Hansen | 10.451 | 9.506 | 0.944 | 0.815 |
| **Government Expenditure** | Sargan | 16.422 | 11.431 | 4.991 | 0.173 |
| **Productivity** | Hansen | 11.468 | 8.779 | 2.689 | 0.442 |
| **External Debt** | Hansen | 10.990 | 9.204 | 1.786 | 0.618 |
| **Unemployment** | Sargan | 15.686 | 13.285 | 2.401 | 0.493 |
| **Military Expenditure** | Hansen | 9.015 | 8.633 | 0.382 | 0.944 |
| **Health Expenditure** | Hansen | 9.472 | 8.809 | 0.664 | 0.882 |
| **Net-ODA** | Sargan | 14.521 | 12.466 | 2.055 | 0.561 |
| **Human Capital Formation** | Hansen | 8.915 | 8.372 | 0.543 | 0.909 |
| **Gross Fixed Investments** | Hansen | 10.350 | 9.576 | 0.773 | 0.856 |
| **Constant** | Hansen | 11.351 | 8.512 | 2.839 | 0.417 |
| **Imports from HDCs** | Hansen | 10.474 | 9.750 | 0.723 | 0.868 |
| **Imports from LMDCs in Latin America or Caribbean** | Hansen | 8.656 | 8.386 | 0.270 | 0.966 |
| **Imports from LMDCs in Europe or Central-Asia** | Sargan | 15.406 | 13.348 | 2.058 | 0.560 |
| **Imports from LMDCs in Eastern-Asia or Pacific** | Hansen | 9.456 | 7.277 | 2.179 | 0.536 |
| **Imports from LMDCs in Southern-Asia** | Hansen | 8.970 | 8.411 | 0.559 | 0.906 |
| **Imports from LMDCs in Sub-Saharan Africa** | Sargan | 13.332 | 12.398 | 0.934 | 0.817 |
| **Exports to HDCs** | Hansen | 9.218 | 9.129 | 0.089 | 0.993 |
| **Exports to LMDCs in Latin America or Caribbean** | Hansen | 10.843 | 7.955 | 2.888 | 0.409 |
| **Exports to LMDCs in Europe or Central-Asia** | Hansen | 9.385 | 8.392 | 0.993 | 0.803 |
| **Exports to LMDCs in Eastern-Asia or Pacific** | Hansen | 9.207 | 9.068 | 0.139 | 0.987 |
| **Exports to LMDCs in North Africa or Middle East** | Hansen | 10.753 | 8.861 | 1.891 | 0.595 |
| **Exports to LMDCs in Sub-Saharan Africa** | Hansen | 12.194 | 8.911 | 3.283 | 0.350 |

**Table A.6.** Difference-in-Sargan or -Hansen test for the validity of instruments (exogeneity) in the models in Table A.5.

*Source: our elaboration.*

## Statements and Declarations

### *Conflicts of Interest*

There are no relevant financial or non-financial interests regarding the study.


### *Funding*

No funding was received for conducting the study.

*Data Availability*

No datasets were generated during the study and all data sources were properly quoted in the text.

## Footnotes

[1] *Northern-Africa*: Algeria, Egypt, Libya, Morocco, Tunisia. *Western-Africa*: Benin, Burkina-Faso, Cabo Verde, Gambia, Ghana, Guinea, Guinea-Bissau, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Togo. *Central-Africa*: Burundi, Cameroon, Central African Rep., Chad, Congo Dem. Rep., Congo Rep., Equatorial Guinea, Gabon, Liberia, São Tomé and Principe. *Eastern-Africa*: Comoros, Côte d'Ivoire, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Mauritius, Rwanda, Seychelles, Somalia, South-Sudan, Sudan, Tanzania, Uganda. *Southern-Africa*: Angola, Botswana, Eswatini, Lesotho, Malawi, Mozambique, Namibia, South-Africa, Zambia, Zimbabwe. *Sub-Saharan Africa-SSA*: Western-, Central-, Eastern-, and Southern-Africa.

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