

Digital Financial Inclusion and Trade Openness in Africa

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Abstract

The objective of this study was to test the impact of digital financial inclusion on trade openness using a panel of 16 African countries observed over a 17-year period from 2002 to 2018. T > N, this study favors a methodology based on static panel estimates using the generalized least squares (GLS) method. The results obtained revealed that only one variable (logGDP) out of the five retained has a statistically significant influence on trade openness at the 1% level (p > t = 0.06) with a coefficient opposite to the predicted sign of (-0.2371655). This coefficient shows that the decrease in national production in these countries by 0.23% leads to a decrease in the level of trade by 1%. In relation to the variable of interest (ATMs), it was found that it negatively and significantly influences trade openness at the 1% level. When the level of trade decreases by 0.6%, it means that the use of digital finance has decreased by 1%. Also, the study finds an R² within of meaning 0.0527 that at 5.27% the fluctuations in trade in these economies are explained by the model variables.

Keywords

Digital Finance Inclusion, Trade Openness, Africa

1. Introduction

Having an account provides an entry point into the formal financial system. It makes it affordable and easy to pay and receive bills, send or receive funds. It is a place to save money, and opens the door to obtaining bank loans. Account ownership is an index of financial inclusion (Haoudi & Raibhi, 2018). For Global (Demirguc-Kunt et al., 2014), 60% of people worldwide reported having an ac-

count in a financial institution. This holding varies considerably across the world and in developing regions. In high-income economies, 94% of adults 2014 reported having an account and only 54% in developing over the past five years, mobile payments and online shopping have led to a redefinition of finance. This new definition takes into account the innovative financial services contained in development programs and strategies (Jones et al., 2017). They are provided by financial technology companies and telecom operators. They are gradually filling the gaps left by traditional banks in Africa and facilitating the movement of capital between economic agents in the same or different countries. In essence, it is the use of these services that are at the origin of "digital finance" with the internet as a medium. Africa accounted for 132,019.5% of the world's internet users and covers approximately 14.72% of the world's internet users.

In the same year, 5.1 billion of the world's population owned a mobile phone and only 57% of them used 4.4 the internet. In Africa, the rate of internet use shows a strong dispersion. It is 12% in Central Africa, 1 percentage point higher in North Africa and the Horn of Africa, 1 percentage point 2 higher in West and Southern Africa and 5 percentage points higher in East Africa (Amsili & Maussion, 2019). As a result, it has become the social and economic concern for both developed and developing countries (Licoppe, 2009). The number of users of digital tools (internet, mobile phones, credit cards, etc.) is growing exponentially across Africa and the world. This increase is driving value addition in the regional and international market (Efendioglu & Yip, 2004). Digital finance has pushed people to adopt a new way of doing business in Africa. It is what has made her the object of covetousness' for several countries in recent decades.

The authors consider that with the presence of the internet and mobile phones in the hands of billions of people, including those with low incomes, digital finance is taking over from traditional finance (Bilodeau, 2008). The authors consider that with the presence of the internet and mobile phones in the hands of billions of people, including those with low incomes, digital finance is taking over from traditional finance (Bilodeau et al., 2011). Thanks to digital finance, imports into Africa have increased over the past two decades. This has made it a major issue in the economic policies of African countries. Moreover, Tang et al., (2007) have shown that the international trade environment is changed by e-trade by speeding up the sale of goods, facilitating tax collection, increasing revenues and bringing firms closer to the international market. Quinlan & Hamilton (2004) and Adimi Biaou et al. (2020) have shown that developed countries experience an increase in imports and exports of goods and services relative to GDP through the use of the internet. Demirkan & Platt (2009), Kauffman & Badar (2014) argue that bilateral trade between large economies and nearby countries is positively correlated with digital technology in contrast to small economies. Almost all empirical studies (Clarke, 2002; Liu & Nath, 2013; Labrousse & Lapointe, 2021) support this view. Other studies involving the OECD (Rallet & Torre, 2001), China, Brazil and India (Trépant, 2008) support the link between trade openness and the use of digital finance. Such studies in developing countries remain mixed. The few studies that analyze the relationship between economic and financial development and digital financial inclusion Osagie & Okafor (2015); Liu, L. and Nath, H., (2013) focus on South Africa, Nigeria and Kenya. Most of these studies use primary data collected from a survey. For our part, the use of secondary data will be favored by using declarative data reported by financial institutions to regulatory agencies (Shankar et al., 2011). In addition, the above-mentioned studies use demand factors for digital financial services (purchasing power of agents, literacy rate, level of education, ...) as well as socio-economic characteristics of households (age of the head of household, gender, household size, ...) in the estimates. We, on the other hand, will focus on the supply factors of digital financial services (credits granted to households and the state by commercial banks, number of automated mobile money operators, size and density of the population, ...) in the estimations. With this approach, our study aims to answer the following main question.

- Does digital financial inclusion have an impact on trade openness for African countries?

The general objective of this study is to analyze the impact of digital financial inclusion on trade openness. Specifically, it aims to analyze the influence of digital financial services on trade openness (1), to determine the variables that accompany digital finance in enhancing trade openness (2). After this introduction, the second section is devoted to the literature review, the identification of the hypotheses and the presentation of the research model. The third section presents the methodology followed by the results and their discussion, economic and policy implications before the conclusion.

2. Review of the Literature

The aim of this section is to present the different theories on trade openness and digital finance. It is structured around two main paragraphs. The first paragraph presents the theories on international trade. The second paragraph presents theories on digital finance.

2.1. Theories on International Trade

Trade openness is defined as the gradual abandonment of protectionism on local industries against foreign competition (Kadid, 2015). It refers to the results of a process aimed at reducing barriers to economic exchange between nations. It refers to financial and trade liberalization. Financial liberalization is understood in the sense of free movement of capital. Trade liberalization is a set of internal and external policies aimed at removing barriers to trade in order to increase trade. In the following, we develop the traditional theories of international trade, the new theory of international trade and the gravity model. Traditional theories of international trade are based on supply-side explanations. It focuses on differences in the cost of producing goods between countries (Lemoine, Madies, &

Madies, 2016). Traditional theories can retain their relevance, particularly in accounting for trade between countries at different levels of development. Criticism from free trade advocates has pushed traditional theories of international trade to give way to the new theory of international trade. The new theory of international trade is based on explanations of imperfect competition. It takes into account economies of scale and gives a role to the size of nations. The existence of such economies has the effect of favoring, all other things being equal, nations that produce large volumes. This allows these countries to benefit from economies of scale.

The size of a nation's domestic market can explain the level of specialization and stability in international trade even if comparative advantages change (Feenstra & Rose, 2000). With the traditional theory, there is basically the existence of perfect competition and free trade becomes optimal. The new theory is based on an analysis in terms of imperfect competition. It develops strong justifications for public intervention through industrial or trade policies. The essential contributions of the new theory of international trade lie more in the explanation of trade and the integration of multinational firms into the analysis than in its prescriptions for trade policy. The new international trade theory focuses on products that can benefit from economies of scale and that can be differentiated. Gravity models, on the other hand, are the set of models that link trade flows to the economic and geographical characteristics of countries (Jean-Yves, 2001). They are based on the principle of physical gravitation which applies the attraction between bodies with masses. And by analogy, these models are used to explain bilateral trade, and are essentially dependent on the geographical factors and incomes of the economic partners. Apart from these theories, several authors (Smith, 1776), (Ricardo, 2007), (Heckscher, 1919) and (Moroney & Walker, 1966) have developed theories on international trade. These are the absolute advantage theory, the comparative advantage theory and the so-called (HOS) model. The HOS model explains international trade by differences in the factor endowments of each country. It is from the HOS theory that the technological gap thesis and the product life cycle thesis were born (Bourdin et al., 2009). These theses were refuted by other authors while showing that this theory allows the economic life of a product to be rationalised by analyzing the period between its launch and its abandonment (Bonnieux & Rainelli, 2003). This last theory is much more applied in the context of marketing. It is in this sense that digital finance plays a crucial role in the business environment.

2.2. Theories on Digital Financial Inclusion

Digital financial inclusion is defined as the digital access and use of formal financial services by previously excluded or underserved populations. These services must be affordable and tailored to the needs of clients, offered in a responsible manner to ensure the sustainability of providers. Digital financial services are provided via cell phones, the internet, or cards to poor and low-income populations that do not have access to traditional financial services (Manyika, Lund, Singer, White, & Berry, 2016).

The literature divides digital financial services into four broad categories based on the nature of the identity that maintains the contractual relationship with the customer. 1) full-service banks offering customers basic or simplified transaction accounts to make payments, transfer funds, and store valuables through mobile devices or payment cards and point-of-sale (POS) terminals; 2) niche banks offering a specific range of products and services accessible through mobile devices or payment cards and POS terminals; 3) mobile phone operators (MTOs) that issue e-money; 4) e-money issuers that are neither banks nor MTOs (Löber & Houben, 2018)¹. These four models become functional through three components: a digital transaction platform, a network of agents, and the access device used by the customer.

The use of digital data is playing an increasingly important role in financial services and financial inclusion for high, middle and low income countries (Kumar & Muhota, 2012). Access to digital financial services by populations excluded from mainstream finance is summarized under the term "digital financial inclusion". In practice, they are provided by fintech companies and innovative financial service providers and public authorities (Gomber, Koch, & Siering, 2017). Currently, the relevance of digital finance and financial inclusion to poverty reduction and economic growth is attracting attention from policy makers and academics. This is largely due to the number of issues that persist and which, if resolved, will make digital finance work better for individuals, businesses, governments and economies (Barbesino, Camerani, & Gaudino, 2005). Digital finance is becoming essential as populations excluded from traditional finance own (or have) mobile phones. To access these services, mobile phones with affordable internet connectivity are required. The use of digital tools is facilitated by fintech platforms. These platforms are more convenient and facilitate basic financial transactions such as sending and withdrawing funds. Globally, these platforms make it easier for businesses to make payments and provide goods and services to their customers at an affordable cost. The reduction in costs especially benefits those excluded and underserved by traditional finance. Digital financial services can increase the productivity and income of rural households by providing economic opportunities beyond their rural communities. This is because it has been shown that 90% of the poor live in rural areas and up to 40% of inequality is attributable to the urban-rural divide (Demirguc-Kunt et al., 2014). Digital payments reduce the cost of sending and receiving money and social transfers. They thus create more inclusive and efficient safety nets for people. With access to digital financial services, digital

¹Committee on Payments and Market Infrastructures (CPMI): report on the analysis of the growing influence of non-banks on retail payment systems. The report finds that efficiencies gained by banks that outsource some of their operations to non-banks can allow them to lower their rates, expand the range of payment methods, and access new markets and customers.

documents and information exist to make transactions more transparent and facilitate verification. **Figure 1** summarizes the benefits of digital finance for an economy (Cruces et al., 2020).

For an economy, digital finance reduces the costs of running the state and allows traceability in the use of finances for state sectors. Transactions are safe and fast, which reduces the administrative and financial burden on the sectors. It improves the financial system of countries by facilitating the redistribution of liquidity to all segments of the population, even those with very low incomes. It facilitates the repatriation of foreign currency by immigrants and expatriates. These currencies help to offset the trade deficit in their current accounts and have a direct and immediate impact on the economy as a whole. However, at the same time, it has a direct and immediate impact on the economy as a whole. Beyond these positive impacts, digital finance also has negative impacts on financial inclusion. Several actors interact in financial inclusion as well as in the use of digital financial services. **Figure 2** illustrates the role of actors in digital finance and financial Inclusion (Ozili, 2018).

This diagram shows that for financial inclusion and poverty reduction to occur, the state must first invest in digital financial services. Establishing high-speed



Figure 1. The benefits of digital finance.





mobile infrastructure and networks of local agents that meet the collection and payment needs of individuals. This is necessarily aimed at providing access to digital information and transactions for the poor. This infrastructure is in turn operated by telecom operators who offer various digital services to the population. In partnership with the banks, digital identification systems, and in particular the biometric device, are developed. This leads to the inclusion of financial data which reduces costs by increasing economies of scale. They increase the speed, security and transparency of transactions. They deploy sustainable financial products, tailored to the needs of people with very low or irregular incomes. They reduce barriers to accessing financial services such as lack of identity documents, lack of formal income and geographical remoteness. These technologies thereby reduce poverty and increase financial inclusion.

2.3. Study Variables, Hypothesis Development and Research Design

In this section we present the structure of the economies of the African countries under study. In the following, we return to the evolution of the variables under study.

- Financial sector in 16 African countries

The depth and development of financial sectors in Africa generally remains weak even when per capita income levels are taken into account. They are generally small, underdeveloped and dominated by a banking sector that is highly concentrated in urban centers. With weak stock and bond markets, the intermediation role is mainly played by banks, which represent the main source of external capital for companies. **Graph 1** shows the evolution of the financial sector structure of the African economies covered by this study.

The following figure shows that:



 $2002\,2003\,2004\,2005\,2006\,2007\,2008\,2009\,2010\,2011\,2012\,2013\,2014\,2015\,2016\,2017\,2018$



Graph 1. Financial sector developments in 16 African countries. Source: designed by the author from the WDI database and processed with stata 13.0.

- Some countries such as Mauritius, South Africa, Ghana, Botswana and Namibia have a developed and medium-sized financial sector. Mauritius and South Africa have a large and developed financial sector. Mauritius' economy is mainly based on financial services, new technologies, tourism, construction and manufacturing.
- Furthermore, this graph shows that Uganda's financial sector is underdeveloped and the most formally used inclusive financial services are provided through mobile money. This sector remains behind the regional level as Uganda has one of the lowest bank penetration rates in Sub-Saharan Africa. This is a particular constraint on access to business finance. This is why the World Bank indicated in its report that only 10% of Ugandan businesses had a bank loan or line of credit in 2013, which is less than half the average for low-income countries (22%) (Bank & Group, 2013). The economy of this country is dominated by small businesses because, the difficulty of access to credit is a major obstacle to the formation of the economy.
- Côte d'Ivoire's financial sector is moderately developed compared to Uganda's. If we look at the graph above, we can see that this sector has developed since 2016, thanks to the development of the financial market, which has facilitated the extension of credit to the private and public sectors. The dynamism of the Ivorian financial sector was motivated by the installation of the Bank of Abidjan (BDA) on the Ivorian banking scene in September 2017 as well as by the listing of Ecobank Côte d'Ivoire, which achieved the highest price increase of the top 10 African IPOs.
- The other countries considered have a weak, underdeveloped and small financial sector. This can be justified by the fact that in these countries, the banking sector is overrun by sectors with higher portfolio risks than in large companies. These are manufacturing, trade, real estate and construction. In addition, in these countries, the sector is overrun by cooperatives covering mostly microenterprises and micro-entrepreneurs, with SMEs being the missing link (Bank & Group, 2013). There is a low penetration of commercial banks in the country, whereas a financial sector with commercial banks that have wide geographical coverage and are able to provide credit to small and medium enterprises can have a greater impact on economic growth than a system concentrated in urban centers (Beck, Feyen, Ize, & Moizeszowic, 2008). Between and 2016-2017, Kenya shows a growth in credit extended to the private sector by commercial banks through the use of digital financial services through mobile banking (M-Pesa) (Demirgüç-Kunt et al., 2015).

H1: A developed financial sector has a positive impact on trade openness.

- Exchange rates in the sixteen African countries

The terms of trade issue is central to the debate on relations between developing and developed countries. The terms of trade contribute to the assessment of the "purchasing power" of different countries in international markets. This is the ratio of export price indices to import price indices. African countries are largely dependent on two or three export commodities (coffee, cocoa and tea) which provide the bulk of their foreign exchange earnings. They face the problem of short-term price volatility, which is higher for this commodity group than for other tradable goods. This situation is exacerbated by Africa's declining share of world trade and the continent's inability to participate in international trade in manufactured goods and finished products (CIE, 2019). **Graph 2** shows the evolution of the terms of trade of African countries.

The results of this graph indicate that:

Some of the African countries under consideration participate in trade with the rest of the world. These are Algeria, Cameroon, Equatorial Guinea, Ghana, Libya, Mauritius, South Africa, Rwanda and Uganda, but in different ways. The evolution of the terms of trade varies from country to country and from period to period. Uganda, being one of the fastest growing economies, has been able to improve its terms of trade thanks to a 7.23% increase in exports. Good economic governance, the importance of business tourism, the development of the ICT sector with 80% mobile penetration with a 4G network covering 95% of the population have enabled Rwanda to improve its terms of trade.

In South Africa, production tailored to the exploitation of natural resources with the extraction of minerals is the basis for improving the terms of exchange. These minerals constitute the monopoly of powerful international conglomerates for diamond, gold and platinum. Other countries such as Botswana and Côte d'Ivoire are in a disastrous situation with respect to export price indices. These countries are running deficits in terms of the price index. The deterioration of the terms of trade in Côte d'Ivoire is a 2002 result 2006 of the low level of investment in the 2000s. It should be noted, however, that Côte d'Ivoire currently has 50% of the UEMOA road network, which facilitated the movement of trade during 2017. During this period, there was a strong export of cocoa and coffee, representing more than 30% of the export sector. In addition, there was local processing of raw materials and diversification of exports. During the same period, it recorded a deficit due to the fall in the world price of cocoa by almost 50%, the rise in oil prices and social movements and mutinies.

H2: The improvement in the terms of trade has a positive impact on trade openness.





Graph 2. Evolution of the terms of trade of the sixteen African countries. Source: designed by the author from the WDI database and processed with stata 13.0.

- Foreign direct investment in the sixteen African countries

FDI inflows to Africa amounted to US\$54 billion in 2014, making it the third most attractive region among developing economies for FDI flows. Despite this ranking, Africa is nowadays the "hot spot" for FDI as it remains a high growth destination (Makoni, 2015). Between and 2002 the growth 2014, rate of FDI inflows is 267% in Africa. Africa is not only a preferred FDI destination, but also a supplier with outflows estimated at billions 13 of US dollars during the same period (Bruno, 2016). The evolution of FDI in the economies of the African countries concerned is presented in Graph 3.

From this graph it can be seen that:

- Among the countries considered in this study, Ghana, Kenya, Mauritius, Egypt, Equatorial Guinea, Namibia, RSA and Uganda are attracting foreign investors compared to other countries but to different degrees.
- The strong attraction of FDI flows noted in Equatorial Guinea in 2010 is due to high oil and gas production, making it one of the largest recipients of foreign investment in Africa. For Egypt, the attraction of FDI is linked to the production, marketing and export of natural gas. The strong attraction in 2016 is due to the increase in natural gas discovered offshore the Nile Delta in the Mediterranean Sea.
- In Ghana, the attractiveness of FDI is due to the political stability, economic and political management that has convinced most investors to move their capital to Ghana and Senegal. Ghana has thus taken the place of Nigeria and Cote d'Ivoire because of the new upsurge in violence and inter-communal tensions observed in these countries. Namibia and Rwanda were able to attract foreign investors in 2011 due to economic and political stability as well as expansion in ICT. In Côte d'Ivoire, there 2014, has been a small movement of foreign direct investment. This is explained by the return of peace in this country.



2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018



Graph 3. Evolution of FDI in the sixteen African countries. Source: designed by the author from the WDI database and processed with stata 13.0.

H3: The attraction of foreign investors has a positive impact on trade openness.

- GDP of the sixteen African countries

Economic growth in Africa is estimated at 3.4% for the year, 2019, roughly the same as in 2018. Although stable, this is below the ten-year average growth rate for the region (5%). The slower-than-expected growth is partly due to the moderate expansion of the continent's five largest countries (Algeria, Egypt, Moroc-co, Nigeria and South Africa), which together recorded an average growth rate of only 3.1%, compared to an average of 4% for the rest of the continent. Growth is expected to accelerate to 3.9 per cent in 2020 and 4.1 per cent in 2021 (Cuckler et al., 2018). Africa's estimated growth masks large variations between regions and countries. For the African countries concerned, the evolution of GDP can be seen in Graph 4.

The following can be seen from this graph:

- Four countries out of all the countries considered in this study show an increasing GDP per capita over the period under review. These are Botswana, Equatorial Guinea, Mauritius and Namibia. All other countries show a low growth rate of GDP per capita.
- The GDP growth recorded in South Africa during the period under review is driven by the services sector accounting for 44.7% of GDP, industry 41.5% of GDP and Agriculture 13.8% of GDP. In Botswana, GDP growth is driven by its rich subsoil. Mauritius' GDP is driven by the financial services sector and tourism.
- Kenya and Uganda recorded GDP growth of 4.8% and 4.5% respectively in 2018. In Rwanda, growth remained stable at 6% during the period under review. The stable GDP growth in Rwanda is attributed to good governance and investment in research and development. Algeria shows a growing GDP during the period under review. The 2002, 2004 low GDP growth rate in Algeria is 1.40% in and 2003-2017 1.4% in apart 2018 from Algeria, Egypt also shows a growing GDP during the period under review. This strong growth of GDP noticed in Egypt during certain years can be justified by its potential in natural resources and mainly the exploitation of natural gas. On the other hand, the low GDP growth rate recorded in Egypt is 1.76% in 2011 against 5.31% in 2018.
- As for the Ivory Coast, it is recording GDP growth with positive signs. Indeed, the Ivorian economy is essentially based on the agricultural sector, which is favored by the hot and humid climate. The agricultural sector contributes 50% to the GDP of Cote d'Ivoire while the contribution of industry to the GDP is 20%. In 2002, Cote d'Ivoire experienced a recession favored by the fall in world commodity prices (coffee and cocoa) and aggravated by various factors, including the politico-military crisis triggered in 2002.

H4: Economic growth has a positive influence on trade openness.

- Demographic structure of the sixteen African countries



Graph 4. Evolution of the GDP of the sixteen African countries. Source: designed by the author from the WDI database and processed with stata 13.

Africa is the continent with the highest population growth (an annual growth rate of 2.5% compared to a rate of 1.12% worldwide) with a high proportion of young people. Fertility in Africa is between 6 and 7 children per woman (Gabon and CAR are exceptions with an index of 5.4). The generalized economic crisis in Africa multiplies the number of young people left behind street children and child soldiers (Tabutin & Schoumaker, 2005). Graph 5 shows the evolution of the rural population as a percentage of the total population of African economies.

Looking at this graph, the results show that:

- Algeria shows a growing rural population curve throughout the period under consideration. The fertility rate in rural areas is increasing significantly and regularly. This explosion in births can be explained by the improvement in living conditions, in particular better access to housing, more jobs and the improvement in the security situation following the end of the war (Breil, 2020).
- Botswana has a specific demography characterized by a mortality rate higher than the birth rate, i.e. 21.9% against 20.7%. It is only in the past that 2016 this country has experienced a 1.19% growth in its population. This under population of Botswana can be explained by the low life expectancy and the predominance of HIV (about 20% of the population affected by this disease) and the high rate of migration (4.5%).
- In Cameroon, the population curve also shows an increasing curve throughout the period in question with a variation of 1.06% in 2018. In the Central African Republic, this curve is downward. The decrease in the rural population in the Central African Republic is justified by the civil wars that have ravaged certain regions and by the permanent insecurity in others, pushing the rural population to seek refuge and work in the capital Bangui. As a result, the capital, the only city of any size in the country, is facing a large influx of

people². Other countries such as Côte d'Ivoire, Egypt and Uganda show an increasing rural population trend over the period. Gabon and South Africa have a low percentage of rural population. In South Africa, the change in rural population over the period is less than 1. In 2018, the rural population change is 0.77% and in Gabon it is 0.44%. Libya, Kenya, Rwanda and Ghana show a curve with a constant evolution varying between 0 and 1% during the whole period concerned. Equatorial Guinea, Namibia and Mauritius show an upward curve reflecting the growth of the rural population.

H5: The rural population has a positive impact on trade openness.

- Imports and exports of the sixteen African countries

Export diversification can accelerate economic growth in a sustainable way. The majority of Africa's exports are unprocessed goods. More diversified export baskets are associated with higher growth rates. The introduction of new products into export markets is strongly correlated with long-term cumulative growth in GDP per capita (Klinger & Lederman, 2004), (Rieländer & Traoré, 2016). **Graph** 6 shows the evolution of imports added to exports relative to GDP in the economies of the African countries concerned.

The graph shows that:

Most of the African countries considered are not very open to the rest of the world. This is the case of Rwanda, Mauritius, Ghana, Kenya, Libya, the Central African Republic, Cameroon, etc. In Rwanda, for example, beyond its dependence on international aid, the problem of being landlocked hinders its commercial



Graph 5. Evolution of the rural population of the sixteen African countries. Source: designed by the author from the WDI database and processed with stata 13.0.



 $2002 \ 2003 \ 2004 \ 2005 \ 2006 \ 2007 \ 2008 \ 2009 \ 2010 \ 2011 \ 2012 \ 2013 \ 2014 \ 2015 \ 2016 \ 2017 \ 2018$



Graph 6. Level of trade openness of the sixteen African countries. Source: designed by the author from the WDI database and processed with stata 13.0.

²Grraeme vileret, population data.net.

openness. This country has no access to the sea and therefore no port. Equatorial Guinea has a better position in terms of trade with the rest of the world, thanks in particular to exports of oil, methanol and some forestry products (exotic wood) and agricultural products (notably cocoa). These exports are facilitated by the ports of Malabo and Bata.

Egypt trades mainly with France and other countries along the Mediterranean Sea, but to a small extent. This participation in trade is largely due to the diversification of its economy invaded by the manufacturing sector (16%), the real estate and construction sector (15%), the wholesale and retail trade (13%), the extractive sector (12%), the agricultural sector, the forestry and fishing sector (11%). However, despite this potential, Egypt has a structural deficit that reflects a deficit in the hydrocarbon balance and dependence on imports of intermediate goods and consumer products. In Libya, on the other hand, the annual average opening rate for the period from to 1990 is 2018 11.13%. The change between the two periods is 158%, with the highest value in 2006 (45.26%) and the lowest in 2014 (-44.87%). This result is the result of the stability and openness of its economy, which is mainly based on mining resources.

Namibia exports fish to Spain, which accounts for 30% of its export earnings. It is the fourth largest mineral exporter in Africa and the fourth largest producer of uranium (9% of GDP). Diamond mining accounts for 13% of GDP and is Namibia's main source of revenue with 36% of exports. With an undiversified economy, Namibia is highly dependent on foreign trade and especially on the South African economy. The lack of diversification of its economy exposes it to fluctuations in commodity prices. South Africa, on the other hand, exports a lot to the southern states of the continent. This is the case for more than 50% of imports from Zimbabwe and the European Union (machinery, food products, equipment, chemicals and scientific instruments). The trade situation in Uganda remains precarious, particularly because of political instability, isolation and repeated wars in the Great Lakes region. Algeria also has a less diversified economy dependent on hydrocarbon revenues as the main source of income.

Botswana presents a model of economic success on the African continent with a democratic, stable, competent and uncorrupt administration. With a rich sub-soil, 80% of Botswana's exports come from diamonds and minerals. However, the economy is over-dependent on the mining sector and for the rest, the country relies on imports. Cameroon has a much diversified economy thanks to numerous multinational firms and national business groups. For this reason, there was some movement in trade towards 2008, even though for the whole of the period under consideration, the country recorded losses in terms of its trade balance.

H6: The sum of exports plus imports relative to GDP has a positive influence on digital financial inclusion in Africa.

- Monetary structure of the sixteen African countries

Over the past five years, inflation in Africa has risen to 10% from 7.5% and is expected to remain at about this level in 2017. Domestic supply-side factors,

drought, rising electricity prices and currency depreciation have been key factors. The economic literature shows that inflation negatively influences growth, in that higher prices lead to lower demand and hence supply. Therefore, the persistence of high volatility in inflation and economic activity leads to uncertainty. The monetary structure of the African countries covered by this study can be seen in **Graph 7**.

The results of this graph show that:

The majority of the countries under consideration have inflationary economies. However, the highest inflation is observed in Equatorial Guinea and Ghana. Since 2000, almost all the other countries have been able to control inflation thanks to the rehabilitation of infrastructure, increased exports and investments. In Algeria, monetary depreciation has increased the inflation rate from 3.5% to 3.9% between 2014 and 2015. This led to a budget deficit of 3% of gross GDP. In Egypt, inflation increased from 8.3% to 8.7% between 2014 and 2015 2016 due to a sharp depreciation of the currency and an increase in the approved electricity tariff. In Kenya, on the other hand, inflation was slowed down by lower oil prices and moderate increases in food prices. In Ghana, it increased from 13% to 18.1% between 2015 and 2016 as a result of rising fuel and service prices. In Côte d'Ivoire, it rose from 1.2% to 1.7% between and 2013-2014 due to the pegging of its currency to the euro (which largely helped curb imported inflation). In Equatorial 2013 Guinea, it is 8.2% due to lower world food and oil prices.

H7: The currency structure of African countries would have a mixed impact on trade openness.

This development above allows us to build the theoretical model of our study. **Figure 3** shows the structure linking the dependent variable to the different independent variables.

This diagram allows the analysis of the relationship between trade openness and the economic structure composed of exogenous variables. Despite the differences in the relationship between the independent variables and the dependent variable according to the theoretical approaches, they are commonly considered as explanatory factors of digital financial inclusion.





Graph 7. Evolution of the monetary structure of the sixteen African countries. Source: designed by the author from the WDI database and processed with stata 14.0.



Figure 3. Conceptualization of the research.

3. Methodology

The study sample consists of 16 African countries. These are mainly eight upper-middle-income countries, namely the Republic of South Africa, Algeria, Botswana, Gabon, Equatorial Guinea, Libya, Mauritius and Namibia, and eight low-income African countries, selected in pairs on the basis of African economic zones and data availability. These countries are the Central African Republic, Cameroon, Kenya, Rwanda, Cote d'Ivoire, Ghana, Uganda and Egypt. The communities selected are the EAC (East African Community), CEMAC (Central African Economic and Monetary Community), COMESSA (Common Market for Eastern and Southern Africa) and ECOWAS (Economic Community of West African States). The data used to test the hypotheses comes from the World Bank's World Development Indicators database 2018 and Findex 2018.

3.1. Specification of Model

To test our hypotheses, we used the model developed by Sarma and Pais (2011). This model considers the financial inclusion index as a dependent variable. Consequently, in the empirical model, the study specifies a dynamic log-linear equation of the financial inclusion index, which includes a dependent variable lagged by one period (Sarma & Pais, 2011). This model is presented as follows:

 $LnFI_{it} = \beta_0 + \gamma LnFI_{it-1} + \beta_1 LnY_{it-1} + \beta_2 LnC_{it-1} + \beta_3 LnM_{it-1} + \beta_4 Lnp_{it-1} + U_{it}$ (1)

In this estimation, (*FI*: Financial Inclusion Index) which represents the dependent variable, Y(GDP or gross domestic product), represents GDP per capita in constant US dollars, (*C*: Domestic credit to the private sector), represents the volume of total domestic credit taken by households and governments in financial institutions as a percentage of GDP, (*M*: Mobile phone subscriptions), represents mobile phone subscriptions (per 100 inhabitants), (*p*: rural population), represents the percentage of the rural population (as a % of the total population) and U_{it} is an error term that contains the country effect, (U_i), represents time specific fixed effects and $\varepsilon\varepsilon t$ represents random errors. Inspired by this model, our study considers the logarithm of trade openness as the dependent variable. Taking into account the variables retained earlier, our model is as follows:

$$LnOuvert_{it} = \beta_0 + \gamma LnOuvert_{it-1} + \beta_1 Y_{it-1} + \beta_2 C_{it-1} + \beta_3 T e_{it-1} + \beta_4 P_{it-1} + \beta_6 I f l_{it-1} + \beta_6 I D E_{it-1} + \beta_7 A T M s_{it-1} + U_{it}$$
(2)

In this model, (Open) represents trade openness and is considered the dependent variable; (ATM per 100.000 adults) is the variable that captures digital financial inclusion and is our variable of interest, (Y) which represents GDP per capita captured in constant US dollars, (C) represents the total volume of domestic credit extended to the private sectors by commercial banks as a percentage of GDP; (P) represents the percentage of the rural population captured as a % of the total population, (FDI) represents the flow of foreign direct investment captured in constant US dollars, (Te) represents the term of trade captured from the export and import price index, (Ifl), represents inflation captured from the price movements of goods and services as well as that of the currency. However, the population will be considered as an error term that contains the country effect (1), time fixed effects (2) and random error (3). = $u_i + \varepsilon_t + u_{it}$ which is assumed to be independently and identically distributed with zero mean and Σv_{it} variance 2; while u_i and v_{it} are as discussed above as in the reference model. The operationalization of these variables and the expected signs are presented in Table 1.

3.1.1. Presentation of the Panel Methodology

Panel data consist of a set of temporal observations on several statistical units (an individual, a company, a country, etc.). Since the number of observation periods for our study T[18] is greater than the number of individuals N[16], we will estimate the static panel instead of the dynamic panel. The static panel model is written as follows:

$$Y_{it} = x_{it}\beta + \varepsilon_{it} \tag{1}$$

Table 1. Operationalization of variables and sign of coefficients.

Variables	Measurement indicators	Sign
	Trade openness (dependent variable)	
Evolution ot the mon	Generalized Price Index (Murphy & Smith, 2015)	+/-
Digital financial	The number of automated adult 100.000 mobile money operators (ATMs) (Sarigul, 2020)	+
Rural population	Of the rural population (Chen & Ravallion, 2004)	+
GDP	Economic growth Njunguna, N., Armando, M., and Lydia N, (2016)	+
Exchange term	Ratio of export price indices to import price indices (Hérouville, 1975)	+
IDE	FDI flows (Thaalbi, 2013)	+
Financial development	Domestic credit to the private sector as a percentage of GDP (Levine, 2005)	+

Source: designed by the author based on the literature review.

where *Y* is the endogenous variable and *X* is the matrix of values of the explanatory variables. It is assumed that: ε_{it} is a centers random disturbance, $(\varepsilon_{it}) = 0$ $\forall i\varepsilon_{it}$, the variables x_{it} are independent of ε_{it} the explanatory variables are non-collinear.

1) Fixed effects model

The coefficients are assumed to be uniform across individuals except for the constant term:

$$y_{it} = \alpha_i + x_{it}\beta + \varepsilon_{it} \tag{2}$$

 α_i is the individual effect (constant over time but specific to each individual). It is called the specific effect of individual *i* and captures individual heterogeneity. The coefficients α_i are considered as fixed parameters to be estimated with the parameter β . The estimator defined on this model is called within. One can also include a non-linear time effect *rt* in the writing of the fixed effects model. The model then becomes:

$$y_{it} = \alpha_i + \tau_t + x_{it}\beta + \varepsilon_{it}$$
(3)

The estimator defined on this model is the Double Within.

2) The random effect model

The random effect model is written as follows:

$$y_{it} = x_{it}\beta + \varepsilon_{it} \tag{4}$$

is $\varepsilon_{ii} = \alpha_i + u_{ii}$; or α_i and u_{ii} are uncorrelated random disturbances. The error of the equation is composed of 2 parts: α_i individual effects and u_{ii} residual effects. Hence the name compound error model. In this model, α_i is considered as random, it is not a constant specific to each individual, but a perturbation specific to each individual. The estimator defined on this model is the generalized least squares (GLS).

3) Model without effects

In this model, α_i are assumed to be constant and equal. The model is written as

$$y_{it} = \alpha + x_{it}\beta + \varepsilon_{it} \tag{5}$$

This model is without specific effects and without random effects. The estimator defined is ordinary least squares (OLS).

3.1.2. Specification Tests on Panel Data

When considering panel data, the very first thing to check is the avec homogeneous or heterogeneous specification of the data generating process. From an econometric point of view, it amounts to testing the equality of the coefficients of the model studied in the individual dimension. From an economic point of view, the specification tests consist in determining whether we are entitled to assume that the theoretical model studied is perfectly identical for all individuals or, on the contrary, whether there are specificities specific to each individual. To test this specification, several tests can be carried out:

- The Fisher test which allows to choose between the fixed effects model and the model without effects.
- The Breusch and Paga (1980) test is a Lagrange multiplier test; it tests the random effects hypothesis. It is based on errors obtained by OLS.
- The Hausman (1978) is a general test that can be applied to many specification problems in econometrics. Its most common specification is the individual effects panel specification. It also allows to choose between fixed and random effects.

3.1.3. Stationarity with Panel Data

Unit root and co-integration tests on time series panel data are indeed more powerful than their analogues on individual time series in small samples. The use of panel data makes it possible to work on smaller samples (in the time dimension) by increasing the number of available data (in the individual dimension), thus reducing the probability of facing structural breaks and alleviating the problem of the low power of small sample tests. As Baltagi & Kao, (2001) note, non-stationary panel data econometrics aims to combine the "best of both worlds": the treatment of non-stationary series using time series methods is the increase in data and test power with the use of the individual dimension.

- Im, Pesaran and Shi test

The tests proposed by these authors respectively in (1997, 2002 and 2003) make it possible to respond to the criticisms levelled at Levin and Lin's test concerning the independence of the error terms in the individual dimension. Indeed, these authors were the first to develop a test allowing, under the alternative hypothesis, not only heterogeneity in the autoregressive root, but also heterogeneity in the presence of a unit root in the panel. These tests consider a model with individual effects and no deterministic trend. In the absence of autocorrelation of the residuals, this model is written: IPS model:

$$\Delta y_{i,t} = \vartheta_i + p_i y_{i,t-1} + \vartheta_{it}$$
(6)

The IPS test is a joint test of the null hypothesis of unit root ($\tilde{n}_i = 0$) and the absence of individual effects since under null hypothesis ($\dot{a}_i = 0$). SPI test:

$$H_0: n_i = 0, \forall i = 1, \dots, N$$
$$H_1 = \tilde{n}_i < 0, \forall i = 1, 2, \dots, N$$
$$\tilde{n}_i = 0 \quad \forall i = N_1 + 1, N_1 + 2, \dots, N$$

Under the alternative hypothesis, two types of individuals can coexist: individuals with a $i = 1, \dots, N$ for which the variable Y is staionary and individuals index $i = N_1 + 1, \dots, N$ for which the dynamics of the variable $y_{i,t}$ admits a unit root. The size N_1 of the set of stationary individuals is a priori unknown but verifies $0 < N_1 \le N$, since if $N_1 = 0$ then the null hypothesis is found. Thus, the first advantage of the IPS approach lies in taking into account the heterogeneity of the autoregressive root under alternative. But this is not the only advantage. The authors propose a very simple test statistic based on the average of the Dickey-Fuller or Augmented Dickey-Fuller statistics.

- Hadri (2000) stionarity test

Differs from the first generation unit root tests based on the null hypothesis of no stationarity, it is based on a null hypothesis of stationarity. It is a Lagrange multiplier test aimed at testing the null hypothesis of stationarity of y_i series for (i = 1, ..., N) against an alternative unit root hypothesis. To test the performance of his test, Hadri, (2000) conducted Monte Carlo simulations. The overall result is that the accuracy of the test is higher when T and N are sufficiently large. More specifically, the size of the test Z is close to the theoretical size of 5% for T > 25. As for the power, it appears that it increases with the value of λ for all T and N.

4. Results

The results of the descriptive statistics are presented in **Table 2**, showing the arithmetic means, geometric means, and coefficients of variation in percent, medians, minimums and maximums of the variables under study.

The results of the descriptive statistics show that, on average, there are about 100,000 automated 17 mobile money operators per 100,000 adults in the countries that make up the regions considered in this study. Despite the low representativeness of this average (1.96%), the maximum number that can be found in some countries such as Algeria or South Africa, estimated at about 72 automated mobile money operators per 100,000 adults, remains low. Indeed, between 2002 and 2018, digital technology grew by only about 2% despite the strong growth of the telephone sector. This reflects the reality of Africa in general and in particular the countries considered where digital technology is still rudimentary. This shows that digital finance is still underdeveloped in these countries and its progress remains slow.

Furthermore, credit to the private sector averages about 26% of GDP in the different countries. This shows that access to financial services is still low on average in the different countries. However, some countries have a well-developed

Variables	Obs	Mean	Geometric mean	Standard deviation	Min	Max
Lntrade	269	3.447541	1.96508	0.54788779	1.96054	4.491176
Lnfindev	272	2.968904	26.045	0.7840867	0.7647839	4.66889
LnATMs	225	2.049531	19.47058	1.482607	-3.223712	4.275906
LnExchangT	251	25.90863	1.79e+11	5.083739	0.8450869	29.90315
LnFID	263	0.6823487	1.97852	1.059462	-3.823234	3.323618
LnGDP	272	7.903712	3.31333	1.138722	5.811485	9.928809
LnEvolMon	239	1.779264	5.925492	1.007089	-1.719549	4.391415

Table 2. Results of descriptive statistics.

Source: Author's calculations based on Stata output 14.0.

financial sector. This is the case in Mauritius, where the ratio of credit to GDP for the private sector is 106.2%. Between 2002 and 2018, this sector represents a growth of about 19%, which is more or less acceptable compared to the growth rates in various African countries in general and the countries under consideration in particular. These results are in line with those found by CIE (2019) that the high rate of financial inclusion in Africa is attributed to Mauritius and South Africa. These two countries have the most advanced banking sector on the continent. As for the terms of trade, it shows an average of about 2 points in the different countries between 2002 and 2018. The import price index is higher than the export price index. In this context, there is a deterioration in the terms of trade of the various countries. The countries selected for this study show a deterioration in their terms of trade, but to different degrees. Some are experiencing a greater deterioration of up to 10 points. This shows that different countries are losing trade participation. Furthermore, between 2002 and 2018, these countries experienced a deterioration in their terms of trade of about 2 points, which leads to the conclusion that during this period they have moved from deficits to deficits in their trade balance. The net flow of foreign direct investment as a percentage of GDP is on average 3.003187% in all the countries considered. This means that these countries attract less foreign direct investment. This is in line with Africa in general, which attracts less foreign direct investment except in certain sectors such as mining and telecommunications. Indeed, growth for most African countries is strongly oriented towards the export of mineral materials. This can lead to a deterioration in the terms of trade of the exporting country. These results show that the evolution of FDI remains almost stagnant in the countries under study with an increase of about 2 points between 2002 and 2018. These results corroborate those of the (Group, 2016) showing that the increase in FDI points 2 for these countries is due to the return of peace in some countries of the region and to mining and oil exploitation in others. In terms of gross domestic product (GDP) per capita, the results indicate an average of US\$4654.406 across the countries. However, this does not reflect the reality of the study area and even of Africa in general. However, the realities between countries diverge enormously. While in some countries the GDP per capita can be as high as US\$1.000 20,512.94 per month, in others it may not even exceed half a thousand (US\$33.1146). However, what is interesting is the fact that these different countries under consideration have grown by about 3 percentage points on average between 2002 and 2018. For those countries that did not grow during the period under consideration, the Global Financial Development Report 2019/2020 (Bank, 2019) results show that it was instability and drought that held back growth. This is the case for East African countries and Egypt. The same results show that the consumer price index averages 7.141742 in all countries. This index is still more or less acceptable. However, this is the product of certain countries that have managed to control their inflation to the point of recording deflation, even to the point of -25.3128. On the other hand, the context is such that overall inflation

has increased. 2002 These 2018. Results are in line with those of the Bank (2018), which show that if inflation has reached 10% in Africa, it is mainly due to internal supply factors, the rise in electricity prices and the depreciation of currencies.

For the rural population, the results show that the average is about 88% in all these countries. This reflects the reality of African countries where the population is predominantly rural. However, it can be seen that the growth of the rural population has remained low between 2002 and 2018. It grew by only about two percentage points during the whole period under study. This situation can be justified by the fact that in Africa in general and specifically in the countries considered by this study, the majority of the rural population prefers to reside in urban centers either to seek employment or to escape insecurity and violence. Rural-urban migration thus reduces the growth of the rural population living in extreme poverty. The Bank (2018) justifies this decrease by the repeated conflicts and wars but also by the rural exodus and the high unemployment rate. This is in line with the results obtained by this study. The sum of imports and exports in relation to GDP represents around 36% of GDP on average in all the different countries. This finding implies that the transactions with the rest of the world for each country tend to be about half of the transactions that each country makes. This shows that these countries are moderately open to the rest of the world. However, some are more open than others. While in some years there are countries that have recorded no transactions with the rest of the world, others have dealt with the rest of the world at 89% of GDP, which is huge. Even more interesting is the increase between 2002 and 2018 of about 31 points. It is therefore the only variable to have recorded such a percentage during the period under study. The question that guides this work is whether this growth would not have effects on other variables such as the demand for digital finance which is necessary for foreign settlements. A priori, it is not possible to say. To answer this question, careful analyses are needed. These analyses are the subject of the next section.

Results of Specification Tests on Panel Data and Stationarity

When considering panel data, the very first thing to check is the homogeneous or heterogeneous specification of the data generating process, *i.e.* whether the coefficients of the model studied are equal in the individual dimension.

1) Results of specification tests on panel data

The Fisher test makes it possible to choose between the model with no effects (OLS estimator) and the model with fixed effects (Within estimator). The results are obtained by performing automatically estimate the parameters of the fixed effects model and are given in **Table 3**.

For the sixteen African countries considered in our study, the hypothesis of absence of effects is rejected at the 5% threshold because the probability associated with the Fisher statistic is equal to 0.0000%. This test therefore suggests the use of the within estimator (fixed-effects model) because it is more efficient

Table 3. Fisher test results.

Explained variable	Calculated value F	Prob. At 5% threshold	Decision
Commercial opening	40.27	0.0000	Fixed effects

Source: our own from stata estimates 14.0.

than the OLS estimator (model without effects). Breusch and Pagan (1980) proposed a Lagrange multiplier test to test the random effects hypothesis. This test is based on errors obtained by the ordinary least squares method. It allows to choose between the model without effects and the model with random effects. The results are given in Table 4.

Through these results, we reject the hypothesis of absence of effects at the 5% threshold. This is because the probability associated with the Breusch-Pagan statistic is equal to 0.0000%. This test therefore suggests the use of the between estimator (random effects model) because it is more efficient than the OLS estimator (no effects model). The Hausman statistic, under the null hypothesis of the presence of random effects, asymptotically follows (N tends to infinity) a Chi-square distribution with k degrees of freedom. The null hypothesis of the presence of random effects is not rejected if the Hausman statistic is lower than the critical value read from the Chi-square table. **Table 5** gives the results of this test.

The calculated Hausman value is 116.81 and an associated probability below the conventional 5% significance level. The null hypothesis of no correlation between the individual effects and the explanatory variable is therefore rejected. The fixed-effects model should therefore be preferred and the within estimator should be retained.

2) Results of the stationarity tests

Stationarity of the series helps to avoid biased results. The Levin, Lin and Chu, IPS and Perron tests are used to check the stationarity of the panel variables. **Table 6** gives the results of the level tests.

The results given in the table above show that six out of eight variables considered in this study are stationary. These are the logarithm of trade openness (LogTradeOpen), the number of money operators per 100,000 inhabitants (LogATMs), the logarithm of foreign exchange terms (LogTe), the logarithm of foreign direct investment flows (logIDE), the logarithm of gross domestic product (LogGDP) and the logarithm of the generalized price index (logInfl). On the other hand, the logarithms of domestic credits granted by commercial banks to the private sector and the logarithm of the rural population as a function of the total population (logDevfin) and (logPop) are non-stationary under the Perron (PP) and Levin-Lin-Chu (LCC) tests. To do this, we remove these two variables from our study model. Indeed, as the six variables retained are integrated of order (0), it is not necessary to proceed to any co-integration test.

3) Estimation of the specified models

Table 4. Results of the lagrange multiplier test (Breush and Pagan).

Khi-deux Breush and Pagan	Prob. At 5% threshold	Decision
116.81	0.0000	Fixed effects
	Khi-deux Breush and Pagan 116.81	Khi-deuxProb.Breush and PaganAt 5% threshold116.810.0000

Source: our own from stata estimates 14.0.

Table 5. The result of the Hausman test.

Explained variable	Hausman Chi-square	Prob. At 5% threshold	Decision
Commercial opening	116.81	0.0000	Fixed effects

Source: our own from stata estimates 14.0.

Table 6. Stationarity test result.

	Stationarity in Level				
Variables	Levin-Lin-Chu		Perron		Decisions
	Stat. IPS	Val reviews	Stat. Peron	Val. review	
Trade openness	0.5124	0.6958	0.6359	0.7367	I (0) Stationary
ATMS	-6.6046	0.0000*	-9.7938	0.0000*	I (0) Stationary
FinancDev	0.8530	0.8032	0.8199	0.7927	Non-stationary
Exchange term	-5.4877	0.0000*	-7.5375	0.0000*	I (0) Stationary
FID	-4.3362	0.0000*	-6.0506	0.0000*	I (0) Stationary
GDP	0.5133	0.6961	-0.0044	-04983	I (0) Stationary
Evolmon	-8.8724	0.0000*	-12.8759	0.0000*	I (0) Stationary
Poprur	9.8323	1.0000	2.5717	0.9937	Non-stationary

*, **, *** significant at 1%, 5% and 10% respectively. Source: our own from stata estimates 14.0.

The results of the specification tests showed that for the sixteen African countries the estimation should be fixed effects. The results of the fixed effects test are shown in **Table 7**.

Through these results, we accept the hypothesis of the nullity of time effects. Only the fixed effects are sufficient. The probability associated with the Fisher statistic (0.0000%) shows that the model is globally good. In addition, the R^2 within, which gives the share of intra-individual variability of the dependent variable explained by those of the explanatory variables, shows a value of this 0.0527 means that only 5.27% of the fluctuations in trade openness of the African countries under consideration are explained by the variables of the model. At the individual level, it appears that only the logarithm of GDP is positively

variables	Fixed effects
log Commercial opening	
(Coefficients) Std_Err (p > [t])	
	(-0.0062877)*
Ln automated mobile money operators	0.0159699
	(0.694)
	(0.0017781)*
Ln Exchange rate terms	0.0028428
	(0.533)
	(0.0251363)**
Ln Foreign Direct Investment	0.0197683
	(0.205)
	(-0.2371655)
Ln Gross Domestic Product	0.1252073
	(0.060)***
	(0.0270906)**
Ln Inflation	0.020393
	(0.186)
	(5.168734)
Cons_	0.9851962
	(0.0000)*
Nbr Obs	192
F-Stat	20.30
Prob F-Stat	0.0000
R-Sq Whithin	0.0527

Table 7. Estimation results for fixed effects models.

*, **, *** significant at 1%, 5% and 10% respectively. Source: our own from stata estimates 14.0.

and statistically significant at the 10% level. However, when analyzing the coefficient generated by the log (GDP), it turns out that this variable has a negative influence on trade openness. This means that when production decreases by 0.23%, the trade openness rate decreases by 1%, all other things being equal. Similarly, the use of digital finance also has a significantly negative influence on trade openness at the 1% threshold. This means that when the use of digital financial services by actors in the economy of the countries under consideration decreases by one point 1, the level of trade decreases by 0.6%. This proves that the use of digital financial services has a positive influence on trade between countries. The exchange rate variable has a significant positive influence on trade openness. Indeed, when the terms of exchange improve to 0.17%, the openness rate increases by 1%. Similarly, when foreign direct investment flows increase by 2.5%, trade openness improves by 1%. Finally, when the general price index improves, *i.e.* when these economies are deflated to 2.7%, there is an improvement in imports and exports relative to GDP of 1%.

4) Results of diagnostic tests on residues

These are the autocorrelation test and the heteroscedasticity test. The results of these tests are given in the following. Autocorrelation is a problem that is only relevant in the case of time series. The ρ -test is the simplest test to perform for the presence of autocorrelation. The procedure is as follows (Ouellet et al., 2005): recover the residuals of the regression to be tested; regress \hat{u}_i on \hat{u}_{i-1} at \hat{u}_{t-n} and X and test the joint significance of the coefficients of this regression by an F-test. The results of this test are given in Table 8.

- The autocorrelation test

The results in the table above show that the Fisher statistic is greater than the probability attached to it. Therefore, there is autocorrelation of the errors; it is therefore necessary that an autocorrelation correction is made for this model. **Table 9** gives the results of the correction.

Using the "xtpcse" command, we find that the Wald statistic is higher than the probability which is below the 5% threshold. As a result, we reject the hypothesis that the errors are correlated. The good thing is that when we analyze the results of the test that corrects for error autocorrelation, we find that only the logarithm of GDP per capita positively and statistically explains trade openness at the 1% level for those African countries considered in this study. However, all variables retained their predictive signs except for the logarithm of automated mobile money operators per 1000 inhabitants (-0.00644^*) meaning that when the use of digital financial services decreases by 1%, trade openness decreases by 0.64%; and the logarithm of foreign direct investment flows (-0.0048547^*) meaning that when FDI flows decrease by 1%, trade openness also decreases by 0.48%.

Table 8. Autocorrelation test results.

Fisher statistics	Prob > F	Decision
51.810	0.0000	autocorrelation

Source: our own from stata estimates 14.0.

Table 9. Results of error autocorrelation correction.

909.11 0.0000 Corrected autocorrelation	

Source: our own from stata estimates 14.0.

Previously, we hypothesized that these two variables should positively influence trade openness.

In the context of a heteroskedasticity test, the null hypothesis is that all coefficients of the squared residuals regression are zero, in short, there is homoscedasticity. The results summarized in **Table 10** shows that, for the model under study, the null hypothesis of homoscedasticity is rejected because the probability associated with the Chi2 statistic is less than 5%. It can therefore be concluded that heteroscedasticity is present, *i.e.* that the variance of the error, with respect to each equation, is not constant over time. It then becomes necessary to perform another test to try to obtain more information on the form of the heteroscedasticity. Modified Wald is a heteroskedasticity. It is essentially an F-test which, under the null hypothesis, assumes that the variance of the errors is the same for all individuals. The statistic follows a χ^2 distribution with degree of freedom N. **Table 11** gives the results of the modified Wald test.

Since the probability associated with the Wald statistic is less than 5%, the null hypothesis that the error variance is not constant is rejected. By accepting the alternative hypothesis, it is appropriate to conclude that the error variance is the same for all individuals. Since we had already concluded that heteroscedasticity is present in some form with the previous test, this rejection of the null hypothesis does not allow us to specify the structure of the heteroscedasticity further. We remain with the conclusion that there is heteroscedasticity for all i, t.

5) Policy implications of the results

Based on the analysis, our study concludes that digital financial inclusion has a negative and statistically significant impact on trade openness. These results are consistent with those of (Macmillan et al., 2016) who confirmed that the number of payment instruments in an economy creates inflation. These results corroborate with the reality of the evolution of imports and exports in the African countries presented in the stylized facts. Despite the high penetration of mobile phones and internet in these African countries, most of them have less diversified economies and are mostly landlocked and without access to the sea and ocean. Furthermore, the populations in these countries are numerically included but not

Table 10. Results of the likelihood-ratio test of heteroscedasticity of errors.

Wald chi-2	Probably.	Decision
121.32	0.0000	Non-homoscedastic

Source: our own from stata estimates 14.0.

Table 11. Results of the modified Wald test for inter-individual heteroscedasticity.

Wald chi-2	Probably.	Decision	
1719.68	0.0000	H1	

Source: our own from stata estimates 14.0.

financially for the most part. That is, they use the internet but not digital financial services. This significantly reduces exports and imports from these countries. This leads us to make the following recommendations:

For a more open economy, government strategies need to put technology investment issues at the heart of strategies and therefore make them a priority. They should diversify the tools in the use of digital finance to facilitate financial inclusion. They must work towards the creation of public-private partnerships between the banking sector, technological finance operators and the public authorities with a view to moving towards exports that value local raw materials. This would enable them to rehabilitate and create new industrial zones. The digital transfer of capital can radically change the structures of economies and thus accelerate growth.

Similarly, these countries need to build the technological capacity of local financial institutions (banks and other financial institutions) to enable them to carry out capital transfer operations using digital finance. This allows countries to compete with the rest of the world by increasing the flow of trade and thereby financial inclusion.

As inflation hinders or paralyses trade between countries, a deflationary policy must be implemented to restrict the volume of money held in virtual wallets, with the aim of restoring or maintaining the value of money. This is because, as the theory has shown previously, every time an electronic wallet is created, there is an automatic risk of inflation. It is also necessary to fight against imported inflation due to cost increases resulting from the rise in prices of imported goods, whether raw materials, semi-finished goods or finished products. This must be done by the institutions in charge of money management in collusion with the technology finance companies that regulate the price in relation to the use of digital finance. To reduce barriers to entry, governments need to deregulate the goods market by increasing competition. This should reduce prices and increase innovation and thus productivity. Indeed, by boosting factor productivity in the long run, this policy would reduce competitiveness gaps between countries as it would have the same effect on unit labor costs as a wage cut.

These countries need to address the problem of exchange rate depreciation. Indeed, when the exchange rate depreciates, the impact on the price of imported products, expressed in local currency, may be less than the change in the exchange rate. This is the case if part of the price increase is absorbed, for example, by a fall in the margins of intermediate (importing) companies. The depreciation of the exchange rate would reduce the use of digital finance. In this perspective, these countries need to apply the trade facilitation policy. This policy simplifies and lowers the costs of trade transactions. This makes trade activities more efficient, more predictable, and based on internationally accepted norms, standards and best practices. These practices should take into account the use of digital finance as a favorable means of transferring capital internationally to facilitate trade.

Finally, these countries must have good quality institutions. Indeed, theoretically, (Helpman, 2008); Acemoglu et al., (2001) and Rodrik et al., (2004) have stressed the importance of institutional quality and good governance in trade openness policy. They have shown that good quality institutions are conducive to open trade policy. For the African countries considered in this study to be open to trade, they must have strong institutions and good governance. The development of the financial sector in this country depends to a large extent on the quality of banking and financial institutions and governance.

5. Limitations and Future Prospects

Although the results of our study are satisfactory, they are not without their limitations. The first limitation of our study relates to the nature of the data used to make different estimates. Indeed, by using secondary data, it was difficult to capture the opinions of users of digital financial services on the real impact of digital financial inclusion on trade openness. To do so, we would have had to either use primary data to allow users to express their views, or use mixed data that includes both primary and secondary data. The second limitation is related to the size of the individuals (i) observed in our study. Our study considered 16 African countries, which does not represent half of the countries on the continent. Therefore, given the small size of the countries observed, we could not generalize our results to the entire African continent. In addition, the choice of this country did not follow any objective criteria, but was dictated by the availability of data for each country. Therefore, the use of primary data would be advantageous because it does not exclude some countries to the advantage of others; all countries will have the chance to be selected. Moreover, in the analyses, our study did not take into account all the explanatory variables of trade openness such as the languages spoken between the countries considered, the distances separating them, the mineral wealth, the religions.

However, these limitations do not diminish the scientific value of this study and, to this end, our results remain scientifically valid. Therefore, to address these limitations, we intend to conduct a future study on the impact of digital financial inclusion on trade openness in Africa by expanding the number of countries (all of Africa) and increasing the period of analysis. Also, in this study, the estimates will combine qualitative and quantitative data (primary and secondary) while making use of dynamic panel estimates. Similarly, it is possible to analyze the adoption of digital financial services among small, medium, and large firms in Africa with the aim of understanding how digital financial services make business easier for firms. Ultimately, we plan to conduct an impact study of the digital financial inclusion of banks on the behavior of their customers in Africa. This study will provide a clear understanding of the relationships between banks and their customers once they are financially and digitally included.

6. Conclusion

One of the objectives of this study, which covered a set of 16 African countries (8 low-income and 8 upper-middle-income), was to measure the effects of digital

financial inclusion on trade openness in these countries. Using the panel data specification, the Fisher test allowed us to retain fixed effects instead of the no-effects model and the random effects model. The within estimator (GCM) yielded a R² within of 0.527, which means that 5.27% of trade fluctuations in these African countries are explained by the explanatory variables of the model. On the other hand, the results of the estimation of fixed effects on all the variables of the model revealed only one variable that positively explains and statistically significant trade in these countries at the 10% level; this is the log of national output (logGDP/capita). Other variables, logATMs, log terms of trade (logTe), log foreign direct investment flows (logIDE) and log inflation (logIfl) influence significantly but not statistically the trade movements at the 1% threshold, for logATMs with a negative sign contrary to the predictive sign, logTe with the same positive sign predicted beforehand and at the 5% threshold for logIDE and log Inflation which has kept the same positive sign predicted beforehand. However, we do not believe that we have captured all the contours of this theme, particularly by considering all the necessary variables, given the unavailability of data either for certain countries or for all the countries under study. Despite this, this does not in any way diminish the quality of the results obtained. We therefore propose to return to this theme by using not only secondary data but also and above all primary data in order to understand the opinions of users of digital financial services. This will also allow us to integrate other elements and aspects of analysis not taken into account, especially by focusing on the financial inclusion index.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- Acemoglu, D., Johnson, S., & Robinson, J. A. (2001). The Colonial Origins of Comparative Development: An Empirical Investigation. *American Economic Review*, *91*, 1369-1401. https://doi.org/10.1257/aer.91.5.1369
- Adimi biaou, O. O., Balley, P. F., & Avoutou, M. (2020). Analysis of the Effects of Digital Development on Trade in UEMOA Countries. University of Parakou.
- Amsili, S., & Maussion, F. (2019). Usage d'internet dans le monde. Nouvelle Technologie.
- Baltagi, B. H., & Kao, C. (2001). Nonstationary Panels, Cointegration in Panels and Dynamic Panels: A Survey. In B. H. Baltagi, T. B. Fomby, & R. Carter Hill (Eds.), Nonstationary Panels, Panel Cointegration, and Dynamic Panels (Vol. 15, pp. 7-51). Emerald Group Publishing Limited. https://doi.org/10.1016/S0731-9053(00)15002-9
- Bank, W. (2018). *Poverty and Shared Prosperity 2018 : Piecing Together the Poverty Puzzle*. The World Bank.
- Bank, W. (2019). *Global Financial Development Report 2019/2020 : Bank Regulation and Supervision a Decade after the Global Financial Crisis.* The World Bank.
- Bank, W., & Group, W. B. (2013). Global Financial Development Report 2014 : Financial

Inclusion. World Bank Publications.

- Barbesino, P., Camerani, R., & Gaudino, A. (2005). Digital Finance in Europe: Competitive Dynamics and Online Behaviour. *Journal of Financial Services Marketing*, 9, 329-343. https://doi.org/10.1057/palgrave.fsm.4770164
- Beck, T., Feyen, E., Ize, A., & Moizeszowic, F. (2008). Benchmarking Financial Development. Policy Research Working Papers No. 4638, World Bank. https://doi.org/10.1596/1813-9450-4638
- Bilodeau, A. (2008). Immigrants' Voice through Protest Politics in Canada and Australia: Assessing the Impact of Pre-Migration Political Repression. *Journal of Ethnic and Migration Studies, 34*, 975-1002. <u>https://doi.org/10.1080/13691830802211281</u>
- Bilodeau, A., Galarneau, M., Fournier, M., & Potvin, L. (2011). L'Outil diagnostique de l'action en partenariat: Fondements, élaboration et validation. *Canadian Journal of Public Health*, *102*, 298-302. <u>https://doi.org/10.1007/BF03404054</u>
- Bonnieux, F., & Rainelli, P. (2003). The Transfer Technique in the Valuation of Non-Market Goods: An Application. *Revued Economie Regionale Urbaine*, 2, 187-208. https://doi.org/10.3917/reru.032.0187
- Bourdin, S., Thiec, A. L., & Elissalde, B. (2009). Le changement spatial dans l'industrie automobile en Europe centrale et orientale: Entre effets d'héritage, cycles de vie et transition. *Géocarrefour, 84,* 193-204.
- Breil, J. (2020). *Evolution de la population Algérienne. Estimations au milieu de l'année.* ONS.
- Breusch, T. S., & Pagan, A. R. (1980). The Lagrange Multiplier Test and Its Applications to Model Specification in Econometrics. *The Review of Economic Studies*, *47*, 239-253. https://doi.org/10.2307/2297111
- Bruno, E. (2016). Investissements directs étrangers et industrialisation de L'afrique: Un nouveau regard. *De Boeck Supérieur, 3*, 173-196. <u>https://doi.org/10.3917/inno.051.0173</u>
- Chen, S., & Ravallion, M. (2004). How Have the World's Poorest Fared since the Early 1980s? *The World Bank Research Observer, 19,* 141-169. https://doi.org/10.1093/wbro/lkh020
- CIE (2019). *Transformations numériques et diversificationéconomique en Afrique centrale: Enjeux, defis et opportunités.* Commission économique pour l'Afrique.
- Clarke, N. (2002). Job/Work Environment Factors Influencing Training Transfer within a Human Service Agency: Some Indicative Support for Baldwin and Ford's Transfer Climate Construct. *International Journal of Training and Development*, 6, 146-162. https://doi.org/10.1111/1468-2419.00156
- Cruces, G., Amarante, V., Ramírez, L., & Baez, M. J. (2020). Low Take-Up and Financial Inclusion: Experimental Evidence from Argentina's Cash Transfers. Partnership for Economic Policy Working Paper No. 2020-22, Social Science Research Network. https://doi.org/10.2139/ssrn.3717959
- Cuckler, G. A., Sisko, A. M., Poisal, J. A., Keehan, S. P., Smith, S. D., Madison, A. J., Wolfe, C. J., & Hardesty, J. C. (2018). National Health Expenditure Projections, 2017-26: Despite Uncertainty, Fundamentals Primarily Drive Spending Growth. *Health Affairs*, *37*, 482-492. https://doi.org/10.1377/hlthaff.2017.1655
- Demirgüç-Kunt, A., Klapper, L. F., Singer, D., & van Oudheusden, P. (2015). *The Global Findex Database 2014: Measuring Financial Inclusion around the World*. Policy Research Working Paper No. 7255, World Bank. <u>https://doi.org/10.1596/1813-9450-7255</u> https://papers.ssrn.com/abstract=2594973

- Demirguc-Kunt, A., Klapper, L., & Singer, D. (2014). P Van Oudheusden. *The Global Findex Database*, 2015.
- Demirkan, S., & Platt, H. (2009). Financial Status, Corporate Governance Quality, and the Likelihood of Managers Using Discretionary Accruals. Accounting Research Journal, 22, 93-117. <u>https://doi.org/10.1108/10309610910987475</u>
- Efendioglu, A. M., & Yip, V. F. (2004). Chinese Culture and E-Commerce: An Exploratory Study. *Interacting with Computers, 16,* 45-62. https://doi.org/10.1016/j.intcom.2003.11.004
- Feenstra, R., & Rose, A. (2000). The *Journal of International Economics* at Fifty: A Retrospective. *Journal of International Economics*, 50, 3-15. https://doi.org/10.1016/S0022-1996(99)00019-7
- Gomber, P., Koch, J. A., & Siering, M. (2017). Digital Finance and FinTech: Current Research and Future Research Directions. *Journal of Business Economics*, *87*, 537-580. <u>https://doi.org/10.1007/s11573-017-0852-x</u>
- Group, W. B. (2016). *World Development Report 2016 : Digital Dividends*. World Bank Publications.
- Hadri, K. (2000). Testing for Stationarity in Heterogeneous Panel Data. *The Econometrics Journal*, *3*, 148-161. <u>https://doi.org/10.1111/1368-423X.00043</u>
- Haoudi, A., & Rabhi, A. (2018). Les déterminants de de l'inclusion financière en Afrique: Évidence sur ladétention d'un compte courant. HAL.
- Hausman, J. A. (1978). Specification Tests in Econometrics. *Econometrica*, 46, 1251-1271. https://doi.org/10.2307/1913827
- Heckscher, E. F. (1919). Utrikeshandelns verkan på inkomstfördelningen. Några teoretiska grundlinjer. *Ekonomisktidskrift*, 1-32.
- Helpman, E. (2008). *Institutions and Economic Performance*. Harvard University Press. https://doi.org/10.4159/9780674038578
- Hérouville, H. (1975). Termes de l'échange des pays développés et des pays en voie de développement. *Economie et Statistique, 67*, 23-36. https://doi.org/10.3406/estat.1975.1722
- Jean-Yves, C.-L. (2001). Impact de l'ouverture commerciale sur la localisation industrielle au Mexique. *Revue Tiers Monde, 42,* 841-864. <u>https://doi.org/10.3406/tiers.2001.1552</u>
- Jones, P., Wynn, M., Hillier, D., & Comfort, D. (2017). The Sustainable Development Goals and Information and Communication Technologies. *Indonesian Journal of Sustainability Accounting and Management*, 1, 1-15. https://doi.org/10.28992/ijsam.vli1.22
- Kadid, A. (2015). Nouvelle Approche de Mesure de l'Ouverture Commerciale dans les Modèles de Gravite. *Revue académique de sétudes humaines et sociales, No. 13*, 9-18. https://doi.org/10.12816/0034533
- Kauffman, J. M., & Badar, J. (2014). Instruction, Not Inclusion, Should Be the Central Issue in Special Education: An Alternative View from the USA. *Journal of International Special Needs Education*, 17, 13-20. https://doi.org/10.9782/2159-4341-17.1.13
- Klinger, B., & Lederman, D. (2004). Discovery and Development: An Empirical Exploration of 'New' Products. Policy Research Working Paper No. 3450, World Bank. https://doi.org/10.1596/1813-9450-3450
- Kumar, K., & Muhota, K. (2012). Can Digital Footprints Lead to Greater Financial Inclusion? World Bank. <u>https://openknowledge.worldbank.org/handle/10986/9439</u>
- Labrousse, M., & Lapointe, M.-C. (2021). The Digital Book and Digital Practices: A State

of the Art. *Enjeux et société: Approches transdisciplinaires, 8*, 200-219. https://doi.org/10.7202/1076541ar

- Lemoine, M., Madies, P., & Madies, T. (2016). *Les grandes questions d'économie et des finances internationales.* De Boeck.
- Levine, R. (2005). Finance and Growth: Theory and Evidence. In P. Aghion, & S. Durlauf (Eds.), *Handbook of Economic Growth* (Vol. 1, pp. 865-934). Elsevier. https://doi.org/10.1016/S1574-0684(05)01012-9
- Licoppe, C. (2009). *Evolution des cultures numériques: De la mutation du lien social à l'organisation du travail.* Fyp.
- Liu, L., & Nath, H. K. (2013). Information and Communications Technology and Trade in Emerging Market Economies. *Emerging Markets Finance and Trade, 49*, 67-87. https://doi.org/10.2753/REE1540-496X490605
- Löber, K., & Houben, A. (2018). *Committee on Payments and Market Infrastructures Markets Committee*.
- Macmillan, R., Paelo, A., & Paremoer, T. (2016). The "Evolution" of Regulation in Uganda's Mobile Money Sector. *The African Journal of Information and Communication*, 2016, 89-110. https://doi.org/10.23962/10539/21627
- Makoni, P. L. (2015). Foreign Direct Investment—The Case of Botswana. Acta Universitatis Danubius, ØEconomica, 11, 160-173.
- Manyika, J., Lund, S., Singer, M., White, O., & Berry, C. (2016). Digital Finance for All: Powering Inclusive Growth in Emerging Economies. McKinsey Global Institute.
- Moroney, J. R., & Walker, J. M. (1966). A Regional Test of the Heckscher-Ohlin Hypothesis. *Journal of Political Economy*, 74, 573-586. https://doi.org/10.1086/259221
- Murphy, R., & Smith, T. (2015). *Aggregate Demand Shortfalls and Economic Institutions*. SSRN Scholarly Paper ID: 2680477, Social Science Research Network. <u>https://doi.org/10.2139/ssrn.2680477</u>
- Njunguna, N., Armando, M., & Lydia, N. (2016). *Les dividendes de la révolution numériques*. Finances et Développement.
- Osagie, R. O., & Okafor, C. J. (2015). Relationship between Human Resources Management Variables and the Academic Performance of Students in Secondary Schools in Egor Local Government Area, Edo State, Nigeria. *Journal of Educational and Social Research*, 5, 323. https://doi.org/10.5901/jesr.2015.v5n1p323
- Ouellet, E., Belley-Ferris, I., & Leblond, S. (2005). *Applied Econometrics Guide for Stata for ECN and 3950FAS3900.* University of Montreal.
- Ozili, P. K. (2018). Impact of Digital Finance on Financial Inclusion and Stability. *Borsa Istanbul Review, 18,* 329-340. https://doi.org/10.1016/j.bir.2017.12.003
- Quinlan, J. P., & Hamilton, D. S. (2004). *Drift or Rapprochement? The Pre-Eminence of the Transatlantic Economy*. Robert Schuman Foundation.
- Rallet, A., & Torre, A. (2001). Proximité géographique ou proximité organisationnelle ? Une analyse spatiale des coopérations technologiques dans les réseaux localisés d'innovation. Économie appliquée: Archives de l'Institut de science économique appliquée, 54, 147.

Ricardo, D. (2007). Les avantages comparatifs. Sociétal, 58, 103-110.

Rieländer, J., & Traoré, B. (2016). Explaining Diversification in Exports across Higher Manufacturing Content: What Is the Role of Commodities? *Journal of International Commerce, Economics and Policy, 7*, Article ID: 16500071. https://doi.org/10.1142/S1793993316500071 http://www.worldscientific.com/doi/abs/10.1142/S1793993316500071

- Rodrik, D., Subramanian, A., & Trebbi, F. (2004). Institutions Rule: The Primacy of Institutions over Geography and Integration in Economic Development. *Journal of Economic Growth*, 9, 131-165. <u>https://doi.org/10.1023/B:JOEG.0000031425.72248.85</u>
- Sarigul, H. (2020). The Determining Factors of Financial Inclusion in Turkey. *Journal of Economics Finance and Accounting*, 7, 223-235. https://doi.org/10.17261/Pressacademia.2020.1290
- Sarma, M., & Pais, J. (2011). Financial inclusion and development. *Journal of Interna*tional Development, 23, 613-628. <u>https://doi.org/10.1002/jid.1698</u>
- Shankar, V., Inman, J. J., Mantrala, M., Kelley, E., & Rizley, R. (2011). Innovations in Shopper Marketing: Current Insights and Future Research Issues. *Journal of Retailing*, 87, S29-S42. https://doi.org/10.1016/j.jretai.2011.04.007
- Smith, A. (1776). An Inquiry into the Nature and Causes of the Wealth of Nations: Volume One. https://era.ed.ac.uk/handle/1842/1455
- Tabutin, D., & Schoumaker, B. (2005). La démographie du monde arabe et du Moyen-Orient des années 1950 aux années 2000. Synthèse des changements et bilan statistique. *Population, 60,* 609-724. <u>https://doi.org/10.3917/popu.505.0611</u>
- Tang, Y.-Y., Ma, Y., Wang, J., Fan, Y., Feng, S., Lu, Q., Yu, Q., Sui, D., Rothbart, M. K., Fan, M., & Posner, M. I. (2007). Short-Term Meditation Training Improves Attention and Self-Regulation. *Proceedings of the National Academy of Sciences, 104*, 17152-17156. https://doi.org/10.1073/pnas.0707678104
- Thaalbi, I. (2013). *Déterminants et impacts des IDE sur la croissance économique en Tunisie*. PhD Thesis, Strasbourg.
- Trépant, I. (2008). Pays émergents et nouvel équilibre des forces. Courrier hebdomadaire du CRISP, 6-7, 6-54. https://doi.org/10.3917/cris.1991.0006