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Mapping Blended Finance and Green Venture Capital in African Entrepreneurial Ecosystems

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Abstract

This study investigates the impact of blended finance investments and green venture capital on improving entrepreneurial ecosystems in African countries. The primary aim is to understand the relationship between development finance for sustainable development and entrepreneurial ecosystems in developing countries, highlighting the particular mechanisms and dynamics different from those in the Western world. This research conducts a comprehensive quantitative analysis using the latest available data. Using a sample of 27 countries in Africa, three hypotheses are used to test how blended finance investments are distributed, what is their long term relationship with entrepreneurial ecosystems, and whether there is a interaction effect between green venture capital and blended finance. The findings indicate a positive and significant relationship between blended finance and the quality of entrepreneurial ecosystems. Conversely, the effect of green venture capital activity on entrepreneurial ecosystems remains unclear. These results suggest that targeted financial investments can enhance entrepreneurial ecosystems while promoting sustainable development. However, they also highlight the need for a more holistic approach, particularly focused on riskier and less developed countries. For practitioners and policymakers, these findings underscore the importance of strategic co-investment and supportive policies to foster favorable conditions for entrepreneurship, entrepreneurial and development finance across Africa.

JEL codes: L26, O16, O55, P33, R11

Keywords
Entrepreneurial Ecosystems
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Table of Contents

1. Introduction

In the last two decades, the concept of entrepreneurial ecosystems (EE) has become increasingly important both for policy and practitioners (Acs et al., 2017; Cao & Shi, 2021; Wurth et al., 2022) and it represents the most accepted framework to understand and strengthen entrepreneurship in a territory (Audretsch et al., 2024). At the same time, entrepreneurship scholars recognized the role of entrepreneurship in fighting poverty especially in emerging economies, shifting away from the notion of the developing world as a potential market for firms from mature economies to increase their returns, and more toward a notion of entrepreneurship as a mean for people in poverty to change their situation and leverage underserved markets (Bruton et al., 2013). Moreover, entrepreneurship has the potential to serve as one of the driving forces behind the tackling of the numerous global challenges that affect our world, particularly the sustainability ones captured by the UN sustainable development goals (SDGs) (Apostolopoulos et al., 2018). Promoting entrepreneurship can be seen as one of the possible approaches to tackle development problems such as youth unemployment, poverty, and inequality (Nkontwana & Stam, 2023), with some development economists claiming that private-led economic growth is the only solution to endemic poverty in some regions of the world such as sub-Saharan Africa (Kuada, 2021). Still, there has not been enough attention so far in the academic world in trying to understand the link between EEs and sustainable development (Audretsch et al., 2024). Simultaneously, the great majority of the research conducted on EEs and entrepreneurship is focused on developed countries, particularly in the Western world, such as North America and Europe (Cao & Shi, 2021), to the point that entrepreneurship in developing countries is considered one of the most neglected, and yet crucial global economic phenomena (Lingelbach et al., 2005). For these reasons, better understanding EEs' links with sustainable development in emerging countries is critical to all the stakeholders involved to move toward policies and practices that allow faster and more efficient value creation beneficial for the entire ecosystem and beyond.

Another crucial aspect deeply embedded into the EEs framework, particularly concerning developing nations and entrepreneurship, is the accessibility to financial resources. Arguably, the financial resource gap is one of the leading factors in explaining start-up failure rates among emerging economies (Sheriff & Muffatto, 2015), and this is highly related to the fact that the primary sources of financing for entrepreneurs in these geographies are private savings and retained profits (Adly, 2014), contrary to the mainstream fundraising sources in the western world such as angel investors, venture capital (VC), bank business credit and new sources like crowdfunding. The cause for this disparity in funding options between development and developing nations is due to two main factors, on the one hand, more sophisticated investors such as venture capitalists are still in the embryonal phase of their existence, while on the other hand, institutional credit is very limited due to institutional voids (Cao & Shi, 2021). Simultaneously, when considering the sustainable development aspect of access to finance, financial development is thought to be responsible for helping the poorest segments of the population to increase their income and alleviate inequality (Beck et al., 2007). For these reasons, adopting the sustainable

development lens when considering the entrepreneurial finance aspect of EEs is crucial to bringing knowledge forward in the field, especially when investigating EEs in the less developed part of the world. Even more, because the EE framework has been crafted to overcome the Silicon Valley model of entrepreneurship, with its pervasive focus on financial value creation and the three key elements of venture capital, radical technological innovation, and rapid business growth (Audretsch, 2021; Nkontwana & Stam, 2023), and not to reinforce it. It is highly plausible that applying this model to the investigation of developing countries and their EEs would not substantially contribute to the existing body of knowledge in the field. The attention to the finance element of EEs is just the first step toward a more nuanced understanding of how ecosystems, especially in developing countries, can and should tackle sustainable development challenges.

The study of entrepreneurial ecosystems and access to finance in developing countries should be conducted from a sustainable development point of view, delving deeper into diverse sources of development finance and their relations with EEs. One reason for this is that finance is a crucial ingredient in EEs, that not only brings funds much needed for start-up survival and growth but also provides resources usually associated with a service firm such as mentorship, advice, and connections (Clayton et al., 2023). In this context, two important sources of finance that both individually and in conjunction, can significantly impact EEs' quality and evolution, while closing the financial resources gap of developing countries are national and international Development Financial Institutions (DFIs) and Green (or climate) Venture Capital. DFIs are specialized development banks established to contribute to private sector growth in developing countries (Hehenberger, 2022). They mostly do so through the approach of blended finance for sustainable development, defined as "the use of catalytic capital from public or philanthropic sources to increase private sector investment in developing countries to realize the Sustainable Development Goals (SDGs)." (Convergence, 2023; p. 6). On the other hand, green venture capital, a sub-segment of impact investing that is defined as investments made with the aim of producing tangible social and environmental benefits alongside financial profits (Global Impact Investing Network, 2023), is a form of high-risk investments for eco-innovative ventures that produce both sustainable development and financial returns (Randjelovic et al., 2003)

In the literature, the focus on entrepreneurial ecosystems in developing countries has been growing in the last decade (Atiase et al., 2017; Baldin, 2023; Barnard et al., 2017; Cao & Shi, 2021; Guerrero et al., 2021; Sheriff & Muffatto, 2015), but it is still lagging vis-à-vis the attention that the Western world is receiving. One possible reason may be the lack of available data to make comprehensive studies (Cao & Shi, 2021). At the same time, the literature about EEs has not placed extensive relevance on the finance element of the ecosystem, at first including it within the general ecosystem resources (Frimanslund et al., 2023; Spigel, 2017), and only later recognizing it as one of the 10 elements of the ecosystem (Stam & Van De Ven, 2021). The great majority of the studies that investigated finance within the context of EEs did so focusing Western economies and venture capital in general (Bonini & Capizzi, 2019; Clayton et al., 2023), sometimes distinguishing

between public or private VC (Vogelaar & Stam, 2021). As with the focus on developing countries, in recent years there has been increasing attention of scholars on EEs and sustainable development (Theodoraki et al., 2022; Volkmann et al., 2021), with studies that focused on how particular elements of the ecosystem foster sustainability, such as social capital or entrepreneurial support organizations (Theodoraki et al., 2018; Van Rijnsoever, 2022), and more recently Nkontwana & Stam (2023) employing a development as outcome approach to study EEs in Africa. On the other hand, the academic literature on entrepreneurial finance, particularly VC, has also in recent years moved more toward sustainable development and developing economies, with studies focused on the determinants of venture capitalists' investments in emerging markets (Divakaran et al., 2014; Groh & Wallmeroth, 2016), and others focusing on the connection between venture capital and sustainable growth (Bocken, 2015; Dhayal et al., 2023; Maiti, 2022). Concerning blended finance and DFIs, academic literature has not given much attention to this approach and how it could fit in the broader picture of EEs or sustainable development in general. The bulk of the investigation into this topic has been done by practitioners or policymakers (Attridge & Engen, 2019; Havemann et al., 2022; Xu et al., 2019).

The importance of sustainable development in developing countries, the crucial role that entrepreneurial ecosystems play in achieving these goals, and the key contribution of development finance, inevitably lead to the need to understand better how these concepts relate together. This study aims to explain what is the effect of development finance for sustainable development, in the form of blended finance and GVC, on entrepreneurial ecosystems in developing countries. The results will give valuable insights into how concessional and non-concessional investments toward sustainable development affect the ecosystems' quality. To do so, the study poses the following research question:

RQ: What is the relationship between blended finance for sustainable development, green venture capital activity, and the entrepreneurial ecosystems across African countries?

To be able to distinguish individual effects as clearly as possible, two sub-questions are formulated:

1: How is blended finance distributed and how does it relate to the quality EE across African countries?

2: Are there any interactive effects between blended finance and GVC activity in their relationships with EE in African countries?

By answering these research questions, this paper aims to contribute to the literature on entrepreneurial ecosystems in developing countries (Atiase et al., 2017; Cao & Shi, 2021; Manimala et al., 2020) by trying to give new perspectives on how the context of EEs matters for

their dynamics, adding some indispensable new perspectives from outside the Western world. Moreover, this study adds to the growing literature on EEs and sustainable development (Audretsch et al., 2024; Nkontwana & Stam, 2023). Secondly, this research endeavor contributes to the entrepreneurial finance literature (Bocken, 2015; Clayton et al., 2023; Frimanslund et al., 2023) by taking the first steps to fill the gap and confusion in its relationship with EEs (Cao & Shi, 2021). This is accomplished by further deepening the knowledge of sustainable finance's role in emerging economies and in stimulating entrepreneurship (Bocken, 2015). From a policy point of view, this research will help policymakers and practitioners from the private and public sectors to better understand their role within the ecosystem and it will help the formulation of more effective strategies to tackle SDGs while improving EEs and reducing the risk of offering misguided policy recommendations that are both expensive and merely symptomatic (Cao & Shi, 2021).

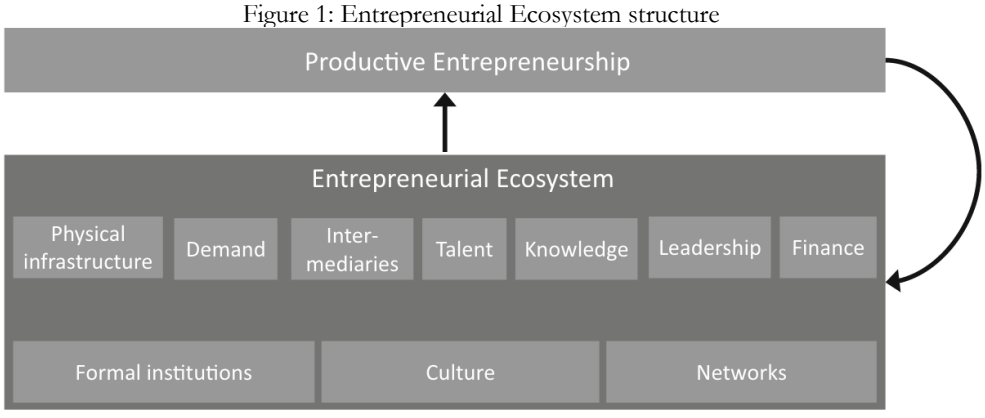
The paper develops as follows: first, an in-depth literature review on entrepreneurial ecosystems and finance in EEs is conducted to set the stage for the entire investigation. This will serve as a basis to develop a theoretical framework adequate for the study. Section 3 will delve deeper into the methodology, describing the data collection methods and sampling strategies that are at the foundation for the empirical strategy. In section 4, the results of the analysis will be laid out, followed in section 5 by a detailed discussion of the findings. Section 6 concludes with implications for theory and practice and suggestions for further research.

2. Literature Review and Theoretical Framework

2.1 Entrepreneurial Ecosystems, Developing Countries and Sustainable Development

The framework of entrepreneurial ecosystems has its roots in the works of Feld (2020) and Isenberg (2010) and has since been adopted by various institutional organizations (Wurth et al., 2022). Stam & Van De Ven (2021), Spigel (2018) and Wurth et al., (2023) conceive an EE as all the elements that promote and foster productive entrepreneurship within a territory. As such, it is not something material, but rather an abstract idea that represents a real-world phenomenon (Wurth et al., 2023). Although the first characterization of an ecosystem was limited to 6 elements, namely

Figure 1: Entrepreneurial Ecosystem structure



policy, finance, culture, supports, human capital, and markets (Isenberg, 2010), later the model evolved to comprise 10 elements, divided into resource endowments, institutional arrangements,

and outputs (Figure 1). Resource endowments are captured by seven elements, which are physical infrastructure, demand, intermediaries, talent, knowledge leadership, and finance, while the institutional arrangements are captured by formal institutions, culture, and networks, finally, the output consists of productive entrepreneurship (Stam & Van De Ven, 2021). Within and among entrepreneurial ecosystems, there are five mechanisms at play: 1. Interdependencies between elements; 2. The connection between elements and the output; 3. Socio-economic development; 4. Feedback mechanism or downward causation; 5. Relationships between different EEs (Wurth et al., 2023).

The geographical aspect of entrepreneurial ecosystems has led academic literature to concentrate primarily on the Western developed world (Cao & Shi, 2021). However, different studies lately tried to fill the gap and analyze EEs in developing countries, finding the model developed on top of developed economies may not be easily applied to developing countries (Cao & Shi, 2021). Manimala et al. (2020) review of EEs in developing countries highlights shortcomings, such as underdeveloped institutions, inadequate governance, and limited funding options, emphasizing interventions in learning and education systems as the most powerful means to address these shortcomings. Cao & Shi (2021) proposed three main aspects that distinguish EEs in developing economies, these are institutional voids, resource scarcities, and structural gaps. They highlighted how some dynamics are different from the developed world, and that for these reasons some elements may have different roles in distinct geographies, for example, the absence of efficient networks with resource providers can impede the access and mobilization of resources. Therefore, as resource constraints for ventures in developed economies are more prominent, resource acquisition is more important for ventures operating in these countries than those in mature economies (Cao & Shi, 2021). Similarly, Atiase et al. (2017) investigates the impact of critical resources – such as credit, electricity, contract enforcement, and political governance – on entrepreneurship quality in Africa, finding the need for improved financial inclusion and more effective contract enforcement. Sheriff & Muffatto (2015) investigate how EE theory could improve policies to foster entrepreneurship in Africa and found that entrepreneurs are omnipresent, only the entrepreneurship ecosystem accounts for the differences in entrepreneurial economic growth. Finally, some studies investigated specific EEs at the country level in the developing world (Abate & Sheferaw, 2023; Arabi & Abdalla, 2020; Barnard et al., 2017; Makara et al., 2023).

Another important lens when considering entrepreneurial ecosystems is the type of output and outcome they can produce, particularly sustainability and sustainable development. This domain in the theory has gained more relevance in recent years. Cohen (2006, p.3) was the first to define a sustainable EEs as “an interconnected group of actors in a local geographic community committed to sustainable development through the support and facilitation of new sustainable ventures.”. Recently, more studies tried to shed new light on this concept and how it can potentially fill the gap between EEs theory and the UN SDGs (Theodoraki et al., 2022). For example, Tiba et al. (2020) investigated the difference in the share of sustainability start-ups among different EEs,

finding that most successful start-ups within an EE, often referred to as "lighthouses" play a significant influence in shaping the cultural, social, and material characteristics of that ecosystem. Focusing more on the particular elements of the ecosystems and sustainability, Van Rijnsoever (2022) investigated what is the effect of entrepreneurial support organizations' (ESOs) mechanisms and admission regimes on the number of investments in sustainable development organizations. The study highlights the crucial role of the financial support network in EEs and shows that without ESOs, the presence of such sustainable development startups negatively affects the ecosystem owing to a loss of brokering in the financial support network. More recently, Audretsch et al. (2024) tried to link the framework of EEs with sustainable development, highlighting how the relationship between the two is still understudied and tried to understand whether EEs foster sustainable development. The paper shows how the few studies on this relationship do not imply causality or feedback loops between the variables and propose sustainable EEs as the main framework to connect EEs with sustainable development. Their inquiry concluded that the gap between the two concepts is still too large to deduce whether EEs foster sustainable development.

This review of the current literature highlights how crucial it is to study entrepreneurial ecosystems in developing countries to comprehensively understand their dynamics and potential contributions to sustainable development. These ecosystems present unique challenges, such as institutional voids and resource scarcities which require tailored interventions to foster economic growth and sustainability. Moreover, by investigating the role of EEs in these contexts, it is possible to identify effective strategies to promote entrepreneurship that in turn fosters sustainable development.

2.2 Finance and Sustainable Development

The finance factor in the entrepreneurial ecosystems framework has been defined as "the supply and accessibility" of funding to new and small firms (Stam, 2018; Stam & Van De Ven, 2021). Despite the fundamental importance of financial access for firm formation and overall entrepreneurial performance, the focus on the finance element in the EE literature is scarce (Frimanslund et al., 2023). The relevance of entrepreneurial finance within the context of the ecosystems is due to the fact that it is a factor with great influence on the entire ecosystem because it not only allocates financial resources, but brings about mentorship, connections, and suggestions to individual firms (Clayton et al., 2023). At the same time, ecosystems that manage to draw meaningful attention from investors reach a buzz status that in turn allows them to attract even more finance, creating a positive self-reinforcing cycle associated with prosperous areas (Munari & Toschi, 2015). And finally, when a firm in a region secures funding, it also serves as a signal to aspiring entrepreneurs, stimulating new firm entries (Clayton et al., 2023).

The literature on EEs in developing countries found the finance factor to be one of the most problematic for the ecosystems in those geographies. When studying ecosystems' differences

between developed and developing countries, Guerrero et al. (2021) noticed the lack of heterogeneous private and public investors as one of the most important weaknesses of ecosystems in emerging economies. Similarly, Cao & Shi (2021) highlighted finance as one of the crucial resources, alongside human capital, knowledge, and physical infrastructure, the absence of which hinders entrepreneurial activities. Despite these findings, literature and academic interest to better understand the role of finance in developing countries EEs are still lagging behind. On the contrary, the relationship between finance and EEs in the developed Western world has received more attention and depth, but still not enough (Frimanslund et al., 2023). Clayton et al. (2023) investigated how three finance sources, namely state, national, and VC funding, influence firm survival rates and how they interact based on the stage of the ecosystem in the Research Triangle region of North Carolina. The study found out that during the nascent stage, VC investments into start-ups were highly related to prior state funding, the latter serving as signals, and that all the sources of finance had a low impact on firm survival. In the accelerated growth stage, finance sources were associated with a higher impact on firm survival rates and a lower reliance on signals for VC. In the later stabilization stage, finance sources had the greatest impact on firms' survival, and government funding had an increased influence.

Not only the literature about finance in entrepreneurial ecosystems is skewed toward developed economies, but its attention toward finance's role in promoting sustainable development is almost non-existent. As pointed out by Elf & Owen (2023), not enough attention has been given to finance factor as a fundamental enabler of EEs that promote entrepreneurship toward sustainable development, especially in emerging economies. This is probably the case because so far the concept of entrepreneurial finance has been seen in a restricted sense, measuring it as VC, the share of small firms that applied for banking finance, ease of access to loans, or crowdfunding (Stam, 2018; Stam & Van De Ven, 2021). However, in parts of the developing world such as Africa, EEs may benefit from other and diverse sources of finance that can have a greater impact on the entire ecosystem and its orientation toward sustainable development. In this context, it is important to focus on blended finance. This structuring approach mobilizes development and private finance, serving as a key strategy to fund sustainable development and achieve the SDGs. (Attridge & Engen, 2019).

The OECD & WEF (2015; p.3) defines blended finance as 'the strategic use of development finance and philanthropic funds to mobilize private capital flows to emerging and frontier markets' and has three main characteristics: 1. Leveraging the use of development finance to crowd in private investors; 2. Impact, or producing sustainable development; 3. Produce market returns that can satisfy private capital allocators. This definition is really similar to the one provided by Convergence (2023), which explain further these three characteristics. First, blended finance transactions contributes to achieving SDGs, even though not every party in the deals has to have impact or development objective. Secondly, the transaction must yield positive returns, but different parties in the capital structure can have very different return expectations, including

concessional. Finally, development and philanthropic parties in a transaction are catalytic, meaning they are willing to take on more risks and accepting lower returns.

Following Convergence (2023), the four most common structures for blended finance transactions are the following: 1. To lower the cost of capital and increasing the protection of private investors in the transaction, within the capital structure public or philanthropic investors provide funds at terms that are below market-rate; 2. public or philanthropic investors provide credit enhancement instruments, such as guarantees, insurance, or first-loss capital; 3. public or philanthropic investors provide a grant to fund a technical assistance facility used to improve the commercial viability or the impact of the investees, so to reduce the risks associated with the transaction; 4. public or philanthropic investors provide a grant to fund the transaction design.

The main players in blended finance are national and international financial institutions (DFIs). DFIs are development banks or subsidiaries, with governments usually as majority owners, established to support private sector development in developing countries (OECD, n.d.) and can be divided into bilateral or multilateral. The tools they use to accomplish their goals are guarantees, credit lines, syndicated loans, direct investments in companies, special purpose vehicles, or collective investment vehicles (Kim & Jun, 2022). The key objective of blended finance is to reduce risks and barriers that private investors face when investing in emerging and frontier markets by deploying financial and non-financial tools, such as technical assistance, network creation, and knowledge sharing (OECD & WEF, 2015). The rationale for blended finance is to solve market failures, therefore the level of public subsidy changes with market development. In areas without developed markets, initial investments are needed to establish them, especially in low-income countries, where risks are too high for commercial investors. As markets grow, blended finance decreases, and commercial finance takes over. Therefore, blended finance should target new markets and sectors with higher social returns initially, then withdraw as private investors become central in the ecosystem (Attridge & Engen, 2019). Massa (2011) investigated the influence of DFIs on overall economic growth, measured by GDP, and found a positive correlation between DFI investments and economic growth, especially in low-income countries compared to high-income ones. As mentioned before, the role of DFIs is not limited to financial tools, on the contrary, they can supply a specific market with other elements needed to foster the private sector, such as entrepreneurial culture and managerial capabilities (Odedokun, 1996). For these reasons, the following hypothesis is formulated:

H1: *When considering the same short timeframe (3-5 years), the volume of blended finance investments for sustainable development is negatively correlated with the quality of entrepreneurial ecosystems across African countries.*

The other important source of finance that is worth investigating because of its role within entrepreneurial ecosystems and its connection with sustainable development is green or climate venture capital. It is important to study GVC because they enable startups to grow faster, be more

innovative, create more value, and at the same time they act as 'scouts' thus determining which type of startups get more funding and are better positioned to succeed (Bocken, 2015). By doing this they can enable sustainability lighthouses (Tiba et al., 2020) and thus shape the sustainable development orientation of the entire ecosystem. Research in this field is more developed even though still at an exploratory stage (Dhayal et al., 2023). Nevertheless, the studies on green venture capital and sustainable development tend to converge to the idea that this finance source is really important for sustainable development. Cojoianu et al. (2020) investigated how green venture capital is fundamental in bridging the financing gap for green startups and eco-entrepreneurs. Maiti (2022) demonstrated how an increase in the average of early and later-stage VC investment at the national level leads to higher green growth. The increasing relevance of the field is demonstrated by the increasing number of publications and their diverse nature (Antarciuc et al., 2018; Bocken, 2015; Bulevska, 2014; Turki & Dang, 2023).

In the same fashion, scholars have also directed their attention to VC activities in the developing world. Groh & Wallmeroth (2016) investigated what are the determinants of VC investments in 78 emerging countries, and found that these determinants change together with the development stage of the country. Hain & Jurowetzki (2018) explored the role of VC in EEs in Sub-Saharan Africa and found how VC activity is different from financial investment providers, as VC couples funding with technical assistance, business support, and network creation. Moreover, VCs were able to adapt their business strategy to higher risk and unstable environments. Hunter (2022) investigated how VC and DFIs interact together in the South African context, finding out that DFIs engage with VC both with equity, by investing in VC funds as limited partners, and with debt, investing alongside them. This is confirmed by the fact that co-investing with other partners is a conventional strategy for sustainable venture capital to mitigate risks and make up for slower financial returns associated with sustainable investments (Bocken, 2015). Moreover, DFIs positively impact VC through collaboration and expertise, influencing funds' parameters and investment thesis, and helping out with due diligence and assisting VC's investees with technical assistance (Hunter, 2022). Accordingly, this paper proposes that there is a relationship between DFIs and the private finance they mobilize, with green VC activities in developing countries.

Albeit still at an embryonal level, the literature about venture capital and development finance recognize the crucial characteristic of these sources of finance, or the fact that they do not exist in a vacuum. On the contrary, they exploit each other strengths, such as concessional capital and de-risking on one side, extensive knowledge, contextual local understanding, and hands-on approach on the other side. Moreover, their shared commitment toward sustainability and sustainable development makes easier for them to work together in the same transactions. This relationship affects entrepreneurial ecosystems not only because it reduces the financial gap that characterizes ecosystems in the developing world, but even more because these two sources of finance foster the ecosystems as a whole by providing expertise, creating networks, and providing

investments in sectors that improve the ecosystem elements' quality. Therefore, the following hypotheses are formulated:

H2: *The overall volume of blended finance investments for sustainable development is positively correlated with the quality of entrepreneurial ecosystems across African countries.*

H3: *There is a positive interactive effect between blended finance and green GVC activity in predicting the quality of entrepreneurial ecosystems in African countries.*

2.3 Conceptual Model

For these reasons, this paper proposes to build on top of the entrepreneurial ecosystem framework by considering two finance providers, one already included in the model, namely GVC, and the other yet to be analyzed in the same context, that is blended finance. The particular sustainable development aim of these two sources of finance, coupled with their aim to not only serve as cash providers, but to a greater degree to facilitate the creation of better markets and growth in developing countries, allows this study to hypothesize that these two elements have an impact on the overall quality of entrepreneurial ecosystem's elements in developing countries. A model for the relationship between blended finance, climate VC, and entrepreneurial ecosystems is proposed in Figure 2.

Figure 2: Conceptual Model

3. Empirical Strategy

3.1 Data Collection and Description

This paper will investigate the distribution and relation between alternative sources of finance directed toward sustainable development and entrepreneurial ecosystems in Africa. The unit of analysis for this endeavor will be African countries. To test the three hypotheses put forward, it is necessary to capture three fundamental variables. The first one is a measure to assess the quality of the entrepreneurial ecosystem at the national level in the African continent. The second fundamental measure is the level of investments with a blended finance structure directed toward African countries. Lastly, green venture capital activity must be taken into account. Secondary data collection from several sources is used to gather the relevant information for each variable.

Highly specific datasets are utilized to measure each variable, ensuring precision, accuracy, and credibility, while also ensuring relevance and affinity.

To measure entrepreneurial ecosystems in Africa, this paper will use the African Entrepreneurial Ecosystem Index (AEEI, 2024). This index is obtained by considering seven factors that affect the context of entrepreneurship in Africa. These factors are governance, culture, support, finance, infrastructure, market access, and human capital. This operationalization for the quality of entrepreneurial ecosystems has only 7 elements and not 10 because of the lack of homogeneous data about the African continent that made it impossible to have an index with the 10 elements outlined by Stam & Van De Ven (2021). Each factor is calculated using a composite index normalized between 0 and 1. Within the entrepreneurial ecosystems framework, all elements are assigned equal weight, as per the methodology outlined by Leendertse et al. (2022) and Stam & Van De Ven (2021). Table 1 gives a detailed overview of the factors and how each is constructed and operationalized. The final result is given by the sum of the scores for each individual factor.

Table 1: AEEI description

Factor	Operationalization	Source
Governance	Rule of law, Control of corruption, Ease of doing business	World Bank Worldwide Governance Indicators (World Justice Project Rule of Law Index); World Bank Ease of Doing Business Project
Culture	Level of trust	Afrobarometer (World Value Study)
Support	LinkedIn users by country, Membership Afrilabs.	World Population Review ; Afrilabs
Finance	Domestic credit to private sector, % of adult population who borrowed from a formal financial institution, venture capital equity and debt deals above $200K, Stock Market Capitalization	World Bank World Development Indicators; World Bank FINDEX database; Partech;
Infrastructure	Access to stable electric power, Total road network, Individuals using the internet as % of the population	World Bank; Logistics Cluster; World Bank World Development Indicators
Market access	Household final consumption, Gross Domestic Product, Population, Import plus Exports as %GDP	World Bank World Development Indicators; United Nations
Human Capital	Life expectancy, Literacy rate, Tertiary education, Gross domestic expenditures on research and development (R&D)	UNESCO Institute for Statistics; World Bank World Development Indicators

Due to data availability, the African Entrepreneurial Ecosystem Index covers 27 countries out of the 52 present in the African continent. However, this dataset represents the first comprehensive attempt to assess the conditions of the entrepreneurial context and economic development in Africa. As such, data for the index is available only for 2023.

The source for the data on blended finance investments is Convergence (2024), the global network for blended finance, which has the largest and most detailed database of historical blended finance transactions available in the market dating back to 1981. Data is collected through three main sources: credible public sources; data-sharing agreements with investors; and validation with members of the Convergence network. Every deal recorded in the database has three characteristics: (1) it crowded-in investment from one or more commercial investors who would not have otherwise participated in the transaction. (2) Public or philanthropic investors are concessional within the capital structure, or provided guarantees or risk insurance at below market rate, the transaction is grant-funded, or associated with a technical assistance facility. (3) The transaction aims to create development impact related to the SDGs in developing countries (Convergence, 2024).

The database contains 502 deals in which the recipient country or countries of the investments are in the African continent, with data points starting in 1981 until 2023. The investments in the database are of 6 different types: company, fund, facility, bond/note, impact bond, or project. The investments in the database are registered as directed to one or multiple countries. However, to assess the relationship between the level of investments and entrepreneurial ecosystems, each investment must be associated with only one country.

There are three different options that can be used to link investments registered for multiple countries to only one. The first method consists of assigning the investments to the country in which the recipient has its headquarters. Although this method at first might seem straightforward and accurate, it does not reflect reality, and it would lead to biased results of the analysis. This is due to the fact that some African countries are preferred to others when it comes to registering a business, because of higher sophistication in the legal system and consideration of shareholders. This is particularly true for Mauritius and for funds (limacap, 2024), projects, and facilities. Thus, this accounting method would lead to reckon investments to a country, while in reality the investments are directed and intended for other countries, but might be deposited to a fund registered in Mauritius.

The second option is to divide the investments proportionally to each country. However, it is not possible to know how much of each investment is directed to each specific country of those who are listed as recipient countries. Moreover, this method is not entirely representative of the underlying reality especially when considering investments in companies and bonds. Indeed, when the recipient of the investment is a company, it might not always be the case that the money is spent within a particular country.

The third option to account for the investments, and the one adopted by this study, is a hybrid method. This method consists of using both the aforementioned techniques and applying them based on the investment type, so to try to represent what happens in reality as closely as possible.

Therefore, investments for which the type is company, bond/note, or impact bond, are assigned to the country in which the recipient is headquartered. While for investments in funds, facilities, or projects, the investments are assigned pro rata to all the countries for which these investments are intended. This approach allows for the acquisition of granular data that closely reflects reality. Table A1 in the Appendix gives examples of blended finance investments, the countries to which these are initially assigned, and how they were assigned in this particular study.

To test H1, the variable of blended finance investments is constructed by taking the sum of investments per country in the period 2019-2023. This choice is dictated by the fact that the data for the elements of the Africa entrepreneurial ecosystem index is from the same period. To test H2, the variable for blended finance consists of the sum of the investments in the period from 2004 to 2023. This variable is used to understand the effects that these investments toward sustainable development had on the entrepreneurial ecosystems. Albeit considering a longer time period would add explanatory power to the study, the chosen period ranges only from 2004 to 2023. This is because the dataset presents too inconsistent data points in the years before 2004.

Green venture capital activity is captured by the normalized number of venture capital deals in climate tech solutions in the period 2019-2023. This data is obtained through a dataset that captures venture capital-sponsored deals in Africa in the four years considered (Africa: The Big Deal, 2024). The deals captured are those openly shared by the investors or the founders. The size of deals captured depends on the year as follows: deals above $ 100,000 from 2021 to 2023, deals above $ 500,000 for 2020, and deals above 1 million for 2019. It is important to stress how this variable is different from blended finance investments and VC as measured in the AEEI because it is a subset of the broader venture capital market that targets a niche sector with its own dynamics, drivers, and constraints. As such the two variables are not measuring the exact same deals 2 times. In blended finance investments, some capital is allocated to venture capital funds, with DFIs or philanthropic investors acting as limited partners. However, the committed capital from Limited partners and the number of climate-related deals a particular fund executes are two distinct metrics and data do not overlap.

Two control variables are used to account for potential confounding factors. The choice of these two variables is partly dictated by the African Entrepreneurial Ecosystem Index composition. As the index captures so many factors, it is quite challenging to add control variables that are not already included in it. However, two important variables with demonstrated effects on entrepreneurship can be used as controls. First, the level of urbanization is not included in the index. Studies confirm that in general entrepreneurial activity is higher in urban areas (Bosma & Sternberg, 2014), therefore because of the feedback effect typical of entrepreneurial ecosystems (Wurth et al., 2023), countries with higher levels of urbanization might have more developed entrepreneurial ecosystems. The operationalization of this variable is made with the share of the urban population as a share of the total population in 2022. Urban population refers to people

living in urban areas (The World Bank, 2022). The second controlling variable that is not already included in the AEEI index is resource rents. Studies demonstrated that resource rents have significantly negative effects on entrepreneurship and governance (Munemo, 2022). In this study, resource rents are calculated as the total natural resources rents (the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents) as a share of GDP. The variable used is the average of resource rents by country in the period 2018 to 2019 (The World Bank, 2023).

The level of analysis in this study is at the country level. As aforementioned, only 27 African countries are taken into consideration because of the data availability for the AEEI. It is important to consider one major challenge when studying entrepreneurial ecosystems: the disconnection between the definitions of regions and the practical geographical divisions used for data collection purposes (Feldman & Lowe, 2015). Moreover, the first criterion when considering the geographic unit of analysis should be the spatial reach of the casual mechanisms taken into consideration (Leendertse et al., 2022). However, the data available for this particular study is very limited for two reasons: the relatively new focus on entrepreneurial ecosystems and development finance for sustainable development and the particular geographic focus in a part of the world for which data is relatively more scarce. For these reasons, it is not possible to have enough data to analyze smaller geographic units as it is usually done when studying entrepreneurial ecosystems in Europe .

Table 2 gives a summary overview of the variables that will be used in the analysis, together with a brief description and the source. Table A2 in the Appendix gives a complete overview of the data used for the study.

Table 2: Variables

Variable	Description	Source
AEEI	Index obtained by the sum of 7 equally weighted sub-indicators normalized between 0-1 (2024)	Utrecht University
GCV	Number of climate tech VC deals in each country from 2019 to 2023	The Big Deal: Africa
BF	Sum of Blended Finance investments per country in the period 2004-2023, per capita. Allocation of investment based on the type of investment.	Convergence
BF 19-23	Sum of Blended Finance investments per country in the period 2019-2023, per capita. Allocation of investment based on the type of investment.	Convergence
Urbanization	Rate of population living in urban areas as % of total population (2022)	World Bank
Resource	total natural resources rents as % of total GDP (average in the time period (2018-2022)	World Bank

Extreme values can significantly influence the results of the analyses to test the three hypotheses proposed by this study, leading to misleading conclusions. To address this issue, it is crucial to recognize extreme values in the data and deal with them effectively. To this end, outliers are detected using the interquartile range (IQR) method, where values beyond 1.5 times the IQR

from the first and third quartiles are considered potential outliers. This method is chosen for its simplicity and robustness (Barbato et al., 2011). A visual inspection through scatter plots is used to confirm these extreme values (Figure A1 in Appendix). To make a robust analysis, two versions of the dataset will be used: one with the outliers included and one with the outliers removed. This is because extreme values in this case are not the result of measurement error, but a characteristic of financial metrics in the African continent. The choice of using both datasets is further motivated by following the Bayesian logic expressed by De Finetti (1961) according to which no existing observation can be rejected. By comparing the results from both datasets, the study aims to provide robust and accurate understanding of the entrepreneurial ecosystem and the effects of development finance for sustainable development.

3.2 Descriptive Statistics

Table 3 presents the descriptive statistics for the data used for the analysis, it includes the main variables used to test the hypothesis, the seven elements that compose the African Entrepreneurial Ecosystem Index, and three elements that are used to construct the finance element. Overall, the study covers 27 African countries. Starting with the AEEI variable, it is possible to observe that the variable is fairly consistent with a moderate standard deviation, in the entrepreneurial ecosystem strength across the countries, these differences are not extreme. On the other hand, the variables that capture the level of development and venture finance toward sustainable development present very high variability, represented by very wide ranges and large standard deviations. For green venture capital activity, some countries have not seen any deal in climate tech happening, while others saw more than 150 deals. However, the low mean, coupled with the high standard deviation compared to the maximum value hints at an extremely high variability. Even if at a slightly lower degree, the measures for blended finance have the same behavior, especially the measure for the time period 2019-2023. However, it is possible to see that every country has received investments in the time period 2004-2023.

Table 3: Descriptive Statistics

Statistic	N	Mean	St. Dev.	Min	Max
AEEI	27	2.488	0.815	1.380	4.730
GCV	27	20.111	39.577	0	173
Blended Finance (BF)	27	85.417	120.375	2.168	562.005
BF.1923	27	37.528	88.469	0.000	459.803
BF (no outliers)	25	54.273	37.723	2.168	128.523
BF.1923 (no outliers)	25	20.910	27.561	0.000	111.913
Urbanization	27	49.085	16.715	17.720	74.770
Resource rent	27	6.407	6.133	0.003	27.790
Governance	27	0.653	0.127	0.417	0.926
Culture	27	0.376	0.202	0.000	0.695
Support	27	0.173	0.180	0.011	0.852
Finance	27	0.206	0.198	0.032	0.929
CredPriS	27	0.356	0.271	0.091	1.000
VC	27	0.176	0.240	0.000	0.788
SMarCap	27	0.084	0.193	0.000	1.000
Infrastructure	27	0.442	0.199	0.100	0.784
Market.access	27	0.199	0.135	0.041	0.581
Human.capital	27	0.437	0.207	0.138	0.835

The behavior of these variables indicates potential focal points for capital allocation in the continent, as well as countries that lag way behind the others in their ability to attract capital. Moreover, The low mean relative to the maximum value for finance-related variables indicates that most regions are underperforming relative to the best-performing ones. However, it is interesting to note how the behavior of the measures for development finance for sustainable development is the same as the finance element for EE and its components. All these metrics present a low mean, a high standard deviation, and a wide range with minimum values close to or equal to zero. This is not only indicative of a pronounced disparity in financial inclusion and access to finance of every kind across the continent but also serves to validate the blended finance and GVC metrics.

Figure 3 and Figure 4 show the African entrepreneurial index distribution for the 27 countries taken into consideration for this study. 5 countries stand out with values for AEEI higher than 3: Mauritius, South Africa, Tunisia, Morocco and Cabo Verde. Only one country, namely Mauritius, has an entrepreneurial ecosystem extremely developed with a value well above 4. Figure 4 showcases the geographic distribution of the countries. It is noteworthy that the northern region and the southern region present adjacent countries with relatively high values for the index, such as Morocco, Tunisia, and Algeria in the north, and South Africa, Namibia, and Botswana in the south. While East and West Africa regions are at the bottom of the range of the African Entrepreneurial Ecosystem Index. The presence of what seems regional clusters with a high quality of entrepreneurial ecosystems in the north and south suggests that proximity to high-performing countries might play a role in fostering strong entrepreneurial ecosystems. This regional clustering could be due to shared factors and spillover effects that enhance entrepreneurial success.

Figure 3: Histogram AEEI

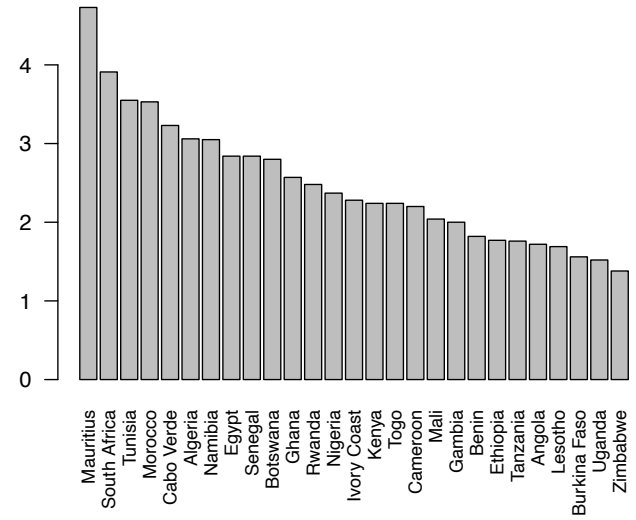
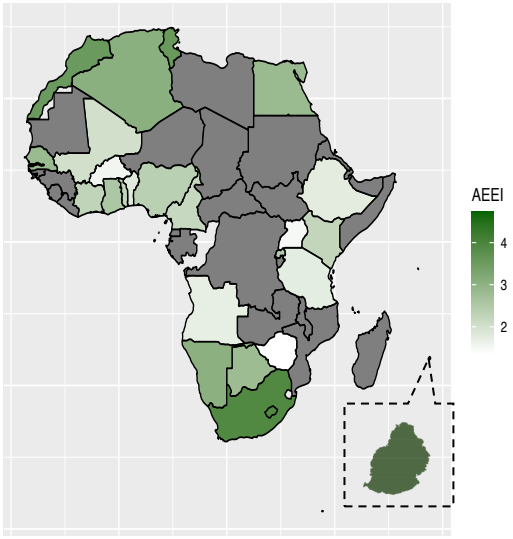


Figure 4: AEEI distribution map



The geographic visualization highlights the exceptional quality of two extremely small countries – compared to the rest of the African countries – when it comes to their entrepreneurial ecosystems. Indeed, Mauritius and Cabo Verde scores 4,73 and 3,23, respectively. This indicates that size does not necessarily limit the development of a robust entrepreneurial ecosystem and that these countries have effectively leveraged their resources and policies to foster entrepreneurial growth.

The distribution of Blended Finance investments (2004-2023) in Africa is much more variable than that of the African Entrepreneurial Ecosystem Index. This is shown in Figures 5 and 6. The distribution for the time period 2019-2023 is very similar and can be found in Table A3 in the Appendix.

Figure 5: Histogram of Blended Finance (2004-2023)

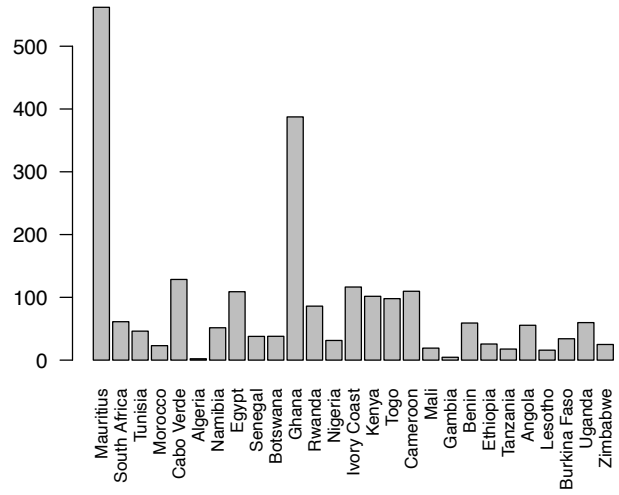
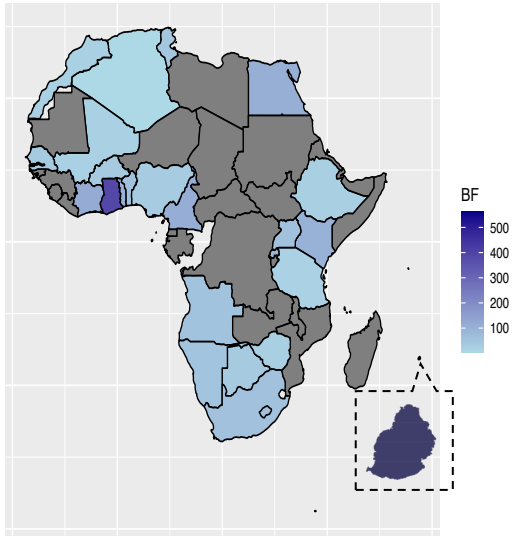
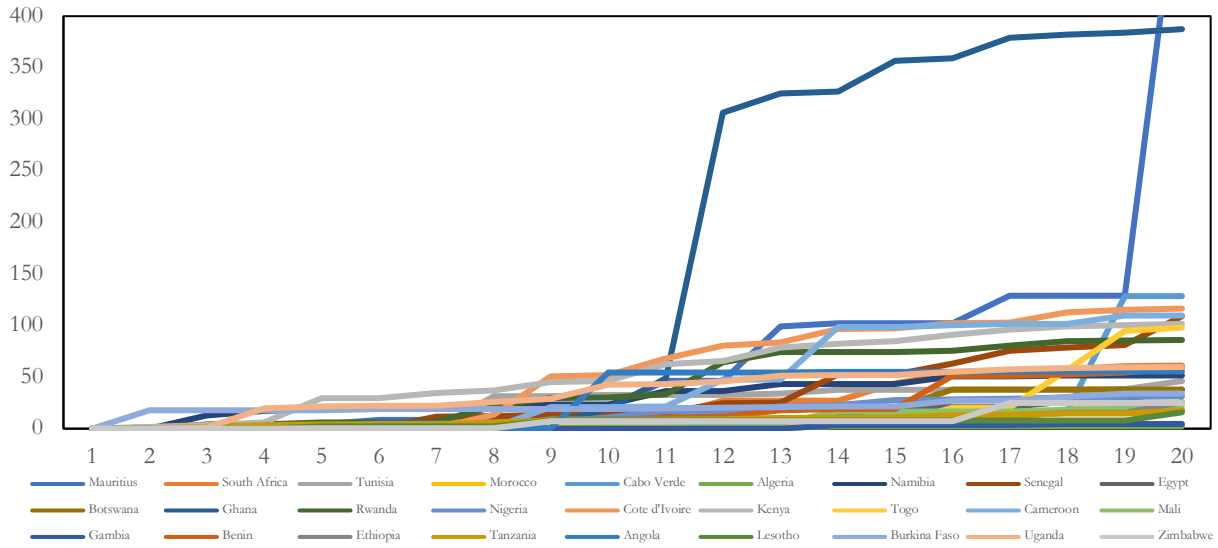


Figure 6: Blended Finance (2004-2023) distribution map



When considering all the data points available, it is possible to see how there are no clear regional effects, in contrast with AEEI data. Mauritius stands out with the highest level of blended finance investments, exceeding $500 per capita in the time period 2004-2023. This indicates a strong ability to attract and leverage blended finance due to a favorable investment climate, robust financial infrastructure, and supportive regulatory frameworks. Ghana follows behind with $387 per capita of investments in the period. However, both values are extremely high compared to the other countries. As explained earlier, the methodology employed to calculate this variable already tames the effect of extreme values, still, these two countries represent outliers in the dataset, with Mauritius that is almost 4 standard deviations from the mean. When considering the sum of all the investments in each country, it is crucial to examine how investments evolved over time for each country because trends over time can reveal whether certain countries have experienced consistent growth in blended finance investments or not. Moreover, a steady influx of blended finance investments similar in all countries would eliminate the need to use specific time-lagged variables in the analysis. Figure 7 highlights how the influx of blended finance is in general stable except for two major investments: one in Ghana in 2011 and one in Mauritius in 2023. These two investments are also the reason why these two countries present an extremely high cumulative value in the time period considered. To deal with these extreme values, a dataset without Mauritius and Ghana is used to increase the robustness of the analysis. Figures 8 and 9 show that blended finance investment levels are clustered around regions when not considering the outliers. North African countries, except Egypt, have attracted the lowest amount of investments.

Figure 7: Cumulative Blended Finance Investments by Country (2004-2023)



The southern region has attracted more investments, but still less than East and West African countries. Worth of notice is the fact that there is no clear overlap between blended finance investments and AEEI when looking at the geographic distribution. Figure 10 shows how the investments have flowed to the countries over time. As before, it is possible to see that investments have been steadily flowing to the African countries, except for Cabo Verde.

Figure 8: Histogram of Blended Finance 2004-2023 (without outliers)

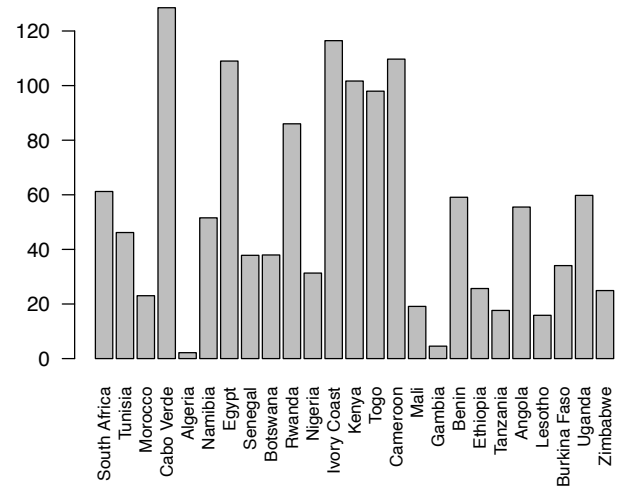


Figure 9: Blended Finance 2004-2023 distribution map (without outliers)

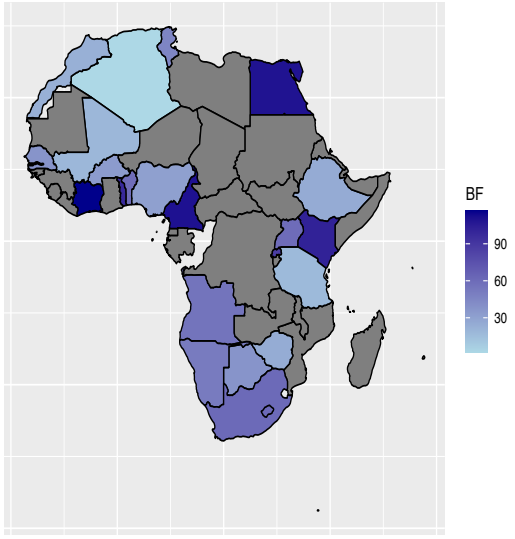
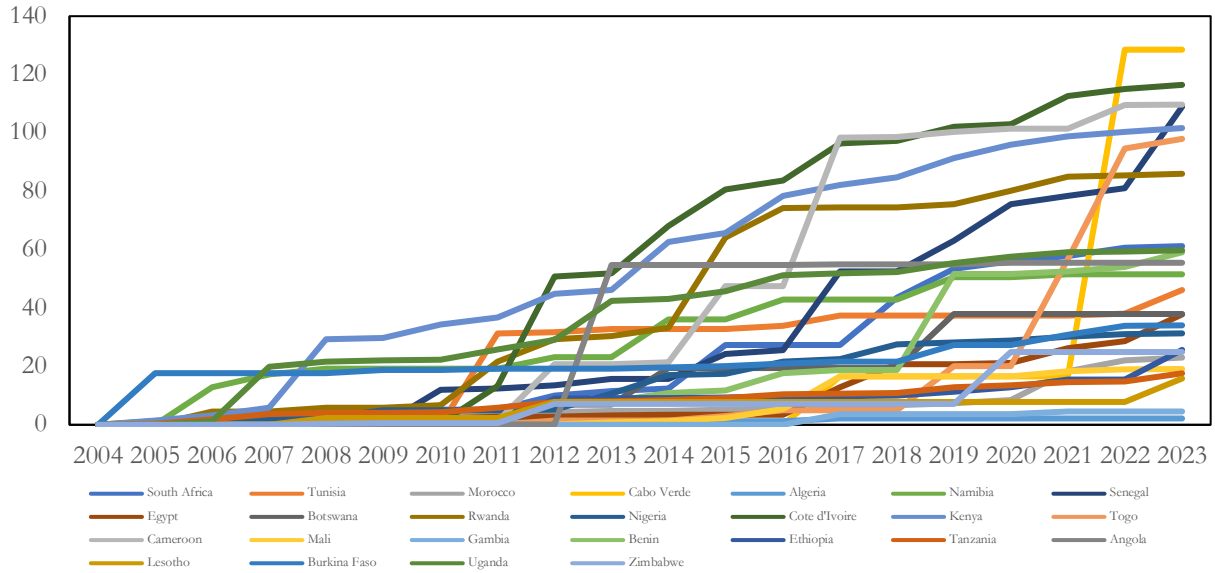


Figure 10: Cumulative Blended Finance Investments by Country 2004-2023 (without outliers)



3.3 Data Analysis

To test the three proposed hypotheses and assess the state of blended finance and GVC in African countries, the analysis is divided into two parts. In the first part, correlation analysis is performed, together with a deeper visual investigation of the data at hand through scatterplots. This will allow to capture the monotonic association between each pair of the variables of interest, measuring the direction and strength (Schober et al., 2018). Two different coefficients will be calculated. First, the Pearson correlation coefficient will be computed. Secondly, the Spearman correlation will be computed because of its robustness toward outliers (Thulin, 2021). Both correlation coefficients range from –1 to +1, with 0 indicating no linear association and the sign of the estimate indicating whether the relation is positive or negative. The relationship is stronger as the values approach the absolute value of 1. To address the statistical significance of the results, hypothesis tests and confidence intervals are used to estimate the strength of the relationship (Schober et al., 2018).

The second part of the analysis is used to test the three hypotheses put forward by the study. A series of multiple linear regressions with ordinary least-squared estimators will be used to explicitly investigate the simultaneous effect of the independent variables on the dependent variable (Wooldridge et al., 2016). This method is chosen because – assuming the classical linear regression model assumptions hold true – OLS provides unbiased and efficient estimators. This method allows to determine the linear relationship between the dependent and independent variables while controlling for potential confounders. Three different models are specified to test each hypothesis separately. To test the first hypothesis, which concerns the relationship between blended finance investments and the AEEI in the same time period, three explanatory independent variables will be used. The explanatory variable is the sum of blended finance investments per

capita in the time period 2019 to 2023. The two control variables used in the regression are the rate of urbanization, operationalized by the share of the population living in urban areas, and the levels of resource rents as a share of GDP. The dependent variable is the African entrepreneurial ecosystem index. Model (1) formalizes the regression structure:

$$AEEI = \beta_0 + \beta_1 BF.1923 + \beta_2 Urbanization + \beta_3 ResourceRents + \mu \qquad (1)$$

β_0 is the intercept term, β_1, β_2, β_3 are the coefficients of the relevant regressors, and μ captures the error term that satisfies the OLS assumptions. The notation $BF.1923$ represents the variable for blended finance investments in the time period 2019-2023. In the context of the first hypothesis, the center of attention is toward the sign, significance, and size of the β_2 coefficient, as it represents the relationship between the African Entrepreneurial Ecosystem Index and the level of blended finance investments.

Model (2) is used to test the second hypothesis, which posits that higher blended finance investments in the past should have a positive effect on the entrepreneurial ecosystems of today. The dependent variable remains AEEI, as well as the two controlling variables urbanization and resource rents. The variable to measure blended finance in this instance is the sum of the investments in each country in the time period 2004 to 2023. The longer timeframe allows to have more data points and assess better the long-term effects of the investments toward sustainable development on the entrepreneurial ecosystems. The model is specified as follows:

$$AEEI = \beta_0 + \beta_1 BF + \beta_2 Urbanization + \beta_3 ResourceRents + \mu \qquad (2)$$

As in model (1), β_0 is the intercept term, β_1, β_2, β_3 are the coefficients of the relevant regressors, and μ captures the error term that satisfies the OLS assumptions. BF is the variable for blended finance as described above. Also in this model, the attention is toward the coefficient β_1, which is expected to be positive as higher investments would lead to higher quality of the entrepreneurial ecosystems, following hypothesis 2.

The third and final model for the analysis of this study is intended to test hypothesis 3. This posits that there is a positive interactive effect of blended finance investments and green venture capital in improving the quality of entrepreneurial ecosystems. As in the two previous models, AEEI is the dependent variable, while urbanization and resource rents are the controlling variables. For this model, the explanatory variables used to test the hypothesis are three: blended finance (BF.1923) as used in model (1), green venture capital activity (GVC), and an interaction term that consists of the multiplication of BF and GCV. As outlined in the previous section, GCV is measured by the number of VC deals in climate tech in the time period 2019-2023. The model specification is the following:

$$AEEI = \beta_0 + \beta_1 BF.1923 + \beta_2 GCV + \beta_3 (BF.1923 * GCV) + \beta_4 Urbanization + \beta_5 ResourceRents + \mu \quad (3)$$

In this model, the coefficients used to test the hypothesis are β_1, β_2, and more importantly β_3. Hypothesis 3 posits that this coefficient is positive.

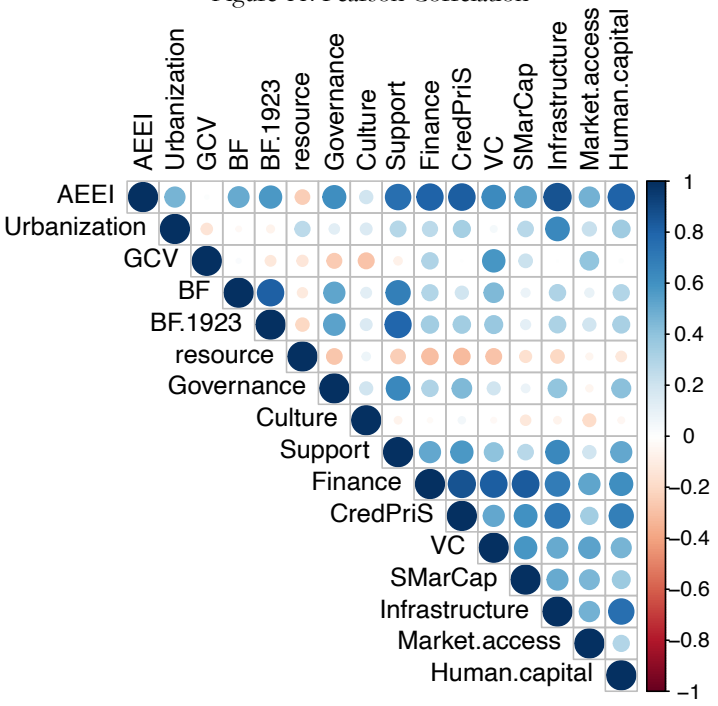
To improve the reliability of the study and make the analysis more robust, two datasets will be used to perform the same tests. First, a complete dataset is used. After that, the same analysis is conducted using a set of data without the outliers. The statistical analysis for this study will be performed using the statistical software R Studio.

4. Results

4.1 Correlation and Visual Analysis

Figure 11 presents the Pearson correlation matrix between the AEEI, the elements that make up the index, the relevant independent variables to test the hypotheses, and the control variables. A more detailed overview of the correlations is available in Appendix (Table B1). Starting with the African Entrepreneurial Ecosystem Index data, it is possible to note that there are significant positive correlations between the elements used to assess the quality of an ecosystem. Albeit with some variation, such as the low correlation between culture and the other elements, and weaker relationships with governance, this confirms the interdependencies between the elements and the systemic nature of the ecosystems as posited by (Leendertse et al., 2022). This result confirms the applicability of the entrepreneurial ecosystem framework, as put forward by Stam & Van De Ven (2021), also to Africa and more in general to the developing part of the world. When considering the control variables used for the regression analyses, their correlations with the AEEI confirm the type of relationships proposed by the literature, even if with relatively low strength and significance. In particular, the urbanization rate has a positive correlation higher than 0.45, while the resource rent variable has a negative correlation with AEEI.

Figure 11: Pearson Correlation



Concerning green venture capital activity, the correlations with the other variables are very variable. There is little to no correlation between AEEI, blended finance investments, and some elements such as infrastructure and human capital. Two interesting results with GVC are its almost non-existent relationship with blended finance investments and the negative correlations – even though very small – with the governance, culture, and support elements of the ecosystems., First, the blended finance motives and modus operandi should direct investments toward venture capital funds in these geographies, especially those with a clear impact thesis. The low correlation between these variables hints at the fact that these are either not happening, or not working as intended. Secondly, GVC's negative correlations with the governance, culture, and support elements may indicate that climate tech solutions in Africa are being put forward by entrepreneurs from riskier countries. However, this result is in line with the riskier investment positions commonly taken by VCs.

On the other hand, blended Finance investments' correlations are more in line with expectations, relative to GVC. Both measures, the one covering the time period 2004 to 2023 and the one covering the time period 2019-2023, have positive correlations higher than 0.5 with AEEI. This result is twofold because, on one hand, it confirms that there is a positive relationship between cumulative long-term blended finance investments and the quality of entrepreneurial ecosystems. Nevertheless, on the other hand, the positive correlation between BF.1923 and AEEI shows that, when looking at a matching period, blended finance investments for sustainable development tend to be directed toward those countries that already have the best entrepreneurial ecosystems, which is not as put forward by hypothesis 1. What seemed a relative inverse relationship when looking at the map visualization, is not confirmed by the correlation values. This might be due to the disproportionate effects of outliers. As with the AEEI, both BF variables have positive correlations with all the elements of the ecosystem, with varying degrees of strength.

To increase the robustness of the analysis, the correlation analysis is also performed using the Spearman method (figure 12) and the Pearson method without the outliers (Figure 13). More detailed data for the Spearman correlation is shown in the Appendix (Table B2). Starting by looking at the Spearman correlation, it is possible to see how the correlations between EE elements are even stronger. Moreover, now GCV is positively correlated – even though very weakly – with AEEI and BF. On the other hand, Blended finance investments' correlations with AEEI and the ecosystem elements remain positive, even though their strength slightly decreases. To understand the magnitude of the shift, the correlations between BF, BF.1923, and AEEI are now slightly above 0.3. When considering the Pearson correlation matrix without the outliers, it is possible to note how the relations between the EE elements remain positive and strong even if less than in the other two instances, except for culture. For GVC and BF, almost all the correlations lose strength and some even turn negative as the correlation between GCV and BF.1923. This test confirms that the

direction and strength of the relationships are markedly driven by the two outliers countries, Mauritius and Ghana.

Figure 12: Spearman Correlation

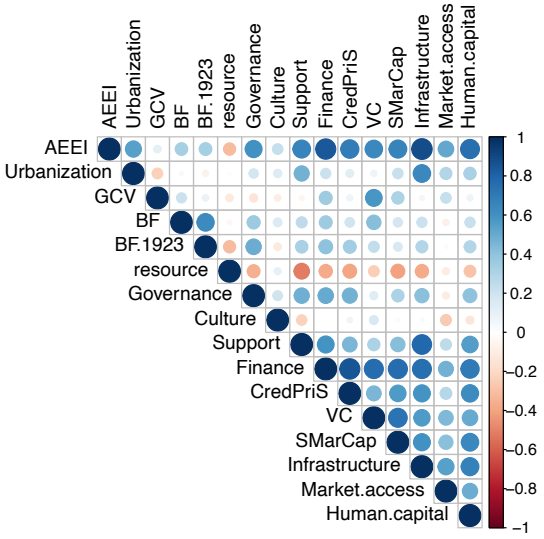
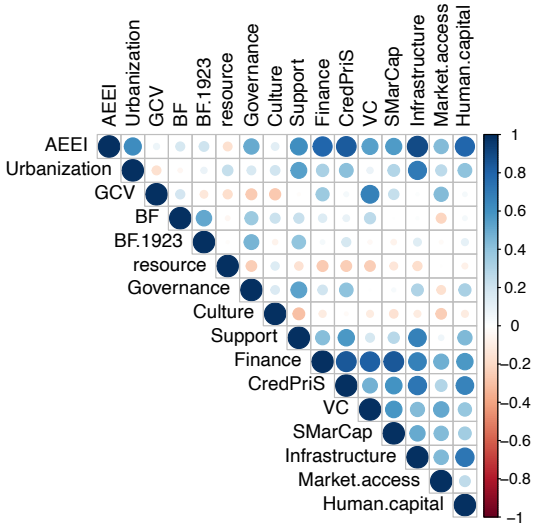


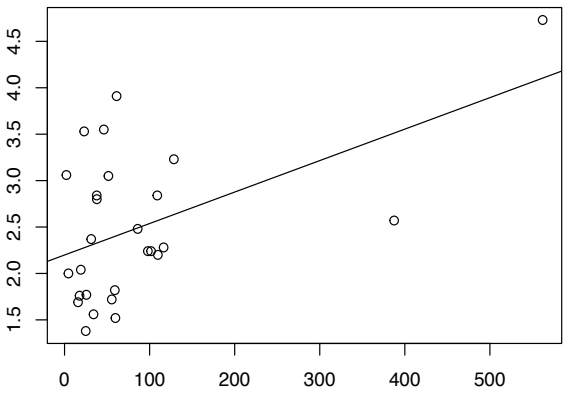
Figure 13: Pearson Correlation without outliers



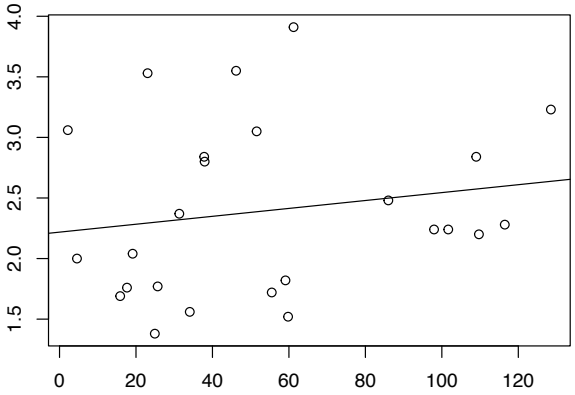
A visual analysis of the variables of interest's behavior is needed to better understand the nature of the data and what is the effect of outliers on the data. To this end, table 4 shows a series of scatterplots with AEEI on the y-axis and BF, BF.1923 on the x axis. First, raw data is used to create the plots. These are then compared with the results obtained by using the filtered dataset without the outliers (Mauritius and Ghana). By comparing visually the slope of the trend lines, it is clear that a sizeable portion of the blended finance investments' relationship with the African entrepreneurial ecosystem index is driven by extreme values. In both cases the relationship is positive, indicating that blended finance investments in the past and in the matching time period taken into consideration are associated with higher quality of EEs. However, the magnitude of the relationship magnitude gets considerably smaller when considering the filtered data.

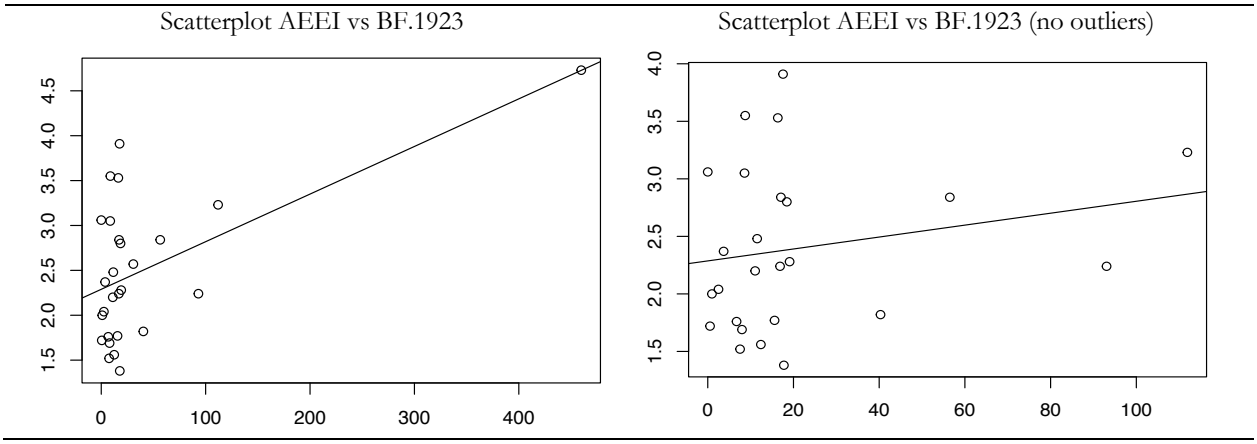
Table 4: Visual investigation

Scatterplot AEEI vs BF



Scatterplot AEEI vs BF (no outliers)





4.2 Hypothesis Testing

The three hypotheses are tested employing the variables and models put forward in the empirical strategy section. As did for the correlation and the visual analyses, the models will be tested first using the complete raw set of data, and then using the filtered dataset. The relevant tests for the assumptions of OLS linear regression are shown in the Appendix for each regression performed. These include controls for the absence of multicollinearity, normality of errors, and homoskedasticity. In every model, the same two control variables are used to control for confounding effects on the dependent variable AEEI. To test whether these two metrics add explanatory power to the regression models, Table C1 in the Appendix shows the result of a regression model that includes only the controls. Both the estimated coefficients are statistically significant, with a positive effect for urbanization on AEEI ($p<0.01$) and a negative effect for resource rents ($p<0.05$).

Hypothesis 1 is used to test the relationship between blended finance investments between 2019 and 2023 and the quality of entrepreneurial ecosystems in the African region. Table 5 presents the results of the regression analysis specified as model (1) using the complete raw data. First, it is possible to see the relevance of the chosen control variables, as the adjusted R^2 doubles from 0.305 to 0.619 The residual standard error decreases from 0.679 to 0.503, indicating an improvement in model fit when the controls are included. Secondly, the parameter estimates for BF.1923 are quite stable around 0.005, and statistically

Table 5: Regression analysis model (1)

	Dependent variable:		
	AEEI		
	(i)	(ii)	(iii)
BF.1923	0.005***	0.006***	0.005***
	(0.002)	(0.001)	(0.001)
Urbanization		0.025***	0.028***
		(0.006)	(0.006)
Resource rents			-0.038**
			(0.017)
Constant	2.289***	1.055***	1.144***
	(0.142)	(0.336)	(0.314)
Observations	27	27	27
R^2	0.332	0.592	0.663
Adjusted R^2	0.305	0.558	0.619
Residual Std. Error	0.679 (df = 25)	0.542 (df = 24)	0.503 (df = 23)
F Statistic	12.410*** (df = 1; 25)	17.386*** (df = 2; 24)	15.104*** (df = 3; 23)
Note:			*p<0.1;**p<0.05;***p<0.01

significant ($p<0.001$). The model suggest that a $1 increase in blended finance investments is associated with a 0.005 higher entrepreneurial ecosystem index.

This study hypothesized that, when considering blended finance investments and the quality of entrepreneurial ecosystem in a matching time period, their relationship should be negative. This is not supported by the regression of model (1), as the coefficient is positive. Even if the estimate for BF.1923 is statistically significant it is not sizeable, and one order of magnitude smaller than the coefficients for the controlling variables. As noted above with the scatterplot, the results might be highly dependent on the value for Mauritius. However, when looking at the scatterplot without the outlier values, the relationship is still positive. Table C2 in the Appendix shows the same regression of model (1) with the filtered data. When eliminating the two extreme values, the parameter estimate for BF.1923 loses statistical significance ($p>0.3$), while maintaining a similar positive coefficient. Together with this, the adjusted R^2 decreases from 0.619 to 0.452. Therefore, even if it is not statistically significant, the coefficient in the regression with filtered data substantiates the positive trend seen in the scatterplot. The results of this analysis provide enough empirical support to challenge the first hypothesis, and corroborates the fact that blended finance investments toward sustainable development are not particularly directed to lower quality entrepreneurial ecosystems.

The aim of hypothesis 2 is to test whether the overall volume of blended finance investments for sustainable development is positively correlated with the quality of entrepreneurial ecosystems across African countries. Table 6 presents the results of a regression analysis that takes into consideration the sum of blended finance investments (BF) in a 20-year time frame (2004-2023), the quality of EEs, and the control variables. The tests for multicollinearity, homoskedasticity, and normality of errors can be found in Figure C1 in the Appendix. When performing the Breush-Pagan test to check for heteroskedasticity (Breusch & Pagan, 1979) in the residuals, the p-value for the test is 0.05073. Therefore, it the null hypothesis of homoskedasticity is rejected at a 0.05 significance level, indicating heteroskedasticity in the errors. To resolve this issue, we compute model (2) using robust standard errors (ii). The parameter estimate for BF is 0.003, lower than in hypothesis 1, and still quite modest. The estimate evaluates the effect of a $1 increase in blended finance investments in the 20-years time period improving the entrepreneurial ecosystem's quality by 0.003. When correcting for heteroskedasticity using robust standard errors, the estimate remains significant ($p<0.05$) even if the p-value increases from model (i).

Table 6: Regression analysis model (2)

	Dependent variable:	
	AEEI	
	OLS	*Robust s.e.*
	(i)	(ii)
BF	0.003***	0.003**
	(0.001)	(0.001)
Urbanization	0.028***	0.028***
	(0.007)	(0.007)
resource	-0.045**	-0.045**
	(0.018)	(0.016)
Constant	1.125***	1.125***
	(0.349)	(0.321)
Observations	27	
R^2	0.592	
Adjusted R^2	0.539	
Residual Std. Error	0.553 (df = 23)	
F Statistic	11.143*** (df = 3; 23)	
Note:		*p<0.1;**p<0.05;***p<0.01

Contrarily to H1, The positive sign and significance of the parameter for BF are in line with the expectations put forward by hypothesis 2. The model confirms that investments toward sustainable development are associated with higher-quality EEs. Unfortunately, not having access to time-varying data for EEs, it is not possible to infer causation from this regression. Moreover, this model faces the same problems as model (2) concerning the effects of extreme values. For this reason, a regression using filtered data is used to compare the results without including Mauritius and Ghana (Table C3 in the Appendix). When outliers are excluded, the parameter estimate for BF increases to 0.04, however, it loses statistical significance with a p-value higher than 0.1. Again, the behavior seen in the scatterplot is confirmed by the regression analysis. Overall, the positive effect of BF on AEEI posited by hypothesis 2 is confirmed even if outliers still play a significant role in determining the significance of the analysis. The fact that the coefficient remains positive and somewhat stable hints at confirming what predicted, even if concerns about extreme values and the size of the effect must be carefully taken into consideration.

The last hypothesis predicts the interaction between blended finance and green venture capital to have an effect on the quality of entrepreneurial ecosystems. This hypothesis is tested by using model (3) and the results can be seen in Table 7. Starting with BF.1923, the estimate is significant ($p<0.01$) equal to the estimate for model (1). On the other hand, the estimate for green venture capital activity is 0.001, not significant and smaller than that of BF.1923. Similarly, the interaction term is not significant and one order of magnitude smaller than BF.1923 and GCV at 0.0002. The R^2 for the regression indicates that 68,6% of the variation in AEEI is explained by the explanatory variables included in the regression.

Table 7: Regression analysis model (3)

	Dependent variable:
	AEEI
BF.mix.1923	0.005***
	(0.001)
GCV	0.001
	(0.005)
Urbanization	0.029***
	(0.006)
resource	-0.034*
	(0.017)
BF.1923:GCV	0.0002
	(0.0003)
Constant	1.013***
	(0.337)
Observations	27
R^2	0.686
Adjusted R^2	0.611
Residual Std. Error	0.508 (df = 21)
F Statistic	9.157*** (df = 5; 21)
Note:	*p<0.1;**p<0.05;***p<0.01

Albeit the parameter for the interaction effect is positive, its small size and absence of significance, together with the other estimates of model (3), suggest that there is no evidence to support hypothesis 3. This is further confirmed by the fact that also the estimate for GVC is not significant. As for the other two models, Table C4 in the appendix shows the results of model (3) using the filtered dataset without outliers. By excluding Mauritius and Ghana the coefficient for BF.1923 almost halves, and as in model (1) loses significance. Interestingly, the GVC estimate turns negative (-0.001) and remains statistically insignificant, while the interaction term increases by one-third remaining insignificant. The lack of a significant interaction effect between blended finance investments and GVC on the quality of entrepreneurial ecosystems indicates that these financial mechanisms might operate independently and not synergistically. Moreover, the

insignificant and minimal GVC effect challenges the assumption that green venture capital affects entrepreneurial ecosystem quality.

5. Discussion

The aim of this study was to investigate the relationship between entrepreneurial ecosystems and development finance in developing countries. The exploration of entrepreneurial ecosystems allowed to have the first insights into the dynamics playing out in this region. From the correlation analysis, it has been possible to assess the functioning of ecosystems in the African continent and their quality. This study builds upon the foundational works on entrepreneurial ecosystems by Stam & Van De Ven (2021), who defined the elements essential for fostering entrepreneurship within a territory and applied them to the African context. Most notably, the empirical findings confirm the systemic nature of elements of the ecosystem, in line with the study by Leendertse et al. (2022), who emphasized their interdependencies. In specific, the correlation analysis indicates significant positive relationships among the elements, corroborating the EE theoretical framework. This is particularly important because the application of this framework is done in a different geography with dissimilar characteristics than Europe or the United States, where the bulk of research on EE has been applied.

Moreover, the visual investigation gave indication of the presence of regional clusters with different ecosystems' quality. In particular, the northern and southern regions exhibited higher quality, while East and West Africa lagged behind. This finding suggests that proximity and spillover effects play a crucial role in fostering higher-quality entrepreneurial ecosystems, thus supporting the notion of interdependencies – not only between the elements – but also between entire ecosystems as posited by Wurth et al. (2022). Albeit this study does not provide further descriptions of the other mechanisms between EE with output, outcomes, and downward causation (Wurth et al., 2022), there is enough empirical evidence to support the claim that EE can be successfully applied also to emerging economies. This is a step forward in the understanding of EE in developing countries which have been overlooked for too long (Cao & Shi, 2021).

The aim of this study was to improve the understanding of entrepreneurial ecosystems by connecting them with development finance, particularly blended finance investments, and understand the latter's role in enhancing EE in Africa. The visual analysis of the distribution of blended finance investments in the African continent showed the huge disparities in financial access between the countries taken into consideration. This aligns with the studies of Guerrero et al. (2021), Atiase et al. (2017), and Cao & Shi (2021) who identified finance as one of the elements, alongside human capital, knowledge, and physical infrastructure, the absence of which hinders entrepreneurial activities and EE in developing countries.

Another important finding is that Mauritius is the country with both the highest quality of the entrepreneurial ecosystem (EE) and the largest amount of blended finance investments per capita. Together with Ghana, these are two clear outliers for the amounts of investments received. To make sense of this result it is important to consider the dynamics of the African continent and the character of the data. First, the results are driven mainly by two una tantum big investments received by these two countries. However, Mauritius would be the top-performing country even when not considering that particular investment, while this cannot be said for Ghana. This would

make Ghana a clear outlier, but it is more difficult to say the same about Mauritius. This study does not allow to understand whether Mauritius receives investments because of the quality of its EE or the other way around. It is important to note that Mauritius has business-friendly regulations and a predictable and developed legal system that make it the best choice for registering companies in the African continent, especially for fund managers (limacap, 2024). However, this is indicative that the investments toward Mauritius hardly stay there and are directly invested within its ecosystem.

The research question of study was about the relationships between blended finance for sustainable development, green venture capital activity, and the entrepreneurial ecosystems across African countries. To answer it, two research sub-questions were formulated and answered. The first one concerned the distribution and relationship between blended finance investments and entrepreneurial ecosystems. To answer this specific question, two hypotheses were formulated. Hypothesis 1 concerned the relationship between blended finance investments and EE quality considered in the same period. Contrary to expectations, the empirical evidence points to a positive relationship between the two. This result challenges the notion that blended finance should target new markets and sectors with higher social returns initially, then withdraw to leave space to private investors (Attridge & Engen, 2019). This means that DFIs and other investors that use blended finance mechanisms to fund sustainable development in Africa are targeting the countries that have already the EE with the best quality. One possible explanation for this result is that the capital markets in some countries are so underdeveloped and the risks for investments so high that it is not possible even with these alternative finance sources to penetrate these markets. Also because the returns on the investments must be acceptable for private investors to crowd in in this type of transaction. Therefore, even if DFIs take on a big part of the financial risks, the expected returns for investments in some geographies are just not high enough. Another reason for this positive effect can be that who provides concessional capital has still a too high bar for the level of risks that is willing to accept, dictating in the first place what investments are ultimately presented to private investors.

The second hypothesis proposed by this study was instrumental in investigating the effects of blended finance investments in the past on the quality of EEs today. Considering blended finance investments in a 20 year time span from 2004 to 2023, it was possible to see a positive - albeit quite modest – relationship with the quality of EEs today. This result is in line with the expectations of the paper and confirms that, at least in the long term, blended finance investments are partially reaching the goal of lowering market risks, providing valuable technical assistance, network creation, knowledge sharing (OECD & WEF, 2015), and mentorship (Clayton et al., 2023). Moreover, there are hints that this approach is improving the conditions for entrepreneurship in less developed countries, in line with the notion that DFIs do not only provide development capital but also elements such as entrepreneurial culture and managerial capabilities that in turn foster the private sector (Odedokun, 1996). However, this study is wary of establishing directed causation and ascribing these effects directly to blended finance investments.

In order to answer the second sub-question, hypothesis 3 was used to investigate the presence of a positive interaction effect between blended finance and green venture capital activity that mediates their relationship with the quality of entrepreneurial ecosystems. The results this study obtained suggest that there is no empirical evidence of this effect. Both GVC and the interaction

effect have shown no effect on the quality of entrepreneurial ecosystems. This challenges the assumption of a synergic effect between the two sources of finance as suggested by Bocken (2015) and Hunter (2022). Making sense of this result is not straightforward and really challenging given the data at disposal. It is important to remember that the time period taken into consideration for this hypothesis was only from 2019 to 2023. Moreover, there is the possibility that because of the private nature of venture capital deals, some of them have not been recorded in the database used for this study. However, the results indicate that the relationship between blended finance and GVC is stuck at the level of just DFIs investing in funds in the region, and it is not going deeper at the level of direct investments and market creation activities on the ground.

This study is one of the first attempts to see how development finance can serve as a catalyst for entrepreneurial ecosystems in developing countries. Future research should address how this relationship evolves over time, trying to test more carefully for causation. It would be helpful to understand how the distribution of development finance and the quality of the ecosystems evolve over time. Secondly, more in-depth qualitative studies of specific African countries or regions could shed light on the mechanisms of blended finance investments, what are the actors involved in these kinds of transactions, and whether these mechanisms are more likely to work better in ecosystems with particular configurations. A more qualitative approach would complement quantitative findings and offer a more comprehensive understanding of local dynamics. Thirdly, the sustainability aspect of EEs and development finance should be studied more in detail, exploring the direct and indirect effects of entrepreneurial ecosystems and development finance on sustainable development outcomes as identified by Audretsch et al. (2024). This could imply the integration of sustainability metrics to better understand how and whether impact is achieved. Lastly, more attention should be directed to the configurations of entrepreneurial ecosystems in Africa, understanding what are the configurations that are more effective in fostering entrepreneurship and sustainable development in particular.

The first implication of this study follows from the main finding, that is a modest relationship between blended finance investments, green venture capital and the quality of EEs. This is one of the first confirmations that financial mechanisms shaped around particular local contexts can enhance ecosystem quality. Moreover, the study highlights the need to consider a wider range of financial sources when investigating entrepreneurial ecosystems in developing countries. Venture capital is an important capital provider in the Western world, but it might be less effective in Africa where the development of markets and EEs still lags behind. However, policymakers and practitioners should recognize that risk mitigation through blended finance structuring still remain a priority and there is a lot still to do in this regard in the African continent. As capital is still predominantly directed to countries with the lowest risk level in Africa. In this regard, DFIs should continue to provide technical assistance alongside financial support but should also try to increase coordination with other financial institutions to amplify the impact of investments and ensure that resources are used effectively to promote sustainable development. Policymakers both in Africa and not should understand how to facilitate the coordination between DFIs and GVC to maximize their potential impact, and make sure to bridge the gap for entrepreneurs to have the possibility to get the funding they need.

This study is one of the early investigations into development finance and entrepreneurial ecosystems in developing countries, as such it has a number of limitations. First of all, there is a lack of time-varying data on entrepreneurial ecosystems' quality that hinders the ability of this study to assess causation. Also for GVC, the data available covered a short time frame. Moreover, as the African Entrepreneurial Ecosystem Index represents the first effort to measure the EEs in Africa, its data is only limited to 27 countries, which is little more than half of the African continent. The low number of observations, coupled with limited time-varying data entail that the generalization of the results of this study must be taken very carefully into consideration. Finally, the accounting technique used to assign blended finance deals to the countries can be improved further, analyzing more in-depth how money flows from DFIs to the African economies. At the moment, dividing deals by type is the first solution. However, the approach taken by this study can be considered still too much arbitrary. Even though there are reasonable justifications for using this approach, a case-by-case analysis of deals could undercover new dynamics in the data and thus require a different approach.

6. Conclusion

This thesis set out to investigate the impact of development finance, in the form of blended finance investments, and green venture capital on the quality of entrepreneurial ecosystems in developing countries, with a specific focus on the African continent. The research question aimed to determine the extent to which these financial mechanisms influence the quality of entrepreneurial ecosystems and promote sustainable development. The findings suggest that the blended finance structuring approach positively influences the quality of entrepreneurial ecosystems in Africa, although the effect is modest and varies across regions. Moreover, there has been no evidence of an interaction effect between blended finance investments and GVC in affecting EEs.

The main argument of this thesis is that blended finance investments and green venture capital are crucial financial mechanisms that can improve the quality of entrepreneurial ecosystems in developing countries, while at the same time promoting sustainable development. The theoretical framework posits that these sources of finance not only affect ventures directly by providing valuable capital but also improve entrepreneurial ecosystems as they mitigate financial risks thus attracting private capital, creating networks, providing technical assistance, and supporting sustainable entrepreneurship. Empirical evidence from the study confirms a positive correlation between blended finance and EEs quality, while the impact of GVC remains still unclear. This underlines the need for more tailored financial strategies to maximize benefits for entrepreneurs and all the actors of the ecosystem.

Theoretically, this research contributes to the literature on entrepreneurial ecosystems by expanding the understanding of how financial mechanisms such as blended finance and green venture capital function within Africa. It fills the gap in the literature about development finance, entrepreneurial ecosystems, and sustainable development in the context of developing countries. Practically, the results offer insights for policymakers, development financial institutions, development organizations, and entrepreneurs. This study highlights the importance of creating more effective policies to target less developed countries by creating new ways to leverage diverse

and contextualized financial strategies aimed at improving the quality and quantity of entrepreneurship.

The findings of this study are the outcome of a robust empirical strategy, including data collection from a diverse set of sources at the frontiers of EEs research, descriptive statistics, and regression analysis. The positive correlation between blended finance investments and EE quality is consistent across all the models, suggesting reliable results. However, the unclear impact of GVC, both on its own and together with BF, indicates that further research is needed to explore the underlying mechanisms that affect this specific capital source, especially in the particular context of developing countries.

While the study confirms the positive impact of blended finance on EE quality, it also points toward a regional differentiation in the results. Northern and southern regions of Africa exhibit higher quality ecosystems compared to East and West Africa, indicating the importance of geographical and contextual factors. It is important that Africa is a continent with a considerable size, and that African countries are very different in the stage of their development. Therefore, it is crucial to move forward keeping in mind that a one-size-fits-all approach is unlikely to be effective. Tailored financial and developmental strategies are essential to address needs and challenges that are extremely local and regional in character. By doing so, practitioners and policymakers can improve the quality of entrepreneurial ecosystems and contribute to sustainable development, effectively tackling development goals such as poverty reduction and economic growth.

Appendix

Table A1: Selected examples of Blended Finance Investments and the countries to which they are assigned.

Type of deal	description	Countries	Assigned to
Bond/note	Sonatel, one of West Africa's largest telecommunications companies, issued a XOF 100B ($170M) local currency corporate bond, with proceeds going towards the expansion of 4G networks in urban and rural areas, as well as growing the company's investment in off-grid energy and digital banking. The issuance marked the largest ever corporate bond placement in West African Francs and was publicly listed on the BRVM (Bourse Régionale des Valeurs Mobilières).	Guinea, Guinea-Bissau, Mali, Senegal, Sierra Leone	Senegal
	The Women's Livelihood Bond 5 is the fifth instalment of the Women's Livelihood Bond™ Series and the world's first Orange Bond (i.e. aligned with SDG 5 and with a mission to build a gender-empowered financial system). As with the previous instalments, the bond seeks to empower women and girls in emerging economies and will be listed on SGX. WLB5 will use the bond proceeds to support enterprises in Cambodia, India, Indonesia, Kenya, and the Philippines operating in microfinance, SME lending, clean energy, sustainable agriculture, water and sanitation, and affordable housing. A portion of the proceeds have also been committed towards climate action.	Cambodia, India, Indonesia, Kenya, Philippines	Singapore
Company	Redavia designs, builds, installs and maintains containerized modular solar farms in East and West Africa.	Ghana;Kenya;Tanzania	Germany
	Ciments de l'Afrique (CIMAF) a subsidiary of OIP Group (the leading cement producer in Morocco and West Africa) secured financing to expand its existing cement grinding plants in Ghana and Mali and to build a new integrated cement plant in Senegal, collectively reducing the region's reliance on imports.	Ghana, Mali, Senegal	Morocco
Fund	CardinalStone Capital Adivsers Growth Fund is a private equity fund that aims to expand access to finance for high-growth, underserved SMEs in Nigeria and Ghana.	Ghana;Nigeria	50% each
	Private equity fund providing growth equity ($3M-$8M tickets) to SMEs in Ethiopia, and other East African countries where possible. Funding will be focused on underserved industries and is complemented by technical assistance when necessary.	Ethiopia;Kenya;Rwanda;Tanzania;Uganda	20% each
Facility	The Facility is a collaboration between Vital Capital's Impact Relief Facility and USAID's Kenya Investment Mechanism. The Vital Impact relief Facility provides debt financing to promising businesses in Sub-Saharan Africa to help them weather the challenges presented by the coronavirus pandemic, while KIM is an initiative aiming to mobilize ~$400M for key sectors of the Kenyan economy.	Angola, Congo, Dem. Rep., Cote d'Ivoire, Ghana, Kenya, Senegal, Uganda	12,5% each
	The Africa Medical Equipment Facility (AMEF) is an $100 million unfunded risk sharing facility established by IFC in partnership with local participating financial institutions to increase small and medium-sized healthcare providers' access to loan and acquisition of medical equipment in West, Central and East Africa.	Cameroon, Cote d'Ivoire, Kenya, Rwanda, Senegal, Tanzania, Uganda	14,3% each
Project	Koster Keunen is a global processor, refiner and marketer of natural beeswax and related products. The company raised financing to develop its international supply chain, namely between the US and Africa. The project aims to upgrade existing farms across West Africa, as well as introduce beekeeping activities as a secondary source of income to farmers.	Benin, Burkina Faso, Cote d'Ivoire, Ghana, Mali, Nigeria, Togo	14,3% each
	The East Africa Marine Transport project, involves the development of commercial maritime transportation infrastructure in the Lake Victoria region (Tanzania, Uganda, Kenya). The Project is a two-phase initiative. In Phase 1, a cost-effective pilot freight service will be established, involving investment in ports and the introduction of appropriate vessels capable of handling diverse freight, such as bulk cargo, intermodal containers, and vehicles. Phase 2 will focus on expanding the pilot operations by enhancing port facilities to accommodate larger and more complex freight activities, including dredging services and onshore infrastructure provisions.	Kenya, Tanzania, Uganda	33% each

Table A2: Complete Data

Country	AEEI	Urbanization	GCV	BF	BF.1923	resource	Gov.	Culture	Support	Finance	CredPriS	VC	SMarCap	Infrastr.	Market acc	Human cap
Mauritius	4,73	40,81	1	562,0047612	459,8029921	0,0025281	0,925	0,563	0,852	0,551	0,784	0,652	0,217	0,730	0,344	0,762
South Africa	3,91	68,33	62	61,21374295	17,56043309	4,8509169	0,609	0,237	0,272	0,929	1,000	0,788	1,000	0,784	0,466	0,616
Tunisia	3,55	70,21	8	46,18192313	8,737201124	2,1964188	0,733	0,415	0,300	0,421	0,886	0,316	0,062	0,674	0,216	0,791
Morocco	3,53	64,6	9	23,03418722	16,34762795	0,8558774	0,708	0,510	0,169	0,403	0,954	0,086	0,168	0,694	0,246	0,803
Cabo Verde	3,23	67,55	0	128,5230631	111,9125011	14,18633	0,926	0,208	0,540	0,210	0,630	0,000	0,000	0,610	0,163	0,568
Algeria	3,06	74,77	0	2,168409105	0	18,966382	0,570	0,534	0,098	0,133	0,229	0,091	0,079	0,636	0,251	0,835
Namibia	3,05	53,96	1	51,5587051	8,57714607	2,1652544	0,671	0,347	0,290	0,318	0,644	0,248	0,062	0,688	0,207	0,528
Egypt	2,84	42,97	28	108,9904526	17,06669678	5,4295971	0,752	0,663	0,093	0,319	0,350	0,588	0,020	0,437	0,105	0,474
Senegal	2,84	49,09	13	37,8301914	56,48358588	3,2294167	0,651	0,184	0,107	0,242	0,334	0,358	0,035	0,608	0,511	0,532
Botswana	2,8	72,22	1	37,95644081	18,44854944	0,8098313	0,740	0,116	0,298	0,184	0,323	0,008	0,219	0,723	0,174	0,562
Ghana	2,57	58,62	38	387,4241452	30,72272015	10,34796	0,742	0,215	0,222	0,151	0,133	0,280	0,040	0,567	0,175	0,498
Rwanda	2,48	17,72	11	86,00693364	11,52389978	4,1632552	0,874	0,515	0,073	0,149	0,248	0,095	0,106	0,252	0,084	0,537
Nigeria	2,37	53,52	118	31,32699729	3,705270058	7,9448813	0,551	0,386	0,099	0,182	0,153	0,334	0,059	0,396	0,581	0,179
Cote d'Ivoire	2,28	52,66	3	116,46532	19,09797317	3,3487253	0,691	0,606	0,072	0,101	0,229	0,053	0,020	0,433	0,152	0,230
Kenya	2,24	29	173	101,6733412	16,86605875	1,2713123	0,532	0,066	0,162	0,352	0,342	0,650	0,065	0,385	0,183	0,560
Togo	2,24	43,92	3	97,96015081	93,05924139	5,4488399	0,662	0,634	0,059	0,136	0,299	0,090	0,020	0,302	0,072	0,373
Cameroon	2,2	58,73	7	109,699314	11,05455567	5,3821224	0,510	0,656	0,139	0,064	0,159	0,033	0,000	0,391	0,115	0,323
Mali	2,04	45,44	8	19,12204642	2,502362902	10,872171	0,552	0,695	0,058	0,122	0,321	0,024	0,020	0,376	0,098	0,138
Gambia	2	63,85	0	4,559566692	0,973615735	2,8568894	0,694	0,471	0,254	0,032	0,097	0,000	0,000	0,310	0,041	0,201
Benin	1,82	49,53	5	59,09679142	40,31487541	2,4521771	0,696	0,471	0,078	0,070	0,185	0,004	0,020	0,246	0,082	0,172
Ethiopia	1,77	22,66	2	25,66810016	15,58751209	5,8093474	0,558	0,346	0,011	0,065	0,192	0,002	0,000	0,216	0,240	0,336
Tanzania	1,76	36,68	24	17,64101934	6,718427565	4,422113	0,558	0,290	0,011	0,065	0,192	0,002	0,000	0,216	0,240	0,336
Angola	1,72	68,08	0	55,51206683	0,529616848	27,789591	0,480	0,400	0,028	0,032	0,091	0,004	0,000	0,279	0,186	0,310
Lesotho	1,69	29,94	1	15,85927022	7,981743264	4,0543006	0,652	0,052	0,147	0,083	0,248	0,000	0,000	0,369	0,133	0,252
Burkina Faso	1,56	31,88	0	34,06795766	12,39287597	11,629349	0,631	0,354	0,048	0,121	0,339	0,004	0,020	0,100	0,091	0,212
Uganda	1,52	26,16	23	59,78162341	7,536532025	7,7040581	0,547	0,205	0,060	0,081	0,160	0,034	0,049	0,161	0,120	0,345
Zimbabwe	1,38	32,4	4	24,9244014	17,76134027	4,8097687	0,417	0,000	0,127	0,034	0,095	0,006	0,000	0,359	0,108	0,336

Figure A1: IQR method boxplot to detect outliers

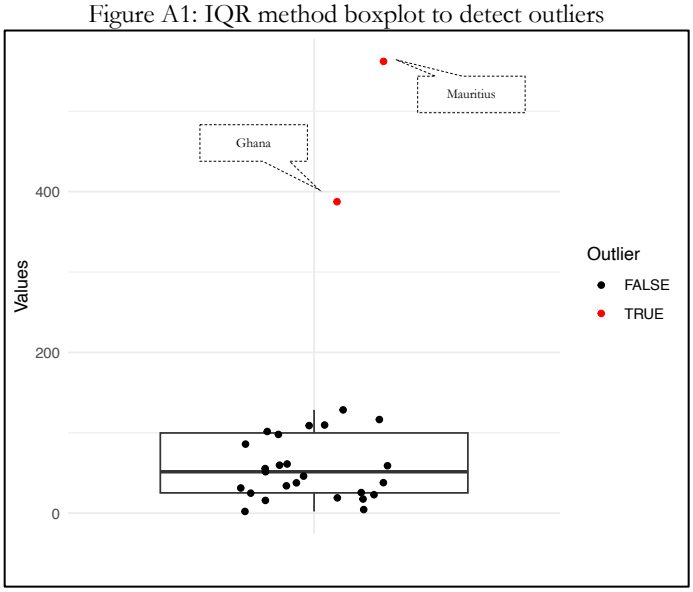
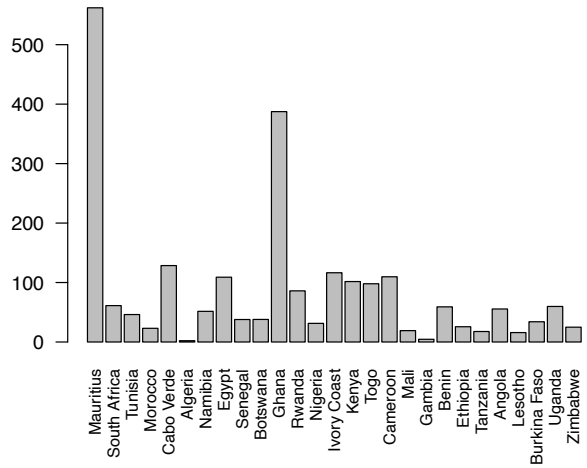


Table A3 : Histogram and Map for Blended Finance investments (2019-2023)



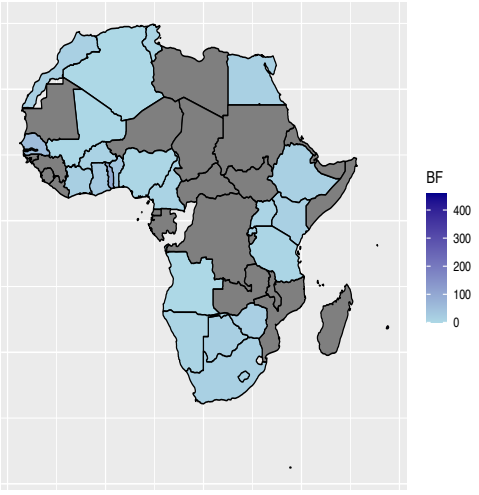


Table B1: Pearson Correlation

	AEEI	Urbanization	GCV	BF	BF.1923	Resource	Governance	Culture	Support	Finance	CredPriS	VC	SMarCap	Infrastructure	Market access	Human Capital
AEEI	1.000***	0.470*	0.016	0.501**	0.576**	-0.242	0.614***	0.198	0.752***	0.809***	0.821***	0.640***	0.537**	0.869***	0.473*	0.803***
Urbanization	0.470*	1.000***	-0.146	-0.032	-0.067	0.263	0.120	0.156	0.284	0.261	0.332	0.048	0.275	0.650***	0.228	0.357
GCV	0.016	-0.146	1.000***	0.024	-0.128	-0.139	-0.253	-0.288	-0.076	0.305	0.002	0.583**	0.211	0.002	0.395*	0.016
BF	0.501**	-0.032	0.024	1.000***	0.812***	-0.115	0.521**	0.128	0.684***	0.296	0.194	0.442*	0.087	0.306	0.092	0.298
BF.1923	0.576**	-0.067	-0.128	0.812***	1.000***	-0.202	0.537**	0.156	0.797***	0.344	0.347	0.370	0.111	0.317	0.195	0.330
Resource	-0.242	0.263	-0.139	-0.115	-0.202	1.000***	-0.279	0.080	-0.243	-0.309	-0.310	-0.284	-0.162	-0.208	-0.051	-0.124
Governance	0.614***	0.120	-0.253	0.521**	0.537**	-0.279	1.000***	0.193	0.650***	0.306	0.445*	0.190	0.082	0.399*	-0.055	0.415*
Culture	0.198	0.156	-0.288	0.128	0.156	0.080	0.193	1.000***	-0.062	-0.027	0.056	-0.033	-0.120	-0.061	-0.186	-0.047
Support	0.752***	0.284	-0.076	0.684***	0.797***	-0.243	0.650***	-0.062	1.000***	0.518**	0.576**	0.410*	0.275	0.643***	0.199	0.515**
Finance	0.809***	0.261	0.305	0.296	0.344	-0.309	0.306	-0.027	0.518**	1.000***	0.861***	0.828***	0.835***	0.694***	0.521**	0.617***
CredPriS	0.821***	0.332	0.002	0.194	0.347	-0.310	0.445*	0.056	0.576**	0.861***	1.000***	0.516**	0.600**	0.711***	0.341	0.682***
VC	0.640***	0.048	0.583**	0.442*	0.370	-0.284	0.190	-0.033	0.410*	0.828***	0.516**	1.000***	0.580**	0.502**	0.536**	0.461*
SMarCap	0.537**	0.275	0.211	0.087	0.111	-0.162	0.082	-0.120	0.275	0.835***	0.600***	0.580**	1.000***	0.509**	0.456*	0.365
Infrastructure	0.869***	0.650***	0.002	0.306	0.317	-0.208	0.399*	-0.061	0.643***	0.694***	0.711***	0.502**	0.509**	1.000***	0.474*	0.752***
Market access	0.473*	0.228	0.395*	0.092	0.195	-0.051	-0.055	-0.186	0.199	0.521**	0.341	0.536**	0.456*	0.474*	1.000***	0.298
16	0.803***	0.357	0.016	0.298	0.330	-0.124	0.415*	-0.047	0.515**	0.617***	0.682***	0.461*	0.365	0.752***	0.298	1.000***

Table B2: Spearman Correlation

	AEEI	Urbanization	GCV	BF	BF.1923	Resource	Governance	Culture	Support	Finance	CredPriS	VC	SMarCap	Infrastructure	Market access	Human Capital
AEEI	1.000***	0.541*	0.120	0.330**	0.336**	-0.313	0.606***	0.234	0.662***	0.849***	0.700***	0.644***	0.670**	0.883***	0.510*	0.755***
Urbanization	0.541*	1.000***	-0.237	-0.032	-0.075	0.020	0.184	0.145	0.479	0.218	0.128	0.079	0.225	0.642***	0.299	0.320
GCV	0.120	-0.237	1.000***	0.212	0.089	-0.118	-0.142	-0.092	-0.052	0.352	0.078	0.585**	0.314	0.052	0.233*	0.076
BF	0.330**	-0.032	0.212	1.000***	0.635***	-0.047	0.363**	0.157	0.251***	0.350	0.193	0.428*	0.181	0.220	-0.084	0.224
BF.1923	0.336**	-0.075	0.089	0.635***	1.000***	-0.311	0.497**	-0.118	0.325***	0.403	0.348	0.249	0.161	0.299	-0.026	0.292
Resource	-0.313	0.020	-0.118	-0.047	-0.311	1.000***	-0.351	0.106	-0.512	-0.376	-0.397	-0.246	-0.404	-0.375	-0.107	-0.288
Governance	0.606***	0.184	-0.142	0.363**	0.497**	-0.351	1.000***	0.201	0.489***	0.501	0.474*	0.137	0.319	0.419*	-0.102	0.401*
Culture	0.234	0.145	-0.092	0.157	-0.118	0.106	0.201	1.000***	-0.230	0.003	0.068	0.163	0.030	0.032	-0.251	-0.131
Support	0.662***	0.479	-0.052	0.251***	0.325***	-0.512	0.489***	-0.230	1.000***	0.593**	0.454**	0.318*	0.426	0.789***	0.257	0.560**
Finance	0.849***	0.218	0.352	0.350	0.403	-0.376	0.501	0.003	0.593**	1.000***	0.855***	0.761***	0.768***	0.755***	0.473**	0.709***
CredPriS	0.700***	0.128	0.078	0.193	0.348	-0.397	0.474*	0.068	0.454**	0.855***	1.000***	0.456**	0.563**	0.598***	0.289	0.623***
VC	0.644***	0.079	0.585**	0.428*	0.249	-0.246	0.137	0.163	0.318*	0.761***	0.456**	1.000***	0.737**	0.561**	0.444**	0.506*
SMarCap	0.670**	0.225	0.314	0.181	0.161	-0.404	0.319	0.030	0.426	0.768***	0.563***	0.737**	1.000***	0.603**	0.416*	0.646
Infrastructure	0.883***	0.642***	0.052	0.220	0.299	-0.375	0.419*	0.032	0.789***	0.755***	0.598***	0.561**	0.603**	1.000***	0.549*	0.670***
Market access	0.510*	0.299	0.233*	-0.084	-0.026	-0.107	-0.102	-0.251	0.257	0.473**	0.289	0.444**	0.416*	0.549*	1.000***	0.493
Human Capital	0.755***	0.320	0.076	0.224	0.292	-0.288	0.401*	-0.131	0.560**	0.709***	0.623***	0.506*	0.646	0.670***	0.493	1.000***

Table C1: Regression with control variables

	Dependent variable:
	AEEI
Urbanization	0.028***
	(0.008)
resource	-0.052**
	(0.022)
Constant	1.452***
	(0.412)
Observations	27
R^2	0.365
Adjusted R^2	0.312
Residual Std. Error	0.676 (df = 24)
F Statistic	6.884*** (df = 2; 24)
Note:	*p<0.1;**p<0.05;***p<0.01

Table C2: Regression model (1) with filtered data

	Dependent variable:	
	AEEI	
	(raw data)	(filtered dataset)
BF.1923	0.005***	
	(0.001)	
BF.1923		0.004
		(0.004)
Urbanization	0.028***	0.029***
	(0.006)	(0.006)
resource	-0.038**	-0.037**
	(0.017)	(0.018)
Constant	1.144***	1.160***
	(0.314)	(0.330)
Observations	27	25
R^2	0.663	0.520
Adjusted R^2	0.619	0.452
Residual Std. Error	0.503 (df = 23)	0.524 (df = 21)
F Statistic	15.104*** (df = 3; 23)	7.593*** (df = 3; 21)
Note:		*p<0.1;**p<0.05;***p<0.01

Figure C1: Tests H1

Breush-Pagan Test			Variance Inflation Factor		
Statistic	Degrees of Freedom	p-value	BF.1923	Urbanization	Resource
3.5718	df = 3	0.3116	1.042654	1.074399	1.114878

*p<0.1;**p<0.05;***p<0.01

Figure Normal Q-Q Plot

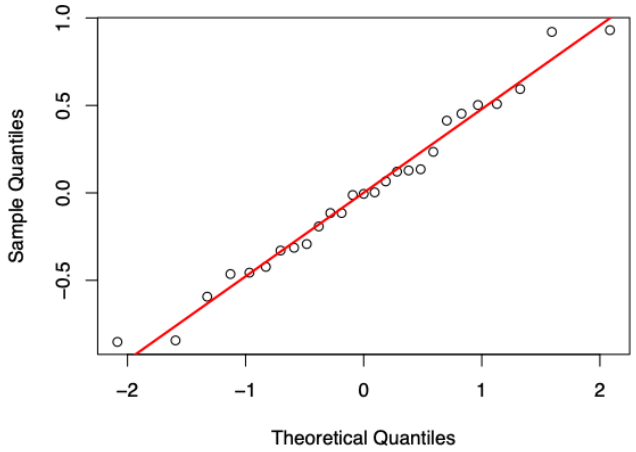


Table C3: Regression model (2) with filtered data

	Dependent variable:	
	AEEI	
	(raw data)	(filtered dataset)
BF	0.003**	0.004
	(0.001)	(0.003)
Urbanization	0.028***	0.029***
	(0.007)	(0.006)
resource	-0.045**	-0.037**
	(0.016)	(0.017)
Constant	1.125***	1.002**
	(0.321)	(0.359)
Observations		25
R^2		0.537
Adjusted R^2		0.471
Residual Std. Error		0.514 (df = 21)
F Statistic		8.119*** (df = 3; 21)
Note:		*p<0.1;**p<0.05;***p<0.01

Figure C2: Tests H2

Breush-Pagan Test			Variance Inflation Factor		
Statistic	Degrees of Freedom	p-value	BF	Urbanization	Resource
7.7824	df = 3	0.05073*	1.013325	1.074154	1.087339

*p<0.1;**p<0.05;***p<0.01

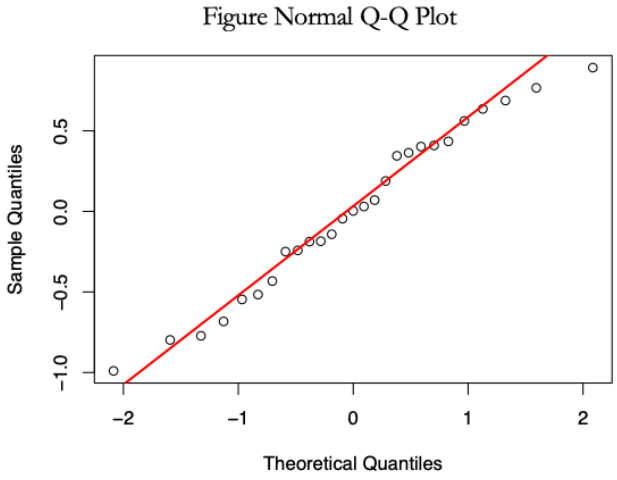


Table C4: Regression model (3) with filtered data

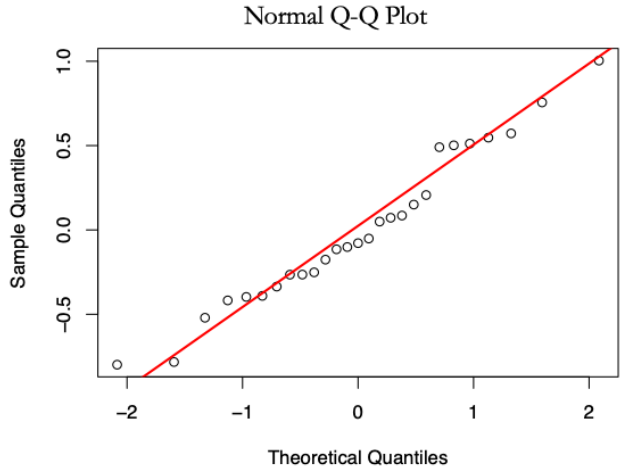
	Dependent variable:	
	AEEI	
	(raw data)	(filtered dataset)
BF.1923	0.005***	0.003
	(0.001)	(0.004)
GCV	0.001	-0.001
	(0.005)	(0.006)
Urbanization	0.029***	0.030***
	(0.006)	(0.007)
resource	-0.034*	-0.032*
	(0.017)	(0.018)
BF.1923:GCV	0.0002	0.0003
	(0.0003)	(0.0004)
Constant	1.013***	1.015**
	(0.337)	(0.356)
Observations	27	25
R^2	0.686	0.557
Adjusted R^2	0.611	0.441
Residual Std. Error	0.508 (df = 21)	0.529 (df = 19)
F Statistic	9.157*** (df = 5; 21)	4.781*** (df = 5; 19)
Note:		*p<0.1;**p<0.05;***p<0.01

Figure C3: Tests H3

Breush-Pagan Test		
Statistic	Degrees of Freedom	p-value
3.6395	df = 5	0.6024

*p<0.1;**p<0.05;***p<0.01

Variance Inflation Factor				
BF.1923	GCV	Urbanization	Resource	GCV:BF.1923
1.171235	3.986659	1.089726	1.148545	3.965739



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