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The green bond market: a potential source of climate finance for developing countries

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ABSTRACT

This paper examines the potential of green bonds in mobilizing adaptation and mitigation finance for developing countries. Building upon a theoretical approach, it identifies the key drivers of the green bond market over the last few years and the barriers that impede its appropriation by developing countries. The results suggest that the rise of green bonds is a fact in developed and emerging countries, backed by an increasing climate-awareness from investors. However, in developing countries, the market remains incipient, and its full potential seems to be underappreciated. The lack of appropriate institutional arrangements for green bond management, the issue of minimum size, and high transactions costs associated with green bond issuance, are the key barriers to the development of green bonds in developing countries. In order to cope with these challenges, this paper suggests an efficient use of multilateral and national development banks as intermediary institutions for local green bond management. Furthermore, local governments are required to provide local green bond issuers with guarantees aimed at covering the transaction costs associated with green bond issuance.

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Green bonds; minimum size; transaction costs; development banks; developing countries

1. Introduction

The transition to a resilient and lower-carbon economy requires significant investment from both public and private sectors. Recent climate summits have revealed that finance is critical for the implementation of Intended Nationally Determined Contributions (INDCs), in which nearly 200 countries have publicly outlined their intentions in terms of greenhouse gas reduction. For many developing countries, these intentions are highly dependent on the pledges of developed countries to provide them with USD 100 billion annually for their adaptation and mitigation projects (UNFCCC 2009). However, the current economic turmoil that prevails in most developed countries (King 2017) and the lack of common understanding about the balancing between adaptation and mitigation finance (Pickering et al. 2015) suggest that developing countries are unlikely to achieve their emission reduction targets by solely relying on those pledges. Rather, developing countries must also explore new financing mechanisms, such as green bonds if their commitments should be respected.

As innovative financial instruments, green bonds provide an opportunity to tap into new pools of private capital to finance green projects (EY 2018).

The term 'green bonds' refers to bonds whose proceeds are used to finance environmentally-friendly projects (Mercer 2015), such as renewables, water and energy efficiency, bioenergy, and low carbon transports (Campiglio 2016).

So far, there is no universal definition of green bonds, though a growing consensus has emerged on what they are intended to do (OECD 2017; German Development Institute 2016). For the purpose of this paper, a green bond should be defined as a fixed-income financial instrument for raising capital to finance or refinance eligible green projects (OECD 2017; ICMA 2017).

As such, green bonds are of significant importance to both investors and policy makers. On one hand, governments need access to affordable and reliable financial resources in order to fulfill their commitment under the 2015 Paris Agreement, which aims to hold the increase in the global average temperature to well below 2° Celsius above pre-industrial levels (United Nations 2015). In the other hand, investors are increasingly encouraged to adapt their business models to create a not only financial value but also social and environmental values (Schoenmaker 2017).

During the 2008 financial crisis, green bonds were a concept of limited interest to investors (United Nations Secretary-General 2015; German Development Institute 2016), since environmental projects were deemed risky and non-profitable by traditional investors (Wharthon 2015). Surprisingly, there has been an exponential growth in green bond issuance since then, attributable to an increased awareness from traditional investors about the benefits of green investments (Shishlov, Morel, and Cochran 2016) and the potential impacts of climate change on financial assets (Carney 2016; Mercer 2015; Schoenmaker 2017; Caldecott 2017).

Investors' appetite for green bonds has therefore grown rapidly (Pham 2016), as they realize that climate change is a new investment return variable, which deserves significant attention (Mercer 2015). Many investors, especially those in the carbon-intensive sectors of the economy, have now become very reactive to climate-related technologies, such as carbon capture and sequestration (CCS). More importantly, an increasing number of investors began to incorporate climate change risk assessments into their investment strategies (Byrd and Cooperman 2018).

The European Investment Bank (EIB) was the first multilateral development institution to issue a climate-awareness bond, worth USD 1 billion, in 2007. A year later, the World Bank issued a second green bond to finance climate mitigation and adaptation projects in its countries of operations. Since then, municipalities, commercial banks and some of the world's largest companies followed in the same direction. For instance, green bond issuance has grown drastically from USD 1 billion in 2007 to USD 895 billion in 2017, of which USD 674 billion were self-labeled green bonds, and USD 221 billion of certified labeled green bonds, according to the Climate Bonds Initiative. Certified green bonds refer to bonds that completed a certification process to receive the green label, which means that all their proceeds must be used to finance the green projects for which they have been issued. In contrast, self-labeled green bonds are bonds labeled as green by the issuer but not attested by an independent reviewer, as is the case for certified green bonds.

Since 2014, there have been significant efforts aimed at making green bond standards more popular to investors (Ceres 2014). Yet, the size and scope of the green bond market

remain negligible compared to the global fixed-income market (Franklin 2016; Moody's 2017). Furthermore, the development of the green bond market is only perceptible in some developed and emerging countries.¹ In many developing countries, however, the market remains incipient, and its full potential seems to be underappreciated. According to the Climate Bonds Initiative, only USD 2.2 billion of total flows in the green bond market, have been directed towards cities in developing countries compared to USD 17 billion in developed countries (Climate Bonds Initiative 2016).

The objective of this paper is to analyze the rise of the green bond market over the last few years, by putting an emphasis on its key drivers and the barriers that prevent developing countries from exploiting this new yet growing source of climate finance. Beyond its analytical contribution, this paper aims to push forward the literature on green bonds.

The remaining of the paper is structured as follows. Section 2 shows recent trends in the green bond market. Section 3 identifies relevant barriers that prevent developing countries from taking advantage of that market. Section 4 discusses the findings and provides a set of policy recommendations aimed at helping developing countries overcome these barriers. Section 5 concludes.

2. Recent trends in the green bond market

Green bonds provide an opportunity for long-term and sustainable infrastructure financing. Previously carried out by multilateral development banks (MDBs), namely the World Bank and the European Investment Bank, green bond issuance has promptly spread to other traditional investors, such as institutional investors, commercial banks, municipalities, and some of the world's largest companies. Investments in this new and growing segment of fixed-income markets have increased more than ten-fold over the past five years and is expected to reach USD 1 trillion by 2020, as the demand for green bonds continues to rise (CBI and HSBC 2017).

The launching of the Green Bond Principles (GBPs)² in 2014, which now involve a consortium of more than 200 financial and non-financial institutions, has only strengthened the emergence of green bonds. According to Climate Bonds Initiative's database,³ the total number of green bonds issued has increased from one in 2007 to more than 2000 issued green bonds in 2017, a spectacular annual growth of more than 113% during the same period. In 2017, the United States, China, and France accounted for 56% of global green bond issuance (see Figure 1).

Developing countries, however, are excluded from this growing source of climate finance they need to implement their adaptation and mitigation projects. A thorough analysis of the Climate Bonds Initiative's database shows that only a small handful of investors and governments from those countries have issued green bonds so far. Nevertheless, a growing number of them are progressively looking after the market,⁴ which is drawn by several factors.

2.1. The key drivers of the green bond market

Without claiming to be exhaustive, this subsection identifies several forces that have been decisive for the development of the green bond market in developed and emerging countries over the last few years.

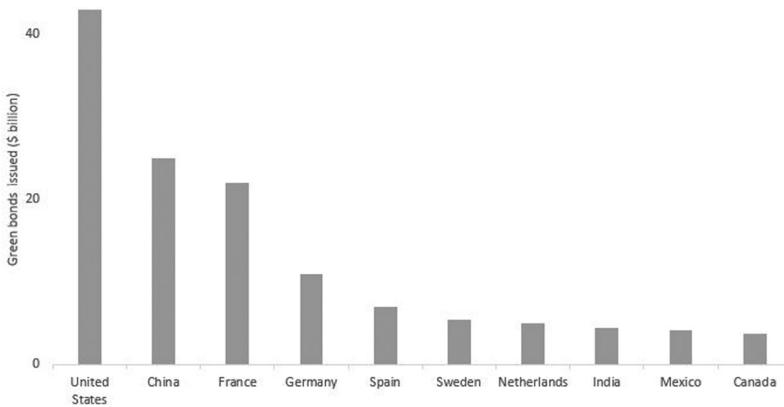


Figure 1. Top ten issuers of green bonds, January-November 2017. Data source: Climate Bonds Initiative.

First, with few exceptions, green bonds are inherently similar to conventional bonds in terms of structure. Their deals carry the same risk/return profile like any conventional bond issued in the fixed-income market. The pricing and yield to maturity of green bonds are indeed akin to that of conventional bonds. Recent empirical studies showed that there is a strong correlation between the yield to maturity (YTM)⁵ of green bonds and that of conventional bonds (Wanke 2017). Figure 2 depicts this correlation for green bonds and conventional bonds issued by the German Development Bank (KfW) and Apple.

The fact that green bonds are ranked *pari passu* with conventional bonds in terms of yield to maturity, is to some extent a key element that boosts investor’s appetite for green bonds. Furthermore, investors have realized that investing in environment-related projects, does not necessarily jeopardize return on investment.

The main difference between green bonds and conventional bonds is that unlike the latter the proceeds of the former must be entirely allocated for environmentally-friendly projects (CBI and HSBC 2017). Moreover, green bonds often require a more complex-issuance process, since their deal typically involves at least three market players, whose roles are discussed in the next subsection.

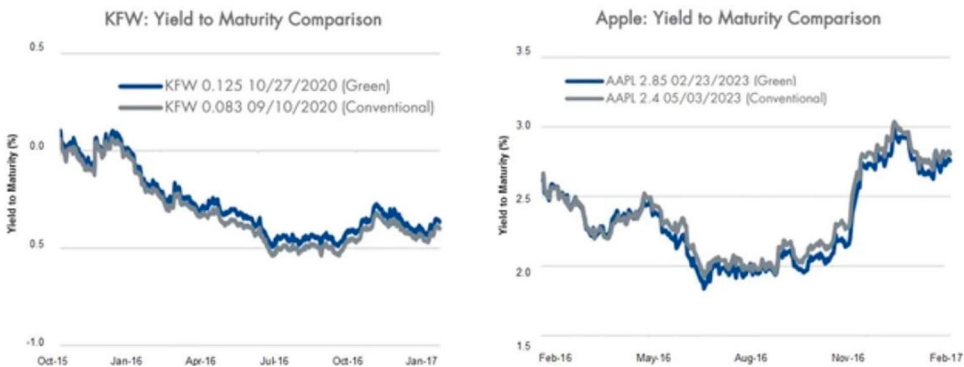


Figure 2. Yield to maturity: green bond vs. conventional bond. Data Source: Bloomberg as of 1/31/2017.

The recent rise of the green bond market also stems from two mutually re-enforcing arguments. The first is due to an increased understanding about the potential links between climate change and financial stability.

Investors and policy makers have indeed become increasingly aware of the potential risks climate change poses to businesses and the financial sector as a whole (Carney 2016; TCFD 2017). This climate-awareness has led to the implementation of preventive measures, such as climate risk stress tests aimed at assessing the exposure of financial institutions to climate change risks (Battiston et al. 2017; Mercer 2015). The ultimate goal of these tests is to ensure that the whole financial system is resilient to climate change impacts. This is why some authors urge investors to move from the shareholder model which focuses on profit maximization only, to the stakeholder model which aims to create not only a financial value but also social and environmental values (Schoemaker 2017). As Weber (2018) suggests, the adoption of voluntary sustainability codes of conduct could help create a more sustainable financial system, in which environmental risks are well recognized and managed. By doing so, investors could sensibly reduce their exposure to climate change risks, thereby limiting their potential capital loss due to stranded assets, as a result of climate change impacts. Stranded assets are 'assets that have suffered from unanticipated or premature write-downs, devaluations or conversions to liabilities' (Caldecott, Howarth, and McSharry 2013).

It is therefore important that investors include environmental-social-governance (ESG) criteria into their investment decision-making. The incorporation of such criteria within financial markets' structures is becoming increasingly obvious as rating agencies such as Moody's, Standard & Spoor, and Barclay's MSCI have started to establish green bond standards and indexes aimed at assessing the environmental impacts of their clients' portfolios.

The second argument is political in nature and derives from the 2015 Paris agreement, signed in December 2015. At the Paris climate conference (COP 21), nearly 200 countries have adopted a binding climate deal aimed at cutting down greenhouse gas emissions in order to limit global warming 2° Celsius above pre-industrial levels, with 66% of probability by the end of this century. Furthermore, during the 2016 G20 summit held in Hangzhou, the world's political leaders have agreed to 'support the development of local green bond markets and promote international collaboration to facilitate cross-border investments in green bonds' (G20 2016). This historic political support for climate action has sent positive signals to investors, thereby strengthening the green bond market development, especially in advanced and emerging countries. Figure 3, for instance, highlights the positive response of financial markets to the ratification of the Paris climate agreement. This figure shows that the S&P 500 renewable energy index over-performed the STOWE global coal index shortly after the ratification of the Paris agreement, thereby highlighting the importance of policy support in scaling up the green bond market.

Last but not least, the development of the green bond market arguably stems from the consequences of 'unconventional monetary policies' implemented by the world's major central banks in the aftermath of the 2008 financial crisis. The failure of monetary authorities to achieve economic recovery through accommodative monetary policies has resulted in low-interest rates and hungry for yield, especially in advanced economies (King 2017). Consequently, institutional investors, 'such as pension funds and insurance companies are coming under pressure to find ways of making their savings products more

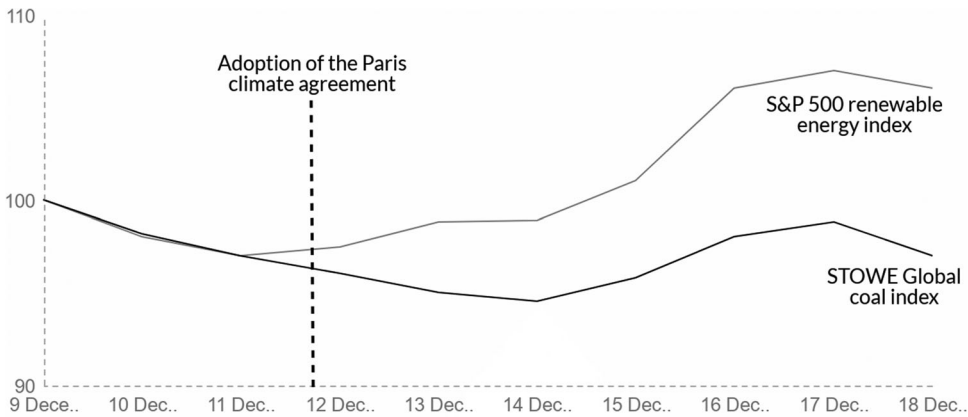


Figure 3. Reaction of financial markets to Paris climate announcement. This figure shows how the rates of green (S&P 500 renewable energy index) and brown (STOWE Global Coal Index) companies responded to the ratification of the Paris climate agreement. Source: Adapted from DNB (2017).

attractive and reduce the rising costs of pension provision in the face of falling real interest rates’ (King 2017, 32). Such a pressure has led many institutional investors – who hold nearly USD 100 trillion in assets (Arezki et al. 2016) – to look for new investment opportunities such as those of the low-carbon transition, which also match their investment horizons. As one of the major market players in the fixed-income markets, institutional investors have realized that sustainable investing can preserve wealth and provide reliable streams of revenue, while reducing volatility in the equity markets. This increased climate-awareness and the low-interest rate environment prevailing in most developed countries have led institutional investors to recognize green bonds as a portfolio diversification instrument.

2.2. Typology and the functioning of green bonds

Depending on the use of proceeds, it is possible to currently distinguish between four specific types of green bonds, all of which are consistent with the Green Bond Principles: standard green use of proceeds bonds, green revenue bonds, green project bonds, and green securitized bonds (ICMA 2017).

A standard green use of proceeds bond is a debt obligation with recourse to the issuer in the case of default on interest payment or return of principal. The proceeds of such a bond should be tracked with a specific sub-account or by the issuer following an internal process that links the issuer’s lending and green investments. While purchasing such a bond, it is recommended that the issuer makes known to investors the intended types of eligible investments for the balance of unallocated proceeds (Ceres 2014). Green revenue bonds are non-recourse-to-the-issuer debt obligations, for which the credit exposure in the bond is to the pledged cash flows of the revenue streams, fees, and taxes (ICMA 2017). The proceeds of that bond could go to related or unrelated green projects. Next, a green project bond is a bond issued for a single or pooled green project(s) for which risks are entirely bore by the underwriter, with or without potential recourse to the issuer (Ceres 2014; ICMA 2017). Finally, green securitized bonds are collateralized by

one or more specific green projects. They include but are not limited to covered bond and asset-backed securities (ICMA 2017). In the event of default of payment, green securitized bonds could provide recourse to the issuer only to the underlying assets. The repayment of such bonds usually depends upon the cash flows generated by these assets. It could be, for instance, the charge paid by consumers to use infrastructures that have been set up thanks to the proceeds of the green bond (Kaminker and Stewart 2012).

Given the lack of universal standards and definition for green bonds, it is likely that their characteristics (i.e. coupon and maturity) may differ from one issuer to another (Flaherty et al. 2017). Nevertheless, the goal remains the same, which is to finance green projects.

The process of issuing a certified green bond involves at least three major market players, including the issuer, an independent reviewer, and the underwriters as highlighted in Figure 4 below.

The process then begins when an issuer or a project developer sets up a green project. In the project document, the issuer should itemize, as much as possible, the expected positive impacts of its project on the environment. In order to avoid overestimations or underestimations of such impacts, an independent reviewer who is a specialist of environmental impact assessment, is required to confirm whether the project is actually environmentally-friendly. The role of the independent reviewer is to carry out a quantitative and qualitative assessment of the project, based on the following criteria suggested by ICMA (2017).

- (1) The use of proceeds: prior to issuance, a legal document must specify how the proceeds of the bond will be used.
- (2) A technical assessment of specific risks and opportunities tied to the project and the creditworthiness of the green bond issuer.
- (3) The monitoring, reporting, and traceability requirements: several reports are regularly produced to monitor both the project and the use of the proceeds in order to make sure that the green bond proceeds are being allocated in accordance with the Green Bonds Principles.

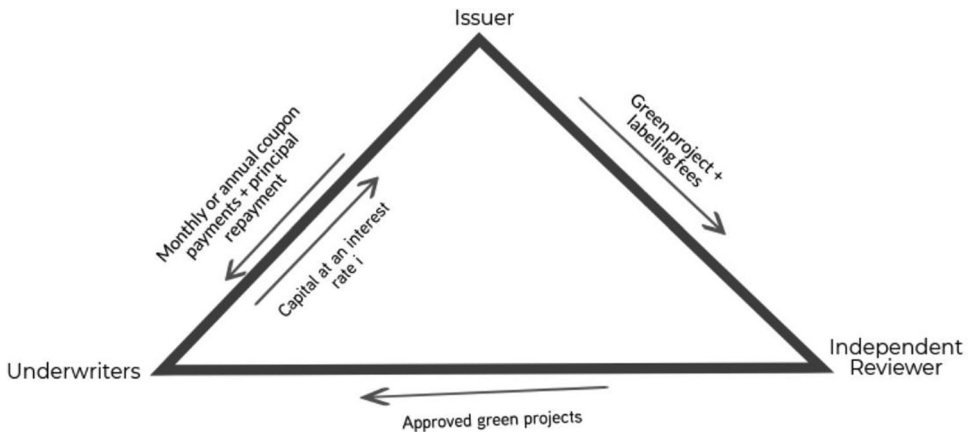


Figure 4. The process for issuing a certified green bond involves three markets players with specific roles. Source: author's construction.

Failures in complying with these requirements could result in the exclusion of the issuer from the green bond market. Once the second opinion attests the green nature of the project to be financed, the issuer is allowed to issue a certified labeled green bond in order to raise funds in the debt capital market. Green bond underwriters then provide capital to the issuer for a certain period of time at a fixed or variable interest rate (German Development Institute 2016). This tripartite process of green bond issuance could entail some significant transaction costs, as argued in the next section.

It is worth noting that Figure 4 below is made simplistic for illustration purposes. In practice, however, this process may vary from one market to another.

Although the green bond market is quickly growing, its size still remains small compared to the global fixed-income market (Franklin 2016; Moody's 2017). According to S&P Global, green bonds represent only 1.4% of the total fixed-income market (S&P Global 2017). Furthermore, the market is mainly polarized in developed and emerging economies. According to the Climate Bond Initiative data, China represented over 40% of the global green bond issuance in 2016, while regions such as Asia (excluding China) and Africa accounted for less than 6.5% of global green bond issuance in 2007-2016. These figures suggest that the green bond market faces many challenges that jeopardize its development in developing countries.

3. Barriers to the green bond market in developing countries

Although green bonds have the potential to attract significant private climate finance for developing countries, their adoption is still plagued with several barriers. These obstacles range from institutional to market barriers and are deemed to be the most challenging for the development of the market. This section elaborates on these barriers, while recognizing that their importance may vary across countries.

3.1. Institutional barriers

Green bonds foremost require technical skills for monitoring and assessing of their use of proceeds throughout the project's lifecycle. Many developing countries, however, lack such technical skills which are essential to ensure that projects are implemented in accordance with the Green Bond Principles.

A recent survey by the G20 Green Finance Study Group revealed that the lack of knowledge of existing international practices in green bond transactions was reported by respondents (up to 74%) as an important barrier for the development of the green bond market (GFSG 2016). This is particularly true in many developing countries, where this knowledge gap could also be exacerbated by the fact that the benefits of green bonds have not yet caught policy-makers' attention, as well as bond issuers and investors. The lack of commonly agreed standards for green bonds (OECD 2017) and their relative newness could justify this gap of knowledge.

Next, inappropriate institutional arrangements in some developing countries do not enable the emergence of green bonds. Often, different ministry departments with different mandates and skills are pursuing different, if not conflicting goals in the implementation of the government's policy. As a result, environmentally-friendly projects

in countries where voters do not show strong support for climate policies (Obradovich and Zimmerman 2016), are likely to become less of a priority.

Pickering et al. (2015)'s argument that there is often a disagreement among ministries in developed countries about the balance between adaptation and mitigation finance for recipients countries, also holds for developing countries regarding the country's development priorities and the mandates of different ministry departments. These divergences of priorities and mandates may result in diminished policy influence of Environment Ministries, meaning that an effective coordination between the Ministry of Finance and that of Environment, is essential for the development of government-based green bond issuance and the emergence of local green bond markets. However, institutional barriers are compounded by market barriers that hinder the development of green bond in developing countries.

3.2. Market barriers

There are three important market barriers, which dampen the development of the green bond market in developing countries: the issue of minimum size, the currency of issuance, and high transaction costs associated with green bond issuance.

The issue of minimum size refers to the minimum value that a green bond should bear to be appealing to green bond underwriters.

If green bonds offer an opportunity to tap into private capital for sustainable infrastructure financing, one of their major constraints, is that their size must be large enough to be appealing to green bond purchasers, such as those of the Green Bond Underwriters League Table (GBULT). The GBULT includes some of the world largest banks such as Citi, HSBC, JP Morgan or Bank of America Merrill Lynch, as well as some institutional investors who are managing trillions of dollars in assets. For these investors, the size, tenure, and liquidity of green bonds are key elements that they consider before lending their money (EY 2018; Chiang 2017; Duru and Nyong 2016). According to Franklin (2016), bond investors like to see at least USD 200 million equivalent in liquidity before lending their money, while for the world's major rating agencies such as Moody's, green bonds must have a minimum value of USD 250 million to be eligible for index inclusion (Chiang 2017).

It is worth noting, however, that many green projects implemented in developing countries, are of small size and do not comply with the minimum size required by investors for a green bond transaction. In many of those countries, the low population density, coupled with high poverty rates usually makes standalone small projects more cost-effective than large-scale projects, especially in rural areas (UNCTAD 2017). However, the size of the vast majority of these small scale projects barely exceeds USD 10 billion on average, suggesting that the minimum size required by investors could ultimately stand as an important barrier to market entry for developing countries. Figure 5, for instance, displays both the costs of different green projects implemented in selected developing countries and the minimum size required by investors. The underlying projects are coordinated and implemented by the World Bank and the United Nations Development Programme (UNDP) under the Least Developed Countries Fund (LDCF). For comparison purposes, this Figure 5 has been adjusted to display the annual cost of China's pollution abatement projects (USD 310 billion) as well as the cost of the Green Wall Initiative (GWI), which is a regional green projects of Sub-Saharan African countries. It can be

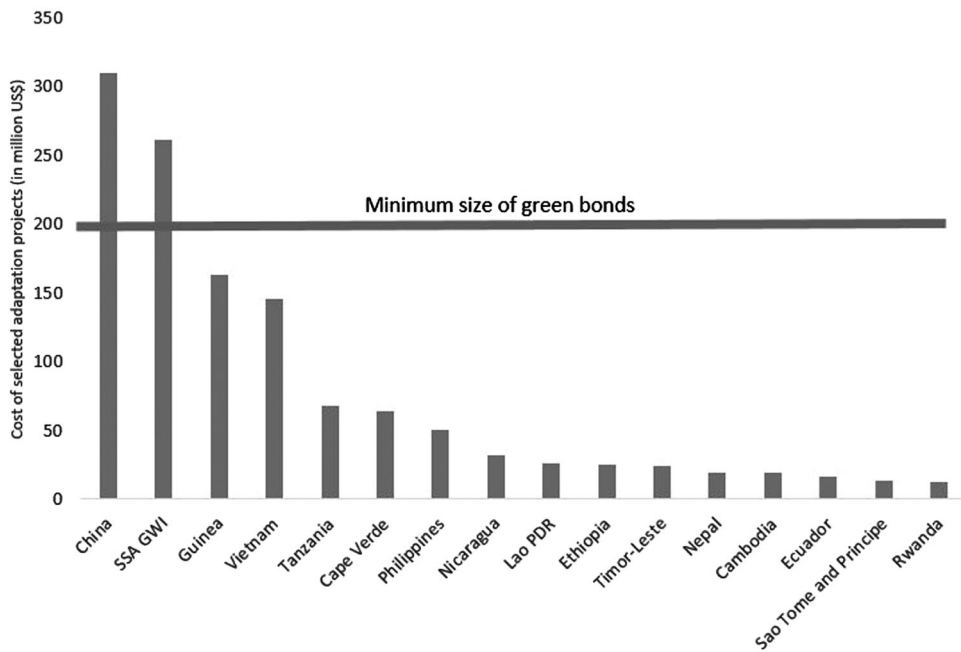


Figure 5. Green projects in developing countries do not match the minimum size required by green bond underwriters in the green bond market. Data source: Author's construction based on the Least Developed Countries Fund data.

easily observed that the cost of individual projects is well below the minimum size that GBULT members require for green bond transactions.

Next, transaction costs refer to costs incurred by the issuer to get a green label certification from the independent reviewer and to produce regular documents showing the allocation of the green bond proceeds throughout the project's life cycle. Such transaction costs could prove to be significant (EY 2018), especially when a creditworthiness survey of the issuer is required alongside the technical assessment of the potential impact of its project. According to Kaminker, Kidney, and Pfaff (2016), the relatively high cost of obtaining a second opinion or third-party assurance could range from USD 10 to 100 thousand dollars. These transaction costs from pre-issuance to post-issuance could ultimately stand as an important barrier for small green bond issuers.

Finally, a non-negligible barrier to the spread of green bonds in developing countries is likely the currency of issuance. A review of the Climate Bonds Initiative's database shows that, between 2005 and 2017, investors have mainly use the Renminbi (32%), the US dollar (26%), and the Euro (20%) to issue green bonds. These figures suggest that developing countries -the majority of which have unconvertible currencies- must issue their green bonds in international currencies, should they desire to raise large amounts of capital in international financial markets. This financing mechanism, however, presents both the lenders and the borrowers with a currency risk, as the revenue flows of the project to be financed typically relate to local currencies (Edwards 1983).

It must be recalled that the currency risk is not new to developing countries, nor is it specific to the green bond market. Eichengreen and Hausman (1999) neatly termed this

issue the ‘original sin’ to characterize the fragile structure of developing countries’ financial markets that undermines their ability to borrow abroad due to the inconvertibility of their currency or to borrow long-term domestically due to the dearth of domestic long-term credit instruments (UNCTAD 2007). Nevertheless, it suggests that the implementation of local currency-based green bond issuance could be beneficial for developing countries.

4. Avenues for scaling up green bond issuances in developing countries

The green bond market is experiencing many challenges in developing countries that hinder its development. However, recent trends suggest that appropriate policy measures could help address these challenges and enable the market to take root.

Some market analysts have suggested a ‘green stripping’ system to cope with the issue of minimum size (Franklin 2016). Under such a framework, an issuer could issue a bond aimed at financing both green and brown projects rather than issuing a one hundred percent green bond. In that case, only a fraction of the proceeds of that bond- the green stripe – should be used to finance the green project.

Although the green stripping system is a possible remedy to the issue of minimum size, this paper argues that it is only suitable for investors who are familiar with the market and have a good creditworthiness. However, the high debt service ratios of developing countries reduce their creditworthiness, thereby increasing their perceived probability of default (Edwards 1986). Since issuers’ creditworthiness is one of the key elements that investors consider before lending their money, it is likely that the green stripping system may not fit as the best solution for developing countries.

Moreover, the green stripping strategy could give rise to greenwashing behaviors. Greenwashing occurs when an issuer promotes green-based projects in order to raise funds in the green bond market, but actually operates in a way that damages the environment. Greenwashing ‘sins’ could have, therefore, profound negative effects on investors’ confidence on green bonds, thereby hampering the market development. Lax and uncertain regulations (Delmas and Burbano 2011), as well as monitoring failures throughout the project’s lifespan, are the key drivers of greenwashing behaviors.

Given the unsuitability of the green stripping strategy as a solution for developing countries and the problems it may give rise to, this paper calls for the implementation of local green bond markets based on a top-down approach, in which local governments play a central role. Such a role should consist of promoting local green investments and providing guarantees for local green bond issuances. For instance, the government could cover all the transaction costs associated with green bond issuance, so that the cost of issuing a green bond is on par with that of issuing a conventional bond.

The issue of minimum size is, however, just the tip of the iceberg. The core issue is that developing countries have a very limited access to national and international capital markets. According to the World Bank, less than 20% of the largest cities in developing countries have access to local capital markets, and only 4% have access to international capital markets (World Bank 2013). Furthermore, projected population growth (UN-DESA 2017) suggests that most of climate change adaptation and mitigation projects in developing countries will be the responsibility of cities. This means that local governments need access to reliable and affordable green finance to implement their clean projects of the future.

Beyond the importance of an effective coordination between Ministries of finance and environment, it is important that multilateral and national development banks act as intermediaries for green bond issuance and management in developing countries. Development banks are indeed able to borrow from financial markets on favorable terms due to their excellent credit ratings (UNFCCC Standing Committee on Finance 2016). This fundraising capacity makes them able to lend funds to their developing countries clients on more favorable terms than they would get from other lenders (Campiglio 2016). However, as argued in previous sections most green projects implemented in developing countries are of small sizes, meaning that development banks would need to adopt a pooling strategy to cope with the market minimum requirements for green bond transactions. By pooling small size projects or focusing on regional-scale projects, such as the Green Wall Initiative, multilateral development banks could raise finance in more favorable terms and fund green project sponsors, who otherwise would not have access to capital at an efficient cost (RCB 2017).

Another possible way to fill the green investment gap in developing countries could be, for instance, the establishment of green investment banks. According to OECD (2014), a green bank is a public or quasi-public entity established to facilitate private investment into domestic low-carbon, climate-resilient infrastructures. A well-designed green banking model could indeed be an effective tool for channeling private investments towards adaptation and mitigation projects. However, given the high costs of setting up a new bank, the dearth of capital, and the shortfall of skilled human resources in developing countries, making efficient use of existing multilateral and national development banks as well as existing climate funds, is undoubtedly the best solution. In the short to medium term, it is important to not only further research on the technical implementation of the green banking model but also to improve data collection for future empirical-based research on the green bond market in developing countries.

Although the paper has reached its aim, which is to examine the rise of the green bond market over the last few years and the key barriers that undermine its rise in developing countries, one should not overlook its major limitations. First, by treating developing countries as a homogenous whole, the paper neglects their diversities in terms of green bond intake, intuitional arrangements, and economic features. Second, the paper does not capture all the barriers to the green bond market development in developing countries. As the market grows, new barriers may unfold, while the barriers highlighted in this paper may become less important. Finally, the relative dearth of academic literature on green bonds was challenging for the author in embedding the paper within a theoretical framework. Nevertheless, it has the benefit of drawing at least the attention of policy makers and investors in developing countries, as well as rolling the red carpet out for future research.

5. Conclusion

Green bonds are quickly growing and are expected to reach record levels over the next few years. Factors such as similarity in terms of yield to maturity between green bonds and conventional bonds, increased climate-awareness from investors, the commitment of policy makers to counter climate change, and the current macroeconomic environment in most developed countries have underpinned the development of green bonds over the last few years. As innovative financial instruments, green bonds provide a historic opportunity to direct private finance towards low-carbon investments.

While companies and local governments in developed and emerging countries are increasingly issuing green bonds to finance their adaptation and mitigation projects, a set of institutional and market barriers are preventing developing countries from appropriating the full benefits of green bonds. The lack of knowledge about how green bonds work, inappropriate institutional arrangement for green bond management, the issue of minimum size, the currency of issuance, and high transaction costs associated with green bond issuance are the key barriers that hamper the development of green bonds in developing countries.

The results suggest, however, that with the right measures developing countries could take full advantage of green bonds to finance their adaptation and mitigations projects, as part of the Paris climate agreement. Potential measures include an effective coordination between ministries of finance and environment, an efficient use of multilateral and national development banks as intermediary institutions for green bond management, the provision of guarantees by local governments for green bond issuance, as well as the promotion of local green bond markets, in which domestic investors could issue local currency-based green bonds. By doing so, developing countries could enhance the development of green bonds, thereby hastening the achievement of sustainable development goals.

Notes

1. Emerging countries are defined here as countries with high levels of economic development and potential for rapid industrialization. They include but are not limited to the top 20 emerging markets ranked by Bloomberg Market Magazine in 2013. Available here: <https://www.bloomberg.com/news/photo-essays/2013-01-31/the-top-20-emerging-markets>.
2. According to the International Capital Market Association, GBPs are voluntary process guidelines that recommend transparency and disclosure and promote integrity in the green bond market. They aid investors by ensuring availability of information necessary to evaluate the environmental impact of their green bond investment.
3. The Climate Bonds Initiative is a London-based not-for-profit international organization, which has been tracking the green labeled market since 2009. It annually produces a report highlighting the state of the green bond market across the world.
4. In 2017, there were ten new entrants to the market, among which the majority are developing countries: Argentina, Chile, Fiji, Malaysia, Lithuania, Nigeria, Slovenia, Singapore, United Arab Emirates, and Switzerland.
5. The Yield to Maturity is the internal rate of return of an investment in a bond if that bond is held until the end of its lifetime.

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Disclosure statement

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