AUGUST 2024
No. 320

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Research papers

How Public Development Banks mobilize their resources to finance transitions?

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How Public Development Banks mobilize their resources to finance transitions?

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Abstract
This paper studies how Public Development Banks (PDBs) are able to finance the transition by focusing on their funding resources. The first part of the paper focuses on an explanatory analysis of funding structure of PDBs. Unlike commercial banks, short-term resources play a minor role (15% on average of all resources), while illiquid resources (e.g., long-term liabilities and equity) account for two thirds of funds of these banks. We provide a robust evidence that the ability to raise long-term resources is mainly driven by the size of PDBs but not by other characteristics. In the second part of the document, we draw special attention to the implication of PDBs in the growth of sustainable finance, especially Green, Social, Sustainability, and Sustainability-linked (GSSS) bonds. Green Bonds are prevalent in developed markets whilst Sustainability Bonds (a mix between social and green) are more prevalent in developing markets. PDBs account for more than one fifth of total issuances worldwide. North America records the strongest activities of PDBs with the highest issued sustainable instrument being sustainability bonds in the market. Europe is the second continent with a high number of sustainable bonds issuances by PDBs. On average, the cost of issuances by PDBs across all regions are lower as compared to other types of issuers.

Keywords
Public Development Banks, Financing Structure, Green bonds

Acknowledgements
This paper was supported by the Agence Française de Développement. We thank Jean-Baptiste Jacouton and Régis Marodon for their insightful comments.

JEL Classification
G21, D73, F64

Original version
English

Accepted
June 2024

Résumé
Cet article examine le rôle des Banques Publiques de Développement (BPD) dans le financement de la transition en se concentrant sur leurs sources de financement. La première partie de l'étude propose une analyse détaillée de la structure de financement des BPD. Contrairement aux banques commerciales, les ressources à court terme ne représentent qu'une fraction minoritaire (15 % en moyenne) du total des ressources, tandis que les ressources illiquides telles que les dettes à long terme et les capitaux propres constituent les deux tiers des fonds des BPD. Nous apportons des preuves démontrant que la capacité des BPD à mobiliser des ressources à long terme est principalement influencée par leur taille, plutôt que par d'autres caractéristiques. Dans la deuxième partie, nous examinons l'implication des BPD dans la promotion de la finance durable, en mettant particulièrement l'accent sur les obligations vertes, sociales, durables et liées à la durabilité (GSSS). Les obligations vertes sont largement émises sur les marchés développés, tandis que les obligations durables (combinaison de critères sociaux et environnementaux) sont plus fréquentes sur les marchés en développement. Les BPD contribuent à plus d'un cinquième du volume total des émissions dans le monde. L'Amérique du Nord se distingue par son activité soutenue dans ce domaine, avec les obligations durables comme instrument le plus émis sur le marché. L'Europe se positionne en deuxième place en termes d'émissions d'obligations durables par les BPD. En moyenne, le coût des émissions des BPD dans toutes les régions est inférieur à celui des autres types d'émetteurs.

Mots-clés
Banques Publiques de Développement, Financement, Obligations vertes

Remerciements
Cet article a été soutenu par l'Agence Française de Développement. Nous remercions Jean-Baptiste Jacouton et Régis Marodon pour leurs commentaires judicieux.

Classification JEL
G21, D73, F64

Version originale
Anglais

Acceptée
June 2024

Introduction

The Sustainable Development Goals (SDGs), adopted in 2015, aim to reduce poverty, protect the planet and ensure prosperity for all by 2030. It is already clear that the targets set will not be met by that date. At the same time, efforts will have to be intensified, particularly in favor of the climate and the environment, given the developments that are endangering the global ecology (rapid global warming, loss of biodiversity).

Public Development Banks (PDBs) have a central role to play in meeting this challenge by financing sustainable projects and catalysing funds towards these projects. Increasing the role of PDBs implies increasing and stabilizing the resources at their disposal to be able to trigger a change of scale. Contrary to their private counterparts, PDBs are more likely to finance long-term investments (Hu et al., 2022) and continue to lend during downturns (Brei and Schclarek, 2018; Frigerio and Vandone, 2020). In addition to mobilize their funds, PDBs can also catalyze private funds towards impactful projects by mobilizing private investors. The ecological transition, and more broadly, the achievement of the SDGs, can only be achieved by mobilizing the financial system and changing the scale of capital mobilization. The PDBs play a role in catalyzing private financial flows towards environmentally sustainable and socially responsible projects, notably through the issuance of sustainable bonds. PDBs have been precursors in the development of green bonds. In the mid-2000s, both European Development Bank and World Bank have been among the first to issue green bonds.

To date, there is a lack of knowledge on how PDBs are (will be) able to finance the transition through (i) the mobilization of long-term resources or (ii) their capacity to catalyse private funds. Their ability to finance long-term projects without disruption takes roots in their ability to mobilize stable and long-term resources (Bertay et al., 2015; Léon, 2023). Due to maturity mismatch, ability to mobilize long-term funds is crucial to allow banks to finance long-term assets (Diamond, 1991). However, the funding structure of PDBs has been rarely examined. The only analyses on this topic are based on surveys of development banks (Luna-Martinez et al., 2012, 2018). Despite its interest, the information provided is partial and focuses only on a sub-sample of development banks.[1] Meanwhile, the issuances of green or SDG-compatible

[1] The authors conducted a survey of 90 national development banks. The study is broader than simply analyzing the resources of development banks as the authors study the ownership structure of and the use of resources of surveyed banks. Only four binary questions are dedicated to the financing of PBDs. The study shows that 89% of BPDs borrow in local currency from local

bonds by PDBs have scantily been explored. In particular, while multilateral PDBs have played a major role in the development of this market in Western countries, their implication in developing world is uncertain.

The aim of this study is to fill the gap on the question of how PDBs will be able to finance transition. We operate in two steps. First, we explore the funding structure of Public Development Banks (PDBs). We examine in details how PDBs finance their activity, and in particular how PDBs are able to mobilize long-term resources. Second, we track the sustainable bonds issuances of PDBs, in comparison with other issuers.

The first part of the paper focuses on an explanatory analysis of funding structure of PDBs. To do so, we collect financial data from a sample of 263 PBDs. PDBs are selected according to the Public Development Banks and Development Financing Institutions Database (Xu et al. 2021). Financial data about PDBs are extracted from Fitch Connect. We examine the funding structure of PDBs on a whole and differences across PDBs according to their characteristics (ownership, mandate, size). We collect financial data for one half of PDBs (263 out of 528) identified in the Public Development Banks and Development Financing Institutions Database. We first examine the funding structure of PDBs without considering differences across banks. Short-term resources play a minor role, especially customer deposit (15% on average of all resources). This finding contrasts with commercial banks, for which retail deposits often represent more than 50% of assets. At the opposite, illiquid resources (e.g., long-term liabilities and equity) account for two thirds of funds of PDBs. We also document that the weight of long-term liabilities has increased over the past two decades from 25% to 35%. This shift is correlated by a decrease of wholesale short-term liabilities.

We then investigate whether PDB characteristics influence their ability to mobilize long-term resources. We consider six different characteristics that may affect their resources mix: size, age, ownership structure, mandate, continent and income level of their country of origin. We provide a robust evidence that the ability to raise long-term resources is mainly driven by the size of PDBs. Other characteristics play a more minor role and their influence vanishes when we control for size. Finally, we document that capital ratios are more diverse and driven not only by size but also by other factors. We found some evidence that both sources can be partially substituted as size is negatively correlated with capital. PDBs able to raise long-term debts have lower capitalization, while smaller PDBs

financial institutions or by raising debt, 40% receive a budget transfer, 41% receive bank deposits, and two-thirds receive a government guarantee.

facing difficulties to attract long-term funds have higher capital ratios. However, capitalization ratios are also correlated with other characteristics. In particular, multinational PDBs and those from richer countries are more capitalized than their counterparts.

In the second part of the document, we draw special attention to the implication of PDBs in the growth of sustainable finance. We examine the issuances of green, social, sustainability and sustainability linked bonds of PDBs (in comparison with issuances by other issuers). The ecological transition, and more broadly, the achievement of the SDGs, can only be achieved by mobilizing the financial system and changing the scale of capital mobilization. Financial players have a duty to direct global savings towards sustainable investments that are aligned with the SDGs, and not just to focus on strictly financial returns. There is some work that have been done on green bonds where studies have spanned across corporates, sovereigns, municipals, agencies without in-depth analysis on the public development banks specifically. Academic research on PDBs has mostly focused on understanding their roles, business and lending models, financial products and the challenges they might face to fulfil their tasks (i.e., Griffith-Jones & Ocampo, 2018; Mazzucato, 2015; Xu et al., 2019). To the best of our knowledge, this will be the first study analyzing PDBs role in the advancement of sustainable finance and the achievement of sustainable goals by comparing their issuances of sustainable instruments to other issuers across continents. The recent policy and practice alignment have seen a drive for financial institutions aimed solely to finance sustainable activities. Financial institutions in emerging markets make up around fifty percent of cumulative green bond issuance by volume with total cumulative issuances from China standing at a total of sixty percent of emerging markets contributions (Amundi & IFC, 2021). There is no denying that PDBs play a role to catalyze private financial flows towards environmentally sustainable and socially responsible projects, notably through the issuance of sustainable bonds and this study sheds more light on how PDBs have contributed so far in this respect. PDBs have been precursors in the development of green bonds. In the mid-2000s, both European Development Bank and World Bank have been among the first to issue green bonds. Since then, the range of bonds has diversified with the creation of social bonds or sustainable bonds. The Appendix B presents some definition of existing bonds.

Empirical analysis begins with a global study of Green, Social, Sustainability, and Sustainability-linked (GSSS) bonds, irrespective of issuers. We document that North America and Europe account for the largest share of issuance in volume and number, while Africa is lagging. Green

bonds dominate the market, accounting for 60% of all GSSS bonds. PDBs account for more than one fifth of total issuances worldwide. The highest number of issuances by PDBs are in sustainability bonds followed specifically by CBI Aligned Green bonds and then social bonds with no issuances of sustainability linked bonds recorded as at the point of data collection. North America records the strongest activities of PDBs with the highest issued sustainable instrument being sustainability bonds in the market. Europe is the second continent with a high number of sustainable bonds issuances by PDBs. The activities of PDBs in Africa is the lowest when compared to other regions such as Europe, North America, and Asia Pacific. On average, the cost of issuances by PDBs across all regions is lower as compared to other types of issuers. PDBs pay 1.5 percent less on average than other type of issuers on green bonds issued with a higher average maturity period of 4 years more than other types of issuers. Average amount of green bonds issued by PDBs also averages twenty percent more than the average issuer.

The rest of the document is as follows. Section 2 describes data used and construction of variable. Section 3 provides an analysis of the funding structure of PDBs, dedicating special attention to their long-term resources. Section 4 focuses on issuances of green, social, and sustainability bunds by PDBs. The final section concludes.

1. Datas and variables

1.1. Definition of PDBs

We first exploit a novel database on Public Development Banks, the Public Development Banks and Development Financing Institutions Database (Xu et al. 2021).[2] As highlighted by the authors, despite a renewed interest for PDBs, there is a lack of data on these actors. They initiated a new project to collect harmonized information on PDBs. They identify five criteria to be considered as a PBDs: (i) being a stand-alone entity; (ii) using the fund-reflow-seeking financial instruments as main products and services; (iii) funding sources going beyond the periodic budgetary transfers; (iv) the proactive public policy orientation; and, (v) government steering of their corporate strategy. The third criterium is at the crux of our analysis. It implies that PDBs are able to have their own funding.

In the rest of the paper, we follow the classification of PBDs provided by Xu et al. (2021). PDBs are classified according to their size (total assets), ownership structure, age, mandate, level of income, and geography.

Total assets are used as a criterion to classify PDBs and DFIs into five size categories: mega (more than $500 billion), large (more than $100 billion and less than or equal to $500 billion), medium (more than $20 billion and less than or equal to $100 billion), small (more than $500 million and less than or equal to $20 billion), and micro (less than or equal to $500 million). A last category assembles PDBs without information on their size.

Ownership structure is divided in three categories: Multinational (owned by entities from more than two countries), national (owned by a central government) and subnational (owned by one or several local entities).

Eight different mandates are considered: general development (FLEX), rural and agricultural development (AGRI), promotion of exports and foreign trade (EXIM), social housing (HOUS), infrastructure (INFRA), international financing of private sector development (INTL), local government (LOCAL) and micro, small, and medium-sized enterprises support (MSME).

[2] The database is available at this link: https://www.nse.pku.edu.cn/dfidatabase/index.htm (consulted in March 2023).

For age, we consider three categories based on the three waves of development banks implementation.[3] Old PDBs are those created before 1979 (conservative backlash). Young PDBs are those created since 2005 and Medium are PDBs created between 1980 and 2004.

Finally, Xu et al. (2021) provide the continent of origin of PDBs (Africa, Americas, Asia, Europe, Oceania, and World for others) as well as the level of income of the country of origin using the World Bank classification.

1.2. Funding structure

1.2.1. Bank data

We combine the list of PDBs build by Xu et al. (2021) with financial information provided by FitchConnect database. FitchConnect is one of the two international databases that report financial information of banks (the other source is Orbis BankFocus, and both databases have been developed after the end of Bankscope). We collect financial information for a total of 255 PDBs, representing a half of PDBs provided by Xu et al. (2021) in their database, which considers a total of 527 PDBs.[4]

Before examining the characteristics of funding structure of PDBs, it is useful to examine which PDBs are included in our analysis. While representing one half of the number of banks, our sample accounts for more than 90% of assets managed by PDBs. Indeed, larger PDBs are more likely to be included in international databases and we are more likely to get financial information on them. As indicated in Table A1 in Appendix, we collect information on 85% of PDBs classified as Mega, Large or Medium in the database, two thirds for Small PDBs but only one quarter for micro PDBs. We find consistent results if we rely on jurisdiction levels of ownership, which is strongly correlated with size. We extract financial data for 80% of

[3] For age, we exploit the year of establishment provided in the Public Development Banks, the Public Development Banks and Development Financing Institutions Database. Xu et al. (2021) describe the dynamics of creation of PDBs. After WWII, there was an increase in the number of PDBs both in developed countries (reconstruction) and in newly independent countries. In the 1980s, PDBs came under fire due to conservative backlash. The number of newly PDBs sharply decrease during this decade. However, the collapse of Soviet Union induced a new wave of creation to channel international financial support. Recently, the world has witnessed a new third wave after the 2008 Global Financial Crisis that highlighted the limits of the free market and the importance of state involvement in the financial sector (World Bank, 2013). We therefore consider three categories based on the three waves.

[4] We initially identified 263 PBDs with financial variables. However, we exclude 8 banks because their financial data reported in Fitch were old (before 2012). These institutions are National Bank for Economic Development (Burundi, last year is 2009), Agricultural Bank of Faso (Burkina Faso, 2006), Eritrean Investment and Development Bank (Eritrea, 2004), Catalan Institute of Finance (Spain, 2010), Maharashtra State Financial Corporation (India, 2010), IDB Capital Ltd (Kenya, 2003), Malta Development Bank (Malta, 2003), Industrial Development Corporation of Zimbabwe Limited (Zimbabwe, 2006).

multinational PDBs, one half of national PDBs but only one third of subnational PDBs. PDBs are more likely to be reported in financial data if they are larger but also older. We are able to collect data for only 30% of PDBs created after 2005 (Young) but 59% for those created before 1975 (Old) and 50% of PDBs created between 1980 and 2004. Turning to the mandate, we see that PDBs dedicated to international financing of private sector development (INTL), social housing (HOUS), the promotion of exports and foreign trade (EXIM) and local government (LOCAL) are more likely to be in international databases. However, PDBs focusing on rural and agricultural development (AGRI), infrastructure (INFRA) and micro, and SMEs are less likely to be included in our analysis. Finally, we examine the geography of PBDs included in this study. In terms of continent, we do not see a real divergence, except for Oceania, which account for a small number of total PDBs (Xu et al., 2021). PBDs located in the least developed countries are less likely to be included in our analysis. For instance, we extract financial data for less than 20% of PDBs located in low-income countries and one third of them operating in lower-middle-income countries.

As many characteristics are correlated with each other, we run a multivariate model to examine which factors play a major role to explain inclusion in our model (available upon request). After controlling for all characteristics, the likelihood to be included in our analysis is mainly due to size, age and ownership structure. However, the geography (both continents and level of income) and mandate play a negligible role.

1.2.2. Funding structure

Our analysis focuses on the funding structure of PDBs. Banks are very specific firms and their funding structure strongly differ from non-financial corporations. The question of funding structure is crucial in banking literature as resources mix may affect performances and stability of banks (Diamond and Rajan, 2001, Demirgüç-Kunt and Huizinga, 2010; Vazquez and Federico, 2015). Both theoretical and empirical papers have examined the determinants of funding structure of banks (Diamond and Rajan, 2000; Gropp and Heider, 2010, DeYoung and Jang, 2016). It is rather common to distinguish between illiquid, semi-liquid and liquid bank liabilities; an approach followed by authorities to build the Net Stable Funding ratio (Basel Committee of Banking and Supervision, 2009).

The most illiquid resources for a bank are long-term liabilities (often defined as having a maturity exceeding one year) and shareholder equity. Investors or shareholders cannot easily withdraw these funds. There is, however, a difference in case of bank default. While investors (of senior debts) are prioritized, shareholders are served in the last and may experience important losses.

On the opposite of the liquidity spectrum, we find the short-term wholesale deposits. Wholesale funds are usually raised on a short-term rollover basis through instruments such as certificates of deposits, repurchase agreements or commercial paper. Even if wholesale funds have some benefits for banks, they have also a major dark side as they are highly liquid and therefore are an unstable source of funds for banks (Huang and Ratnovski, 2011).

Finally, retail deposits are in a middle of the ford in terms of liquidity. Their withdrawals in most circumstances are usually predictable at the aggregate level and mostly linked to depositors' liquidity needs (Song and Thakor, 2007). Another reason for the "sluggishness" is the high switching costs associated with transaction services that retail depositors receive from banks (Kim et al., 2003). Finally, partly because they are insured by government in many countries (Diamond and Dybvig, 1993; Demirgüç-Kunt and Sobaci, 2001; Demirgüç-Kunt et al., 2015), deposits from customers are largely insensitive to crisis and more stable in periods of crisis (Shleifer and Vishny, 2010; Cornett et al., 2011).

Based on the previous discussion, we divide funding structure into 4 components:

- Wholesale short-term funding (liquid resources);
- Retail deposit (semi-liquid resources);
- Long-term liabilities (illiquid resources);
- Equity (illiquid resources);

There is a fifth category for unclassified liabilities. Each component is divided by the sum of total liabilities and equity (which is also equal to total assets) to have its relative weight in funding structure. The following table presents a stylized balance sheet and the categories considered in our paper, as well as weights used to compute the Net Stable Funding Ratio (NSFR) by authorities.

Table 1. Stylized balance sheet and funding structure categories

	NSFR	Liquid	Whole	Retail	LT	Equity	Other
1. Deposits & Short term funding							
1.A Customer Deposits							
1.A.1 Customer Desposits-Current	85	Semi		X			
1.A.2 Customer Desposits-Savings	70	Semi		X			
1.A.3 Customer Desposits-Term	70	Semi		X			
1.B Deposits from banks		Liquid	X				
1.C Other Deposits and Short-term Borrowings	0	Liquid	X				
2. Other interest bearing liabilities							
2.A Derivatives	0	Liquid					X
2.B Trading liabilities	0	Liquid					X
2.C Long-term funding	100	Illiquid			X		
3. Other Liabilities							
3.A Non-interest bearing liabilities	100	Illiquid					X
3.B Loan loss reserves	100	Illiquid					X
3.C Other reserves	100	Illiquid					X
4. Equity	100	Illiquid				X	

1.3. Bond issuances

We finally extract data on green, social, and sustainable bond issuances of PDBs and other issuers. Data are extracted from Reuters DataStream (as of May 2023). The various instruments under consideration includes CBI Certified Green Bonds, CBI Aligned Green Bonds, Self Labelled Green Bonds, Social Bonds, Sustainability Bonds and Sustainability Linked Bonds. The precise definition of each types of bonds is provided in Appendix B. The most restrictive category is the CBI Certified Green Bonds that requires bonds to be certified by an independent agency. CBI Aligned Green Bonds imply that issuers follow the guidelines and recommendations provided by Certified Bonds Initiative (CBI) but bonds are not certified. Other categories are self-declaration of issuers. Green bonds (CBI Certified, CBI Aligned and Self-labeled) are bonds where funds collected are used to finance environmentally sustainable projects (renewable energy, sustainable transportation, green building, etc.). The key characteristic of social bonds is that the proceeds are exclusively allocated to finance projects that aim to address or alleviate social issues (healthcare, education, affordable housing, food security, etc.). Sustainability Bonds are broader in scope than Social Bonds. These bonds are issued to raise funds for projects that have both environmental and

social objectives. Sustainability Linked Bonds are a unique type of bond where the financial terms, such as the coupon rate or maturity, are tied to the issuer's ability to achieve predefined sustainability targets. Unlike the proceeds of Social Bonds and Sustainability Bonds that are earmarked for specific projects, the proceeds from sustainability-linked bonds can be used for general corporate purposes. The analysis compares the issuances of bonds by different types of issuers, including PDBs. Other issuers considered are central governments, local governments, corporates, and agency issuers.

2. An exploratory analysis of funding structure of PDBs

2.1. Global overview

We begin our exploration of funding structure by examining the relative weight of each component for all PBDs.

Figure 1. Decomposition of funding, global analysis

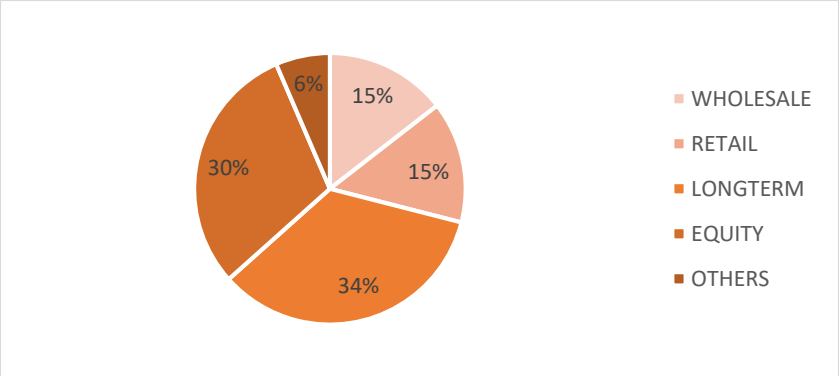


Figure reports the average value of the different blocks for all PDBs (N=263).

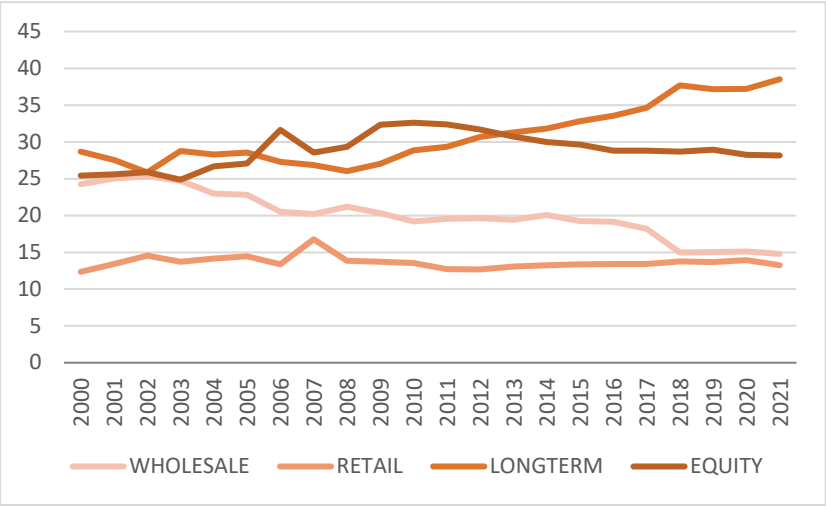
Interpretation: On average, long-term liabilities account for 34% of total funding of PDBs.

Short-term wholesale funds and retail deposits account for 15% each of total resources. It should be noted that the share of illiquid resources is particularly dominant in PDBs as they account for two thirds of funds, as long-term liabilities account for 34% and equity for 30%. The funding structure of PDBs strongly differs from the funding structure of commercial banks. Retail deposits is the major resources of funds for commercial banks, often accounting for more than half of all liabilities. On the opposite, long-term liabilities and equity accounts play a more minor role for commercial banks as they rarely exceed 15% each (Vazquez and Federico, 2015; DeYoung and Jang, 2016). We see that the inverse is observed for PDBs.

Figure 2 examines the evolution of four components of funding structure from 2000 to 2021. To avoid changes in the composition of PDBs considered, we only consider 203 banks with financial data from 2010 to 2020.[5] We document that the share of wholesale short-term liabilities has been reduced by 10 points over the past two decades. Meanwhile, long-term liabilities have increased of the same amplitude. Finally, retail deposits and equity remain relatively stable over time.

[5] Considering all PDBs provides the same picture as well as using median value instead of average.

Figure 2. Evolution of wholesale short-term liabilities, retail deposits, long-term liabilities, and equity over time (2000-2021)

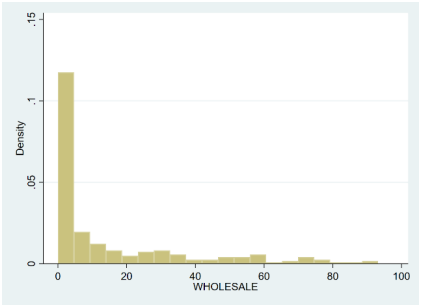


The figure presents the evolution of average value of the share of wholesale short-term funds (WHOLESALE), the share of retail deposits (RETAIL), of long-term liabilities (LONGTERM) and equity (EQUITY).

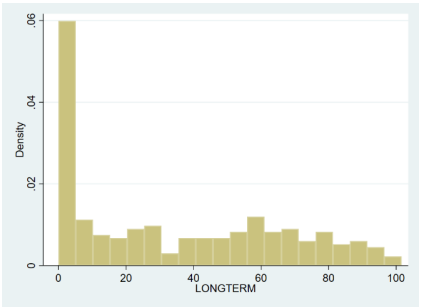
We finish our exploration by examining the distribution of the four components of the funding structure (in a static perspective). Figure 3 presents the distribution of the four components. The funding structure of PDBs is far from homogenous. While short-term wholesale liabilities account for 15% of PDBs' resources on average, 30% of PDBs do not use these highly liquid resources and they represent less than 10% of assets for two thirds of PDBs, as indicated in Table A2 in Appendix. The picture regarding retail deposits (Panel B) is rather similar. Almost one half (45%) of them do not accept deposits from customers. It should be noted that this ratio is lower than those reported in previous surveys that identify around 60% of development banks do not have the possibility to use deposits (Luna-Martinez et al., 2012, 2018). When they receive deposits, the share of these resources is rather limited. Retail deposits account for more than half of liabilities (usual ratio for commercial banks) for only 12.5% of PDBs.

Figure 3. Distribution of the four categories of resources in total funding

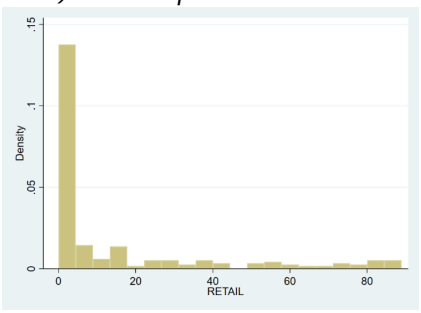
Panel A) Wholesale short-term liabilities



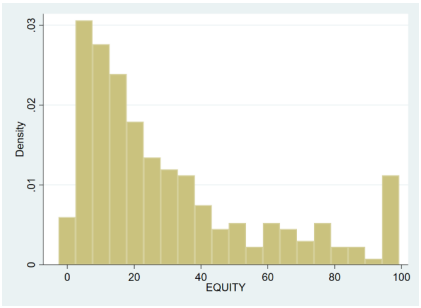
Panel C) Long-term liabilities



Panel B) Retail deposit



Panel D) Equity



The figure displays the distribution of the share of wholesale short-term funds (Panel A), the share of retail deposits (Panel B), of long-term liabilities (Panel C) and equity (Panel D). Ratios are built by intervals of five percent from 0 to 100 and associated table is provided in the Appendix.

On the opposite, we document in Figures 1 and 2 that long-term liabilities play a significant role in funding structure of PDBs. Global picture, however, masks some heterogeneity. Long-term liabilities account for less than 10% of total funding for one third of PDBs. However, the distribution is more diversified for PDBs relying on long-term liabilities. For instance, one quarter of PDBs has a ratio of long-term funding to total funding exceeding 50%.

Finally, we see a strong diversity of situation for equity ratio, in line with existing literature on commercial banks (Gropp and Heider, 2010). However, we continue to note that equity ratio for PDBs largely exceeds the ratio for commercial banks. Indeed, almost any commercial bank holds less than 20% of their resources in capital, contrary to PDBs where capital often exceed one fifth of their resources.

2.2. How the characteristics of PDBs are correlated with funding structure?

Figure 3 points out that PDBs diverge in their reliance on illiquid resources (long-term liabilities and equity). We explore in this section how characteristics of PDBs are correlated with their ratio of long-term liabilities and capital to total assets.

2.2.1. Long-term liabilities

A major fact illustrated above is the importance of long-term liabilities for PDBs. The larger reliance of long-term liabilities can be explained by the business model of PDBs. PDBs are more likely to finance long-term loans than commercial banks (Hu et al. 2022). As a result, they have to raise long-term to avoid maturity mismatch and liquidity risk (Diamond, 1991). Another fact revealed by Figure 3 is the strong heterogeneity across PDBs in their use of long-term liabilities. This sub-section focuses on this second point. Our aim is to examine which characteristics of PDBs are correlated with the ratio of long-term liabilities to total funding.

Table 2 displays the mean and the median values of the ratio long-term liabilities to total resources (columns 1 and 2) per category of PBDs. Descriptive statistics indicate that long-term liabilities are more likely to represent a higher share of total funding for larger banks. For instance, we see that on average long-term liabilities account for 19% of total funds for micro PDBs (median is 9%) and 33% for small PDBs. On the opposite, long-term liabilities represent more than half of funding for large and mega PDBs. The second main source of difference is the level of income, as PDBs in low-income countries are less likely to raise long-term debts. Finally, we document that PDBs having a mandate for social housing and local government are more likely to have long-term liabilities.

The other elements of PDBs seem to play a more minor role. There is a difference according to age or ownership but the effect is less marked with a differential of only 7 points between old and young PDBs or between multinational and subnational PDBs. Differences are also rather limited across continents, even if long-term debts are more likely in Asia.

Table 2. Share of long-term liabilities and of equity, by category of PDBs

	Long-term liabilities		Equity		Obs.
	Mean	Median	Mean	Median	
All	34.4	28.6	30.1	20.9	263
Micro	19.0	9.1	46.0	40.5	55
Small	33.1	29.5	31.6	21.8	137
Medium	44.9	48.6	13.7	10.4	37
Large	64.9	70.5	21.4	13.3	18
Mega	56.7	73.0	5.2	6.3	9
Young	30.0	26.6	32.1	26.2	43
Medium	33.4	25.8	30.8	20.2	98
Old	36.8	31.9	28.9	18.4	122
Subnational	29.3	20.2	21.8	12.2	42
National	34.9	27.5	29.1	18.9	181
Multinational	37.6	45.8	43.3	32.6	40
Africa	29.2	26.3	39.4	36.3	48
Americas	35.4	28.6	31.6	24.8	55
Asia	41.4	41.0	26.6	15.2	79
Europe	30.8	15.1	26.2	13.7	79
Oceania	24.5	24.6	22.5	24.1	4
World	28.8	30.2	49.0	46.7	4
Low-income	19.3	0.0	22.2	26.0	7
Lower-middle income	27.2	19.3	25.9	16.5	54
Upper-middle	38.4	37.0	29.6	21.2	75
High income	35.2	25.3	27.8	13.9	87
FLEX	34.7	29.8	28.3	21.9	100
AGRI	26.0	19.7	25.6	10.8	14
EXIM	39.6	36.5	24.8	16.7	32
HOUS	51.9	58.3	22.9	10.8	21
INFRA	41.4	47.9	34.5	32.0	12
INTL	26.2	17.5	49.5	34.8	20
LOCAL	67.7	84.3	8.8	6.1	10
MSME	21.5	11.0	36.4	25.6	54

The table displays the mean and median value of the ratio of long-term liabilities to total assets (two first columns) and of the ratio of equity to total assets (two last columns).

Table 3. Determinants of the ratio of long-term liabilities and equity

	Long-term liabilities			Equity		
	Coefficient	Std. Err.		Coefficient	Std. Err.	
Size (omitted: Micro)						
Small	11.89	4.27	***	-16.43	4.41	***
Medium	19.82	6.87	***	-32.44	4.80	***
Large	45.52	6.98	***	-32.27	7.61	***
Mega	33.91	12.87	***	-44.43	5.70	***
Age (omitted: Young)						
Medium	0.26	4.90		5.17	4.73	
Old	0.27	4.69		3.59	4.94	
Ownership (omitted: Multinational)						
National	-10.46	12.90		-34.68	7.98	***
Subnational	-14.74	13.80		-46.44	9.32	***
Continent (omitted: World)						
Africa	16.39	10.40		-2.85	9.78	
Americas	8.93	10.47		-6.02	9.21	
Asia	16.28	10.43		-6.80	9.60	
Europe	7.03	11.29		-16.43	9.31	*
Oceania	9.88	14.40		-26.97	9.66	***
Level of income						
Lower-middle	3.49	11.84		9.04	5.55	
Upper-middle	12.53	11.87		21.36	5.78	***
High-income	6.21	12.87		32.61	7.46	***
Mandate (omitted: FLEX)						
AGRI	-8.34	6.95		-3.36	5.64	
EXIM	6.24	6.67		-7.61	4.64	
HOUS	10.16	8.61		-8.26	5.07	
INFRA	7.02	6.67		4.13	6.93	
INTL	-4.69	6.85		8.35	8.50	
LOCAL	35.94	13.37	***	-8.67	3.74	**
MSMS	-8.05	4.51	*	5.06	4.73	
Obs. (R^2)	263	(0.27)		263	(0.31)	

The dependent variable if the ratio of long-term liabilities to total funding in column (1) and the ratio of equity to total funds in column (2). For each block of variables, we identify the omitted variables. *, **, and *** signal statistical significance at 10, 5 and 1% respectively (robust standard errors).

Results should be read according to the omitted variable. For instance, coefficients of 11.89 associated to Small indicates that the ratio of long-term debt to total funding is 11.89 points higher for Small PDBs, in comparison to Micro PDBs (omitted category), after controlling for other characteristics.

To sum up, the main determinant explaining the ratio long-term liabilities to total resources is the size of PDBs. Other characteristics of PDBs, such as their age, ownership, mandate or country of origin, do not play a role.

2.2.2. Equity

We then turn to the second form of illiquid resources. Long-term liabilities and equity differ in some aspects. The degree of seniority is higher for debt than capital in case of default. In addition, contrary to debt, equity shall not be redeemed or subject to renewal at maturity. The banking literature has dedicated a special attention to the capital structure of banks. Existing researchs have tried to study the determinants of capital level and its implication in terms of stability, profitability and activity for banks. The concern is that while they may provide a buffer against unexpected losses, high capital requirements constrain the banks' capacity to lend. In addition, despite regulation fixing a minimal capital requirement, there is a strong heterogeneity across (commercial) banks in terms of equity ratio.

Data on PDBs, presented above, indicate that capital account for a substantial larger share of funds for PDBs. In addition, we also document that heterogeneity observed for commercial banks exists also for PDBs. In the following, we will follow the previous approach to document whether different PDBs differ in their capital ratios.

The last two columns of Table 2 present mean and median of equity ratio by the type of PDBs. Descriptive statistics provide two facts that are somewhat paradoxical. The ratio of equity to total funds is negatively correlated with the size of PDBs but it is lower for subnational PDBs and larger for multinational PDBs. The other characteristics do not seem to play a role in explaining difference across PDBs. We refine the analysis in Table 3 by running a multivariate analysis allowing us to control for correlation. Our analysis confirms the role of size and ownership. Larger PDB, which are able to raise long-term liabilities, have a lower equity ratio than small PDBs. This suggests a possible substitution between these two sources of illiquid resources. PDBs able to raise long-term debts have lower capitalization, while smaller PDBs facing difficulties to attract long-term funds have higher capital ratios.

Results from Table 3 also confirm that multinational PDBs are more likely to have higher equity ratio than national and subnational PDBs. We also document that, after controlling for other characteristics, PDBs from richer countries have higher level of capitalization. Finally, other characteristics do not seem to play a major role (age, mandate, geography).

3. The implication of PDBs on the growth of sustainable finance: evidence from bonds

The last section of this paper draws special attention to the implication of PDBs on the growth of sustainable finance.

To examine the importance of PDBs on this market of sustainable bonds, we compare their issuances of different sustainable instruments with other issuers. We first give an overview of the global picture of sustainable bonds issuance by type of bonds issued according to continents. We then compare issuances of PDBs to issuances of other institutions in terms of volume, number of issuances, average maturity periods, yields and coupons to understand the characteristics of each bond type and the essential roles they play in influencing the bond types issued by the different issuers across the different continents.

3.1. Data

Green, Social, Sustainability, and Sustainability-linked (GSSS) bonds offer a significant extra source of funding for initiatives relevant to the Sustainable Development Goals, especially in developing and emerging economies. Amidst restricted bank lending, GSSS bonds enable issuers to broaden their funding sources and offer a substitute for traditional financing, which is frequently costlier. Importantly, GSSS bonds offer long-term financing because the cash flows from green infrastructure projects typically align with the date of bond issuance. Second, banks' ability to offer long-term green loans is limited in many nations due to the short maturity of bank obligations and the absence of tools for hedging duration risks. Consequently, public development banks (PBDs) play a vital and varied role as GSSS bond issuers, anchoring investors, private finance mobilizers, and technical assistance providers. Green, social, and sustainability bonds (GSS) have gained momentum in developed markets in recent years due to their potential in closing the financing gap for Sustainable Development Goals (SDGs). However, their adoption in developing countries remains limited. GSS bonds, classified into two primary categories, encompass fixed income instruments:

Use of proceeds bonds: most common type of sustainable bonds, whose characteristics are similar to normal bonds, but whose proceeds are exclusively allocated to projects aimed at achieving green and/or social impact. A use-of-proceeds approach allows any company to issue such bonds, regardless of their main business activity. Usually, bonds labelled as green, social, or sustainable are use-of-proceeds bonds.

Sustainability-linked bonds ("SLBs"): any type of bond instrument for which the financial and/or structural characteristics vary depending on the issuer's achievement of predefined sustainability/ESG objectives. Issuers thereby commit explicitly to future improvements in sustainability outcomes. This characteristic makes such bonds a forward-looking performance-based instrument. Importantly, the proceeds of SLBs are intended to be used for general purposes. This is further explained in Appendix B.

Our data is a collection of all sustainable finance debt instruments (bonds) issued and available on Reuters DataStream as of May 2023 from all issuers. The dataset spans from the period of 2013 to 2023. This enables us to have data from all continents as the first green bond was issued by African Development Bank in 2013. We limited our data set to bonds because they are the only financing mechanism that cuts across a broad set of actors involved in the realization of the SDGs, including corporates, sovereigns, municipalities, agencies, and development banks providing a broad variety of actors as well as the scale and liquidity necessary for investors. The bond market is a longer-term, lower-risk asset class and is almost double the size of the equity market (PIMCO). We also restricted our data to bonds because returns on bonds are relatively stable and predictable when compared to equity (Climate Bonds Initiative, 2015) and the long-term nature of bonds investing is also well aligned to sustainable investing approaches that could contribute to the attainment of the SDGs. The various instruments under consideration includes all types of Green Bonds under the different classifications, thus Certified Green Bonds, CBI Aligned Green Bonds, Self Labelled Green Bonds and Social Bonds, Sustainability Bonds and Sustainability Linked Bonds. With over 10,000 unique bonds, we refined the data by:

- ***Maturity***: We excluded bonds that are perpetual and bonds that had less than 2-year maturity period. The maturity periods of the bonds ranged from a minimum of 5 years to a maximum of 25 years.
- ***Issue period***: The issue period spans between 2013 and 2023.
- ***Ratings***: Instruments that did not have any ratings were excluded from the data sample.
- ***Coupons***: Bonds with floating coupons and bonds with no coupons were excluded from the sample size.
- ***Yield***: The yield to maturity of the bonds as at the time of data extraction. Bonds without yield to maturities were exempted.

- ***Currency***: All currency was set to EUR and the issue amount in original currency were converted to euros to give consistency to amount issued during data extraction on DataStream.

3.2. Global picture of sustainable bonds issuance in the world

3.2.1. Issuance of all bonds by continents

The first bond issued to mitigate climate change risk was named a climate bond and was issued by the EIB in 2007. Since then, there has been a rapid growth and relevance due to strong appetite for these instruments. Green bonds became the leading fixed-income debt instrument in the bid to fight climate change. In order to contribute to long-term environmental and social projects, new labels and formats have arisen to further expand the sustainable finance instrument market, which is a clear signal that issuers and investors are highly committed to a greener, fairer, and more sustainable world. The advancement in research on how best to attain an equilibria progress in sustainable development without stifling growth in other areas of development contributed to the emergence of new labels such as social, sustainability and sustainability-linked bonds. Even though the first issuance of a green bond happened in Europe, sustainable instruments are now common across all continents. Whilst Europe remains the leading issuer in all bond types by number of issuances and volume, Africa has the lowest volume whilst Latin America has the lowest number of issuances across all sustainable finance instruments. From the first climate awareness bond issued in 2007 at a value of 600 million euros, the sustainable debt market now stood at a combined value of close to four trillion dollars with Europe recording the largest percentage of issuances in both numbers and volumes. Across regions, Europe accounts for the most issuances of green bonds which is in a close contention with Asia. Whilst most Europe issuances of green bonds are CBI aligned, issuances of green bonds in Asia are mostly self labelled which can be explained by the differences in principles with regards to green bond issuances until Asia adopted the Green Bond Principles in 2018. Africa is the region with the least number of green bond issuances and any other sustainable finance instrument. The low number of issuances in the African region is however not reflective in the yield and cost of issuance which in effect is the coupon. Africa has the highest average yield and highest average cost of issuance amongst all regions which can be explored as an attributable factor that accounts for the low issuances in the region. Is the cost of issuance in Africa inclusive of uncertainty risk in the region?

Figure 4. Number of Issuances, continent analysis

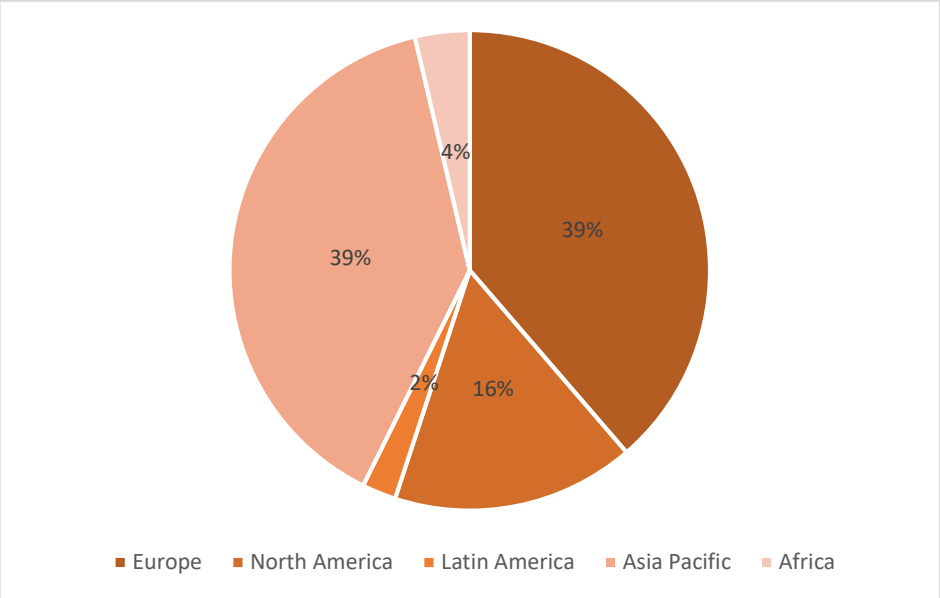


Figure reports the number of issuances of all sustainable instruments across various continents. Europe is the lead issuer and Latin America is the least issuing continent. Source: Reuters DataStream.

Figure 5. Volume of Issuances, continent analysis

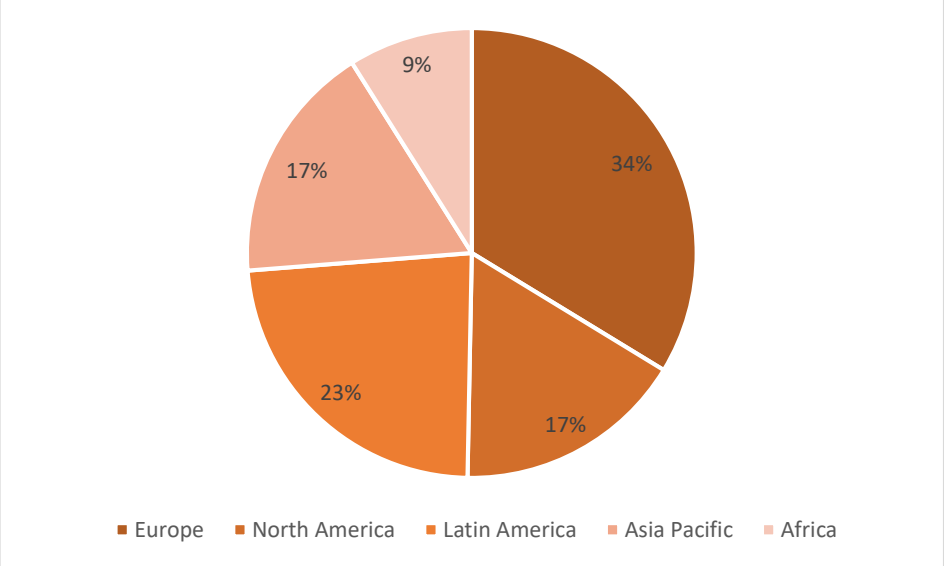


Figure reports the volume of issuances of all sustainable instruments across various continents. Europe has the highest volume of issuances and Africa has the lowest volume of issuances. Source: Reuters DataStream.

3.2.2. Issuance of all bonds by type of bonds

From our data sample, on the global font, the most frequently issued bonds are green bonds followed closely by sustainability bonds and then social bonds which saw a surge in issuances during the covid 19 global pandemic. Sustainability linked bonds which made their debut in 2019 with first issuance recorded by Enel is still growing and as at now has a total issuance in value of over 200 billion dollars.

Figure 6. Global Issuances, bond type analysis

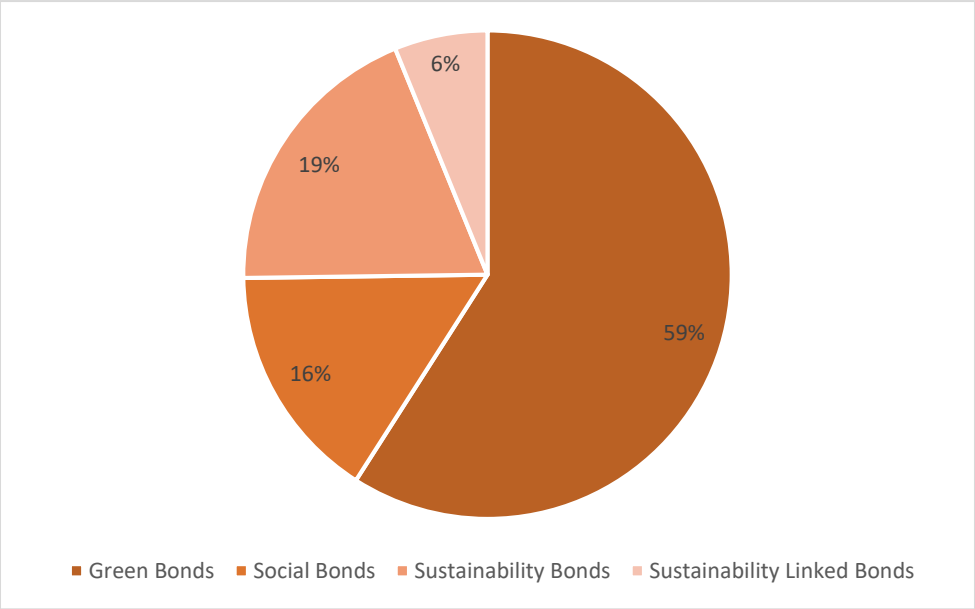


Figure reports the global issuances of all sustainable instruments across bond types. Green bonds are the most issued bonds. Source: Reuters DataStream

With almost close to 4 trillion dollars in issuances of sustainable instruments, green bonds have a larger share with over 2 trillion-dollar issuances followed by sustainability bonds with 681 billion dollars in issuances and social bonds with 653 billion dollars and sustainability-linked bonds with a little over 200 billion dollars in issuances. The figure below illustrates the different continents and the types of bonds prevalent in issuance across these continents.

Figure 7. Global Issuances, bond type analysis breakdown across continents

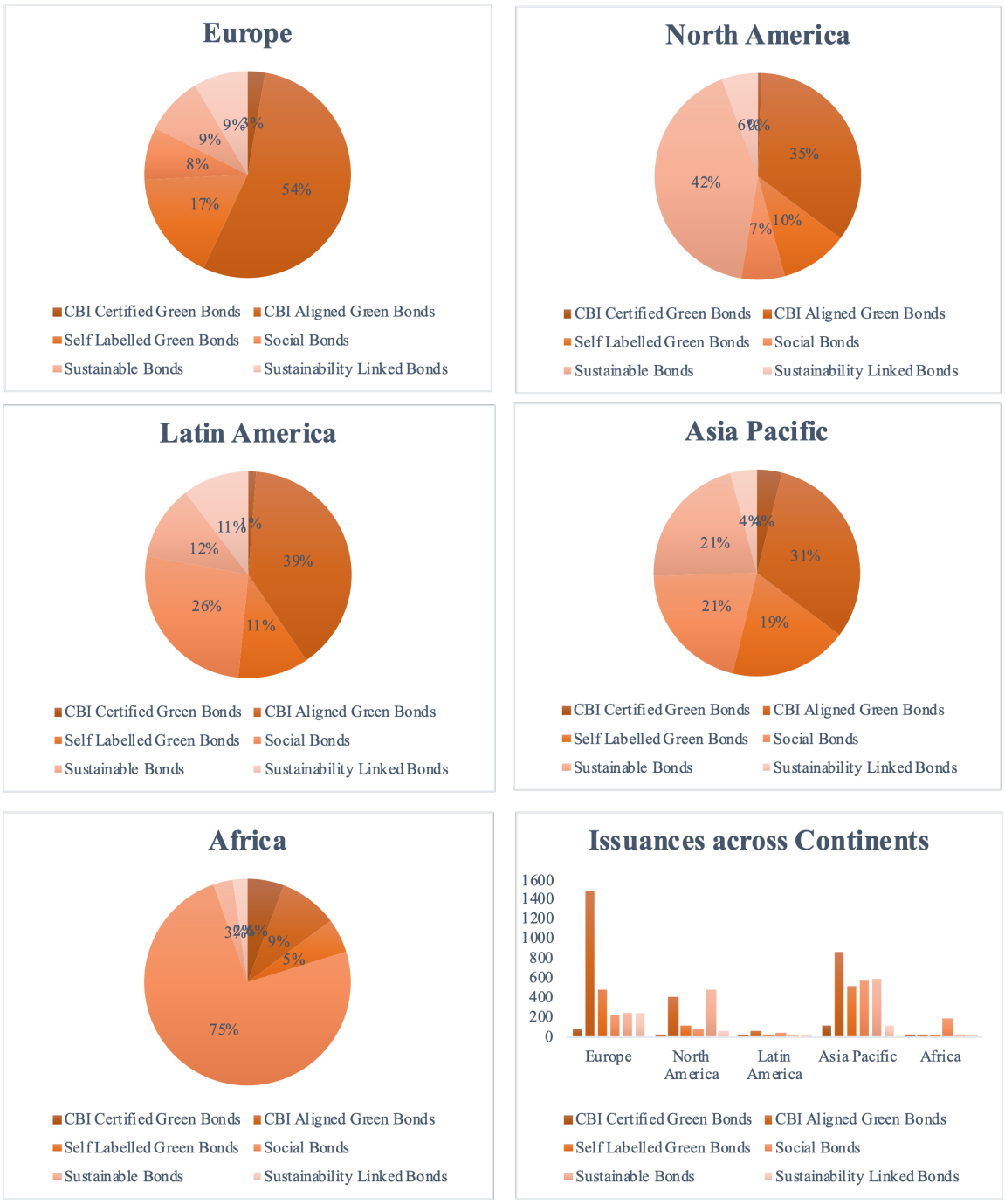


Figure reports the breakdown of different types of bonds across various continents. Europe has the highest volume of issuances and Africa has the lowest volume of issuances. Source: Reuters DataStream.

On the global front, the most issued bond across continent is green bonds with the exception of Africa with social bonds taking up the highest percentage of sustainable bonds issued. The surge in volume can be attributed to several factors. Regarding market dynamics, the escalation in demand for sustainable bonds surpasses their availability, indicating a growing interest among institutional investors. This heightened interest has led to an increased number of issuances (OECD, 2021). Additionally, sustainable bonds frequently leverage the strong credit ratings of issuing entities, particularly evident in sovereign and supranational issuances. These entities demonstrate a high capacity to fulfill financial obligations effortlessly, resulting in a minimal risk of default compared to traditional debt instruments.

3.2.3. Analysis of all bonds by characteristics

Issuers: Corporate issuers haves shown a consistency in issuances of all types of sustainable instruments across regions. Agencies follow closely after corporates with heavy issuances in green, social, and sustainable bonds. Sovereign and PDB issuers contribute more to sustainability bonds growth globally whilst Agencies contribute more to social bonds growth.

Coupons: Corporates however pay a higher coupon than any other type of issuer. Corporates pay the highest average coupon in Latin America and Africa, and this can be attributed to the volatility of the Latin America market amidst political uncertainties which increases the risks of the institutions that play on the market. Sovereign issuers in Africa also pay a higher cost as compared to sovereign issuers in other continents. Our analysis shows that the issuance of sustainable finance instruments in Africa is the lowest in the world. However, African countries face important financing needs to achieve their climate and sustainability objectives. We show a complete breakdown of all bonds across continents in Table A3 in the annexes.

3.3. The issuance of sustainable bonds by PDBs

3.3.1. Issuance of all bonds by type of issuers

The last section of the analysis focuses on PDBs. A higher percentage of the green bonds issued by PDBs are CBI-aligned and, on average, have a lower cost of issuance as compared to other types of issuers. PDBs however have high issuances of sustainability bonds as compared to other types of bonds. With regards to the volume of issuances across all

instruments, however, PDBs and Corporates are at par with 22 percent allotment of all sustainable instruments' issuances. Sovereign issuers have the chunk of issuances as deal size of such issuances are mostly above the billion-dollar mark. Agencies have a high-volume issuance in social bonds as compared to other bonds.

Figure 8. Global Issuances, issuer type analysis

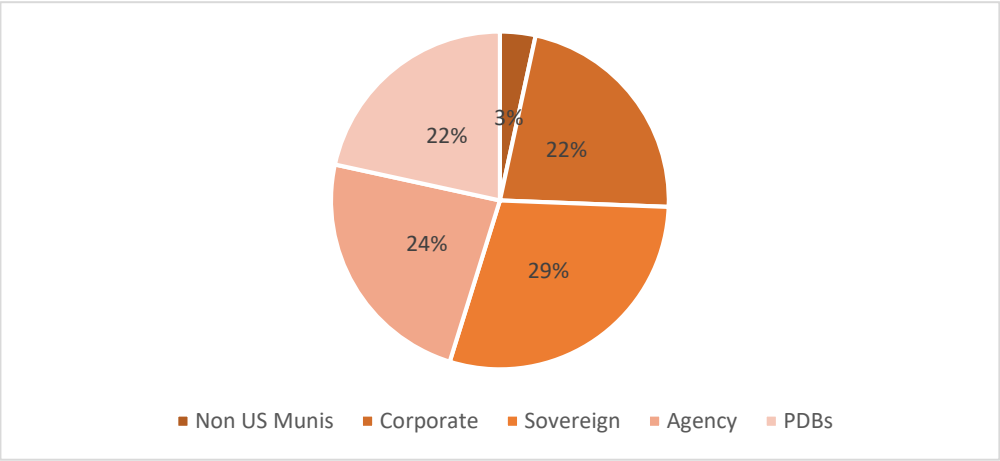


Figure reports the global issuances by issuer type. Non-US Munis refer to "Non-US Municipalities". Source: Reuters DataStream.

The above figure reveals that various issuers across different sectors are actively engaging in the issuance of GSSS bonds while adhering to established standards and guidelines. The primary categories of issuers in the GSSS market encompass sovereign entities, including national governments, local governments, and government-backed institutions; supranational bodies like agencies; public development banks; providers of loans and asset-backed securities (ABS), such as commercial banks; and corporates.

Figure 9. Global Issuances, issuer type volume and number of issuances analysis

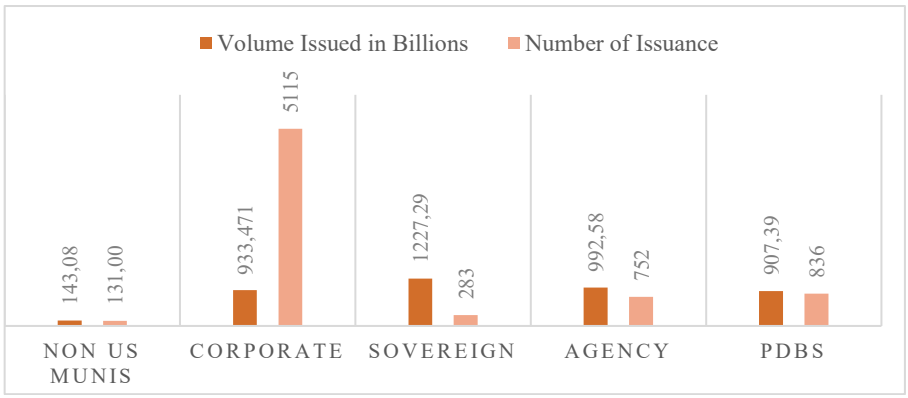


Figure reports the global issuances in volume and numbers by issuer type. Source: Reuters DataStream.

3.3.2. Bond issuance by PDBs according to:

✓ *Type of bonds*

PDBs have issued various types of sustainable PDBs have issued various types of sustainable bonds with the exception of sustainability linked bonds. The highest number of issuances by PDBs are in sustainability bonds followed specifically by CBI Aligned Green bonds and then social bonds with no issuances of sustainability linked bonds recorded as at the point of data collection. PDBs have issued green bonds across all regions with the most issuances found in Europe. The figure below shows the volume and number of issuances across all types of instruments. The data illustrates a higher frequency of issuance of green bonds by PDBs compared to their social counterparts. This discrepancy can be explained by the green bond market's longer establishment in comparison to social bonds. The prevalence of green bonds could stem from the perception within the market that climate-related concerns hold greater urgency than social issues. This perspective is reinforced by global initiatives like the Glasgow Financial Alliance for Net Zero and the Paris Agreement. Furthermore, climate-focused actions tend to have more easily quantifiable metrics and impact indicators, such as reduced greenhouse gas emissions and mitigated risks posed by current climate conditions on economic activities, making them more readily quantifiable than social issues. However, both overall social bond issuance and that by PDBs experienced a swift surge during the pandemic. This spike was driven by urgent economic support requirements during challenging times, solidifying their position in GSSS bond issuers' portfolios, irrespective of the ongoing impact of Covid-19.

Figure 10. Type of bonds issued by PDBs

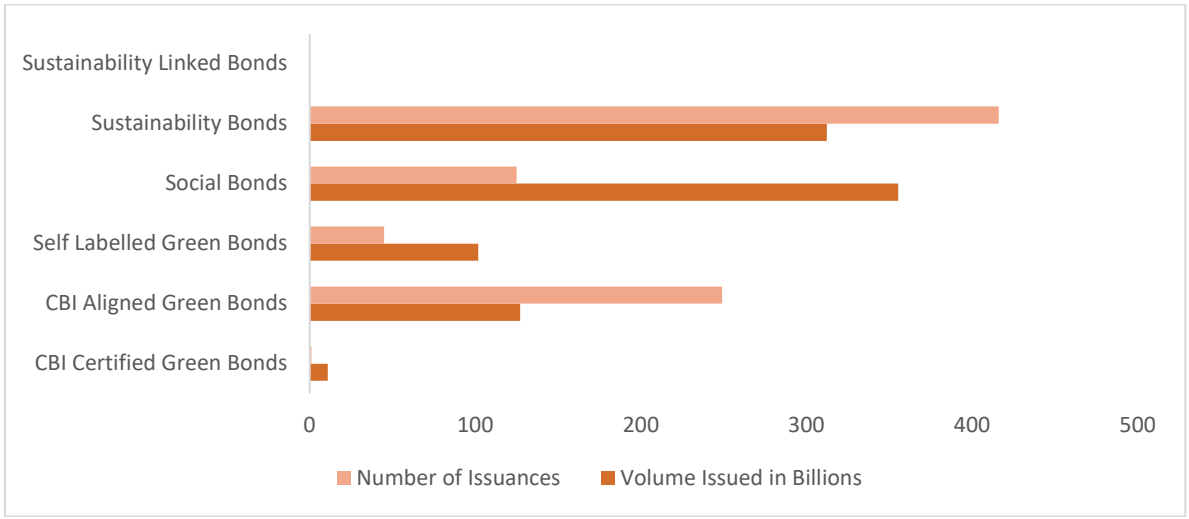


Figure reports the bond types issued by PDBs.
Source: Reuters DataStream.

- ✓ *Geography*

North America records the strongest activities of PDBs with the highest issued sustainable instrument being sustainability bonds in the market. Europe is the second continent with a high number of sustainable bonds issuances by PDBs. The influence of PDBs in the issuance of green bonds in the European market is evident as EIB (European Investment Bank) is often cited as the first issuer of green bond with the Climate Awareness Bond issued in 2007. PDBs have issued a high number of CBI-aligned green bonds on the European market. PDBs have diversified issuances of sustainable instruments on the Asia Pacific market with the exception of sustainability linked bonds. No sustainability linked bond has been issued by a PDB and sustainable bonds were highly issued by PDBs across various markets with the exception of Latin America.

Figure 11. PDBs issuances across continents

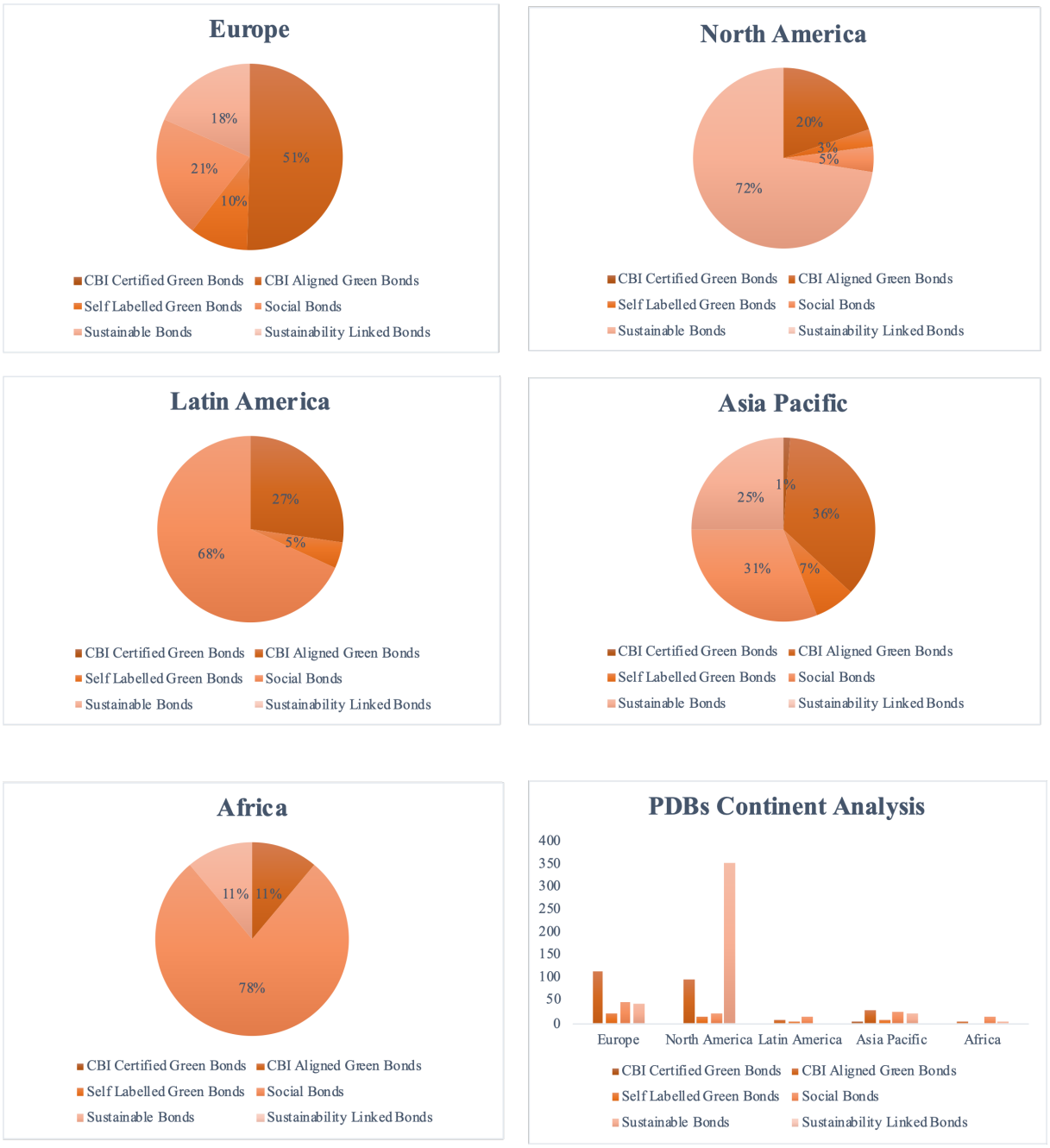


Figure reports the different instrument issuances across continents by PDBs.
Source: Reuters DataStream.

The activities of PDBs in Africa are the lowest when compared to other regions such as Europe, North America, and Asia Pacific. In Africa, social bonds are the most issued instruments by PDBs. However, the need to achieve SDGs and meet nationally determined contributions has seen a steady rise in the issuances of sustainability bonds. The Banque Ouest Africaine de Développement (BOAD), the regional development bank of the member states of the West African Economic and Monetary Union (WAEMU), made history by issuing the first-ever Sustainability Bond in Africa. This landmark transaction amounted to €750 million with a 12-year maturity period. Remarkably, the inaugural issuance received overwhelming interest, being 6 times oversubscribed. Notably, anchor orders predominantly originated from Europe (80%) and the U.S. (17%), indicating widespread international investor confidence. Moreover, the issuance attracted significant attention from Socially Responsible Investing (SRI) investors, with more than 80% of the book reportedly classified as such. The transaction set new benchmarks for the bank, achieving the best coupon (2.75%), and Reoffer Spread (MS +300 bps) conditions ever recorded in the international market. The influence of PDBs in the growth of the sustainable finance market in Europe, North and Latin America is strong but their influence on the African market can be improved as the African sustainable finance market remains nascent. One characteristic that is synonymous with PDBs across geographical points of issuance is the low cost of issuance. PDBs record the lowest cost of issuance in Europe and the highest cost of issuance in Africa which is in turn lower than other issuers.

PDBs also show high issuances in green bonds across all regions except Latin America and Africa markets. In Latin America, the most frequently issued bonds by PDBs are social bonds and in Africa the most issued bonds by PDBs are sustainable bonds.

Figure 12. PDBs volume issuances across continents

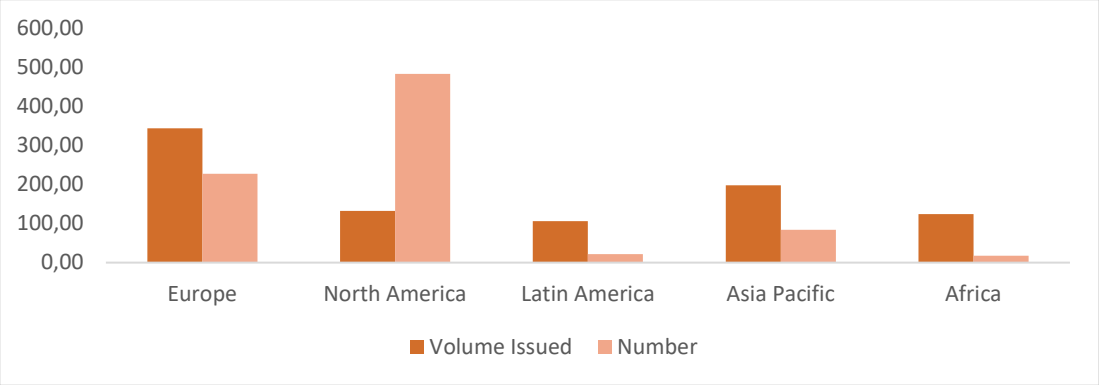


Figure reports the issuances across continents by PDBs.
Source: Reuters DataStream.

✓ *Bond characteristics*

PDBs are mammoth organizations with good credence which can easily be translated into high credit ratings, unlike corporate organizations. With regards to average coupon, PDBs have, on average, lower cost of issuance as compared to all other classes of issuers which includes Corporates, Sovereigns, Agency, and Non-US Munis. PDBs have lower coupons in green bond issuances as compared to other issuers. On average, the cost of issuances by PDBs across all regions are lower as compared to other types of issuers. PDBs pay 1.5 percent less on average than other type of issuers on green bonds issued with a higher average maturity period of 4 years more than other types of issuers. Average amount of green bonds issued by PDBs also averages twenty percent more than the average issuer. With regards to the number of issuances of green bonds, PDBs account for less than 5 percent of total number of green bond issuances and make up for the smallest number of issuances in volume by accounting for 13 percent of the global volume of green bond issuances. Generally, cost of issuance for the various instruments by PDBs were lower as compared to other types of issuers. PDBs have access to international markets with lower interest rates than private institutions, sometimes explained by sovereign guarantees provided by governments.

Table 5. Analysis of PDBs issued bonds by characteristics

PUBLIC DEVELOPMENT BANKS															
	CBI Certified Green Bonds			CBI Aligned Green Bonds			Self-Labelled Green Bonds			Social Bonds			Sustainability Bonds		
	Avg. Mty(Yrs)	Avg Yld(%)	Avg Cpn(%)	Avg. Mty(Yrs)	Avg Yld(%)	Avg Cpn(%)	Avg. Mty(Yrs)	Avg Yld(%)	Avg Cpn(%)	Avg. Mty(Yrs)	Avg Yld(%)	Avg Cpn(%)	Avg. Mty(Yrs)	Avg Yld(%)	Avg Cpn(%)
Europe				8,26	3,07	1,64	15,61	1,02	1,05	11	2,88	1,09	12,36	3,23	1,41
North America				8,80	5,06	3,06	11,87	3,41	2,75	6,50	4,62	2,50	10,42	3,31	1,95
Latin America				8,00	8,06	3,82	5	2,45	0,45	6,07	2,12	2,37			
Asia-Pacific	5,00	1,72	1,66	15,57	3,37	2,23	11,50	3,01	5,46	6,04	4,01	2,42	4,29	5,86	2,42
Africa				5	3,18	0,73				7	5,08	1,11	12,00	5,89	2,75

In Europe, PDBs have lower cost of issuance (coupons) as compared to other issuers. PDBs however pay higher coupons in Latin America because the capital markets are limited and still underdeveloped. PDBs pay lower coupons on the issuance of social bonds and pay higher coupons for the issuance of green bonds on average. The average yield to maturity is high on average in Latin America on green bonds and lowest in Europe.

Conclusion

The report proposes a first analysis of funding structure of Public Development Banks and how the characteristics of PDBs explain differences in funding structure. We define liabilities and funds into four categories based on their level of liquidity. Wholesale short-term liabilities are the most illiquid and long-term liabilities and equity are highly stable resources. Retail deposits are semi-liquid liabilities.

Data exploration indicates that funding structure of PDBs strongly differ from commercial banks. Short-term resources play a minor role, especially customer deposit, while they account for the large share of funds of commercial banks. At the opposite, illiquid resources (long-term liabilities and equity) account for two thirds of funds of PDBs.

We then document that there is a lot of heterogeneity across PDBs in their ability to raise long-term debts and in their equity ratios. We therefore examine characteristics of PDBs correlated with the use of long-term liabilities and with equity ratio. For the former, the main factor affecting ability to attract long-term liabilities is the size of the PDBs. The ratio of long-term liabilities to total assets increases with size. Other characteristics are not discriminant.

We also show that banks capitalization ratio is more diverse and driven by more factors. We found some evidence that both sources can be partially substituted as size is negatively correlated with capital. PDBs able to raise long-term debts have lower capitalization, while smaller PDBs facing difficulties to attract long-term funds have higher capital ratios. However, capitalization ratios are also correlated with other characteristics. In particular, multinational PBDs and those from richer countries are more capitalized than their counterparts.

In the concluding segment of this document, we delve into the role of PDBs (Public Development Banks) in fostering the expansion of sustainable finance. Specifically, we analyze whether PDBs differ from other issuers concerning the issuance of green, social, or sustainable bonds. Data elucidates that the influence of PDBs in advancing sustainable finance instruments is substantial. The volumes they issue across various instruments significantly contribute to achieving the global growth objectives for these financial tools. However, amplifying lending must align with transformative behaviors and investment practices. It's not solely about prompting banks to utilize their capital for more extensive loan offerings; rather, it involves leveraging the latent potential—highlighted in section four's data—to play a more profound and strategic role in sustainable development.

Additionally, beyond rectifying market deficiencies, these institutions possess unexplored potential to steer policy changes towards more sustainable developmental trajectories. They can provide insights derived from their experiences to policymakers or actively engage in discussions centered around SDGs (Sustainable Development Goals). Moreover, by adopting a more proactive stance, not just as funders but as catalysts of investments (Griffith-Jones et al., 2020), PDBs can drive genuinely transformative shifts in the countries or regions where they operate. These changes ideally aim to realize the 2030 Agenda and its SDGs, yielding substantial impact and scale, effecting tangible changes in the territories and communities they aim to support.

This work is a first exploration to examine patterns of funding structure of PDBs. Future works should improve our knowledge by investing in detail how PDBs finance their activity and identify obstacles faced by smaller PDBs to raise long-term debts. In addition, and in line with existing banking literature, another avenue for research consists of examining how funding structure affects PDBs activity in terms of lending, notably during crises and their stability and performance. For future research, there is a promising avenue to explore the question of Key Performance Indicators (KPIs) and methodologies utilized by Public Development Banks (PDBs) to monitor extra-financial impacts, with a specific focus on Sustainability Linked Bonds (SLBs). Investigating this area can provide valuable insights into the effectiveness of current monitoring practices and identify opportunities for refinement to better align with sustainability objectives.

Additionally, further investigation into the extent to which the issuance of sustainable bonds contributes to structuring domestic appetite for sustainability-linked financial products is warranted. This inquiry can delve into the mechanisms through which SLBs influence investor preferences, market dynamics, and broader trends in sustainable finance. By examining the interplay between bond issuance, investor behavior, and market development, researchers can offer actionable recommendations to enhance the efficacy and uptake of sustainability-linked financial instruments. Overall, future research efforts in these areas can contribute to advancing our understanding of sustainable finance practices, informing policy decisions, and driving positive environmental and social outcomes in the financial sector.

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Appendix A. Additional tables

Table A1. Sample composition

	All	Size					Ownership		
	PDBs	Micro	Small	Medium	Large	Mega	Subnational	National	Multi.
% of PBDs	48.3	27.7	65.7	84.1	90.0	81.8	33.6	49.4	78.4
# banks included	*255*	*51*	*136*	*37*	*18*	*9*	*40*	*175*	*40*
# banks (all)	*527*	*184*	*207*	*44*	*20*	*11*	*119*	*354*	*51*

	Age			Mandate							
	Young	Medium	Old	AGRI	EXIM	FLEX	HOUS	INFRA	INTL	LOCAL	MSME
% of PBDs	30.4	50.0	58.7	39.4	58.2	51.1	60.0	35.5	66.7	58.8	37.8
# banks included	*41*	*96*	*118*	*13*	*32*	*97*	*21*	*11*	*20*	*10*	*51*
# banks (all)	*135*	*192*	*201*	*33*	*55*	*190*	*35*	*31*	*30*	*17*	*135*

	Level of income				Geography					
	HIC	UMIC	LMIC	LIC	Africa	Americas	Asia	Europe	Oceania	World
% of PBDs	46.2	56.8	37.5	19.0	43	46.6	50.7	55.2	20	50
# banks included	*85*	*75*	*51*	*4*	*43*	*55*	*75*	*74*	*4*	*11*
# banks (all)	*184*	*132*	*136*	*21*	*100*	*118*	*148*	*134*	*20*	*22*

In each cell, the first row provides the percentage of PDBs included in the analysis, based on the list from Xu et al. (2021).
The second row presents the number of banks and the last row the number of banks in the Xu et al.'s database.

Table A2. Distribution of the four categories of resources in total funding

	WHOLESALE			RETAIL		
	Nb	% (freq)	% (cum)	Nb	% (freq)	% (cum)
Absence	81	30.8	30.8	119	45.2	45.2
]0;10]	89	33.8	64.6	62	23.6	68.8
]10;20]	27	10.3	74.9	21	8.0	76.8
]20;30]	14	5.3	80.2	12	4.6	81.4
]30;40]	17	6.5	86.7	10	3.8	85.2
]40;50]	8	3.0	89.7	6	2.3	87.5
]50;60]	12	4.6	94.3	8	3.0	90.5
]60;70]	3	1.1	95.4	4	1.5	92.0
]70;80]	8	3.0	98.5	9	3.4	95.4
]80;90]	2	0.8	99.2	12	4.6	100.0
]90;100]	2	0.8	100.0	0	0.0	100.0

	LONG TERM			EQUITY		
	Nb	% (freq)	% (cum)	Nb	% (freq)	% (cum)
Absence	51	19.4	19.4	3	1.1	1.1
]0;10]	43	16.3	35.7	62	23.6	24.7
]10;20]	19	7.2	43.0	65	24.7	49.4
]20;30]	26	9.9	52.9	39	14.8	64.3
]30;40]	12	4.6	57.4	26	9.9	74.1
]40;50]	18	6.8	64.3	14	5.3	79.5
]50;60]	25	9.5	73.8	13	4.9	84.4
]60;70]	22	8.4	82.1	8	3.0	87.5
]70;80]	20	7.6	89.7	11	4.2	91.6
]80;90]	17	6.5	96.2	7	2.7	94.3
]90;100]	10	3.8	100.0	15	5.7	100.0

Table A3. Analysis of all bonds by characteristics

ALL ISSUERS																		
	CBI Certified Green Bonds			CBI Aligned Green Bonds			Self-Labelled Green Bonds			Social Bonds			Sustainability Bonds			Sustainability-Linked Bonds		
	Avg. Mty(Yrs)	Avg Yld(%)	Avg Cpn(%)	Avg. Mty(Yrs)	Avg Yld(%)	Avg Cpn(%)	Avg. Mty(Yrs)	Avg Yld(%)	Avg Cpn(%)	Avg. Mty(Yrs)	Avg Yld(%)	Avg Cpn(%)	Avg. Mty(Yrs)	Avg Yld(%)	Avg Cpn(%)	Avg. Mty(Yrs)	Avg Yld(%)	Avg Cpn(%)
NON-US MUNIS																		
Europe				5,69	3,26	2,41	8,63	2,97	2,91	23,86	1,97	1,74	16,40	2,70	1,48	4,74	3,14	2,10
North America													10	3,72	2,30			
Latin America																		
Asia-Pacific	7	4,09	2,40	12,48	1,77	1,18	10,76	0,66	0,39	4,67	0,18	0,07	11,67	0,66	0,47	10,15	0,65	0,31
Africa	10,00	10,07	10,17	10	11,31	10,18												
CORPORATE																		
Europe	11,77	3,90	2,01	10,36	4,45	2,54	6,77	3,01	2,23	10,14	4,11	2,24	9,07	3,37	2,70	7,91	5,58	3,53
North America	12,29	4,65	3,33	12,84	6,40	3,47	11,30	5,93	3,65	8,87	4,67	5,20	10,10	4,74	2,61	8,32	6,69	4,53
Latin America	4,00	0,00	3,35	9,64	5,93	5,41	6,69	3,12	17,23	3,09	0	16,24	11,78	5,37	3,06	6,80	5,83	4,67
Asia-Pacific	7,61	3,21	2,85	6,20	3,21	2,34	6,21	3,60	3,01	7,29	2,83	2,02	5,44	3,96	2,49	7,28	3,37	2,91
Africa	5,00	9,40	6,31	5,89	7,37	6,37	6,15	7,66	6,43	3	0	14	8,00	11,02	8,73	4,74	6,28	9,44
SOVEREIGN																		
Europe				10,06	3,12	1,39							12,50	3,78	1,33			
North America										9,33	4,96	4,67	10,63	3,23	2,17			
Latin America	20,00	3,94	1,25							14,50	5,04	2,82	21,38	3,82	4,36	16,23	4,86	5,05
Asia-Pacific				12,33	3,94	2,03	10,50	4,01	4,25				11,50	2,71	4,62			
Africa				6,67	10,89	5,67	7	11,40	14,50	5,62	3,92	5,78	13,00	8,42	4,95			
AGENCY																		
Europe	27,15	3,00	1,46	7,97	3,92	1,38	5,62	5,43	3,73	7,46	3,67	1,30	6,85	3,59	0,84			
North America				15,67	4,39	3,13	31	4,33	4,15				10	6,70	2,72			
Latin America				7,00	5,69	4,75	10	0,00	3	7,40	1,89	0,76	5,00	5,51	4,63	16,23	4,86	5,05
Asia-Pacific	6,91	4,98	3,80	8,09	4,31	2,63	8,41	3,30	2,33	7,61	3,19	2,56	5,82	3,76	1,96			
Africa																		
PUBLIC DEVELOPMENT BANKS																		
Europe				8,26	3,07	1,64	15,61	1,02	1,05	11	2,88	1,09	12,36	3,23	1,41			
North America				8,80	5,06	3,06	11,87	3,41	2,75	6,50	4,62	2,50	10,42	3,31	1,95			
Latin America				8,00	8,06	3,82	5	2,45	0,45	6,07	2,12	2,37						
Asia-Pacific	5,00	1,72	1,66	15,57	3,37	2,23	11,50	3,01	5,46	6,04	4,01	2,42	4,29	5,86	2,42			
Africa				5	3,18	0,73				7	5,08	1,11	12,00	5,89	2,75			

Appendix B. Definitions

Definition of Bonds

According to the International Capital Market Association (ICMA), sustainable finance incorporates climate, green and social finance while also adding wider considerations concerning the longer-term economic sustainability of the organizations that are being funded, as well as the role and stability of the overall financial system in which they operate. Our data is a collection of all sustainable finance instruments issued and available on Reuters DataStream as of May 2023. The various instruments under consideration includes CBI Certified Green Bonds, CBI Aligned Green Bonds, Self Labelled Green Bonds, Social Bonds, Sustainability Bonds and Sustainability Linked Bonds. We describe each category below.

CBI Certified Green Bonds

CBI Certified Green Bonds are bonds that have undergone a rigorous and independent verification process by the Climate Bonds Initiative. The Climate Bonds Initiative is an international organization working to mobilize the global bond market to finance climate change solutions. When a bond receives CBI certification, it means that the bond issuer has met the specific criteria and standards set by the Climate Bonds Initiative for financing environmentally sustainable projects or assets. These projects can include renewable energy, energy efficiency, sustainable transportation, green buildings, and other climate-focused initiatives. The certification process ensures transparency and credibility in green bond issuance and encourages more responsible investment in climate-related projects.

CBI Aligned Green Bonds

CBI Aligned Green Bonds are bonds that, while not being CBI Certified, are issued by entities that have voluntarily committed to aligning their green bond issuance with the Climate Bonds Standard and Principles. While these bonds may not have undergone the same independent verification process as Certified Green Bonds, the issuers follow the guidelines and recommendations provided by the Climate Bonds Initiative to ensure their green bonds finance eligible green projects and are in line with international best practices for sustainable finance.

Self-Labeled Green Bonds

Self-Labeled Green Bonds, also known as non-certified or unverified green bonds, are bonds where the issuer claims that the proceeds will be used to finance green or environmentally friendly projects without obtaining an independent certification from an external entity like the Climate Bonds Initiative. These bonds rely solely on the issuer's own assertions regarding the use of proceeds and the environmental impact of the funded projects. While self-labeled green bonds can still finance environmentally friendly initiatives, the lack of external verification can raise concerns about the accuracy and transparency of the green claims.

Social Bonds

Social Bonds are a type of debt instrument issued by governments, corporations, or other entities to raise funds for projects or initiatives with a specific social objective. The key characteristic of social bonds is that the proceeds are exclusively allocated to finance projects that aim to address or alleviate social issues. These issues can include, but are not limited to, improving access to healthcare, education, affordable housing, employment opportunities, food security, and supporting vulnerable or disadvantaged populations. Social bonds are designed to promote positive social outcomes and create a measurable impact in the targeted areas. Investors in social bonds seek both financial returns and the satisfaction of contributing to social progress.

Sustainability Bonds

Sustainability Bonds are broader in scope than Social Bonds. These bonds are issued to raise funds for projects that have both environmental and social objectives. The proceeds from sustainability bonds can be used to finance a combination of projects, including those that promote environmental sustainability (e.g., renewable energy, energy efficiency, waste management) and social well-being (e.g., healthcare, education, affordable housing). The main idea behind sustainability bonds is to support initiatives that contribute to a more sustainable and equitable future by addressing both environmental and social challenges.

Sustainability Linked Bonds

Sustainability Linked Bonds are a unique type of bond where the financial terms, such as the coupon rate or maturity, are tied to the issuer's ability to achieve predefined sustainability targets. Unlike the proceeds of Social Bonds and Sustainability Bonds that are earmarked for specific projects, the proceeds from sustainability-linked bonds can be used for general corporate purposes. However, the issuer commits to achieving certain environmental, social, or sustainability performance objectives within a specified timeframe. If the issuer meets the predefined sustainability targets, the bond may offer a reward in the form of a lower interest rate (coupon) or other financial benefits. On the other hand, if the issuer fails to meet the targets, the bondholders might receive a penalty, such as a higher coupon rate. Sustainability-linked bonds aim to incentivize issuers to improve their sustainability performance and align their operations with sustainable practices.

Definition of Issuers

The definition of our issuer types is aligned to financial market definitions.

Non-US Muni Issuer

A non-US Muni issuer refers to a municipal or local government entity that issues bonds outside the United States. In the US, municipal bonds, commonly known as "Munis," are issued by state and local governments or their agencies to finance various public projects such as infrastructure development, schools, hospitals, and other public works. Similarly, outside the US, municipal entities in other countries may issue bonds to finance local projects and public services. These non-US Muni issuers issue bonds in their local currency and are subject to the regulations and governance of their respective countries.

Corporate Issuer

A corporate issuer refers to a private company or corporation that issues bonds to raise capital for its business activities. When a company needs to raise funds for expansion, acquisitions, or other corporate purposes, it can issue corporate bonds. Corporate bonds are debt instruments that pay periodic interest to bondholders and return the principal amount at maturity. The creditworthiness of the corporate issuer, often assessed by credit rating agencies, determines the risk associated with the bonds and the interest rate at which they are issued. Corporate bonds are an important part of the corporate finance landscape, and they can be traded in the bond market.

Sovereign Issuer

A sovereign issuer refers to a national government that issues bonds to finance its operations and fund various projects or initiatives. Sovereign bonds, also known as government bonds, are typically issued in the domestic currency of the issuing country. Governments use sovereign bonds to raise funds for budgetary needs, infrastructure development, social programs, and other public spending. The creditworthiness of a sovereign issuer is a critical factor in determining the interest rate it needs to pay on its bonds, and it is often assessed through credit ratings provided by rating agencies. Sovereign bonds are considered relatively low-risk investments, especially when issued by economically stable and creditworthy countries.

Agency Issuers

Agency issuers refer to entities that are established or sponsored by governments to fulfill specific purposes, often in the public interest. These agencies can be at the national or regional level and may be involved in various sectors, including housing, education, agriculture, and infrastructure. Agency bonds are debt securities issued by these government-sponsored entities to raise funds for their operations or to finance specific projects. Agency bonds might have a slightly higher risk compared to sovereign bonds but are generally considered less risky than corporate bonds. The credit risk associated with agency bonds depends on the financial stability of the issuing agency and, in some cases, the backing or guarantee provided by the government.

Public Development Bank Issuer

A public development bank issuer refers to a type of financial institution that is owned and operated by the government with the primary objective of promoting economic development and addressing social issues. These banks are established to provide long-term financing for projects that contribute to the overall development of the country or region they serve. Public development banks play a crucial role in financing infrastructure projects, supporting small and medium-sized enterprises (SMEs), fostering innovation, and promoting sustainable development initiatives. These banks play a critical role in mobilizing financial resources and supporting projects that might not attract sufficient private sector investment but are vital for a country's long-term economic growth and development.

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Publication Director Rémy Rioux
Editor-in-Chief Thomas Melonio

Legal deposit 3rd quarter 2024
ISSN 2492 - 2846

Graphic design MeMo, Juliegilles, D. Cazeils
Layout Denise Perrin, AFD
Printed by the AFD reprography service

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