

## **Measurement and the Circulation of Risk in Green Bonds**

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Patrick Bigger researches the constitution of risk, standards, and value in environmental finance. His doctoral dissertation in Geography at the University of Kentucky focused on regulatory decisions in the creation of California's cap-and-trade market. His current research investigates a wider range of environmental-financial interfaces, especially biodiversity conservation equity funds with investments in Kenya, as well as green bonds. Recently he has also worked with the African Development Bank on the creation of a new financial mechanism to support climate adaptation in the Global South. Originally from Texas, he has held a Marie Curie post-doctoral fellowship in the European Network for Political Ecology at Manchester University and a Senior Researcher post at the Pentland Centre for Sustainability in Business at Lancaster University.

## **Abstract**

Since their invention in 2007, green bonds have become a key mechanism by which money is channeled into environmentally beneficial projects. However, questions about what, exactly, is “green” about green bonds remain open. This lack of consensus represents one of the major obstacles to continuing to scale green debt. To explore the challenges of ascertaining and communicating potential environmental benefits, this article explores the range of institutions involved in the origination and distribution of green bonds. It does so by conceiving of the connections between these institutions through the communication of risks, both financial and environmental, as the infrastructure of green bonds. The relative complexity of this infrastructure compared to that of “vanilla” debt, owing to the added nodes of environmental risk, is a core challenge. The article includes a visualization of this infrastructure of risk that demonstrates moments in which risk is originated, combined, partitioned, and held. The paper concludes with brief reflections on the utility of conceiving of the green debt value chain as the infrastructure of paired environmental-financial risk.

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## Introduction

Green bonds have emerged over the last decade as a key financial mechanism for channeling investment into climate change mitigation and adaptation. From their creation by the European Investment Bank in 2007 until 2014, green bonds were a niche financial product issued primarily by multilateral development banks to support green lending programs. Early green bonds lacked standardization and wider awareness, inhibiting widespread uptake. However, the asset class has enjoyed explosive growth over the last three years as corporates, municipalities, and now sovereign issuers have begun issuing debt with an explicitly “green” label. This shift has channeled substantial capital into environmentally inflected projects, particularly around renewable energy and energy efficiency. Issuance surged to roughly US\$80 billion in 2016 (Thomson-Reuters 2017).

While recent growth in green bonds has been impressive, some observers fear the asset class is entering a “valley of death” (Lazarova 2016), as investors with an appetite for green debt become satiated. There is also a concern that metrics for communicating “greenness” – both environmental benefits and the risk that those benefits will not be achieved – are not sufficiently developed or standardized to scale the market as its proponents envision. One way this challenge to scale manifests is uneven use of green bonds across different jurisdictions and industries. This unevenness is due, in part, to variations in pre-and-post-issuance reporting of intended/actual use of either proceeds or environmental benefits achieved. This means that various actors throughout the investment process don’t necessarily receive sufficient information on the environmental risks that are commodified in green bonds (see Tripathy, 2017).

This paper examines how risks, both environmental and financial, are quantified, communicated, combined, and distributed throughout the green bond value chain, focusing especially on environmental certification and credit ratings as twinned practices of risk evaluation. It contrasts the degree to which these evaluation practices are commensurable, and so intelligible, to different actors throughout the value chain. To demonstrate the way that financial and environmental risks are originated, partitioned, distributed, and held, the article offers a visual schematic of risk creation and transfer over the life of a green bond. The schematic highlights the moments at which environmental and financial risk diverge or must be sutured together. These moments represent opportunities to commodify these increasingly inseparable risks in a financial form. They also complicate matters for buyers who are unused to evaluating environmental criteria or who face regulatory definitions of fiduciary responsibility that make the incorporation of ESG criteria into investment decisions challenging.

Conceptually, the article starts with the supposition that all financial products represent quantified and priced risk, partitioned and rendered fungible through specific practices up and down the value chain (Dean 1998). That risk is then communicated through key indicators. It is transferred to others by public reporting on the “green” components of a given bond and contractual arrangements, from standard underwriting and bookrunning to post-issuance green auditing. These social artifacts and their practice comprise the infrastructure of risk in green debt: environmental risks are packaged with financial risks in any given green bond, creating different practices whereby risk is transferred to different sets of actors.

The construction of this risk infrastructure is both the primary opportunity and challenge for the growth of the green bond market. The quantification and communication of financial risk through pricing in debt are thoroughly mature and widely agreed upon practices, signaled most explicitly by credit ratings. While green bonds are generally used to fund specific projects or types of projects, the risk of default is (for the most part<sup>1</sup>) based on the full balance sheet of the issuer (Cochu et. al 2016). This makes the evaluation of financial risk relatively simple for buyers of that debt, and hence straightforward to manage.

However, the evaluation of environmental risks in green bonds, both material and reputational, remains an evolving set of practices. There is no consensus on the best way to ascertain the possibility that green goals will not be met. Nor are there agreed upon sanctions in the event of “green default” – there is not even agreement on whether there should be formal sanctions at all. Various standards bodies, financiers, and governments have devised systems for assessing the environmental bonafides of an issuer’s approach to green debt, resulting in a fragmented landscape of risk evaluation practices, and hence an incomplete infrastructure of risk origination, distribution, and management. Environmental standards also differ widely across jurisdictions. Even reporting within the same standards regime may be irregular depending on the detail available through audit reports. The communication and distribution of environmental (and twinned environmental/financial) risk may therefore not be uniform even where one might expect convergence.

While understandable in a new asset class, the lack of harmonization is a problem for some issuers, as it imposes transaction costs beyond simply the money needed to verify a green bond. In turn, this limits the number of entities who label their debt, and so slows the

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<sup>1</sup> Other kinds of debt that are not based on the issuer’s entire balance sheet, including asset-backed securities, are becoming increasingly common.

overall pace of market development, including standardization of metrics. Much of this challenge is rooted in the integration of risk into green bonds.

### **The Intricate Practices of Risk Integration**

I argue that the evolution of climate bonds exemplifies the challenge of folding two different kinds of risk into new debt products: both the commodification of financial risk and the risk of failing to achieve environmental objectives. Because green bonds are both a relatively well understood debt instrument and an environmental derivative at the same time, the challenge of rendering them a standard and standardized asset class turns on the numerous steps of risk origination, transfer, and holding (Tripathy 2017).

Simply put, green bonds are conventional debt instruments used to finance environmentally friendly projects. These projects are often explicitly tied to climate mitigation or adaptation, but there are seemingly limitless possibilities for environmental application. This basic premise is why green bonds have potential to be a critical asset class for financing green transitions: they are familiar to the investment world.

The origination and trading of debt instruments is among the most foundational financial practices in the modern economy. Global outstanding debt hovers around US\$100 trillion – the largest reliably quantifiable asset class in the world. As supporters of green bonds are keen to point out, capturing just a fraction of this debt with a few tweaks to current practices could address the myriad environmental funding gaps (e.g. renewable energy, urban infrastructure, or even biodiversity conservation). In contrast with many of the exotic environmental derivatives that proliferated since the 1980s, such as carbon markets or wetlands banking, green bonds can be easily explained to investors. Nor do they hinge on key politically-defined metrics (e.g. additionality), making them less prone to regulatory capture (Drew and Drew 2010). But despite their relative simplicity, green debt is more involved than conventional “vanilla” bonds.

Green bonds foreground environmental benefits, which is both the premise of the asset *and* the primary challenge to scale. Making the “green” risks embodied in each bond easily intelligible and subject to evaluation in the same way as financial risks requires new metrics. Thus, risk evaluations must be developed that are simple enough for integration into fixed-income managers’ matrices but detailed enough to satisfy environmental campaigners, government regulators, and financial industry backers. On the one hand, if the links between a bond and environmental benefit appear tenuous to investors, then the potential for perceived greenwashing looms large. This does reputational damage not only to the issuer, but also the environmental verifiers and auditors, the underwriter(s), and the holders of the debt. It also damages the reputation of labeled green debt as a whole,

potentially hindering further scale-up.<sup>2</sup> On the other hand, if reporting standards are perceived as onerous – and in the absence of any aggressive regulation – issuers will forego the transaction costs of green labeling and potential purchasers will stick with easily intelligible, but perhaps environmentally harmful, vanilla debt. This disconnect has led some issuers that might be expected to issue green debt to forego the label (e.g. Danish utilities). The issuer avoids added transaction costs this way and trusts that environmentally conscious buyers will proactively seek appropriate opportunities.

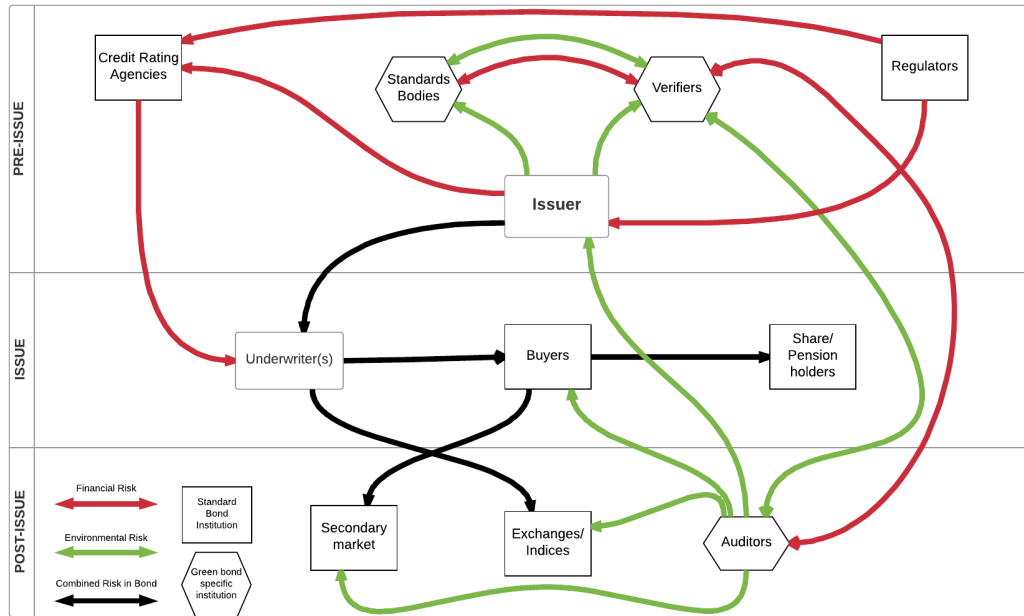
I explore what we might think of as the constitution of green bonds as an asset class that packages environmental and financial risk together in a particular way. The *raison d'être* of these practices, like environmental assessment methodologies, pricing structures, and secondary market indices, is to facilitate the origination, commingling, holding, and trading of environmental and financial risk. The commodification of risks is conducted through these practices with the goal of realizing financial returns while simultaneously rectifying environmental crises. That is, green bonds represent a (largely) private sector endeavor to come to terms with the historical tendency to treat nature as a free gift to capital by pricing environmental risk into existing financial products. I consider how this risk infrastructure is constructed in rather abstract financial space. I also look at how this market and its infrastructure conceptualize and circulate risks through two evaluation practices – environmental certification and credit rating.

The importance of metrics cannot be overstated in the development and future growth of green bonds. After all, how do we know something is “green,” especially when the disparate bits that comprise that something become fungible, commodified representations of financial risk that represent everything from thermal power sulfur scrubbers in China to energy efficient housing retrofits in Sweden? Figure 1 presents a visual schematic of the moments when risks, both environmental and financial, are formally communicated through the various actors in the development, issuance, and circulation of a green bond. While not exhaustive, it highlights the diversity of actors for whom any given metric or reporting mechanism must be intelligible, as well as the sheer volume of extra connections required when making debt green. So, with that motivation in mind, we move to the nuts and bolts of suturing environmental and financial risk together in a green bond, how that risk is represented, and the challenges to circulating those risks.

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<sup>2</sup> All that fallout can occur from *perceptions*, to say nothing of the lack of regulatory enforcement mechanisms in the case of actual “green default.”

**Figure 1. Risk transfer in green bond investment chain**



## A Brief History of Green Bonds

The European Investment Bank (EIB), the EU’s multilateral development bank, issued the first labeled green bond in 2007 as a “Climate Awareness Bond.” The bank was raising capital to lend to member states in both the EU and Africa; these states were pursuing low-carbon investments. As the initial offering in the green bonds space, there were no definitive rules for what constituted “greenness,” so the EIB made up its own.

Ten years later, there is still no standard for what constitutes greenness. Any debt issuer can label their bond offering green regardless of what it ultimately finances. While standards, rules, and norms have proliferated, their application remains uneven, both conceptually and spatially. Risks of greenwashing stalk the asset class and contribute to many of the decisions and developments in the market. Financiers who have a genuine interest in facilitating “the great transition” build self-governance mechanisms into green bond infrastructure to insure the bona fides of a given bond. These assurance mechanisms are to mitigate the risk that proceeds of green debt will be spent on something considered “un-green,” thereby doing reputational damage to the issuer and the nascent asset class as a whole.

After that initial issuance by the EIB, the green bond market developed slowly, driven largely by multilateral lenders like the EIB and the World Bank. The promise of green bonds was still novel and unproven, investors were largely unaware of them, and pricing remained unclear. For instance, should the incorporation of poorly understood

environmental risks entail higher rates, or should the altruistic intentions of the bond create a discount (Petrova 2016)? This question remains largely unresolved.

Growth began to accelerate in 2014, when sub-sovereign issuers, particularly US municipalities and European provinces, began issuing highly rated debt to finance municipal infrastructure projects tied to climate change. These bonds were joined by corporate issuance – especially banks’ – as the market matured and standards and metrics for determining what constitutes green developed. For a time, the global distribution of debt issuance was largely confined to the US and Europe, where the lion’s share of the proceeds was also spent. This has recently changed, as China, India, Mexico, Poland, Indonesia, and a raft of other countries and entities have begun offering labeled green debt (CBI 2017).

Nowhere is this more pronounced than in China, which went from close to zero green debt to being the leader in issuance in 2016, largely because of regulation and government encouragement. Of the roughly US\$80 billion issued globally in 2016, China raised more than US\$23 billion by various state-backed banks (Thomson-Reuters 2017; see also Zhou 2017). Another recent development that bears mentioning is the growth of green bond indices, which each have their own criteria for inclusion. These demonstrate the degree to which green bonds have moved from an experimental to a mainstream financial product. They also play a central role in determining which standards issuers adhere to, and hence the route that risks take in their commodification (Macpherson 2017).

Green bonds today generally adhere to a standardized definition of both environmental commitment and transparency, assuring investors that their commitments will be, or were, met. A bond can be aligned to five primary standards, ranging from the Climate Bonds Initiative’s in-house definition, which is the most rigorous and requires the highest level of transparency, to rules recently issued by the Chinese investment authorities. The most widespread standard in use is the Green Bonds Principles, coordinated by the International Capital Markets Association. These principles are becoming the de facto baseline standard for bonds issued in North America and Europe. Adherence to them is the primary criterion for inclusion on a small but growing number of green bond indices compiled by market service providers and exchanges, including Bloomberg and the London Stock Exchange.

The growth of these indices is critical for the development of green bonds as an asset class. It demonstrates that serious institutions take them seriously. More important, it facilitates trading in secondary markets by significantly reducing transaction costs for secondary market participants.<sup>3</sup> As in all environmental markets that promote the exchange of

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<sup>3</sup> These indices relieve buyers of the need to conduct detailed environmental due diligence. They lower transaction costs and thus encourage further issuance by allowing purchasers to apply their standard financial analysis with minimal complications from additional green risk metrics.



environmental benefit quantified into a security with a specific price, secondary market liquidity is a critical factor for the development of the asset class. For green bonds specifically, this means the possibility of bond traders who hold debt for short periods participating in trades. However, this also requires that issuances be large enough that secondary trading will always be available, anecdotally above US\$500 million.

### **Infrastructure of Green Bond Risk**

Building on this background, I turn to explore the infrastructure and commodification of risk in the green bonds asset class. By infrastructure of risk, I mean the pathways by which risks, both environmental and financial, are originated, partitioned, distributed, and held from top to tail in the green bonds market. It has only become possible in the last two years to speak of green bonds as having an infrastructure. In this time, the asset class has solidified and key path dependencies evolved through the development of standards and a sufficient volume of deals; patterns have become identifiable. The path dependencies that we see largely follow the established route of risk origination, transfer, and holding in existing types of debt. But the network possesses new nodes owing to the inclusion of environmental risk – for example, green standards bodies and environmental auditors.

The environmental risks under consideration are not, for the most part, immediate threats to property and life. Instead, to date, 95% of green bonds have been issued to fund climate mitigation through energy efficiency, renewables, or public transport (CBI 2017). As a result, the risks distributed through green bond infrastructure are primarily reputational, in the event the projects financed by a given bond fail to deliver. To illustrate this, I will work through an idealized green bond, highlighting the moments where risk is originated, partitioned, distributed, and held by different actors. The network these actors comprise forms the infrastructure of the green bond market, in conjunction with material methods of assessment, like forms for validating the green credentials of an issuer or financial statements for determining creditworthiness of borrowers.

The first step in issuing a green bond is for an issuer to identify either an existing set of assets or future assets to finance. These assets must be, in some way, associated with greenness. The Climate Bond Standards identify six classes of environmental concern a bond can finance, from low carbon buildings to water conservation. Other standards are broader in their definitions: the Green Bonds Principals has 37 categories for eligible project types, all with their own construction and delivery risks. The issuer must also draft a set of criteria and assurance mechanisms to affirm the funds raised through the green bond will not finance “brown,” or environmentally damaging, projects – a first hedge on environmental risk. A verifier – either one of the big four, or a specialized environmental auditor, such as CICERO – then signs off on the protocol.

The audit presents the first moment of environmental risk origination, partition, and transfer, as some of the environmental risk is passed from issuer to verifier; verifiers are then exposed to reputational damage if the issuer does not live up to its environmental commitments. To minimize risk, the verifier evaluates the green assurances of the issuer. It is increasingly common, and also best practice, to release this evaluation publicly. This marks another potential moment of risk distribution, as prospective buyers of green debt use these verification statements to evaluate the environmental risk of a particular bond.

Sharing risk through environmental disclosure, even using a standardized, easily understood metric, does not necessarily reduce risk. Rather, it can spread the risk by increasing the likelihood of circulation, with more buyers willing to accept the green risks. If an issuer fails to disclose their green certification, however, they acquire additional financial risk as their debt may be excluded from listing on secondary markets or indices that ESG-oriented investors follow. Non-disclosure is also off-putting to primary market buyers in many jurisdictions, which reduces demand. The quality of public risk assessments as it relates to verification also remains uneven. KPMG often offers a one-page statement certifying that they find an issuers' approach to environmental/financial management sufficient. CICERO, meanwhile, provides an in-depth exploration of the framework and representative projects the bond will (re)finance, along with a grade for the approach on a continuous, color-coded scale. As such, picking different verifiers carries a distinct set of conjoined financial-environmental risks.

Simultaneous with or just after verification, a potential bond can be assessed for compliance with one of the green bond standards. Some standards are more narrowly focused on carbon reductions, while others are tailored to local concerns, like urban air pollution for those originating in China. Each standard also has different requirements for ex-anti and ex-post reporting of green credentials. These are explicitly environmental, *not financial*, standards. The financial rating of green bonds and borrowers is left to the existing credit rating agencies. This allows environmental standards bodies to partially divest themselves of risks (and potential financial liabilities), which are instead held by groups like Moody's and S&P. In an interesting development, credit rating agencies themselves are beginning to offer environmental ratings of bonds, which, while separate from their financial rating systems, more directly tether the two forms of risk in a single corporate actor and in the performance of the bond (Moody's Investor Services 2016).

Once issuers have identified projects for (re)financing and adopted and verified a framework, they contract with one or several underwriting banks. These are typically major investment banks that operate in the jurisdiction where target buyers are located and hold significant balances in the relevant currency. As in all bond issuance, this contract represents a significant – if not *the most* significant – moment in both risk origination and distribution. The underwriter(s) becomes the temporary holder of the full debt load;

assumes the responsibility for pricing the debt (in conjunction with the rating agencies) and finding buyers; and, in the event the entire debt offering does not sell, promises to buy the unsold portion of claims to that debt. The packaging of financial debt and environmental risk through practices of evaluation and pricing represents the moment when these risks coalesce into a commodified form. From here, the commodity can begin to circulate, spreading risk to new nodes.

After underwriting, the financial risk embodied in the bond is distributed to buyers. The environmental and financial risk becomes partitioned more broadly as institutional purchasers, in effect, distribute the conjoined risk across shareholders or pension members. Thus far in the short history of green bonds, a relatively small group of investors has been particularly keen on green bonds: institutional purchasers who have a CSR or ESG mandate, sovereign funds, and investment banks with dedicated ESG (or even green bond) funds. Fixed-income institutional purchasers tend to have very low financial risk tolerance, which manifests in avoidance of environmental/reputation risks that have little historical performance data. With every green bond issuance, however, comes new data that can be used to evaluate the environmental risk commodified in green bonds. This facilitates the further commodification of risk by making it easier for risk-averse investors to purchase green debt, demonstrating increased demand, prompting further issuances.

Described as a virtuous circle by the Climate Bonds Initiative, such a progression turns on the propagation and consolidation of data practices (CBI 2017). Herein lies the rub: there is currently a tradeoff with sharing information about conjoined environmental/financial risk to spur new investor involvement. On the one hand, simple reporting that can be integrated into existing spreadsheets may appeal to fixed income investors with limited capacity to evaluate green bona fides. On the other hand, simplified reporting will miss out on nuanced information that is critical for building confidence in the asset class's capacity to deliver real environmental benefit. This data relationship, perhaps more than any in the green bonds investment chain, lies at the crux of both the promise of green bonds but also of metrological challenges associated with scale-up.

The fiduciary responsibility to provide the highest rates of return at the highest level of certainty (as in the case of pension fund managers) emerges as a key issue at this point. For example, many US and European based pension funds are only authorized to invest in AA/AAA rated securities. Debt issued in Global South countries or by corporates based in those countries, with lower or no credit rating, is therefore off limits. Even though data associated with green bonds in the Global South is often more robust than in the North, this prohibition restricts the types of commodified risk that can flow to some institutional purchasers. Further, a quirk in US tax law exempts US-based investors' returns on municipal debt from capital gains tax, fundamentally shaping the geography of risk circulation in the municipal bond market. Domestic investors and traders hold a huge

proportion of US municipal debt at a discount, inhibiting US municipal green debt (and its risks) from circulating more broadly despite the generally high quality of data associated with this debt. At the same time, many institutional investors are highly risk-averse, with limited capacity to evaluate environmental risk, or even to report on environmental risk provided by pre-issuance validators. This means that European pensions, which have been granted more license than many of their US counterparts to pursue environmentally beneficial investment, may be shut out of the US municipal market, though it is the largest in the world and has massive climate-related infrastructure needs (ASCE 2017). These are only two of the legal quirks that restrict the circulation of risk in fragmented global markets – restrictions that cannot be solved by better reporting, but only legal revision.

The final phase of risk communication and circulation is the secondary market, where claims on already existing debt are traded. Prior to this stage, most aspects of a transaction that packages environmental and financial risk together are bespoke, contractual arrangements, from issuer-verifier relationships to prior agreements between book-runners and buyers to purchase debt pre-issuance. As noted above, indices and exchanges are enrolled at this stage to facilitate liquid electronic trading, where risk assessment techniques of the various standards bodies reach back to the initial practices of risk origination and partition. Indices and exchanges ranging from Bloomberg to the Luxembourg Bourse require adherence to standardized criteria around reporting and use of proceeds to be considered for inclusion, so issuers and underwriters seeking to facilitate trades on secondary markets are nudged to comply with standards adopted by these bodies. Listing on secondary markets is often important for the purchasers of initial debt offerings because it offers an exit strategy. This relationship is the clearest example of how the various parts of the infrastructure of risk in green bonds connect to one another. It also illustrates one of the key challenges the asset class has faced: it requires the full investment chain to coalesce around practices that allow environmental and financial risk to be jointly commodified and circulated on global capital markets that have little experience reorienting their risk assessment practices to incorporate environmental risk.

## **Conclusion**

By thinking of financial products as individual packages of commodified risk, we can identify the moments and practices by which that risk is rendered tradeable on capital markets. This approach is particularly useful for thinking about green bonds, which seek to combine both environmental and financial risk into a single product. The commodification of financial risk is well-trod ground, and the practices for its expression are thoroughly mature. This is not true of environmental risk. Consensuses on best practices for the types of environmental data and sharing of that data in the creation of green bonds are beginning to emerge, but remain fragmented. Moreover, it is not merely disparate data practices or lack of agreement on what constitutes greenness that impede the further growth of green

bond issuance. Regulatory hurdles, such as narrow definitions of fiduciary responsibility, limit some in the green bond investment chain from acting on less environmentally damaging activities. The development of metrics that communicate the benefits of green debt offerings and are satisfactory and actionable to all actors in the investment chain, as well as outside observers, will be necessary to facilitate growth of the market. More important, this development will ensure that environmental goals are achieved.

## References

American Society of Civil Engineers. 2017. *2017 Infrastructure Report Card*. Accessed July 13 2017. Available from <https://www.infrastructurereportcard.org/>.

Climate Bonds Initiative. 2017. *Post-Issuance Reporting the Green Bond Market*. Last accessed July 13, 2017. Available from <https://www.climatebonds.net/resources/reports/post-issuance-reporting-green-bond-market-trends-best-practice-june-2017>.

Cochu, A., et al. 2016. *Study on the Potential of Green Bond Finance for Resource-Efficient Investments*. European Commission. Available from <http://ec.europa.eu/environment/enveco/pdf/potential-green-bond.pdf>.

Dean, M. 1998. "Risk, calculable and incalculable." *Soziale Welt*. 49(1): 25-42.

Drew, J.M. and M.E. Drew. 2010. "Establishing additionality: fraud vulnerabilities in the clean development mechanism." *Accounting Research Journal*. 23(3): 243-253.

Lazarova, Iliana. March 2, 2016. "The Wild West of Green Bonds." *Clean Energy Finance Forum*. Available from <http://www.cleanenergyfinanceforum.com/2016/03/02/the-wild-west-of-green-bonds>.

MacPherson, Martina. March 10, 2017. "The Rise of Green Bonds." *Indexology Blog*. Accessed July 10, 2017. Available from <http://www.indexologyblog.com/2017/03/10/the-rise-of-green-bonds/>.

Mathews, J.A. and S. Kidney. 2012. "Financing climate-friendly energy development through bonds." *Development Southern Africa*. 29(2): 337-349.

Moody's Investor Services. March 30, 2016. "Moody's Publishes Methodology on Green Bonds Assessment." Accessed on July 1, 2017. Available from [https://www.moodys.com/research/Moodys-publishes-methodology-on-Green-Bonds-Assessment--PR\\_346585](https://www.moodys.com/research/Moodys-publishes-methodology-on-Green-Bonds-Assessment--PR_346585).

Petrova, A. 2016. "Green Bonds: Lower Returns of Higher Responsibility?" Unpublished Master's Thesis. Radboud University, The Netherlands.

Thomson Reuters. March 3, 2017. *Green Bonds Take Centre Stage Following 2016 Record Boost*. Accessed on August 16, 2017. Available from <http://lipperalpha.financial.thomsonreuters.com/2017/03/green-bonds-take-centre-stage-following-2016-record-boost/>.

Tripathy, A. 2017. "Translating to Risk: The Legibility of Climate Change and Nature in the Green Bond Market." *Economic Anthropology*. 4(2): 239-250.

Zhou, Ida. February 27, 2017. "Developer Helps China's Green Bonds Branch out." *Reuters*. Accessed on July 1, 2017. Available from <http://www.reuters.com/article/china-bonds-green-idUSL3N1GC1H6>.