Bio Bonds: Unlocking Billions for Biomedical Treatment and Cure

Karen Petrou 23 April 2019

Every day, all of us read about early-stage success with research curing cancer, restoring vision, healing damaged hearts, renewing mental health, or restoring physical mobility. And each day when we read these stories, each of us thinks of someone we love and wish research could move faster. With more money for high-quality biomedical research, it will. With Bio Bonds, the institutional investors now largely on the biomedical-research sidelines, will finally be able to fund perhaps our most critical social-welfare goal: lengthening life, easing suffering, and facilitating independent, productive living. Legislation now moving through the U.S. Congress could make Bio Bonds a billion-dollar market reality in the next year or so, paving the way to a new social-impact construct in which the billions of institutional dollars now locked out of social-impact investing fund high-quality biomedical research secure in the knowledge that a federal guarantee backs half the risk.

Bio Bond Basics

There are indeed many investors hoping to do good along

with doing well with their dollars. Much work is also underway to make it easier to do good with environmental, social, and governance (ESG) obligations by improving disclosures, increasing asset-manager certainty, and creating a clearer legal framework for pension funds and other fiduciaries. However, it will always be challenging to raise real money -- the billions needed for biomedical research, very much included -- if bonds or other financial vehicles do not earn a rate of return close to or equal that of a like-kind investment with a similar risk profile. As green bonds proved, unlocking the key to the financial market's own demand for money-making instruments creates huge balances of new investments that then accelerate critical ESG objectives.

How did this work for green bonds? Despite the widely-shared goal of reducing fossil-fuel dependence and global warming, funds for sustainable energy-and-environmental programs were scarce until the World Bank guaranteed the first of what we now call green bonds in 2007.[1] Depending on how the market is measured, it has grown since then to at least $580 billion in total issuance through 2018.[2] The reason for these hundreds of billions is not that sustainable finance suddenly got safer, but that the World Bank guarantee encouraged other governmental backstops that reduced risk to the point that institutional investors believed that their fiduciary duties were satisfied along with their own personal hopes of a greener, cooler planet.

And, the more knowledge institutional investors gained about green finance with these backstops, the more confident they became, the more the money flowed, and the less need there was for a governmental safety net. The majority of the most recent green-bond issuances are freestanding private-sector capital-market offerings held not only by social-impact focused investors, but also across the entire spectrum of investors looking for the particular risk/return package individual bonds present. The market now is also facilitating efforts to increase the size and depth of the green-bond market, with trade associations in March of 2019 pioneering definitions for loans that ensure that these extensions of credit meet sustainability goals.[3]

Importantly, green bonds are almost exclusively debt instruments -- that is, the investor takes a stake in a bigger loan to the bond's beneficiary (i.e., a solar-energy producer). Institutional investors -- i.e., pension funds, life-insurance companies, most asset managers -- are generally reluctant to take an ownership -- i.e., equity -- stake in commercial ventures because of the far greater risk involved. As a lender, you are repaid, or the fund beneficiary is forced into bankruptcy and you as the lender get at least a bit of your money back. As an owner, all your money is gone in the bankruptcy, leaving you little financially but in contrast a lot of residual liability for risks such as any environmental damage the project may have caused in the interim.

How Would Bio Bonds Work

Starting with a pilot bond program to speed treatments and cures for blindness, Bio Bonds harness billions in institutional capital with the backing of a limited guarantee from the U.S. government. Many nations now have similar guarantees for equity investors in “translational” biomedical research -- that is, research bridging the gap between basic work with test tubes and mice and research demonstrating safety and efficacy in people.[4] However, there is no such program in the U.S., in part because the U.S. Government (USG) has a strong aversion to anything akin to an ownership stake in a private venture. This is not only because equity stakes are riskier, but also because U.S. policy is premised on sharper distinctions between public and private finance than is common in many other nations. Yet, the U.S. has a lengthy history of backing guarantees for debt instruments, including the almost $7.3 trillion of mortgages now backed by the U.S. taxpayer[5,6,7] energy loans, as well as those to small businesses.

As detailed below, the Bio Bond construct works within the confines of U.S. policy to craft new laws to create truly translational funding for under-funded biomedical research -- that is, private capital investment that bridges the gap between direct government spending for basic research and high-return, short-term biomedical-funding sources such as those provided by venture capital (VC)

firms. Pending legislation, the “Faster Treatments and Cures for Eye Diseases Act,” is the legislative vehicle that brings Bio Bonds into the market. Here’s how it works.

The Valley of Death

Media are replete with reports that excite hope about dramatic new medical treatments -- “Blind Mice See” or, “First-Ever Patient Cured of Deadly Cancer.” And, then, it seems to and often takes decades before a promising treatment or cure is approved for widespread use. The period between promising basic research and drug approval/commercialization is called the “valley of death” in biomedical circles because it’s where viable research dies all too often not due to a lack of scientific merit, but because of the dearth of funds.

Federal spending such as that from the National Institutes of Health (NIH) and patient charities fund much of the basic research needed to test hypotheses and then to ready research for clinical testing -- that is, for formulating drugs to test dosage, safety, and -- of course most importantly -- efficacy. But clinical trials cost millions in order to ensure rigorous testing, patient safety, and sufficient sample size.

And, the more progress a treatment or cure takes, the more it costs -- drug development from initial pre-clinical work to final approval on average costs $2.6 billion.[8] Biopharmaceutical and VC firms come in towards the end

of this process, cherry-picking the most promising treatments for the largest patient populations requiring the most pills at the highest cost for the biggest impact in comparison to other possible treatments and cures. Most of these firms generally do not come in as the valley of death dawns before a promising biomedical researcher because they don't lend money; they instead make equity investments that give them ownership rights over a drug or device. These rights are of little value if one has to wait years to know if there will be any return on investment -- the earlier the investment, the greater the return, but the greater the risk -- and then some.

I have seen the quicksand in the biomedical valley of death all too clearly from my perch as a director of the Foundation Fighting Blindness (FFB). FFB is the leading source of private-sector, philanthropic funding for treatments and cures of inherited retinal disease (IRD). Although it seemed for years that scientists had done little more than breed another mouse with another type of IRD for testing purposes, the field has taken off in just the last few years. One reason is not only the personal, family, and economic hardship wrought by blindness, but also the fact that the retina is often called the "window to the brain." Testing drugs, gene therapy, and stem-cell treatments in the retina is a way scientists can literally see what a treatment does; similar observation in a living brain is often difficult, if not impossible. This has sparked a raft of extremely promising research, but FFB -- despite

resources well above those at most patient foundations -- can fund only a small number of the projects its scientists believe could make an important difference.

At a meeting in which the FFB explored the gap between deserving science and the funding to move it forward, a group of venture capitalists said that, as much as they would like to invest early in the biomedical process, their business model does not allow it. Their investment timeframe is short -- three to five years -- and their return on investment is high -- usually at least 20 percent. Too many projects take too long, cure too few patients, or do so at too low a price to warrant VC investment, especially long before proof of success is readily apparent.

Extensive financial-market research bears this out. Andrew Lo at the Massachusetts Institute of Technology (MIT) has been a pioneer in this field, charting the funding gap for cancer[9] and proposing a novel investment vehicle to encourage institutional investors to speed treatments and cures in this life-or-death field.[10] However, years after his ground-breaking research, institutional investment remains largely sidelined from translational biomedical research, leaving the valley of death almost as deep and its quicksand almost as deadly as before.

Seeing the Way with Eye Bonds

The following graphic shows one example of how Eye Bonds would work and thus how they chart the path

forward to Bio Bonds. The steps below occur after an Eye-Bond has been “floated” (i.e., sold to investors), providing the $250 million of funding used for cures and treatment fighting blindness as discussed below.

1. A trust is created to lend money to eligible projects selected by the National Eye Institute (NEI) under terms and conditions that prioritize likely cures and treatments and protect the taxpayer. NEI expenses for project selection are reimbursed (say for $1 million) from bond proceeds so that the taxpayer does not pay for any administrative costs. The cost of underwriting and issuing the Eye-Bond (to be determined by rule, e.g. $5 million) are also deducted before proceeds are distributed to researchers, leaving at least $244 million for cures and treatment.

2. The Eye-Bond has a maturity of 20 years with no interest due until the maturity date. The bond does earn interest at a preset rate (e.g., five percent annually), but the interest payments accrue for 20 years at which time they are payable to the investors. The bond carries a partial federal guarantee equivalent to no more than 50 percent of the principal (e.g., $125 million).

3. As a loan for a project is repaid, the trust may invest the proceeds in approved securities until the bond comes due and is also free to make loans to a new project deemed acceptable by NEI and the underwriter.

4. All cash proceeds received from the repayment of an Eye Bond are first used to reduce the amount of principal guaranteed by the government and the government has a senior claim on all assets and collateral under the Eye Bond to the extent the guarantee has not been extinguished. In practice, this means that the trust will notify the Treasury Department at the time when the assets it has in hand are equivalent to the amount of the Federal guarantee of the Eye Bond (i.e., $125 million using the example above). At that time, the Federal guarantee of the Eye Bond principal will end along with any taxpayer risk and the payment of principal and interest to the eye bond investors will come solely from the assets held in the trust.

1. A Limited Focus on Blindness

Ideally, new U.S. law would kick-start the Bio Bonds market as a whole to speed treatments and cures for a wide variety of diseases and disabilities. However, the huge scale of biomedical research, the all-too-many diseases and disabilities it confronts, and the cost of successful research doom so ambitious an initiative from both a political and policy perspective. We know from the financial research cited above that risk to both taxpayers and investors dramatically increases if an investment pool includes a little blindness, a little cancer, a degenerative muscular condition or two, and a few other syndromes of varying causes, patient populations, severities, and likely cures. Perhaps private bonds someday will cover lots of

diseases in a single financial instrument, but investor and taxpayer protection now has to come from a targeted group of projects selected by experts with knowledge across a single, but entire field of biomedical research to increase the chances that as many projects as possible will succeed. After projects are selected, a financial institution determines which biomedical researchers want loans to fund these projects, how much makes sense, and whether the borrower has the capacity to repay the loan even if the drug or device doesn't work. Loans to eligible projects are then crafted into bonds up to a dollar amount small enough to make taxpayer risk acceptable and big enough to diversify risk across a spectrum of different projects aimed at a single outcome: sight in this case.

And, finally, the bond program must be big enough to make a meaningful difference to patients and their families -- small gains in scientific research are all to the good, but real progress only comes with real dollars. Real dollars are also necessary to get the attention of top-quality financial institutions and deep-pocketed investors. Eye Bonds now and Bio Bonds to come cannot be "one-offs" -- the program must be big enough to create a deep, liquid pool of continuous low-cost, long-term financing for translational biomedical research.

2. Why Blindness

There's no particular reason to start with blindness other than we thought of this construct in connection with the

challenges facing the Foundation Fighting Blindness. We know, though, that to prove the viability of this new biomedical-financing instrument and at the same time limit taxpayer risk, we need to start with a clear target: i.e., one over-arching syndrome in which varying causes work through similar mechanisms known well in a defined biomedical field. Eye Bonds legislation picks one well-defined field -- ophthalmology -- and establishes a high-quality source of expertise -- the National Eye Institute (NEI) -- as the arbiter of projects ready to move from basic to translational trials that would then be funded by private investors backed by a federal guarantee.

Vision research has the advantage of subsuming many types of causes -- injury, diabetes, neural damage, structural defects -- and many possible cures -- drugs, gene therapy, stem-cell treatments, and even whole-eye transplants. Severe vision impairment and blindness also have many sufferers -- an estimated 4.24 million adults in the U.S. alone.[11] Blindness also has a particularly pernicious impact on economic independence for both older Americans fearing loss of independence due to reduced sight and younger people struggling to succeed in the work force. 70.5 percent of working-age blind adults are not employed full time,[12] with vision impairment costing the U.S. economy an estimated $138 billion per year.[13]

With NEI (part of the NIH) picking scientific projects, Eye Bonds solve for the cost of selecting top-flight research.

By focusing on one field, Eye Bonds ensure both measurable risk and diversification, enabling the structuring of viable financial instruments. However, Eye Bonds meets investor demand in one other critical way: the government backs debt, not equity stakes in biomedical-research firms. An equity investor wins or loses it all if a biomedical project succeeds or fails; a lender gets its money back as long as the researcher has the capacity to repay. This makes the cost of funding lower and bond terms can be for a longer time period. Importantly, the final cost of a drug or device is likely to be less because long-term -- not high-risk, high-return -- funding backed a treatment or cure.

3. A Billion Dollar Guarantee for a Five-Year Trial

Pending legislation, the Faster Treatments and Cures for Eye Diseases Act, reflects all of the facts above by sending up a trial balloon that, if it floats for investors and the federal government, will prove the Bio Bonds proposition. The bill authorizes a $1 billion Eye Bond program over five years with the following key terms and condition:

- Eye Bonds would start up during the first year in which a set of tough rules would be set by the Department of Health and Human Services (HHS) in concert with the Department of the Treasury and, in several cases, the Securities and Exchange Commission and bank regulators. These rules --

which will be tested by annual reports to Congress from the General Accountability Office (GAO), demand strict adherence to statutory taxpayer-protection provisions along with a single-minded focus on curing blindness.

- Over the next four years of this five-year pilot, as much as $250 million in Eye Bonds per year will be issued for a total of up to $1 billion in eligible instruments. The legislation expects these to be bonds comprised of loans to numerous eligible researchers, but terms and conditions are not detailed to ensure flexibility to identify ways to attract investors without increasing taxpayer risk. One unbreakable rule, though, is that bonds are issued by private financial institutions under the rules described above, not by the Treasury, avoiding any confusion with direct USG obligations.
- As noted, the National Eye Institute, an arm of the National Institutes of Health, will pick the projects eligible for Eye Bond funding. It won't determine a borrower's capacity to repay -- the financial institution underwriting the bond would do that -- but it will survey the entire landscape of U.S. vision research to pick the projects most likely to treat and cure blindness or severe vision impairment. Many of these projects began with basic funding from NEI. As a result, Eye Bonds leverage the taxpayer's intellectual capital in biomedical research to ensure that great science isn't left behind due to scant

funding.
- Each bond would be backed by a full-faith-and-credit USG guarantee for as much as 50 percent of the principal amount of the bond. As payments from borrowers come in, these would be set aside, with investors entitled only to proceeds above and beyond any risk taxpayers absorb.

4. Negligible Federal-Deficit Impact

As the Eye Bond legislation was crafted, a lot of thought went into how it will be "scored" -- that is, judged for purposes of its federal-budget impact. With the U.S. deficit growing to record heights, the less a proposal costs, the better its chances of enactment.

It is likely that the Eye Bond legislation would score at only a small cost to the U.S. Treasury, if indeed it is deemed to cost anything at all. There are start-up costs -- i.e., those for writing the rules and for setting up NEI's project-selection process (which might well include outsiders with translational-biomed expertise). However, bond proceeds in the first year would pay back any such appropriation and bond proceeds going forward would do the same for still smaller administrative expenses. The costs of the private financial institution underwriting the bond and the "trustee" managing it on behalf of the taxpayer and investors also comes from bond proceeds, as is usually the case with fully-private financial instruments.

The big risk of course is that some or all of the 50 percent guarantee gets called. For this to happen, losses first would have to be more than half of the bond principal since, as noted, investors are only entitled to be repaid by the USG for $50 out of $100 of principal if things go awry. Losses of this magnitude are unlikely to happen due to the diversification and focus of the bonds (see above), but there are also additional buffers to protect both investors and the taxpayer. The most important of these derives from the fact that the financial instruments in an Eye Bond are most likely to be debt and debt must be repaid even if the project being funded fails to meet its goals. Equity investors only win if a drug goes to market; secured lenders are repaid no matter what and take steps to obtain the collateral securing their bonds if payments fall short. Should this occur for a borrower within the Eye Bond debt pool, the bond trustee would move in, require the borrower to repay, or receive bond collateral -- e.g., intellectual property -- to honor at least some of the outstanding obligation. In short, it's like your mortgage -- fail to pay and the bank gets your house.

Curing Blindness and Beyond

Top ophthalmic scientists have told me that a billion dollars will cure blindness for almost every patient in no more than 10 years. This would of course be a miraculous sight, and not only in the U.S. Worldwide, there are at least 36 million blind individuals and another 217 million

with moderate to severe vision impairment,[14] with the obstacles to economic independence even more formidable for many outside the U.S. A cure to blindness would also open the world's beauty to those who have never seen it before and those who remember it all too well despite subsequent vision loss. Surely, this is an important social-welfare objective on par with sustainable energy, affordable housing, enhanced education, and many other worthy focuses of social-impact finance and federal spending.

To gain this hope of vision, the worst that can happen to investors is that they lose 50 percent of their initial principal investment -- a high cost, but one that happens every day in the financial market. $500 million is a miniscule drop in the institutional-investment bucket, which amounts to more than $93.8 trillion worldwide.[15] The worst that can happen to taxpayers is that we lose $500 million, a lot, but again a minuscule portion of a federal budget of $4.5 trillion of planned spending in fiscal 2019.[16]

What's the best that could happen? It's even better than just curing blindness. Successful Eye Bonds will pioneer Bio Bonds and Bio Bonds will speed treatments and cures for much of what ails us. Wouldn't that be something.

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Author bio

The *American Banker* in 2012 dubbed Karen Shaw Petrou "the sharpest mind analyzing banking policy today – maybe ever." In 2017, the International Monetary Fund referred to her as "one of the most prominent non-governmental voices on financial regulation," and in 2018 Bloomberg's banking analyst described her as being "widely viewed by both sides of the bank regulation debate as incredibly smart."

Karen Shaw Petrou is the co-founder and Managing Partner of Federal Financial Analytics, Inc., a privately-held company that since 1985 has provided analytical and advisory services on legislative, regulatory, and public policy issues affecting financial services companies doing business in the U.S. and abroad. Central banks, financial regulators, vendors, and financial-industry investors also rely on the firm's advisory services. The firm's practice is a unique blend of strategic advice and policy analysis that does not include lobbying or any other projects that would compromise its objectivity and independence.

Petrou is a frequent speaker on topics affecting the financial services industry. In addition to presentations to the U.S. Congress and U.S. government agencies, she has spoken before such organizations as the Japanese Diet, the Office of the Comptroller of the Currency, various Federal Reserve Banks, the *Economist's* Buttonwood conference, the Securities Industry and Financial Markets Association, the American Bankers Association, The Clearing House, the Financial Services Roundtable, the Institute of International Bankers, the Conference of State Bank Supervisors, the Brookings Institution, and many other industry, academic, and policymaker audiences. She has also authored numerous articles in professional publications such as the *American Banker* and *International Economy,* as well as general-interest media like *The New York Times* and *Wall Street Journal*. Petrou appears frequently in the media as an expert on banking legislation and regulation.

Prior to founding her own firm in 1985, Petrou worked in Washington as an officer at Bank of America, where she began her career in 1977. She is an honors graduate in Political Science from Wellesley College and also was a special student in an honors program at the Massachusetts Institute of Technology. She earned an M.A. in that subject from the University of California at Berkeley and was a doctoral candidate there. She has served on the boards of banking organizations and sits as a director on the board of the Foundation Fighting

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