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Sustainable Development Goals Implementation in an Evolving Global Development Finance Landscape

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Abstract Investment needs for the Sustainable Development Goals (SDGs) are huge. Official resource flows cannot make up the gap, and private market financing is on the rise. SDGs bonds issued by the World Bank, the Hong Kong and Shanghai Banking Corporation (HSBC), and the Australian and New Zealand Banking Group (ANZ) were all oversubscribed, mainly by institutional investors motivated by the SDGs' promise to save humanity, the planet and ensure global prosperity. As the corporate sector and the financial markets increase their role in SDGs financing, the challenge for the issuers is how to balance financial reward incentives and the necessity to account for sustainable development impact, which is the basic motivation for most SDGs bonds investors. How can SDGs-linked bonds indexes and prices be made to respond to SDGs progress? Insights from financial theory suggest that indexes of bonds issued for development purposes should have a strong correlation with an indicator of well-being and economic progress. A cross-sectional regression of the SDGs Index (a measure of SDGs performance) against the Gross National Income per capita (a proxy for well-being), based on a sample of 117 countries, revealed a strong positive correlation between the two aggregates. From this finding, we recommend that SDGs bonds be linked to the SDGs Index; in this way, bond prices and indexes will reflect sustainable development performance. Moreover, since the relevance of the 17 SDGs, their baselines and pace of progress vary from one country or region to the other, we suggest that SDGs bonds target specific countries or regions, and thematic areas of the SDGs.

Keywords: Sustainable development goals, official development finance, private flows at market terms, bonds, impact investing

1. Introduction

Over the last sixty years, global development finance has evolved considerably in response to changing global development challenges and frameworks. Official resource flows that represented the main part of development financing have gradually declined in relative importance, while private financing at market terms has risen. Between 1960 and 2014, flows of official development financing¹ declined from 68% of total development financing to 29.3%, while the contribution of private development financing at market terms increased from 32.0% of total development financing to 65.5% over the same period. In volume terms, in 1960, flows of private development financing at market terms were about half of the official development finance, US\$2,604.00 and US\$5,521.47 million, respectively (OECD 2018). The reverse is true in 2014, where net flows of private development financing at market terms rose to more than twice the official development finance, US\$184,702.82 and US\$412,877.45, respectively. Worthy of note is the rise in the relative importance of bonds and other securities, which were virtually unreported prior to 1995, but rose progressively

to 26.85% of total private development financing in 2014.²

The Sustainable Development Goals (SDGs) build on the progress made from the Millennium Development Goals' implementation and seek to address the unsolved and emerging global development challenges (UN 2015b). The associated financing needs are huge, and official resource flows alone cannot suffice. The United Nations Conference on Trade and Development (UNCTAD 2014) estimated that between US\$3.3 trillion and US\$4.5 trillion of global investment is needed annually for SDGs implementation in developing countries, which by far exceeds the peak of \$142.6 billion of ODA disbursements reported by the OECD (2017) for 2016.

SDGs-linked bonds have gained popularity among financial institutions as a means of mobilizing private savings and channeling them for sustainable development. The Hong Kong and Shanghai Banking Corporation (HSBC) issued the first ever corporate SDGs-linked bond, which was over-subscribed three times and raised US\$1 billion. The funds were ear-marked for supporting improved access to education, fresh water and sanitation, essential healthcare, development of renewable energy,

1 Official Development financing as used in this report refers to combination of Official Development Assistance (ODA), Other Official Flows (OOF), and Officially Supported Export Credits

(BRÄUTIGAM 2010).

2 Calculations are based on data from OECD. Stat, accessed December 2017.

building sustainable cities and transport systems, and to help communities adapt to climate change effects (HSBC 2017). In March 2017, the World Bank, in collaboration with PNP Paribas Bank, announced the mobilization of €163 million by issuing SDGs-linked bonds. The funds will be used to finance projects that aim at eliminating extreme poverty, furthering shared prosperity, and supporting programs that are aligned with the SDGs (World Bank 2017). In February 2018, the Australia and New Zealand Banking Group Limited (ANZ) also announced having raised €750 million through SDGs-linked bonds that will be used to support 9 of the 17 SDGs.

As market financing becomes the most significant contributor to development financing, the challenge for the corporate world is how to balance financial reward motivations and sustainable development impact motives.

When SDGs-linked bonds are issued, what is being sold? In other words, what is the underlying asset that gives value to the SDGs bonds? At what price are they being sold? What is the relationship between the SDGs bonds prices and changes in the underlying asset value? Pondering on these questions, it can be understood that the underlying asset from which SDGs bonds derive their value is the promise of global prosperity in its three (3) dimensions - humanity, the planet and the society – as follows: (i) the promise of a world free of poverty and want; (ii) the promise to protect the planet from degradation; and (iii) the promise of peaceful, just and inclusive societies (UN 2015b).

If the underlying asset for SDGs-linked bonds is the promise of global prosperity, then the prices of SDGs-linked bonds should reflect progress made toward realizing this promise. This progress is measured by the SDGs indicators and the SDGs Index.

Moreover, SDGs-related investments fall within the framework of impact investments, which combine the desire to generate a measurable economic, social and environmental impact and the desire to enjoy a financial reward (Cambridge Associates 2017). It is the impact motive of SDGs-related investments that is the point of focus of the current study.

Presently, the Index used to construct SDGs-linked bonds is the Solactive Sustainable Development Goals World Market Value Index (World Bank 2017). It is a composite Index constructed as a weighted average of market capitalizations of 50 companies that are assessed to

be compliant with the SDGs. The question here is how the index behaves regarding the change in indicators of progress of the SDGs, the underlying asset for SDGs bonds.

To make it simple, let us consider the April 2018 purchase of 75 million shares of Apple Inc. by Warren Buffet, which increased his Apple Inc. stock holdings to \$42 billion. The investor was moved to buy the stocks based on Apple Inc.'s current performance and product development perspectives (Financial Times 2018). Weak company performance will dampen investor confidence and reduce stock demand, thereby affecting price and returns (Abu Dhabi Securities 2014). This example shows how investment in a company's stock is related to the real performance of the company. This logic underlies the construction of GDP-linked securities, where the returns are related to a country's economic performance measured by its GDP (Schroder et al, 2004, Bowman and Naylor 2017). A change in GDP will lead to a corresponding change in bond returns and prices: positive GDP growth will lead to an increase in coupon payments³ and a rise in bond prices, whereas negative GDP growth is associated with a reduction in coupon payments and a fall in bond prices (Schroder et al 2004).

Now, regarding the Solactive SDGs-linked Index bond, its construction is based on a selection of 50 companies which comply with the SDGs (Solactive 2015). SDGs-linked bond prices and their returns vary with changes in the index level (Solactive 2017).

However, there is no mechanism by which progress made in the SDGs in countries or thematic areas in which the funds are used (as witnessed in a change in the SDGs indicators) is captured in the Solactive SDGs World MV Index or SDGs-linked bonds' prices. At best, the Solactive SDGs World MV Index captures the changes in behavior towards the SDGs by the 50 companies represented in its structure (Vigeo Eiris 2017).

How can SDGs-linked bond prices be made to respond to SDGs performance or to changes in indicators of progress of the SDGs? What is the appropriate metric that when used as an SDGs-linked bonds index would enable bond prices to capture the progress made in SDGs?

The main objective of the study is to ensure that private investments in SDGs bonds generate measurable sustainable development impacts that guided the investment decisions. Specifically, the objectives are as follows:

3 Coupon payments are the periodic financial rewards to

investors agreed in a contract (CFA Institute 2017).

- ✓ Propose an alternative SDGs bond index that is sensitive to SDGs performance.
- ✓ Make recommendations to improve the sustainable development impacts of private investments in SDGs bonds.

The rest of this paper is structured as follows: A review of related literature is followed by a presentation of the methodology. We then provide an understanding of the Solactive SDGs MV Index and its use as an SDGs bond benchmark. Next, we examine the SDGs Index, laying emphasis on its correlation with an indicator of wellbeing, the Gross National Income (GNI) per capita. The paper ends with recommendations and a conclusion.

2. Literature Review

In this section we will review the existing literature on financing the SDGs, impact investing, bond indexing, and the relationship between market discipline and economic efficiency.

2.1. Financing needs for implementing the SDGs

The resource needs for SDGs implementation are considerable. The Addis Ababa Action Agenda (UN 2015), identified six different main types of resources – domestic, international, private, public, debt relief, technology and innovative finance. An increase in private investments is needed to complement public resource flows to hasten the progress towards achieving the SDGs (UNCTAD 2014).

As part of the preparatory work leading up to the formulation of the SDGs, UNCTAD (2014) made an in-depth analysis of the resource needs and financial implications of the SDGs. Recognizing that public resources alone would not make up the resource gap, UNCTAD (2014) recommended increased private sector contributions to complement public sector efforts. According to UNCTAD (2014), such contributions can take the form of behavioral change or financing.

2.2. The SDGs as an impact investing framework

The Cambridge Associates (CA) and the Global Impact Investing Network (GIIN) define impact investing as “investment made in companies, organizations, and funds with the intention to generate a measurable, beneficial, social or environmental impact, alongside (or in lieu of) a financial return” (CA and GIIN 2015). According to Douma, Scott and Bulzomi (2017), the SDGs provide

the most comprehensive framework for identifying impact investing themes and through which investors can contribute to addressing core global sustainable development challenges. Douma, Scott and Bulzomi (2017) mapped out thematic areas of impact investing, directly linking them to all the 17 SDGs. Private investment in SDGs is fiduciary duty of the corporate sector, it serves as a macro and micro risk assessment and mitigation framework and a framework for identifying macro and micro opportunities for investment (Douma, Scott and Bulzomi 2017).

2.3. Index-linked bonds for financing development

In a survey carried out among market participants – investors as well as potential issuers – Schroder, Heinemann, Kruse and Meitner (2004) developed a general framework for designing and evaluating GDP-linked bonds by indexing coupon payments to (i) development of the GDP with respect to a base year, and (ii) the periodic changes in GDP. A specific attribute of this type of bond is that debt servicing is related to the paying capacity of the target economy. For the purpose of designing economic development-related index-linked bonds, Schröder et al. (2004) went forward to recommend the linking of bonds to the GDP or any other benchmark that is highly correlated with GDP, because development-related index-linked bonds have a high correlation with the ability to pay.

Created in October 2007 under the name “Structured Solutions”, the Frankfurt-based German⁴ generator of financial indices, Solactive, has developed over 260 equity trust funds (ETF). For the purposes of issuing SDGs bonds, Solactive (2017) designed the Solactive Sustainable Development Goals Market Value index. This is a composite Index made up of a weighted mean of market values of 50 companies that are selected using the Vigor Eiris’ Equities® methodology to determine their SDGs compliance. While the Solactive SDGs Index is ingenious in its design, a key concern is its ability to respond to SDGs progress or lack of progress.

2.4. Market discipline and economic efficiency

Literature abounds that studies the relationship between firms’ performances, on the one hand, and stock prices and returns. Ratemo (2015) suggests that a significantly positive relationship exists between the stock prices of firms that invest in sustainability reporting and

4 Solactive (2018). For more on this, visit

<https://www.solactive.com/about-us/>.

company's performance, measured in terms of Return on Assets (ROA). In another study, Chrysovalantis, Iftekhar and Fotios (2013) reveal the existence of a positive and statistically significant relationship between profit efficiency changes and market-adjusted stock returns. However, they fail to find strong evidence that cost efficiency changes are associated with stock returns.

Defining firm efficiency as a firm's ability to transform inputs into outputs Frijns, Margaritis, Psillaki (2012) showed that the level of operational efficiency of a firm is reflected in the prices of its securities. This implies that the higher the operating efficiency of a firm, the higher would be its value in the eyes of investors, all other things being equal. This is because an efficient firm would more likely face less risk of default since it makes better use of the funds supplied.

Djankov and Hoekman (2000) suggest that market discipline enhances economic efficiency, measured by total factor productivity (TFP). Controlling for policy changes and making the distinction between exporting and non-exporting firms, Djankov and Hoekman (2000) suggest a positive relationship between enhanced market discipline which arises from increased trade liberalization, on the one hand, and total factor productivity growth of firms, on the other hand.

The above studies offer two important insights that are worthy of consideration in the design of SDGs-linked securities:

Firstly, the price of securities is affected by the performance of the underlying assets (Cortez and Cudia 2010, Ratemo 2015). This means that if SDGs-linked bonds indexes are designed to be sensitive to SDGs outcomes, SDGs performance would affect bond indexes and prices.

Secondly, market discipline enhances economic efficiency (Cortez and Cudia 2010, Nakamura 2011, Ratemo 2015, Chrysovalantis, Iftekhar and Fotios 2013), Frijns, Margaritis, Psillaki 2012, Djankov and Hoekman 2000). The implication for SDGs bonds is that by linking these bonds to indexes that are responsive to SDGs performance, market forces have the potential to influence behaviors of actors to improve sustainable development performance.

Although much literature is available in the area of asset pricing and bond development, (Solactive 2013, Bertelsmann Stiftung and SDSN 2016 & 2017) and bond indexing for development purposes using economic indicators like the GDP (Schroder et al 2004, Bowman and

Naylor 2017), there is scope for more work.

Firstly, the studies on bond indexing studies, mainly address the financial aspect of the rewards to investors. Beyond financial rewards, SDGs-related investments are founded on impact motives – climate change adaptation and mitigation, poverty eradication, elimination of infant mortality, education, etc. (Douma, Scott and Bulzomi 2017). A key concern is how to relate SDGs performance to the movement of the SDGs-linked bonds index. This study attempts to fill this gap by suggesting a different SDGs bonds benchmark.

Secondly, studies examining the relationship between market discipline and efficiency are based on samples of firms. By contrast, the SDGs are a systemic framework, and reporting is done at the level of countries and organizations. This study adds to the existing literature by demonstrating that when SDGs bonds are linked to appropriate indexes, market discipline can influence the issuers and other market participants towards improved use of funds raised and this will improve SDGs outcomes.

3. Methodology and Conceptual Framework

We will present data sources and descriptive statistics, the model used and a conceptual framework.

3.1. Data sources and descriptive statistics

The data used in this study comes from three main sources. Official Development Assistance data was obtained from the OECD statistical database, Gross National Income per capita data was obtained from the World Development Indicators database and the Sustainable Development Goal Index Data was obtained from the Sustainable Development Goals Foundation Network database.

Trends in development financing show an increase in the relative importance of private development flows, while the relative contribution of official development finance (ODA) is falling. OECD development finance statistics show that private development finance is the fastest growing source of development funding (Figure 1). A close look at major components of global development financing - ODA, Officially Supported Export Credits, Other Official Flows, Private Flows at Market Terms and Net Private Grants – confirms this trend (Figure 1).

Figure 2 shows that beginning 2012 bonds and other securities, which constitute mechanisms of mobilizing private savings for development, have gained in significance in terms of their relative contribution to

development financing. In 2007/8, bonds turned negative, possibly as a result of the global financial crisis. When expressed as a percentage of total development disbursements, it can be seen that ODA disbursements decreased from 58% to 28.3% between 1960 and 2014, while disbursements of development financing at market terms increased from 32.0% to 65.5% over the same period (OECD 2018).

Figure 1: This figure shows net development financing disbursed between 1960 and 2014 (\$US millions). It can be observed that private flows at market terms (in yellow) have risen above official development assistance (in blue). Source: Author using data from OECD.Stat, accessed on 30 Dec 2017

Note: Graphs in the figures are Private Flows at Market Terms, Official Development Assistance (ODA), Net Private Grants, Officially Supported Exports Credits, and Other Official Flows (OOF) from the top to bottom in the 2014 results.

Figure 2: Evolution of components of private aid at market terms between 1995 and 2014 (US\$ millions), showing rapid bonds increase beginning 2012.

Source: Author using data from OECD.Stat, accessed on 30 Dec 2017

5 Capelli, C. and Vaggi G. (2013), A better indicator of standards of living: The Gross National Disposable Income, Working paper: Università di Pavia, December 2013, p.21.

3.2. Model used and hypotheses of the study

The construction of a model is based on the empirical work carried out by Schroder et al. (2004) on bond indexing. Schroder et al. (2004) propose that for the purpose of issuing bonds for development purposes the choice of indexes should be based on the degree of correlation of the benchmark with a measure of economic development such as GDP. In this regard, in order to determine the applicability of the SDGs Index as a benchmark for SDGs bonds, we sought to verify its correlation with an indicator of economic development, the Gross National Income per capita, which derives directly from the GDP, as suggested by Schroder et al (2004). The choice of the Sustainable Development Goals Index as a possible benchmark for SDGs bonds is because this index is a summary of all the indicators of progress of the SDGs (Bertelsmann Stiftung and SDSN 2017).

The choice of the Gross National Income (GNI) per capita to test the SDGs Index's correlation with economic wellbeing and thus its suitability as an SDGs bond benchmark is because the GNI per capita is a better measure of the wealth of a nation than GDP per capita (Capelli and Vaggi 2013). Although the Gross National Disposable Income per capita is arguably a better alternative,⁵ data limitations caused us not to employ this aggregate in our model. Based on these considerations, our model is given as follows:

$$\text{Log}(GNI_{percapita}) = \beta_0 + \beta_1 * \text{Log}(SDG_i) + e$$

Where $\text{Log}(GNI_{percapita})$ is the natural logarithm of Gross National Income per capita, and $\text{Log}(SDG_i)$ is the natural log of the SDGs Index. The model will be examined through the following hypotheses:

✓ **H0: SDGs Index is not positively related to GNI per capita**

The null hypothesis will help us check if the GNI per capita is effectively correlated to the SDGs index. If we fail to reject the null hypothesis, then we conclude that there is no correlation between the SDGs index and GNI per capita. This implies that any change in the SDGs index does not reflect a change in economic well-being (Capelli and Vaggi 2013). In this case, we would not recommend the SDGs index as a benchmark for SDGs bonds, since bond price and returns might not truly reflect wellbeing (Ratemo 2015) and may also not be related to the ability to

pay (Schroder et al. 2014).

✓ **H1: SDGs Index is positively related to Gross National Income (GNI) per capita.**

If the null hypothesis is rejected, then we confirm that there is a strong explanatory relationship between GNI per capita and the SDGs index. In this case, we can conclude that the SDGs index can be a good benchmark for indexing SDGs bonds, debt will be related to the ability to pay, and bond price movements will also reflect SDGs performance.

3.3. Conceptual framework

This study is founded on a number of empirical studies that form the rationale for private investment in the SDGs. The first group of studies suggests that market discipline favors economic efficiency (Djankov and Hoekman 2000). If SDGs bond indexes are responsive to sustainable development performance, market forces that sanction poor performance and reward good performance will motivate development actors to achieve improved sustainable development outcomes. Other studies suggest that the underlying asset performance of a company affects the prices of its securities (Cortez and Cudia 2010, Ratemo 2015). The SDGs being an impact investing framework, the SDGs bonds derive their value from the sustainable development results or outcomes, which constitute the underlying assets of the SDGs bonds (Douma, Scott and Bulzomi 2017). This means that poor SDGs performance would adversely affect bond prices and returns, while good performance would improve bond prices.

The present study seeks to build on the empirical findings and recommendations of Schroder et al. (2004), who proposed that bond issues for economic development purposes be linked to indexes that have a strong correlation with an indicator of economic performance like GDP. In this way the associated debt is linked to a country's ability to pay, and price movements can serve as a true barometer of the sustainability performance of the target country.

Delmon (2011), while acknowledging that the private sector plays an important role in implementing economic development programs, suggests that the added efficiency of private firms derives from a number of factors, among which are the following: the use of commercial and cost-effective approaches to problem solving, better governance, improved accountability, less politically oriented decision-making, and transparency.⁶ This relative

efficiency of the private sector and its contribution to the implementation of economic activities, including those managed by the public sector, is a factor that has been harnessed for the development of public private partnership models (Delmon 2011). From this perspective, private participation in SDGs implementation would help foster progress towards sustainable development, as the private actors adopt better approaches to solving development challenges, involving competition, transparency and less politically-oriented decision-making.

3.3.1. A framework for bonds indexing

Let us now review how an index-linked bond works, using the framework employed by Schroder et al. (2004) and Kruse (2009). The coupon payment for an index-linked bond can be linked either to the index development relative to a base year or the periodic change of the index (Kruse 2009) as follows:

✓ For index development:

$$Coupon_t = Fixed Coupon_t * Index_t / Index_0$$

✓ For index growth:

$$Coupon_t = Fixed Coupon_t * Index_t / Index_{t-1}$$

Options can be embedded in the index-linked bonds to ensure minimum coupon payments or to place a ceiling on the amount of coupon payable. When coupon payments have a minimum payment clause, the formula would be as follows:

$$Coupon_t = Fixed Coupon_t * \left[\max \left(Index_t / Index_{t-1} - 1; 0 \right) + 1 \right]$$

Redemption features can also be embedded so that the bond can be redeemed after a specified time at par or at market price.

3.3.2. Examples of index-linked bonds

Many examples of bond-indexing exist whose main objective is to securitize the investor returns. For instance, inflation-linked bonds have their coupon payments and principal repayments linked to price indices (Schroder et al 2004). The coupon payment for an inflation-indexed bond is given by the following formula:

For bonds linked to inflation index development,

$$Coupon_t = Fixed Coupon_t * Inflation Index_t / Inflation Index_0$$

For bonds linked to change in the inflation index,

$$Coupon_t = Fixed Coupon_t * Inflation Index_t / Inflation Index_{t-1}$$

Likewise, GDP-linked bonds have their coupons linked to GDP development or GDP growth. For instance,

6 Delmon (2011), p. 13-14

a GDP-linked bond whose coupon payments are based on GDP growth would be as follows:

$$Coupon_t = Fixed\ Coupon_t * GDP_t / GDP_0.$$

On the other hand, a GDP bond whose coupon is linked to GDP change would have its coupon payment expressed as:

$$Coupon_t = Fixed\ Coupon_t * GDP_t / GDP_{t-1}$$

Most SDGs bonds issued to date, including those issued by the World Bank, have their coupon payments linked to the Solactive Sustainable Development Goals World Market Value Index (Solactive SDGs World MV Index). Let us analyze the structure of the Solactive SDGs World MV Index.

4. A Critical Examination of the Solactive Sustainable Development Goals World Market Value Index

The SDGs-linked bonds are constructed by linking their coupon payments to the performance of an equity index. The index used for most of the SDGs bonds is the Solactive SDGs World MV Index, which is made up of 50 equally-weighted companies which show a track record of positive impactful actions in favor of sustainable development (World Bank 2017, Solactive 2017 & 2018).

4.1. Determination of the Solactive Sustainable Development Goals World Market Value Index

Solactive uses the Vigeo Eiris' Equities® methodology to determine the eligibility of companies for inclusion in the index computation. The methodology controls for Economic, Social and Governance (ESG) aspects of sustainability. It captures the contributions of companies to SDGs, and applies financial filters to adjust for factors such as volatility (Vigeo Eiris Ratings 2017). Through this process, companies are rated with regard to their impact on people, the planet and their business practices.

Companies considered for inclusion in the index are those that operate in areas that promote the SDGs or that have modified their activity lines, procedures and product offerings to fit the SDGs (Vigeo Eiris 2017).

The Index also excludes those companies that operate in industries like nuclear energy, tobacco or firearms, as well as companies marked by controversies such as human rights violations. It also filters companies

for volatility and liquidity, and chooses stocks so as to ensure geographical and sectoral diversification from different regions of the world as well as different sectors of the economy. This way, the Index includes stocks from Europe, Asia and America, which give it a global scope (Vigeo Eiris 2017).

This approach seeks to establish a link between the companies' products, services and behaviors and the three aspects of sustainability.

Table 1: SDGs Index Construction.

SDGs Pillar	Description
1. ESG control	<ul style="list-style-type: none"> - Exclusion of companies with an ESG below the regional average - Exclusion of companies with a major involvement in alcohol, armament, gambling, nuclear, and tobacco, or involved in critical controversies - Exclusion of companies involved in critical controversies - Exclusion of largest sector carbon emitters without a robust (50/100) Energy Transition score
2. SDGs contribution	<ul style="list-style-type: none"> - Inclusion of companies with leading sustainable behavior in their sector - Inclusion of companies with significant involvement in sustainable products
3. Financial filters	<ul style="list-style-type: none"> - Liquidity filter - Low volatility filter - Geographical and sectorial diversification - Equally-weighted - Volatility control - Adjustment factor

Source: Vigeo Eiris (2017)

The formula for determining the value of the Solactive Index is given as the sum product of all Index Components: (1) the Number of Shares of the Index Component; and (2) the Trading Price of the Index Component at the respective index currency. The formula⁷ is as follows:

$$Index_t = \sum_{i=1}^n x_{i,t} * p_{i,t}$$

where:

$Index_t$ is Solactive Sustainable Development Goals World MV Index on business day t rounded to 2 decimal places, $p_{i,t}$ is the price of index component i on business day t

⁷ Solactive (2017), p.7.

converted into the Index Currency, $x_{i,t}$ is the number of shares of the index component i on business day t , calculated as follows:

If t falls into the Rebalancing Period⁸, the Number of Shares $x_{i,t}$ is calculated as follows:

$$x_{i,t} = \frac{w_i^{\text{target}}(t) * \text{index}_{t-1}}{P_{i,t-1}}$$

Otherwise, besides any adjustments due to Corporate Actions, $x_{i,t} = x_{i,t-1}$

The Initial Value of the index is set at 100 at the close of trading on the start date, which has been fixed on February 02, 2004. The Index price is reported on each Business Day in Euros. It is determined from the prices of the Index Components as reported in the respective Exchanges on which they are listed. Only the most recent available prices of Index Components are included. Prices which are not published in Euros are translated using Reuters' spot foreign exchange rates. The Index Closing Level of the day is determined at 4 pm London time using Reuters/WMCO closing spot rates.

4.2. Performance of the Solactive SDGs World MV Index

Figure 3 shows the historical performance of the Solactive SDGs Index index beginning 2004, constructed based on a retrospective application of the index formula (Solactive 2017).

Figure 3: The historical performance of the Solactive SDGs World Market Value Index.

Source: Solactive (2018),

<https://www.solactive.com/?s=sdg&index=DE000SLA24X6>

In the graph, we see an ascending trend in the index from 2004 to 2018. In effect, between 2004 and 2018, the Sloactive SDGs Index in its current construction has increased by 160%, from a value of 100 in 2004 (the base year) to 260.07 in 2018. This good performance of the

index enhances investors' willingness to buy SDGs-linked bonds. However, the index has exhibited high volatility in recent years. After reaching a peak of 292.99 in May 2017, it dropped to 260.07 in April 2018 (Solactive 2018).

4.3. Weaknesses of the Solactive SDGs World MV Index as an impact investing benchmark

The question is how the Solactive SDGs World MV Index, which is constructed from share prices of 50 companies, responds to changes in SDGs' performance indicators, which have country and thematic dimensions.

While SDGs bond prices change with the Solactive Index (Solactive 2017), it is not clear whether the change in Socactive Index is related to change in the SDGs indicators. In other words, there is no clear relationship between the Solactive SDGs Index and the realization or non-realization of the country or thematic SDGs.

The above observation does not mean that the Solactive SDGs World MV Index is bad. The Index is widely accepted by the market due to its ingenious design, its historical performance and the success of bonds linked to it, which in most cases were over-subscribed (World Bank 2018). Our position is that the Solactive SDGs World MV Index is not sufficient as an impact investing benchmark appropriate for the SDGs, since it does not change with the SDGs performance indicators.

5. The Sustainable Development Goals Index: A Performance Sensitive Benchmark for SDGs Bonds

In a report for the Commission on the Measurement of Economic Performance and Social Progress, Stiglitz, Sen and Fitoussi (2009) recommended that any measure of well-being should reflect three things: material conditions, quality of life and sustainability. The SDGs were adopted alongside 169 targets and some 241 indicators of progress that track progress in the economic, social and governance dimensions of sustainability. Progress made against each SDGs is assessed on the basis of the observed changes in indicators of progress (Edouard and Bernstein 2016). Overall progress is judged by the level of the SDGs Index (Bertelsmann Stiftung and SDSN 2017).

5.1. Determination of the SDGs Index

Based on SDGs indicators, the Bertelsmann Stiftung

following Business Day in case the first Wednesday does not fall on a Business Day (Solactive 2017).

⁸ "Rebalancing Period" is a period of 10 Trading Days after the Adjustment Day. "Adjustment Day" is the first Wednesday in February, May, August and November or the immediately

and SDSN (2017) developed the Sustainable Development Goals Index (SDGs Index). The SDGs Index and Dashboards, published annually, present the SDGs baselines for each country and progress made toward agreed targets as well as differences that exist across countries, regions and income groups.

The index is determined using the original data for each variable (indicator), scaled to the interval [0;100] using a linear transformation:

$$x' = \frac{x - \min(x)}{\max(x) - \min(x)}, \text{ where } x \text{ represents the raw data;}$$

max/min are the lower and upper bounds denoting the best and worst performances, respectively; and x' stands for the normalized value following rescaling.

A score of 50 for an indicator shows that the country is half-way to the best performance, and a country which scores 75 is three quarters along the distance from worst to best performance.

The overall SDGs Index is determined by the arithmetic mean of the rescaled variables (indicators) corresponding to each SDG, before aggregating, using equal weights, all the SDGs for which data is reported for the country (Bertelsmann Stiftung and SDSN 2017).

The formula for the determination of the SDGs Index is given by:

$$I_{ij}(N_{ij}, I_{ijk}, \rho) = \left[\sum_{k=1}^{N_{ij}} \frac{1}{N_{ij}} I_{ijk}^\rho \right]^{-1/\rho}$$

Where, I_{ijk} represents the score of indicator k under SDGs j for country i ; N_{ij} is the number of indicators for SDGs j ; and ρ denotes the substitutability across components of the indicator, which takes values between $-1 \leq \rho \leq \infty$.⁹

The elasticity of substitution σ across SDGs Index components is $\sigma = 1 / (1 + \rho)$. Where σ takes values of $0 \leq \sigma \leq \infty$. And $\rho = (1 - \sigma) / \sigma$, where $-1 \leq \rho \leq \infty$.

The overall country score for country, I_i , can be obtained by aggregating the SDGs Index scores, I_{ij} , using a similar equation:

$$I_i(N_i, N_{ij}, I_{ij}, \rho) = \sum_{j=1}^{N_i} \frac{1}{N_i} \left[\sum_{k=1}^{N_{ij}} \frac{1}{N_{ij}} I_{ijk}^\rho \right]^{-1/\rho}$$

where N_i stands for the number of SDGs for which country i has data.

The Bertelsmann Stiftung and SDSN (2017) present three special cases of this function. First, the case of perfect

substitutability, also called weak sustainability, of index components ($\sigma = \infty$, $\rho = -1$); where lack of progress on one indicator can be offset by good performance on another indicator. The function then becomes:

$$I_{ij}(N_{ij}, I_{ijk}) = \sum_{k=1}^{N_{ij}} \frac{1}{N_{ij}} I_{ijk}$$

Second, strong sustainability, occurs when the components of the SDGs Index, are not substitutable ($\sigma = 0$, $\rho = \infty$). Here, the constant elasticity of substitution function becomes a Leontief production function with orthogonal isoquants, with the score I_{ij} of a country i and SDGs j determined by the country's lowest score I_{ijk} across all SDGs indicators k :

$$I_{ij}(I_{ijk}) = \min\{I_{ijk}\}$$

The third is intermediate, linear substitutability, given by the Cobb-Douglas production function where $\sigma = 1$ and $\rho = 1$. The SDGs Index I_{ij} turns into the geometric mean of the index components I_{ijk} :

$$I_{ij}(N_{ij}, I_{ijk}) = \prod_{k=1}^{N_{ij}} \sqrt[N_{ij}]{I_{ijk}}$$

The geometric average is used for combining heterogeneous variables which have limited substitutability and where analysis is based on percentage changes rather than absolute changes, a method adopted in the Human Development Index beginning (HDI) 2010 (UNDP 2015).

The arithmetic mean, equally weighted, has been adopted for aggregating variable (indicator) scores within each SDGs using the perfect substitutability or “weak sustainability” case since each SDGs is a collection of complementary policy priorities. The overall SDGs Index score for country i is determined using the perfect substitutability case, where lack of progress on one indicator can be offset by good performance on another indicator, as follows:

$$I_i(N_i, N_{ij}, I_{ijk}) = \sum_{j=1}^{N_i} \frac{1}{N_i} \sum_{k=1}^{N_{ij}} \frac{1}{N_{ij}} I_{ijk}$$

where I_i represents the index score for country i , N_i the number of SDGs reported by the country i , N_{ij} , the number of indicators for SDGs j reported by country i , and I_{ijk} represents the score of variable (indicator) k under SDGs j for country i .

For the purpose of financing development, Schroder

Stiftung and SDSN (2017) op. cit. p. 44.

9 Arrow et al. (1961), pp. 225-250. As cited by Bertelsmann

et al (2004) recommended the use of benchmarks which have strong positive correlations with GDP. In what follows, we study the nature of the relationship between the SDGs Index and GNI per capita (in place of GDP per capita).

5.2. Relationship between the SDGs Index and the GNI per capita

A cross-sectional regression analysis was conducted using a sample of 113 countries, with GNI per capita, the dependent variable, and the SDGs Index, the autonomous variable. The SDGs Index was chosen as a possible benchmark for the SDGs bonds because it is the ultimate indicator of performance for the SDGs, while GNI per capita was chosen based on data availability and because it reflects better the wellbeing of an economy than GDP per capita. All variable are expressed in natural logs.

The following model will be used:

$$\text{Log}(GNI_{percapita}) = \beta_0 + \beta_1 * \text{Log}(SDG_{index}) + e$$

Figure 4: Relationship between GNI per capita (LGNIPC) and the SDGs Index (LSDGI)

Table 2: Regression of GNI per capita on SDGs Index

Exogenous Variable	Coefficient	Std. Error	t-Statistic	Prob.
LSDGI	5.49	0.260605	21.07	0.00
C	-13.63	1.059551	-12.86	0.00
R-squared	0.80	Mean dependent var		8.66
Adjusted R-squared	0.80	S.D. dependent var		1.58
S.E. of regression	0.71	Akaike info criterion		2.17
Sum squared resid	56.06	Schwarz criterion		2.22
Log likelihood	-120.74	Hannan-Quinn criter.		2.19
F-statistic	444.10	Durbin-Watson stat		2.05
Prob(F-statistic)	0.00			

The scatterplot suggests in Figure 4 the existence of a positive relationship between the SDGs Index and GNI per capita. This relationship is confirmed by the regression results, which are given in Table 2.

The coefficient of the log of SDGs index is positive.

Based on the t-statistic ($21.07 > 2$) and the p-value ($0 < 5\%$), the coefficients are also significantly different from zero. Thus, we reject the null hypothesis. The R-squared shows that the SDGs Index explains more than 80% of the variation in GNI per capita. Therefore, there is a positive relationship between the SDGs Index and GNI per capita.

However, given that other factors also affect GNI per capita, we redefine the relationship by adding the primary income receipts and primary income payments as control variables to verify the robustness of the findings.

5.2.1. Test of robustness using control variables

GNI is the sum total of income earned by the factors of production resident in an economy. Regardless of where the factors of production are hired, the focus is on the primary distribution of income and on the productive activities undertaken by factors worldwide (Capelli & Vaggi, 2013). It is given by: $GNI = GDP + NPI$. Which implies that: $GNI = GDP + PIP - PIR$, where NPI is net primary income, defined as the difference between primary income payments (PIP) and primary income receipts (PIR).

We use primary income payments (PIP) and primary income receipts (PIR) as control variables to verify if the relationship between the SDGs index and the GNI per capita still holds. All variables are expressed in natural logarithms. The new equation becomes:

$$\text{Log}(GNI_{percapita}) = \beta_0 + \beta_1 * \text{Log}(SDG_{index}) + \beta_2 PIP_{percapita} + \beta_3 PIR_{percapita} + e$$

where $\text{Log}(GNI_{percapita})$ is the natural log of gross domestic income per capita, $\text{Log}(SDG_{index})$ the natural log of the SDGs index, $PIP_{percapita}$ the primary income payment per capita, and $PIR_{percapita}$ the primary income receipts per capita. Table 3 gives us the regression results.

5.2.2. Interpretation of results

The coefficients of the log of SDGs index are positive. Based on the t-statistic ($5.65 > 2$) and the p-value ($0 < 5\%$), the coefficients are also significant. Thus, we reject the null hypothesis because the coefficients are significantly different from zero. The R-squared shows that the combined variables explain more than 89% of the variation in GNI per capita. Thus, there is a positive relationship between the SDGs Index and GNI per capita.

The regression results shown in Table 3 indicate that there is a possible positive relationship between GNI per capita and the SDGs Index. The SDGs Index, which measures progress on the achievement of SDGs, could be

a better Index to which the SDGs index could be linked. However, we cannot confirm with all certitude the robustness of the relationship, which will require further testing.

Table 3: Regression of GNI per capita on SDGs Index

Exogenous Variable	Coefficient	Std. Error	t-Statistic	Prob.
LSDGI	2.09	0.37	5.65	0.00
LPIPPERCAPITA	0.22	0.06	3.92	0.00
LPIRPERCAPITA	0.19	0.04	4.99	0.00
C	-1.87	1.34	-1.39	0.17
R-squared	0.90	Mean dependent var		8.75
Adjusted R-squared	0.90	S.D. dependent var		1.52
S.E. of regression	0.49	Akaike info criterion		1.45
Sum squared resid	27.35	Schwarz criterion		1.55
Log likelihood	-80.98	Hannan-Quinn criter.		1.49
F-statistic	332.31	Durbin-Watson stat		2.05

6. Recommendations and Conclusion

This section provides some specific recommendations for improving the impact of SDGs bonds.

6.1. Toward the improved sustainability impact of SDGs bonds

Investments in the SDGs bonds fall within the framework of impact investing, which is motivated by the desire to achieve a measurable social and environmental reward alongside a financial return (CA & GIIN 2015). SDGs' impact can be improved by: (1) linking SDGs bonds to the SDGs Index, as evidenced by its strong correlation with GNI per capita; (2) issuing SDGs bonds for specific geographic settings (country or region) and specific thematic areas (SDGs 1, SDGs 2, and so on); and (3) enhancing statistical capacity and establishing corporate SDGs partnerships.

On linking SDGs bonds to the SDGs Index: The SDGs Index has a strong positive correlation with GNI per capita (Table 5). The advantage of using the SDGs Index as a benchmark index for SDGs bonds is that it captures SDGs performance, since it is built from the SDGs indicators of progress. The issuers of these bonds could be financial institutions or governments.

A mathematical formulation for the construction of the SDGs index is as follows:

$Coupon_t = Fixed\ Coupon_t * SDGindex_t / SDGindex_0$, for coupons linked to index development. And $Coupon_t = Fixed\ Coupon_t * SDGindex_t / SDGindex_{t-1}$, for coupons linked to periodic index change.

Other features such as embedded options, redemption clauses and guarantees may be applied to render the bonds more attractive, as suggested by Schroder et al. (2004).

Table 4 gives a comparison between the SDGs Index and the Solactive Index.

Table 4: Comparison of the SDGs Index and the Solactive SDGs Index

Features	SDSN SDGs Index	Solactive SDGs Index
1. Composition	A summary of all SDGs indicators	Company stock prices for fifty companies adjusted periodically
2. Type of index	Behavior and outcome based	Behavior based
3. Type of bond issue	Medium to long maturities bonds. SDGs reporting is relatively long, could be annually	Short to long term maturities, Solactive index reporting can be obtained on a daily basis
4. Reporting instance	Country reporting	Company reporting
5. Thematic reporting	Yes. SDGs Indicator is available for specific SDGs goals or targets	No.
6. Volatility filter	No	Yes
7. Geographic coverage	Almost all countries have SDGs reporting systems in place	Limited coverage. 50 companies are selected from three Regions: Europe, North America, Asia Pacific.

Source: Author's compilation

On thematic specification and geographic targeting of SDGs bonds: Although general purpose bonds are good, it would be better for corporate SDGs bonds to be issued for specific SDGs (or thematic issues) and to target specific geographical settings (region or country). This is because the relevance of the SDGs, the baselines and pace of progress for each target vary from one country or region to another (UN 2015b)¹⁰. For instance, Goal 2 (End hunger, achieve food security and improved nutrition, and promote sustainable agriculture) does not have the same significance for a country like Switzerland which has Global Food Security Index (GFSI)¹¹ of 81.6 on a scale of 100, as it

¹⁰ UN (2015b) op. cit. para. 54

¹¹ The Global Food Safety Initiative (GFSI) assesses the

vulnerability of countries to food insecurity. It is designed by the

would have for a country like Guinea with a GFSI of 34 (The Economist 2017). Even for equally relevant SDGs and targets, the baselines as well as the pace of progress achieved would vary across countries and regions as given in the SDGs Index and Dashboards published annually by the Bertelsmann Stiftung and SDSN (2016). A mathematical formulation for the returns of an SDGs bond that targets the SDG 1 would be as follows:

$Coupon_t = Fixed\ Coupon_t * SDG1_t / SDG1_0$, for coupons linked to index development. And

$Coupon_t = Fixed\ Coupon_t * SDG1_t / SDG1_{t-1}$, for coupons linked to periodic index change.

Embedded options, redemption clauses and guarantees may equally be applied to render the bonds more attractive, as suggested by Schroder et al. (2004).

On statistical capacity building and corporate SDGs partnerships and alliances. Statistical capacity building is needed to improve the quality of SDGs reporting (Bertelsmann Stiftung and SDSN 2016 & 2017). There is need to enhance statistical capacity for the collection and compilation of data on sustainable development goals. Many countries which do not report SDGs indicators, and which by that fact are not available in the SDSN database, do not yet have statistical systems in place for tracking the SDGs progress. Finally, corporations working on specific thematic areas can create learning alliances where they share knowledge about the experiences in designing and implementing SDG-related interventions (UNCTAD 2014 and UN 2015a).

6.2. Conclusion

The investment needs of the SDGs are substantial. Corporate interest in SDGs is laudable, as official financing flows are now stretched. SDGs bonds have registered great successes in recent months. There is a need to improve on their design to ensure that their benchmarks are sensitive to sustainable development performance. The SDGs Index developed by the Sustainable Development Solutions Network (SDSN) is a good starting point. By linking SDGs bonds to this index, bond prices and coupon payments are directly linked to SDGs performance. More work needs to be done to support countries in putting in place statistical systems to report on SDGs and to improve on their SDGs reporting. For those countries that do not yet have SDGs reporting systems in place, the SDGs indexes of countries with comparable levels of development

as judged by their GNI per capita can be used as SDGs bond benchmarks.

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