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An Exposition of the Gap between Public Sector and Private Sector Participation in Green Finance

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Abstract: Greening the environment cannot be achieved satisfactorily, considering that the private sector lags behind the public sector in participation levels. The purpose of this study was to determine the reasons behind the gap in green finance between the two sectors using numerically derived outcomes. Six-year data in the form of total shareholder returns, comprising capital gains and dividends paid from the largest banks in China, the USA, and Europe involved in financing fossil fuels, were extracted from Yahoo.com finance and Macrotrends public forums. Equity premiums were calculated from the total shareholder returns and risk-free rates. A 95% confidence interval was established to determine the lower and upper limits of the equity premiums. The resulting upper limits were used to project premiums that could attract the private sector by 2030. Equity premiums averaged 2.73%, 9.73%, and 4.31% for China, the USA, and Europe, respectively, indicating the substantial task in the USA of attracting the private sector compared to Europe and China. The projections of total shareholder returns showed the same patterns in equity premiums among China, the United States (USA), and Europe. To bridge the gap, the significant need for economic benefits for the private sector should ideally be addressed through green bonds, tailored to green financing projects that are earmarked for revenue generation.

Keywords: equity premium; green finance; private sector; public sector; total shareholder returns



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1. Introduction

There seems to be a central factor that is detrimental to efforts to scale green finance, which creates the gap between the public and private sector involvement. It would appear that the private sector participation in green financing is lagging behind that of the public sector. Different versions of the meaning of green finance have been offered: green investments, climate finance, sustainable finance, or environmental finance (Akomea-Frimpong et al. 2022). In this study, we adopted the explicit description by Khan et al. (2022) in that green finance is climate mitigation finance. Consequently, green finance is crucial in the attainment of the sustainable development goals (SDGs) such as goals 7, 11 and 13 with green growth as the core dimension (Desalegn and Tangl 2022). There is a widening gap between the public sector funding efforts for green projects and the apathetic efforts of the private sector. Consequently, the significance of this study hinges on the demonstration of the quantitative exposition of premiums that private sector companies in the form of banks are reaping from fossil fuel investments, reflecting why there is a gap between the public and the private sector interests in green finance, as well as denoting the efforts needed to bridge the gap. These outcomes are a result of our comparison between the returns achieved by the banks (private sector) and the risk-free rates, which are governments' (public sector) ten-year treasury yields and, therefore, a proxy for the public sector's required returns.

Despite the rhetoric of much-needed support for greening the environment, the actions of the world's largest banks are contradictory, and the escalation of fossil fuel financing is alarming. According to a report by Noor (2023), some USD 3.2 trillion has been used to

finance fossil fuel industries by the largest banks since the inception of the Paris agreement. These banks are largely financed by the private sector through their listings on the various global stock markets. Why then should the private sector prefer to finance fossil fuel industries (via the banks) than green industries? The gap between private and public sector financing of green projects remains wide despite the well-articulated benefits of green financing such as a reduction in global coal consumption and enhanced non-fossil-fuel electricity generation (Glomsrod and Wei 2018) as cited by [Alonso-Conde and Rojo-Suárez \(2020\)](#). The possibility of maximizing returns on investments to attract the private sector seems to be pivotal, as was highlighted by [Mungai et al. \(2022\)](#). Of note, [Lee \(2020\)](#) talks about the need for a decent rate of returns. However, it is anyone's guess as to what these maximum or decent returns entail. In that context, this study aimed to bridge the literature gap by estimating the equity premiums through the actual returns achieved over a measurable period, which can be argued to be adequate rather than maximum or decent. The novelty of this approach lies in its ability to signify the tangible economic benefits that the private sector should reap by participating in green finance projects.

To determine the reason behind the gap between the private and public sector participation in green finance, a quantitative methodology was systematically used to collect secondary data from Yahoo.com finance and Macrotrends in the form of capital gains (using opening and closing share prices) and paid dividends. Risk-free rates of 10-year government bonds were also calculated and subtracted from the total shareholder returns to yield equity premiums. Our exploration of the gap between the public sector and the private sector was pinned on the resultant differences between the risk-free rate, which is a representation of the public sector's required returns, against the equity premiums, which are representative of the private sector's required returns. The banks that are financing fossil fuels represented the private sector and hence their equity premiums were calculated, which then denoted the surplus of private sector total shareholder returns over the public sector's required returns. Using the sample means, standard error, and reliability coefficients, estimations of the population means were derived. The 95% confidence intervals were determined and the resulting upper limits were employed in the configuration of equity premiums deemed on average to be what the private sector would accept to be swayed into green finance projects.

This study, through the collected data, demonstrates that equity premiums from fossil fuel financing that banks enjoyed differed between China (2.73%), the USA (9.73%), and Europe (4.31%) over a six-year period, indicating that the USA has the greater task in influencing the private sector to enter the green finance arena compared to China and Europe, while China's task is seemingly the easiest to achieve.

This article has started with an introduction in Section 1, and now a literature review is given in Section 2. Section 3 provides the results, whilst Section 4 is a portrayal of the materials and methods. Section 5 discusses the results, and Section 6 concludes and highlights the practical implications of the results.

2. Literature Review

In this section, a detailed literature review is given of the intricacies of conflicts between the private and public sectors in both the economic and social dimensions, as well as related solution-orientated proposals.

2.1. Evidence of Private Sector Participation in Fossil Fuel Industries

A substantial number of private investments are channeled towards fossil fuel industries, with trillions of dollars designated to fossil fuel industries by banks, which is an eye opener with far-reaching consequences. Chinese banks and some top US banks lead the pack in financing oil and gas ([Noor 2023](#)). Other North American banks are also heavily involved, as evidenced by the top five (5) setting the pace for fossil fuel financing in 2022 with USD 42.1 billion ([Walker 2023](#)). These actions are in opposition to the intended goals of green finance, which should lead to a green economy and, in turn, a reduction in

ecological scarcity, mitigation of risks to the environment, and the subsequent achievement of sustainable economic development (Ansah and Sorooshian 2019). In summary, green financing is fundamentally a means of achieving green growth (Soundarrajan and Vivek 2016). Justifications for a lack of enthusiasm in green financing include the myth that green financing is fundamentally more technical than conventional financing (Seshachalam and Asif Ali 2020), as cited by Mustafa et al. (2021). Therefore, most banks, such as in India, are still not comfortable working with and adapting to green financing structures and operations. This leads to the conclusion by Lee (2020) that banks and other financial institutions are far from reaching their peak levels in financing green projects. Evidently, the private sector plays an important role by channeling funds to these publicly listed banks. The proceeds of these funds manifest in the risk-adjusted returns that the private sector enjoys.

2.2. Competing Public and Private Sector Objectives

The private sector has a key role to play in addressing the adaptation needs of vulnerable communities and has much to contribute to the planning, development, and implementation of climate adaptation strategies through sector-specific expertise, financing, technology, efficiency, and entrepreneurship (Ansah and Sorooshian 2019).

It would seem that the private sector, through banking institutions allocating trillions to fossil fuel industries, is seeking adequate risk-adjusted returns, whilst the public sector is mostly earmarking environmental improvement and achieving the best development prospects. The public sector, as represented by policymakers, is keen to achieve the most satisfying development prospects (Soundarrajan and Vivek 2016). In some instances, the private sector is deemed risk averse due to its inclination towards proven technologies more than newly found innovations (Koppenjan 2015). Referencing Buchner et al. (2015), Boule et al. (2016), and the International Finance Corporation (2016a,b), Clark et al. (2018) reflected that of the current investments in the global climate, to the amount of USD 361 billion, USD 341 billion has come from the private sector. However, it should be noted that governments also play a crucial role in incentivizing private investment through policies, subsidies, grants, concessional loans, and risk mitigation mechanisms, including insurance and government guarantees.

Koppenjan (2015) also highlighted the dependence of the private sector on the ability of the government to choose viable projects, a condition that can derail private sector participation if there is mistrust in the ability of the government to do so. Even in the evaluation and assessment of green projects, some banks rank the economic perspective as the most significant factor influencing green financing, followed by the social and environmental dimensions (Zheng et al. 2021).

2.3. Proposals to Bridge the Gap

Several proposals have been submitted to address the gap in financing green projects between the public and private sectors. For example, it is suggested that the establishment of green credit guarantee schemes (GCGSs) as a risk reduction measure would require the government to volunteer to share in the risk exposure of a private entity (Taghizadeh-Hesary and Yoshino 2019). Furthermore, the subsequent return of tax revenue emanating from ripple effects within the green energy supply chain should be considered (Taghizadeh-Hesary and Yoshino 2019). The viability of the public-private sector partnerships (PPPs), which give private investors concession periods to recoup their investments, which is now being pursued in the UK (Koppenjan 2015), is yet another recommendation. However, the aforementioned proposals cannot be fully implantable when the issue of incomplete or asymmetric information, which is among the potential consequences of climate change, concerning both uneven access to information and the lopsided distribution of valuable information to different sectors, including the private sector, is not addressed (Druce et al. 2016). Without accurate and reliable climate data, actors are unable to make informed decisions and invest accordingly. There is also a lack of historical data that can be used

to predict the future performance of green projects (Abdul et al. 2023), so the sooner stakeholders systematically collect and store data from green activities, the better the prospects for investments.

The usefulness of green finance can be enhanced by green bonds, which, according to Czech et al. (2023), are vital tools that are applicable in endeavors designed to bridge the availability gap for financial resources meant to address environmental concerns. According to Tuhkanen (2020), green bonds are an appropriate way of providing funding to the private sector, but only if this type of instrument is aligned with projects that, amongst their other properties, are revenue-generating. Moreover, the private sector itself should be forthcoming and transparent with respect to its strategic intention for green financing, a positive step toward obtaining funds for green finance (Lee 2020). In fact, green finance can only be achieved by attaining an equilibrium between business objectives (rates of return) and environmental benefits (Nawaz et al. 2021). Despite the existence of inconsistencies in rules, regulations, and taxation when it comes to the issuance and buying of green bonds, the bottom line is that they are designed to channel proceeds towards green projects (Grishunin et al. 2023).

While emphasizing the indispensable nature of private investments in sustainable energy, Azhgaliyeva et al. (2018) further argued for the relevance of fiscal policy as a tool to attract private investors. In fact, Azhgaliyeva et al. (2018) referred to in-feed tariffs (which comprise amongst others solar and hydro power and furnish satisfactory returns, which exceed those from electricity provision), grants and subsidies (which are vital in the extension of green energy), loans (constituting low interest rates), and taxes (denoting either relief or credit) as appropriate in the bid to lure private investors to the green financing arena. Worth noting is the truism that there is no consensus as to the effectiveness of public policies in attracting private sector funds, even though it is suggested that the extent of public policy influence is widespread (Prasad et al. 2022).

Furthermore, the private sector should not subordinate the power of social benefits such as environmental improvements, which if not observed will plunge them into financial crises (Lamperti et al. 2021). In fact, there is no way economic benefits can be achieved without respecting the environmental ecology (Caiado et al. 2017).

2.4. The Implication of Returns

Private sector investors are primarily driven by an appetite for returns that more than compensates for the risks they raise. However, issues such as market distortions in oil prices are a source of unattractive yields (Soundarrajan and Vivek 2016). Private sector investors' lack of enthusiasm is also due, among other factors, to exposure to lower returns and technological risks associated with green projects (Yoshino et al. 2019). It is this perceived volatility in returns associated with clean energy projects that has resulted in a slow transition by investors from fossil fuels.

According to Yu et al. (2021), private organizations tend to be more limited by financial constraints than state-owned enterprises despite possessing superior innovative qualities. According to Mustaffa et al. (2021), the prevalence of capital constraints among financial institutions, which in our view are largely private owned, leads to the perception that green financing profit generation is subordinate to conventional financing. Consequently, a gap is created between private participation and public sector involvement.

The uncertainty about the viability of clean energy projects and the expensive nature of associated technology could lead to low returns (Mustaffa et al. 2021). The implication of this situation is that it can be difficult to induce the private sector to switch to green financing. Although there are some investments from the private sector, the major issue is that they have occurred in a climate of uncertainties resulting from, among other factors, having no previous reference points and market imperfections, both of which are not conducive to attracting financial flows (Druce et al. 2016). If financial flows were to be channeled, then it is clear to see high returns would be required.

Using UNEP’s (2016) stance on green finance, [Park and Kim \(2020\)](#) distinguished sustainable development and green finance, pointing out that the latter does not include social and economic benefits while the former is all-encapsulating and depicts social, environmental, and economic dynamics. However, considering most of the arguments mentioned above ([Mustaffa et al. 2021](#); [Druce et al. 2016](#); [Yoshino et al. 2019](#)), it seems logical to posit that economic aspects are at the core of green finance.

2.5. Policies and Regulations in Green Finance

Considering the dynamics at play between the public and the private sectors in green financing activities, it is pertinent to point out, as posited by [Dziwok and Jäger \(2021\)](#), that green finance has evolved to become core to the strategic impetus of the financial sector (with banks being part of it) and an indispensable, pivotal point in governmental policy formulation. However, several regulatory dimensions are important to oversee the effectiveness of green financing, particularly from central banks. Citing [Volz \(2017\)](#), [Ozili \(2022\)](#) included reserve requirements, open market operations, and capital requirements as instruments at the disposal of central banks to effectively facilitate the transition of banks to green finance. The Conferences of Parties (COP) 16 predominantly focused on reducing the green finance gap by challenging central banks to ensure financial flows are spearheaded towards environmentally friendly projects ([Popoyan and Galanis 2022](#)). However, to a large extent, policies and regulations to support green finance are jurisdictional. One such example is in the context of the European Union whereby the EU Regulation on the Establishment of a Framework to Facilitate Sustainable Investments (Regulation (EU) 2020/852, of 12 July 2020, was, amongst other noble ideas, designed to enhance the channeling of financial flows into green investments ([Brühl 2021](#)).

The aforementioned literature provides a comprehensive view of ideas and outcomes regarding to our research objectives, including the conclusions by [Mungai et al. \(2022\)](#), who established that the maximum returns that are the dividing factor, by [Lee \(2020\)](#), who dwelt on decent returns as key to attracting private investors, and by [Mustaffa et al. \(2021\)](#), who linked the uncertainties about clean energy and the expenses of new technology to low returns. This study transcended the aforementioned studies by establishing and quantifying the returns, leading to the derivation of equity premiums that could be used to benchmark the various degrees of effort needed to bridge the green financing gap between the public and private sectors.

3. Results

The study results are presented per geographical jurisdiction of China, the USA, and Europe.

3.1. China

The proportion of banks that obtained a positive TSR during the studied period in China was 58%. The proportion of the derived population at the 95% confidence level is shown in [Table 1](#).

Table 1. Sample proportion with a positive TSR (58%).

58% + TSR	
Std. error	0.142478
95% confidence level π —lower	0.300743
95% confidence level π —upper	0.859257

In [Table 1](#), it can be seen that with a sampling proportion of 58%, the 95% confidence interval leads to the following:

$$0.300 \leq \pi \leq 0.859$$

where π = Population proportion with a positive TSR.

Consequently, the conclusion is that with 95% confidence, the proportion of Chinese banks that obtained a positive TSR was somewhere between 30% and 85.9%. Table 2 is an exposition of the approximate population mean of the TSR in China.

Table 2. Estimated population mean of TSR from Chinese banks financing fossil fuels.

Sample mean	1.606992
Std. error	2.400908
95% confidence level—lower	−2.70475
95% confidence level—upper	5.918734

From Table 2, with a sample mean of 1.607 of the TSR and a standard error of 2.401, we can be 95% confident that, on average, Chinese banks produced between −2.70% and 5.92% TSR during the 6-year period.

Using Equation (1), and taking the upper limit of the TSR, it followed, therefore, that the equity premium was

$$\text{TSR} - R_f = 5.92 - 3.19 = 2.73$$

This equity premium of 2.73% denoted the difference between what the private sector achieved in financing fossil fuels and what the public sector obtained in green financing. For the banks (private sector) to have been swayed into green financing, they needed the achievement of at least returns that were 2.73% above the risk-free rate (public sector).

Table 3 shows a representation of the adjusted estimated required returns for Chinese fossil fuel financiers over the 5-year period of 2024–2028.

Table 3. Projected required TSR by the Chinese private sector for green financing.

Year	Mean Upper Bound 95% Con. TSR	Expected Inflation	Adjusted Estimated Required TSR (%)
2024	5.918734	1.59	7.508734
2025	5.918734	2.16	8.078734
2026	5.918734	2.22	8.138734
2027	5.918734	2.22	8.138734
2028	5.918734	2.22	8.138734
Average			8.00

The adjusted estimated projected returns from the Chinese markets shown in Table 3 are delimited by a minimum of 7.51% and a maximum of 8.14%. The average estimate is 8.00% of the TSR. The difference between this average projection of 8.00% and the ten-year government treasury risk-free rate reflects the equity premiums to be attained by the private sector.

3.2. USA

According to data produced from the sample, all banks in the USA produced a positive TSR during the 6-year period. In Table 4, a clear summarized picture of the approximate population means of the USA's TSR is shown.

Table 4. Estimated population means of TSR from USA banks financing fossil fuels.

Sample mean	7.8339
Std. error	2.119388
95% confidence level—lower	3.715548
95% confidence level—upper	11.95225

From Table 4, with a sample mean of 7.8339 of the TSR and a standard error of 2.119388, we can be 95% confident that, on average, USA banks produced between 3.71% and 11.95% TSR over the 6-year period. Hence, the upper-limit equity premium was

$$11.95 - 2.220 = 9.73$$

This equity premium of 9.73% denoted the difference that the USA private sector achieved in financing fossil fuels compared to what the public sector obtained in green financing. For the USA banks (private sector) to have been lured into green financing, it would have taken the achievement of at least returns that were 9.73% above the risk-free rate (public sector).

Table 5 provides the range of projected inflation-adjusted returns for the 5-year period.

Table 5. Projected TSR required by the US private sector for green financing.

Year	Mean Upper Bound 95% Con. TSR	Expected Inflation	Adjusted Estimated Required TSR (%)
2024	11.95225	2.3	14.25225
2025	11.95225	2.1	14.05225
2026	11.95225	2	13.95225
2027	11.95225	2	13.95225
2028	11.95225	2.1	14.05225
Average			14.05

In Table 5, the minimum forecast return is 13.95 with a maximum projection of 14.24. On average, 14.05% would be required as the TSR. The difference between this average projection of 14.05% and the ten-year government treasury risk-free rate would reflect the equity premiums to be attained by the private sector.

3.3. Europe

From the random sample of 16 banks, 75% had a positive average TSR for the period considered. Assume that the sampling distribution approximated a normal distribution, with the mean equaling the population proportion and standard deviation determined by

$$\sqrt{\frac{P(1-P)}{n}} \text{ which gives us the standard error } S_p \quad (1)$$

In Europe, the picture looked much different from that in China. Table 6 shows the situation. The proportion of banks that obtained a positive TSR during the study period in Europe was 75%. The proportion of the derived population at the 95% confidence level is shown in Table 6.

Table 6. Estimated population proportion with positive TSR.

75% + TSR	
Std. error	0.108253
95% confidence level π —lower	0.537824
95% confidence level π —upper	0.962176

In Table 6, it can be seen that with a sampling proportion of 75%, the confidence interval led to the following:

$$0.538 \leq \pi \leq 0.962$$

where π = Population proportion with positive TSR.

Consequently, the conclusion is that with 95% confidence, the proportion of European banks that obtained a positive TSR was somewhere between 53.8% and 96.2%. In Table 7, the TSR as a mean of the population of European banks is given.

Table 7. Estimated population mean of TSR for European banks financing fossil fuels.

Sample mean	3.337999
Std. error	1.154546
95% confidence level—lower	1.314023
95% confidence level—upper	5.361976

From Table 7, with a sample mean of 3.337999 of the TSR and a standard error of 1.155546, we can be 95% confident that, on average, European banks produced between 1.31% and 5.36% TSR over the 6-year period. Hence, with an average risk-free rate of 1.050 over the 6 years, the equity premium (applying the upper-bound limit) became

$$5.36\% - 1.050\% = 4.31\%$$

This equity premium of 4.31% denoted the difference between what the European private sector achieved in financing fossil fuels and what the public sector obtained in green financing. Over this period, it would have taken the achievement of at least returns that were 4.31% above the risk-free rate (public sector) to lure the European banks (private sector) into green financing.

Table 8 shows the expected inflation-adjusted returns within the European sector for fossil fuel financiers.

Table 8. Projected TSR required by the European private sector for green financing.

Year	Mean Upper Bound 95% Con. TSR	Expected Inflation	Adjusted Estimated Required TSR (%)
2024	5.361976	3.65	9.011976
2025	5.361976	2.42	7.781976
2026	5.361976	2.21	7.571976
2027	5.361976	2.05	7.411976
2028	5.361976	1.98	7.341976
Average			7.82

It can be seen from Table 8 that when adjusting the historical upper-bound TSR by the yearly expected inflation figures, Europe was most likely to see the returns required by investors associated with the fossil fuel financiers, ranging from 7.34% to 9.01% and averaging 7.82%. The difference between this average projection of 7.82% and the ten-year government treasury risk-free rate would reflect the equity premiums to be attained by the private sector.

4. Materials and Methods

This study deployed a quantitative analysis of data in the form of total shareholder returns, emanating from the capital gains and dividends paid to shareholders by the biggest banks that are involved in fossil fuel financing. Data on identified banks deemed the highest financiers of CO₂ emission activities were collected from publicly available consumer news and business channel websites. These banks (60) were categorized according to geographic jurisdictions of China, Europe, and the USA. From the categorized data, random samples per jurisdiction were collected. Only fossil fuel financiers were considered, as the purpose was to establish what it could take to sway them from fossil fuel financing towards green financing. Green financing was not represented by green financing banks, as these would still be categorized as private sector; instead, government ten-year treasury yields were equated to the returns the public sector would require.

In order to calculate the TSR, capital gains were deduced from the difference between opening prices and closing prices of these randomly selected banks' shares per period (annually) over six years (2017–2022) from yahoo.com finance publications. Hence,

$$C_g = P_2 - P_1 \quad (2)$$

where

C_g = Capital gains;
 P_2 = Periodic end price;
 P_1 = Beginning periodic price.

Then, the capital gains were added to the yearly dividend yields in order to arrive at the TSR. This was performed in order to determine the equity premiums that were achieved by the private sector, as represented by the fossil-fuel-financing banks. To obtain the equity premiums, a proxy of required returns by the public sector, the risk-free rates were established for different years, corresponding to the different jurisdictions under study.

Risk-free rates per period, as determined by the 10-year government bond yields for the three (3) jurisdictions, were extracted from the Macrotrends website. Equity premiums were computed as the difference between total shareholder returns and risk-free rates:

$$E_p = \text{TSR} - R_f \quad (3)$$

where

E_p = Equity premium;
 TSR = Total shareholder return;
 R_f = Risk-free rate.

Estimation of the population mean of the equity premiums per jurisdiction for banks deemed heavy financiers of fossil fuels was carried out using the following model:

$$\bar{x} - k_c s_{\bar{x}} \leq \mu \leq \bar{x} + k_c s_{\bar{x}} \quad (4)$$

where

\bar{x} = Sample mean;
 k_c = Reliability coefficient;
 $s_{\bar{x}}$ = Standard error of the mean.

Assuming that the population was normally distributed, it followed that the sampling distribution of the mean was also normally distributed with the mean equal to the population mean μ and standard deviation σ/\sqrt{n} . We used the t-distribution with $n - 1$ degrees of freedom due to the small sample size. The standard error was determined by the following:

$$S_x = \frac{S}{\sqrt{n}} \quad (5)$$

where

S_x = Standard error;
 S = Sample standard deviation;
 n = Sample size.

A 95% confidence interval was established to determine the lower and upper limits of the equity premiums. The resultant upper limits (best case scenarios) were used to determine the projected range of premiums that would be able to attract investments from the private sector away from the fossil fuel financiers (representing non-green initiatives). These premiums, which were determined per jurisdiction for a 5-year period (2024–2028), were considered good indicators of how the 2030 aspirations for green financing would look in terms of efforts required to attract private investors and to bridge the gap between

private and public investors. To estimate the green private sector premiums, the equity premiums were adjusted for the projected inflation rates in the corresponding periods. These projected inflation rates were extracted from the renowned economic and political statistical website Statista. These equity premiums still reflected the surplus of the private sectors' returns over the public sectors' risk-free returns. Hence,

$$GP_p \geq I + E_p \quad (6)$$

where

GP_p = Estimated green private sector premiums;

I = Projected inflation rate;

E_p = Equity premiums.

5. Discussion

With 95% confidence, the proportion of Chinese banks that are financiers of fossil fuel projects and which obtained a positive TSR is somewhere between 30% and 85.9%, in the USA, it is 100%, and in Europe, it is between 53.8% and 96.2%. The immediate implication of the above-mentioned results is that the greater positivity of returns in the USA would make it more challenging for investors to divest from fossil fuel investments than in China. The same reasoning applies to Europe as compared to China, unless the required returns themselves from green financing match or exceed those currently being enjoyed. Those suggested maximum returns on investments can be used to attract these fossil fuel private investors to participate in green financing (Mungai et al. 2022). A key lesson that the private sector must learn is not to view green finance as separate from sustainable development, but as an activity that leads to social and economic benefits, as suggested by (Lamperti et al. 2021). However, accommodating the social dimension may have a dampening effect on the returns to be achieved, though the private sector has a role in addressing the adaptation needs of vulnerable communities (Ansah and Sorooshian 2019). However, its contribution to the planning, development, and implementation of climate adaptation strategies through sector-specific expertise, financing, technology, efficiency, and entrepreneurship can easily be compromised by the positive returns experienced in the fossil fuel arena (Ansah and Sorooshian 2019).

More significantly, the equity premiums for banks that were huge financiers of GHG emission projects averaged 2.73% for China, 9.73 for the USA, and 4.31% for Europe. There was a corresponding relationship between the equity premiums and the proportion of banks that were financiers of fossil fuels and gained a positive TSR, in that where the minimum proportion was located (China), the least premiums were obtained. The same was applicable to Europe and the USA. Therefore, it seems that for these banks, China's task of closing the gap between the public sector and the green financing of the private sector is the narrowest, followed by the European sector, with the hardest effort falling in the USA. Therefore, the quantity of subsidies should be the most in the USA, with Europe needing more than China. Regardless of differences in the size of subsidies, all governments can utilize their fiscal policies to attract private investors to green financing (Azhgaliyeva et al. 2018). Green credit guarantee schemes, which are a sound way in which governments can share in the risk exposure of private entities (Taghizadeh-Hesary and Yoshino 2019), should be intensified the most in the USA. Moreover, there is a need to acknowledge the economic factor as a reason for the strategic existence of the private sector. It would seem that since the objective of securing economic benefits is overwhelming for the private sector, green bonds as instruments that fit projects seeking revenue generation are the most appropriate to avail to the private sector (Tuhkanen 2020).

The homogeneity in the three geographical areas was underpinned by a desire to achieve clear margin-oriented goals by the private sector, above the public sector returns. This empirical evidence suggests that margins take precedence over the direction in which funds flow. Hence, more private sector funds are geared towards fossil fuel financing

because that is where larger returns are achieved. However, in all instances, we found that the gap in financing green projects can be reduced through harmonized efforts such as escalating the availability of green bonds.

However, the private sector itself should also realize that green finance can only be achieved by attaining an equilibrium between business objectives and environmental benefits (Nawaz et al. 2021). Consequently, a reduction in equity premiums can be achieved. Just as in the alignment between the proportion of banks and the equity premiums, the projected TSR follows the same trend, with China and Europe showing a forecasted 8%, while the USA shows a much differentiated 14% forecast. Therefore, all else being equal, the USA is likely to see the most equity premiums achieved. Hence, intensification of the process of bridging the gap between private investors and public investors is required the most in the USA.

The study was limited in the sense that it did not select a specific number of public sector institutions or calculate their investment returns over the period under study. Moreover, it used the long-term ten-year government treasury risk-free rate as a proxy for all public sector institutions' achieved rate of return. Furthermore, this study did not focus on a particular green project with a specific risk profile but considered all green projects as if they had a uniform risk profile.

6. Conclusions

Given the climate of uncertainties in green projects (Druce et al. 2016; Mustaffa et al. 2021), it will take formidable interventions to persuade private sector investors to consider green financing as an alternative unless the equity premiums can be matched or exceeded, even though the magnitudes vary across the globe. Considering the historical average risk-free rates and assuming that they were to grow at an equivalent rate of growth to the TSRs, efforts to bridge the inflows in returns as required by these private sectors are monumental. Clearly, the public sector, particularly governments, has an unprecedented role to play in not only providing policies, subsidies, grants, concessional loans, and risk mitigation mechanisms including insurance and government guarantees, and ensuring that all data pertaining to climate changes are collected and transparently made available to all stakeholders, but also articulating the social benefits thereof. However, banks and the private sector must strike a balance through acknowledging that sustainability can only take place if both economic and social outcomes are manifested. Otherwise, efforts by governments will yield lukewarm results after attracting few private sector organizations to participate in green finance. The much-needed reduction in the gap between the public sector and the private sector in green finance can take place if and only if the two sides are reconciled to realize that there are premiums that the private sector enjoys in fossil fuel financing above the low rates accepted by the public sector in green financing. Furthermore, the private sector needs to realize the power of social benefits prioritized by the public sector, such as environmental improvements, which in the long run will keep the same private sector sustainable.

Although the magnitudes of equity premiums enjoyed by the public sector across the world in the deployment of funds in fossil fuel projects vary, the impact of GHG emissions is not restricted by geographic lines. Supply chain disruptions can occur around the world. Further studies should, therefore, attempt to unearth the workings of green finance within the African continent and the intricacies between the private and public sectors, to highlight the magnitude of effort needed, if any, to close the gap. Africa is generally a big player in fossil fuels and, if left behind, has the potential to dilute green finance efforts elsewhere. This is vital in understanding the magnitudes of the differences between private and public sector reasons for and against green finance as well as establishing if the same solutions such as an increase in the supply of green bonds could be the panacea to bridge the financing gap.

Appreciating the economic benefits, in quantifiable terms, that private sector players such as banks enjoy in their financing of fossil fuels can lead to viable solutions that can

reduce the costs of transitioning to green finance. A prevalence of green bonds at lower interest rates to compensate for lower returns associated with green finance projects, due to risks of uncertainties in project feasibilities and the potential economic outcomes, could be invaluable. Lower financial costs may lead to returns that equate to or exceed what the private sector may be anticipating from fossil fuel projects, with the added advantage of environmental protection. The resultant shift in the private sector's focus on green finance will serve to mitigate climate risks on a global scale. The private sector seems to be inclined towards achieving economic benefits, and green bonds at lower costs can serve to achieve economic benefits as well as environmental benefits. This duality of purpose means the gap between the public sector and the private sector in green finance can be bridged.

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