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## Article

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Article

# Factors Influencing the Green Bond Market Expansion: Evidence from a Multi-Dimensional Analysis

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**Abstract:** Expansion of green bond markets as an appropriate way to lower environmental pollution is one of the most debatable issues among scholars. However, the expansion of this market is not a simple matter and depends on several factors. The main purpose of this study is to carry out a multi-dimensional analysis using the analytic hierarchy process (AHP) method to find and prioritize factors influencing the development of green bond markets. As a case, we do our analysis for Vietnam that, since the last years, has been trying to expand green bond market as an effective investment channel to finance low-carbon projects. The main findings revealed that legal infrastructure, official interest rate of green bonds, and economic stability are the most important factors directly affecting green bond market expansion. Therefore, economic and legal requirements should be addressed by policy makers. As major policy implications, we recommend an affordable price of green bonds and improvement of economic and financial stability to accelerate the development of green bond markets.

**Keywords:** green bonds; market expansion; analytic hierarchy process

## 1. Introduction

Green bonds (GBs) are an important financial tool used to raise capital for low-carbon projects that benefit the environment (World Bank 2019; Tu et al. 2020). According to Tolliver et al. (2020), this new financial tool is an applicable way to increase emissions reductions policies, long-run development, and improvement of ongoing eco-friendly projects to reach the goals of the Paris Agreement. Bachelet et al. (2019) define a green bond as a “plain-vanilla” fixed income product that opens sustainable doors for investors into financing green projects.

The first green bond was issued by the World Bank and the Swedish bank SEB in 2008, and its global market has expanded from \$11 and \$36 billion in 2013 and 2014 to nearly \$167 billion in 2018 (Maltais and Nykvist 2020). Despite the rapid growth of the green bond market because of its remarkable impacts on debt financial expenses and financial performances (Curley 2014; Tang and Zhang 2018; Flammer 2018; DeSchryver and Mariz 2020), the market expansion of green bonds in countries is a debatable issue among scholars. A number of scholars such as Voica et al. (2015) and Partridge and Medda (2020) argue that private investors and public authorities are two important players in the green bond market, and these two players define the expansion level of green bond markets, while some studies believe in the impacts of different factors on development of green bond market. For instance, Ehlers and Packer (2017); Flammer (2018); Zerbib (2018); Reboredo and Ugolini (2019); and Broadstock and Cheng (2019) discuss the effect of financial markets and various

macroeconomic factors on the green bond market, respectively. In addition, several studies (e.g., see [Della Croce and Yermo 2013](#); [Bhattacharya et al. 2015](#)) declare that investment infrastructure can help the green bond market to expand. Therefore, it is clear that green bond market expansion depends on various factors having an interrelationship and makes the development of green bond market multi-dimensional.

In recent years, the green bond markets in different nations have been developed rapidly. Following [Flammer \(2019\)](#), this rapid development is characterized the “green bond boom” in the global financial market. According to the World Bank’s Emerging Market Green Bond Report 2018, East Asia and Pacific is the biggest green bond market among other geographical regions. South Asia, with 7.7 billion US \$, has had the second biggest green bond market expansion over the period 2012–2018. Table 1 represents the green bonds issued in different regions during the 2012–2018 period.

**Table 1.** Green bonds issued by different regions from 2012 to 2018.

Geographical Regions	Number of Countries	Number of Green Bonds Issuers	Volume (\$ Billion)
Africa	4	8	1.5
East Asia and Pacific	7	160	112.3
Europe and Central Asia	5	9	3.2
Latin America and the Caribbean	8	32	14.1
Middle East and North Africa	3	6	1.0
South Asia	1	20	7.7
Total	28	235	139.7

Source: authors’ compilation from the International Finance Cooperation (IFC).

Among Asian nations, Vietnam is one of the players in the green bond market with the most potential. Following the market reforms of this country carried out in 1986, Vietnam’s economic mechanisms are based on emerging systems. [Nguyen and Gray \(2016\)](#) express that Vietnam is facing two important issues of sustainability development and the green movement, which are accelerators of developing green economic instruments. One type of these green instruments is green bonds, which two Vietnamese local government entities—Ho Chi Minh City and Ba Ria Vung Tau—followed in their footsteps by issuing the first VND-denominated GBs and listing them on the Hanoi Stock Exchange in the last decade. Despite all Vietnam’s efforts to enter to this green market, it has not been developed and expand significantly owing to various reasons, such as inappropriate energy pricing policy, non-preferential feed-in tariff, and an undeveloped financial system ([Nguyen et al. 2019](#)).

Owing to the importance of green bond market expansion and the existence of various influencing factors on the expansion, it is a critical need to study and prioritize the influencing factors. In this paper, we seek to classify all important influencing factors on expansion of the green bond market in the case of Vietnam through a multi-dimensional analytic approach entitled analytic hierarchy process (AHP), and find out priorities of these factors based on judgments of a group of experts. Despite some fresh studies about green bond markets such as [Cocho et al. \(2016\)](#); [Shishlov and Morel \(2016\)](#); [Jun et al. \(2016\)](#); [Hachenberg and Schiereck \(2018\)](#); [Hupart \(2019\)](#); [DeSchryver and Mariz \(2020\)](#); and [Tolliver et al. \(2020\)](#), we did not find any academic study focusing on priority of factors affecting the expansion of the green bond market. Therefore, our paper will try to fill in this literature gap. Conducting this research help us to answer questions such as the following: What are the main factors in related to develop green bond market? Which influenced factors are more important than others? How can policy makers expand the green bond market?

Following in this paper, Section 2 summarizes literature review. Next, analytic hierarchy process (AHP) is discussed, and Section 4 represents findings. Then, the robustness check is presented, and Section 6 concludes the paper with useful policy implications.

## 2. Literature Review

The related literature can be divided into two different strands as follows.

The first strand of literature contains earlier studies with a focus on the green bond market. The characteristics of the green bond market have been debated by a vast number of scholars. [Maltais and Nykvist \(2020\)](#) discussed the role of green bond markets in economic sustainability for the case of Sweden. They identified the potential of the green bond market in economic participants' engagement and sustainable economic and social development. [Wang et al. \(2020\)](#) and [Baulkaran \(2019\)](#) showed that a green bond is an interesting field for investors. They found that stock market investors in China have a positive response to green bond issuing news. This result has also been addressed by [Pham and Huynh \(2020\)](#), who revealed positive linkage between reactions of investors and green bond market performance. In addition, [Wang and Zhi \(2016\)](#) also proved the significant role of green bond markets in environmental protection and combating climate change. [Banga \(2019\)](#) investigated the key factors and barriers influencing the green bond market in developing nations. They found that climate-awareness from investors, inappropriate institutional arrangements, and high transactions costs with green bond issuance are major players in developing the green bond market. [Wang et al. \(2019\)](#) studied the factors influencing the risk premium of issuance in China's green bond market. The major results revealed that debt credit rating, issue period, and issue size are three different factors that directly impact the risk premium of green bond issuance. In other study, [Zhou and Cui \(2019\)](#) made an attempt to find out the relationships between green bonds, corporate performance, and social responsibility in China's green bond market. The findings showed that corporate performance and social responsibility to environmental issues positively affect the expansion of the green bond market. [Agliardi and Agliardi \(2019\)](#) argued that improvement in credit quality, lowering cost of capital for green bond issuers, and state support are three main drivers of green bond development. This finding is in line with [Dou and Qi \(2019\)](#), who investigated the factors affecting the choice of green bond issuing by state and private sectors. [Flammer \(2019\)](#) believes that certification is a main governance mechanism in the green bond market that motivates independent third parties in issuing green bonds. [Tolliver et al. \(2020\)](#) investigated drivers of green bond market growth in 49 countries and found out the positive influence of capital market, macroeconomic, and institutional factors on developing green bond markets. [Broadstock and Cheng \(2019\)](#) argued that the development of the green bond market depends on various factors. Using the dynamic conditional correlations (DCC) revealed that economic policy instability, energy price, and financial market uncertainty (the effect of financial market has also been proven by [Reboredo and Ugolini \(2019\)](#)) are major drivers to accelerate growth of the green bond market. [Febi et al. \(2018\)](#) evaluated the impact of liquidity uncertainty on green bonds. They concluded that liquidity risk is an important factor for green bonds' development. In a study, [Tu et al. \(2020\)](#) argued that the existence of an efficient legal framework is a pioneer need for expansion of green bond markets. [Jin et al. \(2020\)](#) focused on the relationship between the hedging effect and the efficiency of green bond markets. They proved that the green bond market is one of the most efficient markets for future emissions reductions. [Zerbib \(2019\)](#) analyzes the relationship between pro-environmental preferences and green bond market development. The major results showed the significant investors' pro-environmental preferences effect on the green bond market expansion. [Wang and Zhi \(2016\)](#) argued that appropriate regulation framework and state support can improve the mechanism efficient of green bond market, which leads to better environmental protections. [Voica et al. \(2015\)](#) proved that an appropriate legal and institutional framework may shape a better atmosphere to expand green bond markets in countries by encouraging investors to have a more efficient participation.

The second strand of literature concentrates on earlier studies that used the AHP method to solve an economic problem. [Saaty \(1987\)](#) introduced AHP as a new technique for macroeconomic forecasting considering policies of monetarist, Keynesian, and supply-side. [Byun \(2001\)](#) provided a model based on the AHP approach to prioritize automobile purchase models. [Bozbura and Beskese \(2007\)](#) employed the AHP approach to study organizational capital measurement indicators. In another study, [Gerdsri and Kocaoglu \(2007\)](#) conducted the AHP method in the problem of technology road

mapping in a knowledge-based economy. Podvezko (2009) discussed advantages of the AHP technique in solving economic and social matters. Lin et al. (2011) applied a mixed model of AHP and DEA (data envelopment analysis) to study the economic activities of local Chinese governments. Sadeghi and Ameli (2012) tried to study energy subsidy in several economic sectors in Iran through the AHP method. In other study, Alizadeh et al. (2014) investigated factors affecting the expansion of wooden commodities exports from Iran. To this end, they conducted the AHP method to prioritize the influencing factors. Oztaysi (2014) used the AHP method to study IT (information technology) selection in a knowledge-based economic framework. Longaray et al. (2015) conducted academic research on services' qualities in the Brazilian retail sector using the AHP method. Hadadian and Rasoulian (2017) used the AHP method to prioritize trade partners for Iran with the goal of economic integration. Lotti and Caetano (2018) evaluated the appropriate airports for fruit exports from Brazil using analytic hierarchy process. In other study, Sharma (2018) explained the capabilities of the AHP method to make decisions in economic problems. Roh et al. (2019) and Lee and Hwang (2010) used the AHP technique to model nuclear power plant export competitiveness in Korea. Ortiz-Barríos et al. (2019) applied a comparison with AHP to study efficiencies of food supply chain management. Mahdiloo et al. (2019) and Jabalameli and Rasoulinezhad (2012) applied the AHP technique to find out the solutions of lowering negative effects of sanctions against Iran. Ren and Ding (2019) performed an analytic hierarchy process to investigate the impacts of high-speed rail on regional economic development in China. Jurík et al. (2020) applied the AHP method to select projects related to the three dimensions of economic, social, and environmental for sustainable development.

Overall, it can be concluded from the earlier studies that the expansion of the green bond market is affected by various factors. The literature gap that will be filled in with our research is the lack of academic study gathering all factor influencing green bond market expansion and ranking them through a logical multi-dimensional method.

### 3. Methodology

To determine the importance of various factors influencing GB market development in Vietnam, we employed a multi-criteria decision making (MCDM) method called the analytic hierarchy process (AHP) method. This method, proposed by T.L. Saaty in the 1970s, is commonly used as a structured approach to analyze complex decisions. Albayrak and Erensal (2004) express that the AHP method can help researchers to solve qualitative problems that involve multiple criteria. Kwong and Bai (2002) and Russo and Camanho (2015) argue that the AHP method is a simple technique to face a multi-dimensional problem. The main reasons for selecting the AHP method in this study are the increasing complexity of the problem of green bond market expansion and the capability of AHP to define the problem in detail and rank the criteria and sub-criteria according to their importance.

To conduct the AHP method, we needed to state the main problem (GB market development in Vietnam) and determine the framework of the problem based on all actors and objectives. Mahmudova and Jabrailova (2020) and Mandić et al. (2017) expressed that construction of the AHP structure addresses all dimensions of the problem, and so we can make the best solutions in an easier way.

Next, we identified the criteria and used the hierarchy structure to design the relationship between purpose, criteria, and factors. Subsequently, pairwise comparisons were conducted to evaluate the weights of the criteria and factors. To this end, we asked ten Asian energy and economy experts to carry out the comparisons through an AHP questionnaire that was distributed to the experts during February 2020 through email. It should be noted that the number of experts in the multi-criteria dimensional model is flexible. However, Tsyganok et al. (2012) proved that the large expert group size would decrease the importance of being an expert in these models. Furthermore, many earlier studies (e.g., see Peterson et al. 1994; Al-Harbi 2001; Armacost et al. 1994; Mawapanga and Debertain 1996; Huang and Yeh 2011; Kil et al. 2016) have considered a small group of experts to conduct the AHP

method. Therefore, we decided to select only 10 experts who have advanced experience in or study green bond markets. Table 2 represents the demographic characteristics of our panel of experts.

**Table 2.** Characteristics of panel of experts.

Characteristics	Items	%
Gender	Male	70
	Female	30
Age	30–40	20
	41–50	70
	51 years +	10
Position	Financial director	20
	Senior manager	30
	Researcher/analyst	50
Education	PhD	80
	MSc/MBA	20

Source: authors’ compilation from SPSS software 10.

Next, we performed calculations to determine the maximum value of eigenvector, consistency index (CI), consistency ratio (CR), and normalized values for each criterion.

$$\lambda_{max} = \frac{1}{n} \sum_{i=1}^n \left\{ \frac{\sum_{j=1}^n a_{ij} * w_j}{w_i} \right\}$$

Here,  $\lambda_{max}$  indicates the principal eigenvector;  $n$  is the matrix size;  $a_{ij}$  denotes an element of the pairwise comparison matrix; and  $w_j$  and  $w_i$  represent the  $j$ th and  $i$ th element of values of eigenvector, respectively. As a rule, if the maximum value of eigenvector, CI, and CR are satisfactory, then the decision is made based on the normalized values; otherwise, the last procedure is conducted again until these values fall within a desired range. If  $CI > 0.1$ , we can interpret the relative weights of factors and also conduct a global ranking of factors related to the goal (Rasolinezhad 2009).

#### 4. Results and Discussion

At the first stage, we determine the objective of our decision making as green bond market expansion in Vietnam. Then, we gather several criteria and factors related to our goal from the earlier literature and ask the panel of our experts to help us finalizing the most important and relevant criteria and sub-criteria. Finally, using a brainstorm method, 4 criteria and 23 factors associated with each criterion were finalized by the group of experts, as expressed in Table 3.



**Table 3.** Network structure of our model. GB, green bond.

Objective of Decision Making	Criterion	Factors
Green bond market expansion in Vietnam	A: Financial	A1: General level of prices A2: GB interest rate A3: Official exchange rate A4: Investment risk A5: Monetary policy A6: Tax incentives A7: Financial openness
	B: Economic and Political	B1: Political stability B2: Economic stability B3: Market-based economic system B4: State support B5: Business climate B6: Balance of state budget B7: CO <sub>2</sub> emissions level
	C: Social	C1: Social support C2: Social–environmental linkage C3: Urbanization growth C4: Unemployment C5: Income inequality
	D: Infrastructural	D1: Legal framework D2: Limited application to international standard D3: Institutional infrastructure D4: International cooperation in GB

Source: authors’ compilation from expert opinions.

Next, we used the judgments of the group of experts to make pairwise comparisons to calculate the relative priority of each criterion. This would help us to find the weights of each criterion and factor related to our model’s goal. The results, expressed in Table 4, reveal that, among the four criteria, the experts emphasized the importance of financial (A) and infrastructural criteria (D), while they thought the economic and political (B) and social criteria (C) are the least influential for GB market expansion in Vietnam. The major roles of financial and infrastructural aspects have also been expressed by [Ketterer et al. \(2019\)](#) and [Climatebonds \(2015\)](#), respectively.

**Table 4.** Compare the relative importance with respect to the goal: GB market development.

Criterion	A: Financial	B: Economic and Political	C: Social	D: Infrastructural	Priorities
A: Financial		3.0	2.0	1.0	0.363
B: Economic and Political			2.0	−2.0	0.179
C: Social				−2.0	0.138
D: Infrastructural					0.320

Note: inconsistency rate is 0.03. Source: authors’ compilation from Expert Choice 10.

After pairwise comparison of the criteria, the group of experts conducted judgments to determine the importance of sub-criteria associated with each criterion (Tables 5–8). The judgments in this step help us to prioritize the importance of factors related to the criteria.

**Table 5.** Compare the relative importance with respect to financial criterion (A).

Factor	A1	A2	A3	A4	A5	A6	A7	Priorities
A1		2	1	2	2	−2	1	0.062
A2			2	2	−3	2	1	0.056
A3				3	1	1	2	0.056
A4					1	−2	−2	0.028
A5						1	2	0.063
A6							1	0.055
A7								0.043

Note: inconsistency rate is 0.01. Source: authors' compilation from Expert Choice 10.

**Table 6.** Compare the relative importance with respect to economic and political criterion (B).

Factor	B1	B2	B3	B4	B5	B6	B7	Priorities
B1		3	3	1	2	2	3	0.046
B2			2	1	−2	1	2	0.023
B3				1	1	2	1	0.021
B4					1	1	2	0.026
B5						−2	1	0.023
B6							1	0.022
B7								0.017

Note: inconsistency rate is 0.06. Source: authors' compilation from Expert Choice 10.

**Table 7.** Compare the relative importance with respect to social criterion (C).

Factor	C1	C2	C3	C4	C5	Priorities
C1		3	3	2	1	0.045
C2			−2	1	1	0.019
C3				−2	−2	0.019
C4					1	0.026
C5						0.030

Note: inconsistency rate is 0.06. Source: authors' compilation from Expert Choice 10.

**Table 8.** Compare the relative importance with respect to infrastructural criterion (D).

Factor	D1	D2	D3	D4	Priorities
D1		2	1	1	0.090
D2			−2	1	0.052
D3				3	0.119
D4					0.058

Note: inconsistency rate is 0.04. Source: authors' compilation from Expert Choice 10.

The results, represented in Table 5, show that the most important sub-criteria of financial criterion (A) based on the experts' judgments are monetary policy (A5) applied by the State Bank of Vietnam and inflation rate (A1), respectively, while investment risk (A4) has the lowest priority among these sub-criteria. The importance of monetary policy on expansion of bond market has also been declared by Nishat and Matsuda (2016). Furthermore, increasing price levels of goods and commodities as inflation rate negatively impact green bond investors. Hence, the factor of inflation rate is one of the



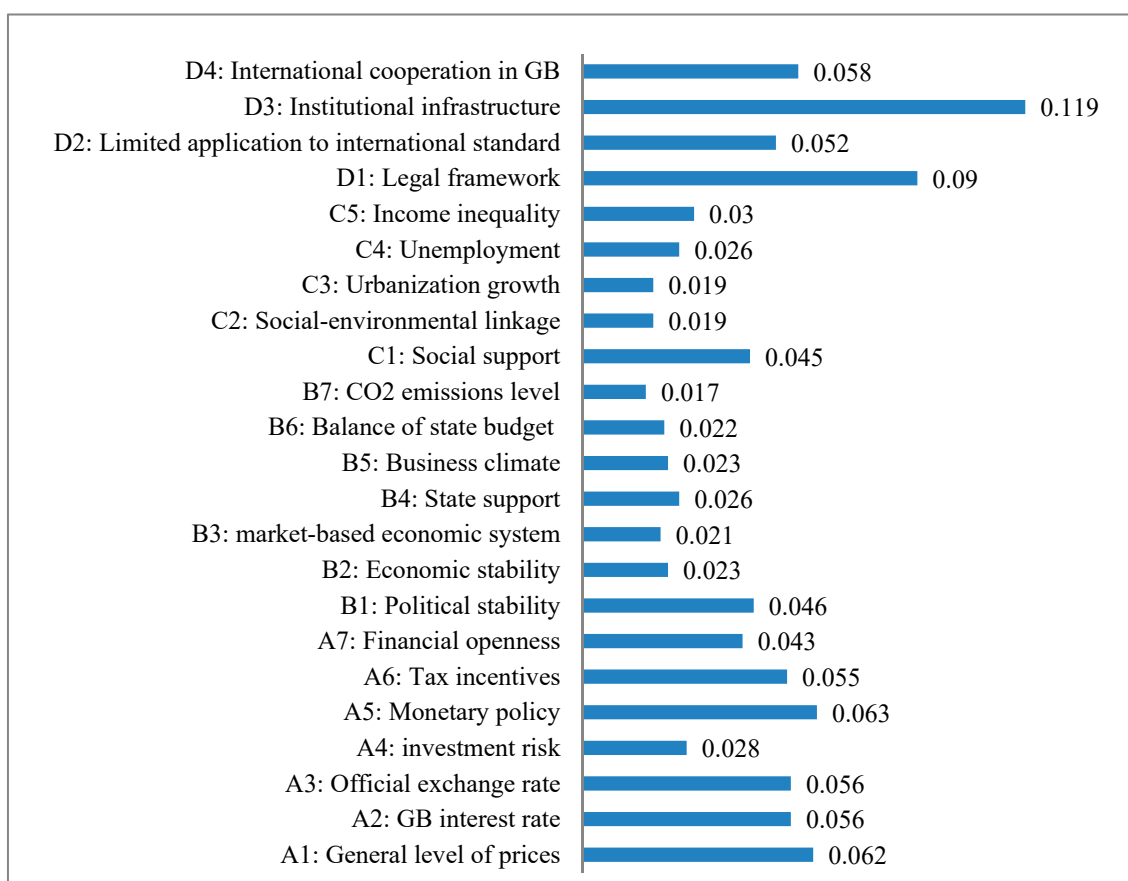
most important financial factors related to green bond market expansion (Sabov and Murphy (1999) and Macchiarelli (2014) proved the importance of the inflation rate in bond markets).

Regarding economic and politics sub-criteria (B), the pairwise comparisons show evidence of the importance of political stability (B1), whereas CO<sub>2</sub> emissions level (B7) and market-based economic system (B3) play a small role in green bond market expansion for Vietnam. The results are in line with Perry and Robertson (1998) and McGee (2007), who showed the relationship between political stability and bond markets. Moreover, our finding about the importance of CO<sub>2</sub> emissions level in the expansion of green bond market is in line with Sartzetakis (2020).

The experts’ judgments about sub-criteria of social criterion (C) reveal that social support (C1) and income inequality (C5) are more important priorities compared with social–environmental linkage (C2), urbanization growth (C3), and unemployment rate (C4) in the green bond market expansion of Vietnam.

Finally, the results, represented in Table 8, depict the high importance of institutional infrastructure (D3) and legal framework (D1), respectively. In addition, limited application to international standard (D2) with a priority of 0.052 is the least important sub-criterion among others.

In the above, the relative weights of sub-criteria associated with each criterion are achieved, and we now calculate the overall ranking of these factors with respect to the goal of the GB market expansion in Vietnam. The ranking of factors influencing the green bond market expansion in Vietnam is shown in Figure 1.



**Figure 1.** Overall weights of sub-criteria with respect to the goal. Note: consistency index is 0.01. Source: Export Choice output. GB, green bond.

As shown in Figure 1, institutional infrastructure (D3), legal framework (D1), and monetary policy (A5) of the State Bank of Vietnam are considered the three most important influential factors on Vietnam’s GB market expansion, while CO<sub>2</sub> emissions level (B7) with a weight of 0.017 and social–environmental

linkage (C2) and urbanization growth (C3) with 0.019 are the least important influencing factors for expanding the GB market expansion in Vietnam. It can be expressed that the factors included in the infrastructural criterion play the major role in developing GB market, while the social criterion is not as important compared with other criteria. This finding is in contrast with [Zhou and Cui \(2019\)](#), who emphasize the role of the social factor, while it is in line with [Voica et al. \(2015\)](#), who prove that an appropriate legal and institutional framework may shape a better atmosphere to expand green bond markets in countries by encouraging investors to have a more efficient participation.

## 5. Robustness Check

To ensure the reliability and viability of our results from the AHP technique, we follow the method of robust partial least squares (R-PLS) regression applied by [Marcarelli et al. \(2013\)](#) to re-calculate the weights of comparison matrices. Using a PLS regression estimator helps us to make priorities from pairwise comparison matrices via correlation coefficient maximizing ([Wang et al. 2007](#)).

Table 9 reports the final priorities of factors based on R-PLS regression.

**Table 9.** Robustness check (robust partial least squares (R-PLS) regression).

Rank	Factor	R-PLS Weight	Rank	Factor	R-PLS Weight
1	D3	0.639	14	C5	0.163
2	D1	0.611	15	B4	0.152
3	A5	0.419	16	A4	0.150
4	A1	0.403	17	B3	0.132
5	D4	0.382	18	B2	0.127
6	A6	0.359	19	B5	0.110
7	D2	0.329	20	B6	0.103
8	A3	0.218	21	C2	0.093
9	A2	0.210	22	C3	0.042
10	A6	0.202	23	B7	0.020
11	B1	0.193			
12	C1	0.178			
13	A7	0.172			

Source: authors' compilation from Software R.

The estimated weights by the R-PLS regression, listed in Table 8, reveal quite similar results with the AHP, indicating the robust of our results.

## 6. Conclusions and Policy Implications

The issue of green bond market expansion for Vietnam is necessary owing to the fossil-fuel intensive nature of the economy of this country and its high potential abundant sources of green energy resources. Expansion of green bond market as a useful instrument of emissions reductions has been considered by many scholars. This study was an academic attempt to determine and find priorities of factors influencing green bond (GB) market expansion in Vietnam. To this end, a multi-dimensional decision making method called analytic hierarchy process (AHP) was conducted in software Expert Decision 10. To apply the AHP, we asked ten Asian energy and economy experts to judge the importance levels of 4 criteria and 23 sub-criteria gathered based on the earlier literature review and consultation with the group of experts. The major highlights from the findings of the AHP method are as follows: (i) among the four major criteria, financial (which has been discussed by [Sun et al. \(2020\)](#) and [Mohsin et al. \(2020\)](#)) and infrastructural criteria play the most important role in

the expansion of the green bond market in Vietnam. (ii) The presence of an efficient monetary policy and a controlled inflation rate is necessary for sustainable expansion of the GB market in Vietnam. (iii) Vietnam's political stability is the most important political factor (in line with [Freeman \(1992\)](#), who argues that the reform in Vietnam was a movement to political stability that ensures the sustainable development in the country). (iv) Societal concern for the environment is not an important factor compared with financial and infrastructural criteria to expand the green bond market in Vietnam. (v) Considering all 23 influential sub-criteria revealed that the most important influencing factors among them are institutional infrastructure and the legal framework for GB operations, the monetary policies of the State Bank of Vietnam, and the general level of prices of goods and services. In other words, financial and infrastructural factors are more important to the growth and expansion of the current Vietnamese GB market than economic-political or social criteria.

Regarding policy, improving financial issues related to the green bond market is recommended. Despite several issued policies related to the green bond market in Vietnam, such as National Power Development Plan (2011), Vietnam Renewable Energy Development Strategy 2050 (2016), and Revised National Power Development Plan 7 (2016), the market needs more relevant regulations to support local and foreign private sectors who can play a big role in developing the green bond market in this country. Ensuring protection for investors in green bond markets, financial transparency, and regulating prices in different markets are highlighted policies in this field. [Bessembinder et al. \(2006\)](#); [Bessembinder and Maxwell \(2008\)](#); and [Schultz \(2012\)](#) show that transparency has a remarkable impact on investors' performances in bond markets. Moreover, according to [Taghizadeh-Hesary and Yoshino \(2020\)](#) and [Pham and Huynh \(2020\)](#), an insufficient rate of return and the existence of several risks are two major challenges for financing green projects. Moreover, lowering different risks such as legal risk, default risk, liquidity risk, inflation risk, political risk, interest rate risk, and investment risk should be considered by the state to create an appropriate climate for private investors. The uni-directional relationship of different risks and the efficiency of bond markets has been discussed by many scholars such as [Helberg and Lindset \(2016\)](#); [Duyvesteyn et al. \(2016\)](#); [Febi et al. \(2018\)](#); [Fendel and Neumann \(2019\)](#); and [Reboredo and Ugolini \(2019\)](#). In addition, there is a potential threat to the growth of green projects owing to the current oil price reduction in the base of the Russia–Saudi Arabia oil war and the Coronavirus outbreak. Currently, owing to low oil prices, the competitiveness of green energy projects compared with fossil fuel projects is reduced, which would endanger their growth post-Covid-19. Hence, wider state support for the green energy projects would be required in the near future.

In fact, considering the need for green financing, public investment will be not sufficient to finance low-carbon projects. A significant contribution from private financial sources (e.g., [Taghizadeh-Hesary and Yoshino 2019](#)) is needed in Vietnam and other emerging economies. Green bond market integrity, enhancing green infrastructure, and improving risk–return profiles are two vital GB expansion policies in emerging nations such as Vietnam.

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