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RESEARCH ARTICLE

Scaling up private investment in low-carbon energy systems through regional cooperation: Effective trade policy measures

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Abstract: How to ensure energy supply and reduce environment pollution have turned into governments' top priorities and key factors to maintain sustainable development. In this context, two major trade and investment agreements that could lead to profound influence on low-carbon energy systems development around the Asia-Pacific region are the Regional comprehensive economic partnership (RCEP) consisted of the Association of Southeast Asian Nations (ASEAN) plus Australia, China, India, Japan, New Zealand, and Republic of Korea and the Belt and road initiative (BRI) initiated by China. In order to have a smooth transition to low-carbon energy systems in Asia, besides RCEP and BRI, it is imperative to boost private sector investment. Success of encouraging private sector investment depends on appropriate government policies towards promoting innovations and reducing financial risks to private investors. The research questions that are examined in this study are: What type of policy measures affects trade in low-carbon transition, particularly renewable energy (RE) transition? How can investment signals and incentives be reframed to scale up private finance in RE? The objective is to investigate and to provide several feasible trade policy and investment policy tools for both national and regional markets that governments could adopt to accelerate the speed of private financing of the low-carbon energy industry, particularly the RE industry.

Keywords: private investment, low-carbon energy, regional cooperation, trade policy

1 Introduction

Recent decade witnessed the fact that the Asia-Pacific countries, especially the emerging economies in East, South and South East Asia have proven to be the new engine of global economic growth. According to the Asian Development Outlook 2017,[1] Asia-Pacific now accounts for 60 per cent of the world's economic growth. Along with this significant economic achievement, issues concerning energy security, trade-environment nexus, and environment-growth nexus have become increasingly crucial in policy making both at the public and private sectors. Now, how to ensure energy supply and reduce environment pollution have turned into governments' top priorities and key factors to maintain sustainable development.

Although it is unanimously accepted in the COP21 meeting in Paris that energy efficiency and renewable energy are explicit, and probably the only, solution to tackle the issues concerning energy, environment, and economic growth, only few countries are aware of the role that international and regional cooperation in trade and investment can play in increasing the pace of transition to low-carbon energy systems. In this, the launching of the Intended Nationally Determined Contributions, which is now ratified as NDCs, is the first international agreement that enhances the collaboration on controlling global climate change between developing and developed countries. However, as NDCs lacks enough binding force as well as the U.S. is threatening to withdraw from the Paris Agreement, it indicates that it may be still too early and immature to reach an effective and worldwide recognized protocol. In this case, seeking a deeper and stronger cooperation within the local region is a more practical way to solve the current dilemma.

In fact, two major trade and investment regional agreements that could lead to profound influence on low-carbon energy systems development are now in prearrangement and/or at the negotiation stage around the Asia-Pacific region. One is the Regional Comprehensive Economic Partnership, which is proposed by the ASEAN 10 countries plus Australia, China, India, Japan, South

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Korea and New Zealand in 2012. A very broad trade deal is expected from RCEP, however, currently it does not put forward any specific target or issue that is related to low-carbon energy systems in negotiation. Unlike the former one, the second is China's national premier development strategy, the Belt and Road Initiative (BRI), which clearly regards developing 'low-carbon and green energy technology' as one of the goals. Nevertheless, in order to have a smooth transition to low-carbon energy systems in Asia, it is imperative to scale up private sector investment, which depends on appropriate government policies towards promoting innovations and reducing financial risks to private investors. The multilateral financial institutions like the Asian Development Bank need to play the middleman role between the national governments and the private sector effectively through feasible policy framework.

Under this macroeconomic scenario, this study aims to analyze the possibility and challenges in encouraging private sector investment in low-carbon energy systems in Asia, particularly in the RCEP region, and to suggest an effective policy framework that governments could apply to properly improve the development and dissemination of low-carbon energy (LCE) goods and technologies. The three main sources of low-carbon energy are renewables (RE), improving energy efficiency (EE) that includes cleaner coal technology (CE), and nuclear. However, the latter source of LCE is controversial in many countries. Hence, renewable energy (RE), energy efficiency (EE), and cleaner coal technology (CCT) have become the main sources of LCE. Given the current status of growth, renewable energy (RE) is the central focus of this study.

The cleaner coal technology, which reduces the emission and increases the amount of energy gained per tonne of coal, seems to be the energy source of choice in the Asia Pacific region in recent times. The *Global Trends in Renewable Energy Investment 2018* report by the UN Environment-Bloomberg New Energy Finance revealed that more CE generation was added in 2017 than conventional fossil fuels. Nevertheless, the report also pointed out that the world spent more money adding solar, wind and other renewable sources than it did adding coal, natural gas or nuclear plants. To be specific, global investment in renewable energy edged up 2% in 2017 to $279.8 billion, taking cumulative investment since 2004 to $2.9 trillion. The latest rise in capital outlays took place in a context of further falls in the costs of wind and solar that made it possible to buy megawatts of equipment more cheaply than ever before (Figure 1-4). It is worth noting that the renewable energy (RE) based power generation is being promoted vigorously in many RCEP countries after the COP21 commitments. The leading locations by far for renewable energy investment in 2018 were China, which accounted for $100.1 billion, and followed by Japan ($27.1 billion), and India ($11.1 billion). India has overtaken the European Union with its renewable capacity expecting to more than double by 2022.[2]

Drawing on the investment climate with respect to the RE sector, it may be noted that the clean energy share prices rose in 2017, by about 28% on the WilderHill New Energy Global Innovation Index, or NEX. However, this has so far not produced a jump in equity issues by specialist companies. Instead, public markets investment in RE dipped 6% to $5.7 billion, a five-year low. Venture capital and private equity (VC/PE) investment was also weak, fading 33% to $1.8 billion. The characteristics of the above financial markets along with the record high of $87.2 billion for asset acquisitions and refinancing in 2017 need an interpretation.[3] It can be argued that RE has become a mature sector increasingly dominated by big industrial players, utilities and institutional investors. One uncertainty ahead for RE is how investors will behave in the coming periods, in which project revenues have no government price support. Hence, private sector power purchases agreements or even just merchant power prices will be crucial for the development of the RE sector. This necessitates unconditional support not only from the governments, but also from the private sector to sustain technological research and development in innovating and disseminating the RE systems around the world. The usual ways the private sector would enter into the RE systems markets are through investment and trade.

There are very few studies exploring the effect of RE goods and services trade on the environment and no study comparing this effect between RE exports and imports. While RE imports are supposed to benefit the environment of the importing countries through the use of environmentally-friendly use of these goods, it is crucial to explore the impact of RE exports on the exporting countries' environments. In the case of exports of RE goods, the impact on the environment of the exporting countries operates both in the production stage and in the final environmental goods consumption stage. In this context, the important question is about the necessity of increasing RE trade in general and RE exports in particular; because, in the case where there is no impact of RE trade on the environment, there is no reason for countries to concentrate on facilitating free trade in RE through trade agreements, such as the RCEP.

The research questions that are examined in this study are: What type of policy measures affects trade in low-carbon transition, particularly RE transition? How can

investment signals and incentives be reframed to scale up private finance in RE? The objective is to investigate and to provide several feasible trade policy and investment policy tools for both national and regional markets that governments could adopt to accelerate the speed of private financing of the low-carbon energy industry, particularly the RE industry.

The following section discusses what the important factors that determine private investment in the RE sector are. The third section describes some of the market based trade policy measures used by the emerging economies in Asia to boost private sector investment and trade in RE systems. A critical evaluation of some of the policies is done with case studies in the next section. Policy suggestions to increase private sector investment in RE production are made in the final section.

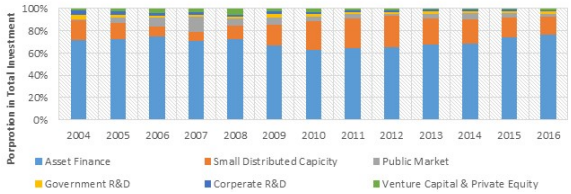

Figure 1. Sources of new investment in renewable energy, 2004-2016

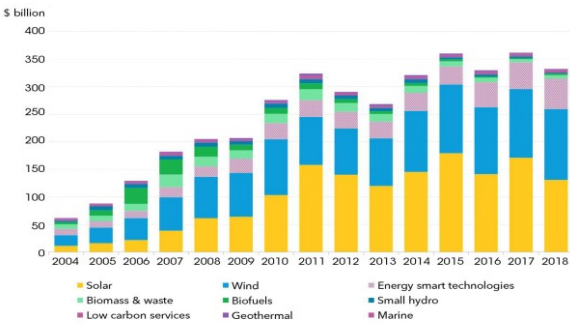

Figure 2. Type of global new investment in clean energy, 2004-2018

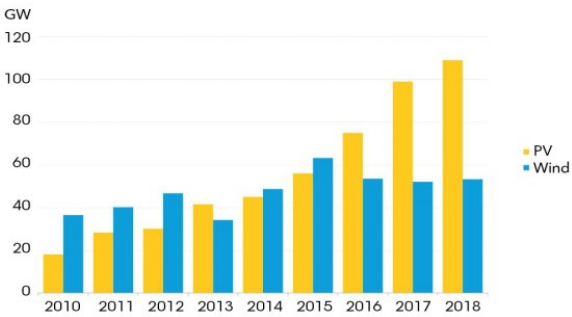

Figure 3. The growth of wind and solar PV, 2010-2018

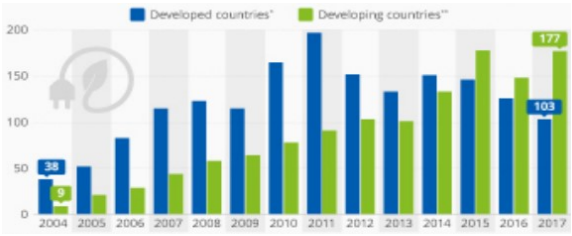

Figure 4. Investment in renewable energy by developing and developed countries

2 Determinants of private investment in the production of RE goods and technologies

The two core methods of financing of any businesses are borrowing from any banks as a loan, and/or through approaching equity capital, which are of many different categories, such as venture capital, private equity, and public market. Also, it is possible for companies to raise funds through 'balance sheet' from the company's own corporate funds as part of their corporate strategy. Such companies draw on monies raised from the financial markets through bond issuance or general corporate bank facilities that are available to the business as a whole, or following the sale of other parts of the business. Often a company will choose whether to use project finance or corporate facilities depending on which offers the cheaper source of funding to the project so that profit from the project is enhanced.[4]

Profit (π) is the difference between total revenue (R) and total cost (C). In functional form, (π) can be written as

$$\pi = f(P, Q, C) \tag{1}$$

Where, P = Price of the output (Q) which is mainly determined in the competitive market; and C = Total cost that includes input cost, operational cost and hidden cost, such as the difference between the government's announced business licence costs and the actual cost to the businesses.

The theory of profits emphasises that profit will be larger in a country where investors can operate their businesses at a lower cost. This implies that the variables that determine profit can equivalently determine the inflow of investment in any country. Therefore, the investment function in the reduced form is as follows:

$$I = f(P, Q, C) \tag{2}$$

The above version of the theoretical I function can be transformed into an empirical I function applying the arguments developed in the theory of profits. Drawing on the theory of profits, it is logical to argue that businesses will prefer to invest in countries where they can produce

large amount of production at a lower cost and therefore, the size of the economy, is an important factor for making investment decisions. Further, UNCTAD (2000) argued that investors who mainly make Greenfield investment in foreign countries preferred to invest in countries with large domestic market. It is rational to expect that not all market seeking foreign investors will invest in foreign countries fully to serve the host economies and some would also be keen to export their products to other countries as well besides serving the host economy. This means that a country with small domestic market, but with open trade regime can also provide scale economies similar to the countries with large domestic market, to foreign investors.

Even projects with considerable expected returns in developing countries could not receive financial support because of their perceived high risks and limited liquidity of financial flows[5] The risks are perceived due to many factors. In this context, Srivastava and Venugopal (2012) have classified the risks into two categories: political and macroeconomic risks, and low carbon market risks. Though it is possible to some extent to include political and macroeconomic risks in empirical analyses, it is difficult to include low carbon market risks because of lack of full information. Thus, reducing, if not eliminating the low carbon market risks plays the crucial role in determining private financing in RE goods and technologies. Here, governments need to make full use of the power of the market, or at least change the preference of the markets, both domestically and internationally, from fossil energy to low-carbon energy. Governments could implement a series of policies to boost the market confidence in developing and producing the RE goods and technologies. However, sometimes it is not as satisfactory as expected, because the selected policy approaches may not be appropriate to exert significant impact on the supply side and the demand side of the RE market. Hence, it is imperative to gauge the effectiveness of such policies on improving market confidence in financing the production of the RE goods and technologies.

3 Scaling up private investment in the RE market: Market based trade policy measures

Different countries have been using different policy measures, such as feed-in tariffs, renewable certificates and public tenders to encourage private financing in the production and the distribution of the RE goods and technologies. By way of boosting the renewable energy sector investment, India, which is a major emerging economy in Asia, has put in place many progressive policies, at the federal and state levels. Federal policy support has been in the form of accelerated depreciation, generation-based incentives and viability gap funding. The state-level policy support has typically been in the form of feed-in tariffs, net metering, and tax/duty exemptions influencing the supply side of the RE market. In China, export tax rebate system is used as an effective tool to guide the market growth. Export tax rebate (ETR), also known as the Value-Added Tax rebate, is an important policy tool to promote exports by influencing the supply side of the market, which is allowed by WTO as long as the rebate rate is not larger than the domestic value-added tax rate. The ETR system is firstly introduced in 1985 in China, and the rebate rates for different goods vary from 5 per cent to 17 per cent. Chinese government regards ETR not only as an international trade policy, but also as a powerful tool to regulate the direction of the market development since export is highly relevant to domestic production activities too. A few researchers have attempted to assess the impact of ETR on the value of exports, and all of them found a significant positive causality relationship at the country level.

Besides carbon tax and emissions trading scheme, in the international trade arena, tariff and non-tariff measures are important policy instruments used by countries to influence the demand side and the supply side of the market for RE goods and technologies in the importing countries and exporting countries respectively, which bear implications for investment in both the exporting and importing countries. It is argued that the monetary value of the non-tariff measures (NTM) exceeds that of the tariffs in many cases. Among the NTMs, in 2014, technical measures were most frequently applied on RE goods exports of RCEP member countries. This necessitates that there is an urgent need to have 'regulatory convergence' concerning non-tariff measures across countries. The present study uses the definition of the United Nations Conference on Trade and Development (UNCTAD) (2012): 'Non-tariff measures are policy measures other than ordinary customs tariffs that can potentially have an economic effect on international trade in goods, changing quantities traded, or prices'. UNCTAD (2012) also points out that 'though many NTMs aim primarily at protecting public health or the environment, they also substantially affect trade through information, compliance and procedural costs'. NTMs data are downloaded from UNCTAD, which is made publicly available through TRAINS.

A regional cooperation agreement such as the RCEP is another powerful instrument to influence the supply side and demand side of the RE markets nationally and re-

gionally. Building low-carbon innovation systems is intrinsically linked with capacity building and technological cooperation. Further, building low-carbon innovation systems is both resource-intensive and long term, which becomes feasible through the regional cooperation agreements. Thus, governments' financial support is required to complement and assist private sector innovation. Governments' financial support can be strengthened further by permanently phasing out fossil fuel subsidies and all subsidies for price-competitive mature technologies. Some RCEP countries have adopted this approach in recent times, though not consistently. Also, governments of few RCEP member countries have targeted their policies towards establishing tax regimes and investment protections for RE investment; encouraging local banks to become involved; developing green bonds linked to RE investment; and supporting RE infrastructure for adaption purposes too. For example, Australia is one of the few RCEP countries with a national green investment bank. Since 2012, the Clean Energy Finance Corporation (CEFC), an independent statutory authority, has financed projects related to renewable energy and energy efficiency. The government credited the CEFC with AUD 2 billion a year from 2013 to 2017.[6] As of June 2018, the CEFC had committed AUD 5.3 billion to projects with a total value of AUD 19 billion (1% of 2018 GDP). Through regional cooperation technology transfer agreements embedded in the RCEP and BRI, China's potential to deploy its solar energy innovation has been exploited by a few member countries in the region.

The following section discusses through case studies how effective are the above discussed market based trade policy measures in influencing the demand and supply sides of the RE markets in the RCEP member countries.

4 Critical evaluation of market based trade policy measures: Empirical analyses

To estimate the effectiveness of ETR on China's RE goods exports, a Stochastic Frontier Gravity model was applied. A panel data for China's RE goods exports to other RCEP countries[Due to the availability of the consistent data from 2006 to 2017 only 11 trading RCEP partners of China were included in the empirical analysis.] from 2006 to 2014 was used as the dependent variable in the gravity frontier model (See the Appendix for data sources). Specifically, because of the data limitation, a simple average ETR rate was used as the renewable energy goods' ETR rate. A positive coefficient of ETR variable is expected. The stochastic frontier gravity equation is written as follows:

Table 1. The Impact of Export Tax Rebate on RE Exports of China

Variables	Coefficient estimates
Constant	9.8765***
	-3.2216
LnGDP	1.0086***
	-0.2276
LnPop	0.2115**
	-0.1003
LnDist	-0.4782**
	-0.2245
LnEx	0.2418
	-0.2159
LnTariff	-12.6531**
	-0.6245
LnETR	0.9356**
	-0.4583
Mu	1.8679**
	-0.9256
Eta	0.4536**
	-0.2252
Gamma	0.8265***
	-0.2457

Notes:
** significant at the 5 percent level; *** significant at the 1 percent level
Source: Authors' estimation

$$\begin{aligned} Lntv_{i,t} =& \beta_0 + \beta_1 \ln \mathrm{GDP}_{i,t} + \beta_2 Ln\mathrm{Pop}_{i,t} + \\ & \beta_3 Ln\mathrm{Dist}_{i,t} + \beta_4 Ln\mathrm{Ex}_{i,t} + \beta_5 Ln \text{ Tariff }_{i,t} + \\ & \beta_6 Ln\mathrm{ETR}_{i,t} - u_{i,t} + \varepsilon_{i,t} \end{aligned} \tag{3}$$

Where lntv is the logarithm of the value of exports of RE goods lngdp is the real GDP of the RCEP importer countries; lnpop is the population of RCEP importer countries; lndist is the distance between exporter and importer countries; Ex represents the relative exchange rate, direct quotation and $lnex = ln(1 + ex)$; similarly, $lntar = ln(1+tariff)$, which is a market demand side factor; and $lnetr = ln(1 + export\ tax\ rebate\ rate)$, which is a market supply side factor. $u_{i,t}$ is the negative influence of non-tariff barriers, which are not fully known to the researchers. It is proxied by as a truncated normal variable with mean μ and a constant variance ${\sigma_u}^2$. $\varepsilon_{i,t}$ is the 'statistical' error term following the normal distribution with mean 0 and variance ${\sigma_v}^2$. The software FRONTIER 4.1 was used to estimate the stochastic frontier gravity equation and the estimation results are presented in Table 1.

It is worth noting that the coefficient of ETR rate in Ta-

ble 1 is significant at the 5 per cent level, which implies that ETR has influenced China's RE exports in a positive way. Export of REs would increase by 1.3% for a 1% increase in ETR. The coefficient of tariff of the importing countries is negative and is significant at the 5 per cent level. Generally, changes in tariff always come with the implementation of trade agreements inducing trade policy changes, which means that tariff rate is a strong indicator of governments' preferences. A lower tariff rate of RE goods reveals a stronger support by the importing country's trade policy, which directly encourages and stimulates the production and consumption of RE goods in the exporting and the importing countries respectively. The coefficient of γ, which is the ratio of the observation specific variance to the total variance, indicates the influence of non-tariff measures on the exports. The coefficient of γ is significant at the 1 per cent level and strongly confirms the influence of non-tariff barriers on the exports. Hence, the empirical results suggest that ETR can be used as a powerful instrument to promote investment in RE market. Also, the results indicate that regional cooperation agreements could be used effectively to eliminate tariff and non-tariff barriers applied on RE goods exports.

Then, a challenging question is as to why some countries promote RE trade liberalization by reducing tariff and non-tariff barriers, whereas others prefer protection. Identifying the root cause of this issue would certainly contribute to the progress of reducing RE trade barriers, and scaling up private investment in RE goods and technologies. An attempt has been made in this study to explain the reasons for the variation in countries' RE trade protection preferences. Political scientists have argued that the pressure for protectionism is generated not from the point of view of the interests of the nation as a whole, but from domestic interests adversely affected by the reduction of tariff and non-tariff barriers. Studies in this field indicate that group interests and domestic political institutions help explain trade policy outcomes. Even though a large literature in political science has been devoted to examining countries' protection preferences, the results of empirical studies vary, and there is no study using domestic politics explicitly to explain variation in trade barriers on RE goods and technologies.

Drawing on the society-centred approaches, the variation in RE liberalization trade preferences among countries can be explained by the different outcomes of domestic political competitions during trade policy making processes among interest groups. The groups who benefit from trade liberalization would lobby for low trade barriers, while the groups who are adversely affected by it would lobby for high trade barriers. The study focuses on examining the assumption of the society-centred approaches that the broader interest the governments represent, the more they liberalize trade. To be more precise, countries with proportional electoral systems and characterized by more democracy are associated with lower RE trade barriers. The environmental concerns will be added into the models to capture the environmental interest with the assumption that the more people prefer to protect the environment, the more they support RE free trade, and their trade preference is a combination of economic and environmental concern. Environmental performance is used to be a proxy of environmental interest/concerns. Countries with better environmental performance are likely to have better awareness of and more attention to environmental protection.

Further, even though society-centred approaches do not explicitly discuss corruption and regulatory quality, these two variables are usually included in the empirical models to control for political institutional quality. It is likely that corruption seems to increase the possibility for group interests to be dominated in domestic politics, while the better regulatory quality facilitates the likelihood of the national interest to be represented by politicians. Therefore, this study also includes these two variables to examine how they affect tariffs and non-tariff measures (NTMs) on RE goods and technologies.

Drawing on Ehrlich (2007), the following empirical model was estimated:

$$\begin{aligned}\text{Tarrifs}_{ik(t+1)} = {} & \alpha + \beta_1 \text{Democracy}_{it} + \beta_2 \text{Corruption}_{it} + \\ & \beta_3 \text{Regulatory\_quality}_{it} + \beta_4 \text{Environmental\_performance}_{it} \\ & + \beta_5 \text{Electional\_system}_{it} + \beta_6 \text{Political\_party}_{it} + \\ & \beta_7 Ln(Import_{ijkt}/GDP_{it}) + \beta_8 Ln\text{GDP}_{it} + \\ & \beta_9 \text{Exchange\_rate}_{it} + \beta_{10} Ln(\text{Agriculral\_value\_added}_{it}) + \\ & \beta_{11} Ln(\text{Manufacturing\_value\_added}_{it}) + \\ & \beta_{12} \text{ASEAN\_membership}_{it} + e_{it}\end{aligned} \tag{4}$$

where Ln is natural log, i and j are country i and j, k is environmental good at HS 6-digits, t refers to year t.

Similar to tariffs models, in the NTMs models, NTMs are on the left-hand side of the equation. They refer to NTMs applied on RE good k at HS-6 digits of the importing country i at time t+1. Following UNCTAD (2012), NTMs are grouped into 3 subgroups: technical measures, non-technical measures, and export-related measures. Different from the case of tariffs, the dataset for NTMs models is cross sectional as there are only data on NTMs in one year, either for 2015 or for 2016.

Based on the Hausman test results, the fixed effect model was chosen for tariffs and the cross section model with heteroscedasticity corrected estimation was chosen

Table 2. Determinants of Tariffs and Non-tariffs Measures on RE Exports

VARIABLES	Tariffs	Non-tariffs measures		
		TM	NTM	NTM_P
Democracy	-0.0125***	-0.0559***	-0.0581***	-0.0476***
	-0.00171	-0.00778	-0.00466	-0.00392
Corruption	0.00812***	0.0275***	0.0201***	0.0165***
	-0.000528	-0.00184	-0.000760	-0.000850
Regulatory quality	-0.0172***	-0.0383***	-0.0208***	0.000699
	-0.000738	-0.00286	-0.00120	-0.000899
Environmental performance	-0.00233***	-0.0138**	-0.0261***	-0.0184***
	-0.000305	-0.00613	-0.00356	-0.00336
Electoral system	-0.107***	1.009***	0.384***	0.368***
	-0.00758	-0.0847	-0.0248	-0.0306
Log of EGs imports/GDP	-0.00137	0.0408***	-0.00430	0.0199***
	-0.00110	-0.0118	-0.00339	-0.00468
Log of GDP	0.178***	1.888***	0.0799***	0.257***
	-0.0379	-0.0311	-0.0101	-0.0111
Exchange rate	-3.25E-06	-0.000198***	-9.28e-06**	-3.77e-05***
	-4.70E-06	-7.46E-06	-3.60E-06	-3.06E-06
Log of Agricultural value added/GDP	0.206***	0.176***	-0.263***	0.105***
	-0.0179	-0.0426	-0.0266	-0.0246
Log of Manufacturing value added/GDP	-0.0317	-3.265***	-0.390***	-0.856***
	-0.0566	-0.0871	-0.0372	-0.0494
ASEAN membership	-	0.363***	-0.309***	0.452***
		-0.0885	-0.0418	-0.0671
Developed countries	-	0.19	0.152***	0.221***
		-0.131	-0.0536	-0.0583
Constant	-3.015***	-36.39***	1.810***	-3.339***
	-1.007	-0.725	-0.363	-0.333
Year dummy	Yes	No	No	No
R-squared	0.571	0.483	0.530	0.543

Notes: (Source: Authors' estimation)
** significant at the 5 per cent level; *** significant at the 1 per cent level

for the non-tariff measures. The results are presented in Table 2. The coefficient of democracy is statistically significant and negative in all cases, which suggests that the more democratic countries seem to apply lower tariffs and fewer NTMs on RE goods. This relieves the worry raised by Kono (2006) that democracies may reduce transparent trade barriers, but replace them with less transparent NTMs. As the results suggested, democratic countries have both lower tariffs and NTMs than non-democratic countries. Even though this does not necessarily mean that democratic countries do not substitute tariffs by NTMs, but at least both of their tariffs and NTMs are lower than the non-democratic countries.

When corruption increases, both tariffs and NTMs tend to increase. This is expected as corruption tends to make politicians more receptive to protectionist pressures of interest groups rather than representing society's interest as a whole. In other words, corruption may facilitate the process for narrow interest for protection of some industries or producers to be reflected in trade policy outcomes. In contrast, an increase in regulatory quality is associated with a decrease in tariffs and technical measures and non-technical measures. This effect is expected as the better the regulatory quality is, the more likely those governments reflect the interest of mass public that prefers free trade.

The sign of the variable environmental performance is as expected in both tariffs and NTMs models. Countries with better environmental performance have lower tariffs and fewer numbers of NTMs on RE imports. It suggests

that environmental interest is reflected in trade policies of these countries; thus, they would lower trade barriers to promote RE imports and consumption. This result implies that, in order to enhance RE free trade, there is a need to enhance individuals' environmental preference and voices of environmental groups. As a result, the environmental preference can be reflected in trade policy outcomes.

In terms of export-related NTMs, there are a variety of reasons for governments to apply these measures, for instance: supply shortage in domestic market, regulating prices, avoiding antidumping and political issues. It is hard to know exactly what induces governments to increase or decrease export-related NTMs. However, the following conjectures can be made, which need further investigation: the governments inclined more towards socialism would have fewer export-related measures, which may come from those governments aim to promote RE exports in order to create more jobs. On the other hand, more export-related NTMs of countries inclined more towards capitalism might be a result of their interest in increasing the RE supply in domestic markets.

The results further show that when countries are more dependent on the RE international market, they are likely to apply more non-technical measures and export-related measures on RE goods and technologies. These results are consistent with the results of Saksena and Anderson's (2008) and Treflers (1993), who argued that high level of imports would cause protection. In addition, the bigger the economy is, the higher the tariffs and the more technical measures, non-technical measures and export-related measures it has. This indicates that big countries use their economic power to increase trade barriers as they face less threat of tit for tat actions from their partner countries. This result conforms to the arguments of Mansfield and Busch (1995) and Scaperlanda (1973). In the case of export-related measures, larger countries may use higher export-related measures to increase domestic supply and the use of RE.

Interestingly, the variable 'developed countries' shows that these countries are associated with a greater number of non-technical measures and export-related measures. The results indicate that if both importer and exporter countries are ASEAN members, non-technical measures on RE are lower, but technical measures and export-related measures are higher than the non-ASEAN members.

5 Conclusions and Policy Suggestions

Given the constraints on government budgets in many RCEP member countries and the large capital outlay required to achieve the renewable energy targets agreed at the COP21 meeting, both public and private capital needs to be mobilized in the long run. Many governments have adopted conventional measures, such as feed-in-tariff, renewable certificates, carbon tax, emissions trading scheme, and public tenders, and some have used less conventional financial instruments, such as credit and risk guarantees, innovative currency hedging facilities, and government green bonds to encourage private financing in the production and the distribution of the RE goods and technologies. Though the above conventional and less conventional financial instruments are used at the national level, only a few countries are aware of the role that international and regional cooperation agreements, such as RCEP and BRI can play in increasing the pace of transition to renewable energy systems.

The basic principle underlying any business investment is profit maximization. However, market demand and supply conditions determine how sustainable the profitable returns would be over a period of time. In other words, the perception of market risk plays a crucial role in scaling up investment in RE. The evidence based research asserts that trade and investment are the two important pillars of any regional cooperation agreements. Hence, scaling up private investment in RE sector through regional cooperation agreements should be effective by facilitating smooth functioning of trade and investment in RE to eliminate the market risk. It is in this context, the present study has gauged the influence of the market based trade policy measures - export tax rebate, tariff and non-tariff measures, and the regional cooperation agreements on both the national and regional RE markets in the RCEP region. Policy suggestions are made about what the governments could do to strengthen the positive influence of those market based trade policies to accelerate the speed of private financing of the low-carbon energy industry, particularly the RE industry.

The empirical results of this study suggest a few policy prescriptions to scale up private financing in the RE sector. No doubts, reduction in corruption and enhancement of democracy and regulatory quality would help improving the demand side of the RE market towards reducing trade barriers on RE goods and technologies. There is a need to enhance individuals' environmental concerns and voices of environmental groups so that this interest can be reflected in trade policies and contribute to tariffs and NTMs reduction.

Governments should continuously support R&D investment that improves power generation and its forecasting ability. Due to the lack of accurate forecasting ability, currently the renewable power supply curve

could not match the demand curve especially during the peak period in many countries, which contributes to investors' aversion to renewable energy. An alternative solution for this issue is to facilitate energy storage technology, which could smooth and RE investment. Unfortunately, even China only accounts for 6 per cent of world investment in energy storage program.

Fiscal risk may emerge in the public-private partnership due to a country's weak legal and institutional frameworks, which can be mitigated through regional knowledge and institutional-infrastructure sharing facilitated through regional cooperation agreements. Drawing on Mustapha *et al*.,[7–13] innovations in RE generation in the form of 'hybrid' projects can be disseminated across countries through regional cooperation agreements too. Finally, IRENA (2017)[2] argued that the power generation cost of solar PV and onshore wind have already been lower than traditional fossil energy sources. However, the transformation from fossil energy to renewable energy is still under a slow paced process. It appears like that people still prefer electricity or gas water heater rather than solar water heater. Therefore, other than price, governments need to work on ways to educate and to create appropriate incentives to induce consumers to change their consumption patterns.

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