How home and host country industrial policies affect investment location choice?
The case of Chinese investments in the EU solar and wind sectors

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Abstract

The paper explores the influences played by renewable energy sources (RES)' supportive measures of EU member states and by asymmetries between European and Chinese incentive policies on location choice of Chinese investments in the EU. In the last decade, while EU countries relied on demand-oriented policies in the RES, aiming at promoting their utilization as sources for the generation of electricity, China has been directly promoting supply-side interventions to support the domestic production of components for renewable energy (Xu, Su, 2016). Such asymmetries have already caused tensions in the world market for renewables' equipment and huge concern in Europe for the potential impact on booming flows of Chinese investments (Curran et al., 2017).

We advance the literature on determinants of Chinese investments abroad, by including relevant variables related to industrial selective policies of RES in home and host countries. We use a firm-level database from the Ministry of Commerce (MofCom) and provide a map of Chinese greenfield and non-greenfield investments in Europe in PV and wind sectors (Criscuolo et al., 2014; Zhang and Gallagher, 2016). We perform a six fixed-effects logit analysis, linking the features of Chinese photovoltaic (PV) and wind investments in EU to the supporting policies, as well as to institutional factors and endowments of resources in home and host countries.

Our paper confirms the findings of previous studies as far as institutional factors and country endowments impact on location choice. For selective policies we got interesting outcomes. For host EU countries, we found that they have acted as catalyst for Chinese investments in Europe in search for market opportunities. For home provinces in China, we find that generous production subsidies have discouraged Chinese investments abroad. The expected increase of the domestic utilization may help to explain such kind of outlets.

Keywords: Chinese investments, Solar and Wind industry, home country; host country; industrial policy; location choice

I. Introduction

The paper is focused on investment location choice of international firms. It analyses the role played on location choice by asymmetries of home and host countries selective policies. In particular, we focus on Chinese investments in Europe in the renewable energy sources (RES) industries, namely photovoltaic (PV) and wind sectors, and study the impact of EU supportive policies in terms of attractiveness of EU countries. At the same time, we investigate the impact that asymmetries of policies might have had on Chinese investment decisions in the last decade: while EU countries relied on demand-oriented measures in the RES, aiming at promoting their utilization as sources for the generation of electricity, China has been promoting supply-side interventions to stimulate domestic production of components for renewable energy (Xu, Su, 2016) as a device for traditional industrial policy.

Because of such a trade off, trade tensions arose in the past in the world solar industry (Haley and Schuler, 2011; Kolk and Curran, 2017; Lewis, 2014); incentives also impacted on RE global value chains and on location choice of multinational firms (Tan et al., 2013). We argue that also outward foreign direct investment (OFDI) from China to Europe might have been influenced by RES policies.

The interest for China and Europe is quite obvious. In the last decade, China became the world largest investor in clean energy sources (Eyraud & Clements, 2012; Buckely & Nicholas, 2017) and made huge technological and industrial progress in the field. Its image has changed "from that of a laggard on the environment, to a position of leadership in many instances" (China Greentech Report, 2011, p. 13; Cao and Groba, 2013). Stimulus packages for production of RES equipment drove this change. In parallel, also active investment strategies of Chinese firms abroad (Scissors, 2013) were promoted, within the *Go Global* policy of the Chinese government (Bellabona & Spigarelli, 2007).

Europe has pushed the shift towards a low carbon economy society leveraging on consumption-oriented policies. Several EU countries have developed world-class companies, with top level technology, competencies, know-how in the green tech sectors. Recently, Chinese firms have started to search in Europe for investment opportunities: European countries have become preferential target destinations for Chinese investors in the green industries (Hanemann, Huotari, 2012) in search for markets where to upgrade and reposition their activities (Clegg, Voss, 2011).

The paper is structured as follows. In the first part, we depict the theoretical background of our study. We describe host country policy specificity, by looking in detail at European countries development of RE and incentives provided by the respective government.

In the second part, we use a unique firm-level Ministry of Commerce (MofCom) database to map Chinese greenfield and non-greenfield investments in Europe in the value chains of PV and wind sectors (Criscuolo et al., 2014; Zhang and Gallagher, 2016). We perform a six fixed-effects logit analysis, linking the features of Chinese investments to a set of variables (Criscuolo et al., 2014; Zhang and Gallagher, 2016). Besides the more traditional ones, as a proxy of endowments of resources of home and host regions and of institutional factors, we introduce industry specificity variables and selective industrial policies proxies.

We find that selective policies in European Countries have acted as catalyst for Chinese investments in the solar and wind sector. The number of solar and wind installation in host countries, as well as the amount of subsidies released have attracted flows of investments. On the other side, Chinese government subsidies had a crowding out effect on Chinese firms' willingness to invest abroad.

Based on our findings, we provide some policy recommendations that are quite relevant considering the recent tightening of EU-China relations and discussions both in the energy sector and in the investment field, including state support to the industries. Our study contributes to the actual debate on EU-China cooperation and approach to climate change in the light also of US's dropping back from COP21.

II. The literature background

The heart of our analysis lies in an intersection of Industrial Policy and International Business literatures.

We look at the influence of RES supportive measures introduced by EU member states on the attractiveness of EU countries, as destination target for Chinese firms investing abroad. At the same time, we consider sectorial policies in China and their impact (as home country factor) on Chinese international expansion towards Europe. In fact, Chinese firms' competitiveness as well as their internationalization exposure have been influenced by Chinese selective industrial policies in the RES, along with simultaneous asymmetries with EU supportive policies. While EU countries relied on demand-oriented policies in the RE, China has been promoting supply-side interventions (Xu, Su, 2016). Those asymmetries in EU and Chinese RES supportive policies have caused tensions in the market and huge concern and debate in Europe on the impact of booming flows of Chinese investments in the EU on local industry (Curran et al., 2016), which might have had an tariff-jumping purpose.

2.1 The industrial policy perspective

From a theoretical perspective, in the Industrial Policy literature, RES policies can be classified as vertical interventions of the governments, in a sector that has been identified as strategic[1] for their economies and for their countries (Chang, 2002b). Rather than involving market failures (Pigou, 1929; Bator, 1958; Baumol, 1965; Stiglitz, 1988, 1989), motivations attached to vertical intervention in the RES can be framed in the context of the need of controlling and driving industrial development with strategic-economic intent (Amsden 1989; 1994; 2003; Chang, 1994; 2002a; 2002b; Rodrik, 2008; Di Tommaso and Schweitzer, 2005; 2013; Stiglitz, 2001; Stiglitz and Lin, 2013).

Development of some renewable technologies has been accompanied by support through feed-in tariffs and feed-in premiums, green certificates, priority in the grid, tax incentives and other support measures[2]. This happened in EU[3] and China, but to a different extent. Only recently, China has been shifting its policies from government-selection to market-selection, and from producer-orientation to consumer-orientation. Many scholars claim that the producer-orientation policy was rather a classical "infant industry" program. On the contrary, Europe has always relied on promotion of consumption of RE products, linking this policy with other de-carbonizing policies (like the Emission Trade System, ETS).

This asymmetry in the type of policies might not only have affected trade flows and induced trade conflict (Haley and Schuler, 2011; Kolk and Curran, 2017; Lewis, 2014), but also influenced investment decisions.

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[1] In the industrial policy literature, a sector can be classified as strategic with reference to its ability to promote positive externalities, having a high degree of upstream and downstream connections with other sectors. Note however that "strategic" is a term descending from the military jargon: a strategic sector was a sector that had to be kept within the domestic territory and not under the control of foreign powers, even if this choice was not economically efficient. (Hirschman, 1958; Krugman, 1987; Michalski, 1991; Soete, 1991; Stevens, 1991; Teece, 1991; Yang, 1993; Chang et al., 2013; Andreoni and Scazzieri, 2014).

[2] As is known, RES expansion contribute to the diversification and security of energy supply, while fuelling the reduction of greenhouse gases (GHG) emissions.

[3] As in other fields, EU establishes general renewable energy targets for the different countries, resulting from discussions with their representants, plus a target for the whole area. The targets of the countries can differ among them or be the same: anyhow, the tools to reach these targets are decided by the single Administrations. There are many reasons for an EU intervention in the field. We quote three at least. First, a lack of coordination between the actions of Member States: States can behave as 'free riders', enjoying the benefits of actions taken by others without acting themselves. Action taken by one Member State might harm another as well, so that EU intervention is necessary to avoid tensions between countries. Second, EU intervention might be needed as economies of scale can be realized and the fact that the EU imposes standards or minimum levels of production is more effective. Third, EU must avoid unfair competition among countries participating it: the renewable energy industry is suitable for this role.

Nevertheless, Curran et al. (2017) compare trends of trade and investment between EU and China in the solar and wind sectors. They found a large increase in both variables from 2005 to 2011, followed by rapid falls since 2012-13. Both trade and investments decreased because of difficulties in the destination market, rather than to trade tensions.

In the recent years, the decisions taken by some European countries to reduce incentives to RES not only had negative effects on foreign investments in general, but also affected the local industry (Del Río and Mir-Artigues, 2012; Jewkes and Gaia, 2014; Moody's, 2015; Noothout et al., 2016). With regards to this point, Tan et al. (2013) show that the shift of selective policies for renewable energy and the decline of incentives in Germany, Spain, Italy, and other markets had a negative impact on domestic solar industries. This fact is turning into an opportunity for Chinese firms, which are eager to invest in those markets via foreign direct investments (FDIs)[4].

2.2 The international business perspective

Looking at the International Business literature, the determinants of location choice for FDIs have been receiving a growing attention in the recent years (De Beule, Van Den Bulcke, 2012) especially with the rise of multinational firms from emerging markets (Dunning, 2010: 93). Based on classical Dunning works (Dunning, 1981, 1986), the key determinants of countries' attractiveness areembedded in institutions, resources and capabilities. The quality level of those factors impacts on inward FDI attracted by each country, as well as OFDI developed by domestic firms (Dunning and Zhang, 2008).

Several authors, at an early stage of growing OFDI from China, confirmed that host country features, in terms of market potential, institutional environment, access to natural resources and intangible assets, affect location choice (Deng, 2004; Kaartemo, 2007; Pradhan, 2009). De Beule and Van Den Bulcke (2012) synthetize key determinants of location choice in the following categories: institutional distance, income difference, natural resources, strategic assets and other variables (such as market size, regional economic integration, geographical distance or common colonial heritage).

With the growing trend of Chinese OFDIs, the literature on location choice of Chinese firms has advanced (Mukim and Nunnenkamp, 2012), embracing several theoretical perspectives, from the resource based view (Govindarajan and Ramamurti, 2011; Buckley et al., 2007; Madhok and Keyhani, 2012), institutional-based view (Child and Rodrigues, 2005; Zeng and Williamson, 2003, Rugman and Li, 2007; Rugman and Oh, 2008, Ramamurti, 2012; Gammeltoft et al., 2010, Voss et al., 2009), to network-based view (Mathews, 2006, Hertenstein et al., 2015).

More recently, some theoretical papers have pointed out the need for multilevel frameworks of analysis, embedding many stream of literature also to include the many heterogeneous factors impacting on location decisions. Castellani et al. (2014) underline that a key aspect to be considered when analyzing location decision is distance, which is a "multifaceted concept including both spatial and institutional features". In this regard, factors determining location choice are heterogeneous and vary across regions, across firms and across functions[5].

On the idea of multilevel framework of analysis, Child and Marinova (2014, p. 367) suggest to consider "the triangle of resource, institutional and political factors that apply" to both home and host country contexts to better assess advantages and disadvantages of Chinese OFDI. Latteman et al. (2017) expand the framework by Child and Marinova and encourage scholars to use a comprehensive model including country-, industry- and firm-level analyses to understand the "why and how" of Chinese investments. Also, they incorporate "time" as a variable into their framework "by introducing and explaining the concept of *dynamic embeddedness* as an interaction dimension to reflect the inherent dynamics on all levels and actors".

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[4] According to Tan et alii, 2013, it happens because Chinese firms accept lower returns.

[5] Recently, the need to look at sub-national variations within countries emerged, as they affect location choice in a more significant way compared to broad country level distance (Mudambi and Beugelsdjik, 2013; Shenkar, 2001). Analysing the case of South-Korea, Hyun and Hur (2013) show that firm and country heterogeneities have a significant role in shaping the cross border strategy of multinational enterprises (MNEs). Gazaniol (2015) shows that previous experience on international markets and affiliated firms' international exposure are key determinants of the location choices of multinational firms.

Several empirical papers have focused on determinants of Chinese OFDI, looking at the home and/or host country characteristics (Yin, 2015).

Quantitative analysis show that home country characteristics such as institutional disadvantages (Child and Rodrigues, 2005; Rui and Yip, 2008) and government constraints (Kolstad and Wiig, 2009; Morck, Yeung, and Zhao, 2008) act as pull and push factors for Chinese firms' international ventures. The support of the Chinese government (Liu and Deng, 2014) is widely recognised as a key factor explaining investment patterns of Chinese firms abroad (Ramasamy et al., 2012). Support might consist of easy access to loans at non-market conditions (Anzkiewicz and Whalley, 2006; Child and Rodrigues, 2005; Warner et al., 2004), administrative support or, more specifically, in selective incentives (Curran et al., 2017).

Studies based on the host country determinants, starting from the seminal work of Buckley et al. (2007), often refer to several locational advantages of host countries (see Table 1), including availability of key resources and interplay of country level and firm level factors (Duanmu, 2012).

Table 1 - Selected empirical papers on host country factors

Authors	**Innovative perspectives on host location choice analysis**
Buckley et al. (2007)	Host country attributes, such as political risk, cultural proximity, policy liberalization, exchange rate, and trade relationship with the host country, geographic distance, and openness to FDI
Cheng and Ma (2008)	Variables of tax haven and offshore financial centers
Cheung and Qian (2009) Hurst (2011)	Wage of the host country, institutional factors (such as political risk, labour freedom and government spending of host countries)
Kolstad and Wiig (2012)	Natural resources endowments, institutional factors
Duanmu, 2012	Interaction terms, to test heterogeneous response of MNEs owing to their ownership structure and strategic intent
Quer et al. (2012)	Host country political risk, cultural factors
Amighini et al. (2013)	Host country's education level
Lv, Spigarelli 2015	Host country Institutional environment and development of RE sector
Lv, Spigarelli 2016	Host country factors (institutional quality, human resource quality, technology readiness) with specific reference to the RE sector in Europe
Karreman et al., 2017	Overseas Chinese communities in host countries

In the specific case of our paper, we contribute to the literature on home and host country factors shaping location choice. Our focus on the wind and solar sector provide an industry insight as called by Yang et al. (2009).

Lv and Spigarelli (2015) derive a map of home province and host location choice by Chinese renewable energy firms from 2004 to 2013, within Europe, finding a strong polarization. They analyzed characteristics of home and host area affecting location choice, focusing on institutional factors and proxies of the development of RE sector[6]. They find that Chinese firms tend to seek countries with similar institutional environment, compared with their origin regions. Immature and inexperienced Chinese firms tend to go to countries with weak and immature institutions. Also, market-seeking firms tend to invest in countries with both well-developed institutional environment and industry development base. R&D-oriented investments are more attracted to countries with well-developed institutional environment.

Liedtke (2017) studies Chinese energy investments in Europe from 2008 to 2015 and analyzes the energy interests and related policy approaches. The author finds that investments were mainly concentrated on the fossil fuel sector. Acquisitions of company shares - in Northern and Central Europe - were the most relevant mode of entry. Motivations of investments were both political and commercial. From a political perspective, China intends to enhance the supply chain security of fossil fuels, promote environmentally sustainable production techniques, and increase the shares of renewable energy and energy efficiency. From a commercial perspective, Chinese companies want to enhance their global competitiveness in the energy market, via acquisition, and improve their position in the energy supply chain. With specific reference to the energy sectors of Southern European countries, Pareja-Alcaraz

[6] In the RE industry, there is a huge concentration of expertise and a polarization of technology and know-how in countries that have invested the most in switching to a greener society, as in the case of Germany, Spain, Italy (Haley and Schuler, 2011).

(2017) shows that Chinese investments tend to be opportunistic, and motivated by the ambition to seek new markets and assets.

Within the broad theoretical background described above, the paper addresses several research questions. Part of them is quite common and well established in studies on determinants of location choice (see research questions from 1 to 3). In this case, our contribution lies in the specific field where we test them, i.e. the RES industry. The most innovative research questions are the ones linked to industry specificity and to the role for industrial policies as determinants of location choice for Chinese firms in the EU (research questions 4 and 5).
Here below we list all research questions.

RQ1: *High quality of home institutions and high level of economic development in home provinces, create a positive environment that stimulate Chinese firms to go abroad.*
Larger endowment of resources, including a good level of technology and human capital and good local institutions in China, should act as push factors in the implementation of international ventures for Chinese firms.

RQ2: *High quality of host institutions and high level of economic development create a positive environment that attract investment of Chinese firms to the EU in the RES sector.*
Larger endowment of resources, including a good level of technology and human capital and good local institutions in Europe, should act as pull factors for Chinese firms.

RQ3: *The level of development of the RES sector in home and host countries impact on decision to invest abroad.*
Home and host RES sectors conditions and characteristics affect location decision. Specifically, high level of development of RES in home provinces acts as push factor. High level of development of RES in host countries attracts more investments from China.

RQ4: *Selective policies of host countries act as determinant of location choice of Chinese firms in EU,*
The underlying idea is that RES subsidies paid in some EU countries acted as pull factors for investments from China. More generous policies paid by a single EU country would result in a higher number of Chinese investments attracted in that country.

RQ5: *Asymmetries in home provinces in China compared to host country selective policies in EU can affect investment decisions of Chinese firms in the RES sector.*
The basic idea underlying this hypothesis is that asymmetry of policies might influence internationalization strategies in RES sector. On one side, Chinese policies were supply-side oriented, thus promoting production of RES products. Subsidies contributed to generate over capacity in China, thus forcing Chinese firms to look abroad for outlet markets (push factor). On the other side, demand-oriented polices developed in Europe to support consumption of RE products, might have acted as pulling factors for investments. Therefore, more subsidies paid in Chinese provinces should result in a higher number of Chinese firms investing in Europe.

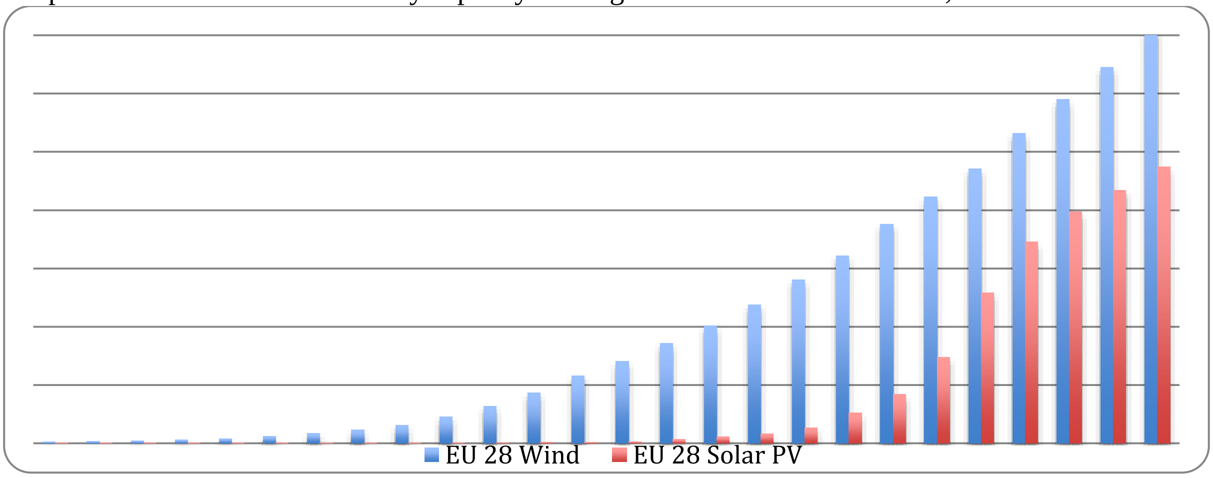
III. Host country specificity: the wind and solar PV in Europe and relevant selective policies

To better understand our research question and sequent quantitative analysis, it is important to provide a general picture of host country specificity, i.e. how EU countries differ in terms of development of RE industries and scope/generosity of selective policies.

As it is known, electrical energy coming from non-hydroelectricity renewable sources, and more specifically from wind and solar PV, started to affect European producers of electricity in a substantial way in the 1990s (Graph 1).

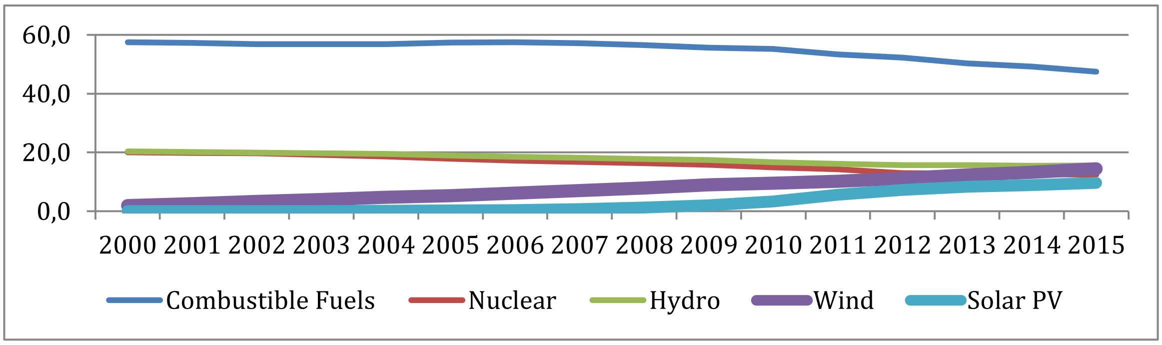
Wind energy was developed for first: the growth of its contribution was relatively slow up to 2000, with rather small figures. The growth rate increased after 2000, reaching substantial levels in absolute and also in relative terms, i.e. with respect to traditional sources for generation of electrical energy (see Graph 2).

Graph 1: Installed EU 28 electricity capacity coming from wind and PV sources, in MW



Source: European Energy Regulators

Graph 2: Installed EU 28 capacity by sources, in percentage of the total electricity generation (2000-2015)



Source: Eurostat

Solar photovoltaic technology became broad-based at the EU level only in 2004-2005, when its overall capacity overcame 1000 MW, but it became really important after 2010-2011. In the period 2011-2015 the annual growth rate of wind energy capacity in EU 28 was around 11 %, lower than the one of PV (16.8%).

Paying particular attention to the links between energy policy and industrial policy, the commercial creation and diffusion process of both technologies have been characterized by both similarities and differences. Initially, wind energy was exploited only by countries where the energy potential of that specific source of energy was expected to be high, like Denmark[7] but also Norway. In Denmark wind energy was of course exploited to substitute for imported, polluting sources for electrical energy[8].The expansion of the domestic wind energy market was however able to nurture the Danish national champion as well, Vestas, which was already an international leader in the field of wind turbines. The some happened in Spain (Gamesa).

On the contrary the first and most important investor in PV capacity was a country where the energy potential of that technology was rather small, i.e. Germany. In fact, Germany was the only large European country where objectives of environmental policy, of energy policy and of industrial policy

[7] In 1990 72% of all the EU wind electrical generation capacity was localized in Denmark

[8] Denmark is rather poor of domestic sources to generate electrical energy: in 1990 91% of all the Danish electricity was produced by using imported coal. Furthermore Denmark has neither domestic coal nor has resources for hydroenergy.

were explicitly interconnected, as a practical test of green industrial policy (Rodrik, 2014). Become popular after the Fukushima nuclear disaster in Japan (2011) this policy interconnection was named *Energiewende:* officially it is told to be the result of the decision of going out of the nuclear energy after 2020, year when the German nuclear plants should have been dismissed. However the policy decisions to involve together both the energy and the economic framework of the country through the renewable energy affaire were hold well before 2010, as the first Renewable Energy Sources Act (EEG) came into force on 1 April, 2000. In fact, as mentioned by Pegels and Lütkenhorst (2014), the "official"[9] objectives of *Energiewende* are: "strengthening Germany's leading global market position for climate-friendly technologies; ensuring reliable and affordable energy supply to maintain competitiveness; boosting innovative capabilities of the industry; creating employment opportunities from renewable energy development; mitigating climate change; saving scarce resources and reducing import dependency from fossil fuels".

Started also as an experiment of green industrial policy in some countries, more aimed to increase domestic employment by assemblers than to increase competitiveness (except for Germany), the utilization of renewable sources to generate electrical energy spread out in other European countries. It is demonstrated by Table 2, which shows the concentration rate of electrical capacity according to the sources of generation in the five largest countries in the EU (Germany, France, United Kingdom, Italy and Spain).

Table 2 - Percentage of the total EU 28 electrical capacity in the five largest countries (Conc5)

	2005	2015
Wind	79,7	71,6
Solar PV	94,6	83,8
Fossil fuels	62,1	62,7

Source: Eurostat

In EU, like in the rest of the world, the success of renewable energy was mainly driven by heavy interventions, mainly on the demand side, as the cost of producing electric energy from renewable sources was higher than that produced by fossil fuels (now with the exception of wind onshore). Germany was the first country to introduce (in 1991) Feed-in Tariff (FiT), the more adopted instrument to incentivize the use of renewable energy.

The history of the EU support schemes suggests some simple features[10]:

- EU countries have not utilized a common instrument, even if the use of FiT is the most frequent;
- many countries have adopted more than one support scheme[11];
- these instruments have been often subject to changes during time;
- often they have been applied to every technology of renewable energy sources: only in 4 of 28 cases they have been applied only to one of them ("specific" support);

[9] Official means available "in various publications, statements and speeches by the relevant (German) Government entities" (Pegels and Lütkenhorst, 2014).

[10] Suggested by the analysis of the various Council of European Energy Regulators (Ceer) reports

[11] As an example in 2013 25 of EU 28 countries adopted more than one support scheme.

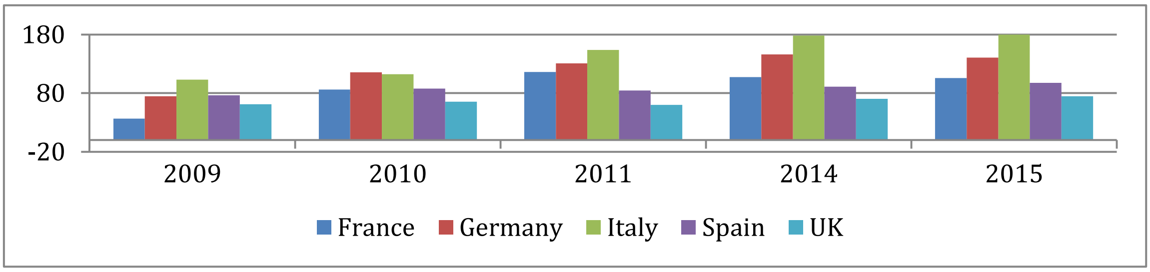
	Feed in Tariff (FiT)	Investment subsidy	Net-metering	Quota system	Loan	Feed in Premium	Tax regulation mechanism	Number of countries where only one (FiT) mechanism is adopted
Number of EU countries adopting it	19	17	4	6	8	10	12	3

Source: EU 5/1/2013, European Commission guidelines for the design of renewable energy schemes", Commission staff Working paper

- the simplest instruments to introduce competition, and therefore more efficiency, among suppliers of different technologies, i.e. tenders, were adopted only in the latest years;
- they are usually financed not by the public budget, but directly by the consumers in their electricity bill.

The overall amount of financing required to support the generation of electricity by renewables (and paid by enterprises and households) in EU countries is not small (CEER): in 2014 it was more 54 billions of euro, i.e. 0.4 % of the total EU 28 GDP, increasing with respect to 2011, when it accounted for 0.3% of GDP. Germany is the most important market, accounting for around 36 % of all the EU 28 estimated expenditure for renewables. Not only Germany is the largest market in quantitative terms, but is one of the most generous: looking at a comparison with other large countries, only Italy appears to be more "generous"[12] (see Graph 3).

Graph 3 - Weighted average level on electricity supported (€/MWh)



Source: Ceer estimates, documents of various years

The general trend of the average level of support is increasing comparing 2014-2015 with 2009-2010, however the peak year of the support is 2014, not 2015. Furthermore, the support towards new plants tends to diminish, so that the increase of capacity is due to the old decisions of investments[13].

Looking more deeply at the two technologies here considered, PV and wind onshore, the trend differs.

In the case of PV(where the French aid is particularly "generous"), the size of the support is decreasing since 2010 for all the five largest countries in Europe (since 2012 for the United Kingdom).

The dynamics of the support in the case of wind onshore is more differentiated among countries, but the average trend is toward increase. In Italy, where the support is generous, it is increasing since 2012 onwards. The same trend is in other countries, where the support is lower.

The major factors explaining the reduction of the costs in the PV industry are technological improvements (mainly in modules, inverters, components of the Balance of the System), competitive pressures (due to the larger utilisation of tenders) and scale economies at the level of group (including vertical integration). In the case of wind onshore the cost reduction from 1983 to 2014 has been of two thirds. It is caused by the same factors, with particular emphasis on innovations in advanced tower designs and in blades materials allowing for the increasing capacity and dimension of turbines.

The reduction of the costs of generating electricity from renewable sources decreases the economic rationale of the supports (Huntington et al., 2017; Winkler et al., 2016). However other two factors must be quoted, in order to explain at least the reduction of the supports in the PV. First of all, the reduction of the supports – as they are paid by consumers - means a larger purchasing power for households (that is important in recession times) and above all a reduction of the costs for the European enterprises, so improving their competitiveness and their profitability. Second, many people able to produce electricity coming from renewables (and generated by the supported plants) sell the surplus of electricity to the

[12] This comparison is partially explained by a mix issue: the largest (in terms of MWh supported) renewable source financed in Italy is solar PV, while the most supported one in Germany is wind onshore. In both countries solar PV is more "expensive" (i.e. receives more support for MWh) than, eolic energy.

[13] The general decision is not to modify the rule framework for the already existing investors.

grid (the neologism is “prosumers”). In such a way they increase the general supply of electrical energy, causing prices to decrease and so jeopardizing the profitability of the electrical utilities.

In this way three powerful interest groups line up against the policy of supporting renewables. The first one are households. Probably they are the less incisive, as the supporters of renewable energy are mainly within them[14] . The second one are enterprises: on average, energy costs account for 7% of the total sales of the EU enterprises, even if their incidence is far higher in the so called energy intensive industries. Anyhow it jeopardizes the competitiveness of the exports: in the Italian case it turned out to be that “other conditions being equal, the magnitude of energy expenditure is negatively associated with firm's performance indicators: firms with higher energy costs have both a lower rate of sales volume growth and a lower propensity to export” (Faiella, Mistretta, 2014). So it is likely this interest group is against the supports.

The third group, utilities, is likely to become the most evil opponent[15], as the variable cost of the renewables is quite null while the variable cost of the traditional sources is positive. Given that the success of the renewable energy policy, joined to their intermittency, obliges utilities fuelled by traditional sources to produce less electricity but to be ready to produce more, if necessary, the payment referred to “capacity” is substituting the payment referred to the “cost”.

IV. Variable Specification and the Empirical Model

IV.1 Data

To study factors affecting Chinese OFDI in Europe, we leverage on MofCom database and perform econometric models on home and host country factors affecting location choice of Chinese multinationals in Europe. The MofCom firm-level database[16] covers both greenfield and non-greenfield (e.g. M&A, joint venture) Chinese investments abroad. For each investment decision, MofCom provides the year of investment, the destination country and the overseas activities. We also collected key information on the parent firm from the sample firms’ homepages or their annual reports, including the year of foundation, the number of employees, the ownership structure and the entry mode. Our research target is all Chinese firms in PV and wind sectors with foreign subsidiaries in EU by the end of 2015.

The dataset incorporates a total of 283 investments in the EU: 218 location choices by 140 Chinese PV firms from 2005 to 2015, as well as 65 location choices by 23 Chinese wind firms from 2009 to 2015. Over this period, 17 EU countries were target destinations for the PV and 14 for the wind sector.

Based on our analysis, the number of China’s investments in Europe in the solar and wind industries had a positive growth trend from 2005 to 2012. After 2 peak years in 2011 and 2012, there was a sharp decrease in 2013 and 2014, and above all in 2015. With a polarization towards Germany, investments were mostly directed to Bulgaria, Italy, and Luxembourg. In 2015 UK and Spain emerged as new relevant destinations (Table 3).

Table 3 - Chinese investments in the EU in wind and solar (n. of investments for destination country)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Austria								1				1
Bulgaria						1	7	10	1	1		20
Belgium							2		1	1		4
Poland							1					1
Denmark						1		4				5

[14] According to Eurobarometer, only 7% of the European citizens think that climatic and energy issues are the main problems in their country.

[15] According to McKinsey the region’s large publicly trade utilities have, on average, lost half of their total market capitalization between 2008 and 2013.

[16]MofCom is the Ministry of Commerce of PR China. It releases statistics about officially approved investments (on official statistics on Chinese OFDI, see Amighini et al., 2014).

Germany	1		3	1	11	12	34	36	14	2	11	125
France						2	2		6	2		12
Netherlands		1			1	2		4	6	1	1	16
Czech Rep.						2	2					4
Luxemburg			1			1	8	10	4	1	1	26
Romania							1	2	1			4
Portugal							1			1		2
Sweden								3			1	3
Slovakia							1					1
Spain			1	1	3	3	2		1	2	3	16
Hungary					2	1		1				4
Italy					1	3	4	4	4	1	1	18
UK				1			6	3	3	2	5	17
Total	1	1	5	3	18	28	71	78	41	14	23	283

Source: author's calculation on MofCom database

Also from the Chinese side, the polarization is considerable: most of the firms are located in Jiangsu and Zhejiang (Table 4).

Table 4 - Chinese investments in the EU in wind and solar (n. of investments from home province)

	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**Total**
Anhui						2	6	2				10
Beijing				1	5		7	6	4		4	27
Fujian								4				4
Gansu											1	1
Guangdong						2	3	4	3	1	1	14
Hebei					2		4	1	1	1	1	10
Henan										1		1
Hubei							1	2		1		4
Hunan						1	6	9	1			17
Jilin									1			1
Jiangsu	1	1	4		4	8	20	26	13	6	8	92
Jiangxi						1		3		1		5
Liaoning						1		1			2	4
Neimenggu								1				1
Shandong				1	1	2	3	2	1		2	12
Shan'xi							1					1
Shanghai					2	3	3	1	3		2	14
Sichuan							1				1	2
Tianjin						4						4
Xinjiang							1					4
Yunnan										1		1
Zhejiang			1	1	4	4	15	12	14	1	1	53
Chongqing								1	1			2
Total	1	1	5	3	18	28	71	78	41	14	23	283

Source: author's calculation on MofCom database

3. Variable selection and the empirical model

To test our two research questions, we developed an econometric model which includes home region and host country endowments, institutional and sectoral variables as determinants of Chinese investment in Europe. We incorporate control variables at firm level. Since China is a huge country with regional disparity and heterogeneous regional institutional environments (Meyer, 2008), we adopt a provincial level analysis for the home country that is quite rare in the literature on Chinese OFDI (Sun et al., 2015).

Regarding the dependent variable (OFDI), since we have 18 potential choices (i.e. the 18 EU countries where Chinese PV and wind firms invested in the period of observation), by definition, 17 alternatives are possible apart from the chosen destination. The dependent variable is labelled as 1 if the location is chosen, 0 for all other locations no chosen[17].

In terms of country endowments, we consider the market effect of the home region and host country on Chinese OFDI in PV and wind sectors.

We include GDP to measure the home region and host country market size, and GDP per capita to measure home regional and host country market affluence.

To measure the technological level of the home region and host country, we employ the index of technological readiness and the gross secondary education enrolment rate. The home regional technological readiness is the perceptions of the likelihood that the technology market will be impartial and efficiency and comes from the Business Environment Index for China's Province (BEICP) (Wanget al., 2013)[18]. The host country technological readiness measures the agility with which an economy adopts existing technologies to enhance the productivity of its industries and come from the Global Competitiveness Report[19]. The gross secondary education enrolment rate is included as a proxy for the level of human capital, coming from National Bureau of Statistics of China and the Global Competitiveness Report, respectively.

Institutional factors are included in the model for both home regions and host countries. We employ government management as variable, which is drawn from BEICP. Moreover, we select a variable for the host country, i.e. prevalence of trade barriers, which is drawn from Global Competitiveness Report[20].

Specificity of RE sector includes measures of environmental pressure of home country, reflecting the level of intensity of use of natural resources. We use power consumption and emissions to reflect such a pressure. Variables such as sulfur dioxide emission and power energy consumption are standard proxy indicators for environmental pressure (He, 2006; Khan et al., 2014; Pao & Tsai, 2011). These are taken from National Bureau of Statistics of China.

Furthermore, to test the influence of home government support, we include two variables that disclose the production oriented subsidies: the number and size of regional projects subsidized by the government, respectively (see Appendix). The projects lists and relevant information were issued by Ministry of Finance of the People's Republic of China. Subsidies are incentives for the generation of electricity by RES. In fact, the list includes subsidized firms producing electricity using renewable sources, including project name, location, and production capability. The subsidy is paid to firm for electricity price. Hence, we abstract two regional level variables from the lists: one is the number of

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[17] We use a Logit model that is appropriate for a 1 stage location choice (from home to host country). We build a choice set: all the destination countries in our sample can be a selection target (specifically all 28 EU member states). If a firm select Germany as investment destination, we code Germany as 1, while all the other 27 member states are coded as 0. Thus the number of investment and the 28 countries constitute a matrix in our study.

[18] BEICP is published by The National Economic Research Institute (NERI) of China and the China Reform Foundation. The NERI indexes are the official and most comprehensive measures of China's multifaceted institutional development and have been widely used in recent studies (Gao et al., 2010; Liu et al., 2014).

[19] See: http://www.weforum.org/reports/global-competitiveness-report-2014-2015.

Although all EU countries are required to have the same trade policy under Art 133 of the EU Treaty, there are still differences at least in terms of the perceptions of firms. For example, Global Competitiveness Report (2013) indicates that the barriers to trade of Finland, Luxembourg, and Portugal are the most serious, while Romania, Poland and Italy are the least severe.

[20] Compared to the 5 indicators in World Governance that are available within the Global Competitiveness Report, only "Prevalence of Trade Barriers" is significant in the model. Indeed, it is relevant considering that we are investigating internationalization issue and we can detect if the investments from China are "welcomed" by EU countries or if barriers in trade are perceived by foreign firms.

project subsidized by the government for each province, the other is the production capability of the projects subsidized by the government for each province.

As for host countries, RE sector specificity is embedded in solar and wind instalment, and solar and wind energy capacity (MW) derived from Eurostat. Also, we included the subsidies weighted average support level by technology, derived from Council of European Energy Regulators[21] which is a quite innovative variable introduced in our model.

Control variables at the firm level are incorporated into the econometric model. First, we control for firm size by using the logarithm of the number of employees. Second, we control for the age of the firms, using a continuous variable indicating the number of years since the founding of the firm. Third, we control for firm's ownership type, which is represented by a dummy variable that takes the value 1 if the firm is a state-owned enterprise (SOE) and 0 otherwise. Fourthly, we control for the type of entry mode of foreign subsidiary, which equals 1 if foreign subsidiary is greenfield investment and 0 otherwise.

The measurement of all variables and data sources is listed in more details in Table 5.

Table 5 - Variables and data sources

Variables	Measurement	Data sources
Dependent variable		
Country chosen	1 = the choice of the country, 0 = otherwise	MofCom
Independent variables		
Home country: regional endowments and institutions		
GDP	Log of home country GDP	National Bureau of Statistics of China
GDP per capita	Log of home country GDP per capita	National Bureau of Statistics of China
Human capital	Gross secondary education enrolment rate	National Bureau of Statistics of China
Technological readiness	Perceptions of the likelihood that the technology market will be impartial and efficiency. Scoring from0 (weak) to 5 (strong).	Business Environment Index for China's Province
Government Management	Perceptions of the likelihood that the government will be open, fair, impartial and efficiency. Scoring from 0 (weak) to 5 (strong).	Business Environment Index for China's Province
Host country: endowments and institutions		
GDP	Log of host country GDP	World Bank
GDP per capita	Log of host country GDP per capita	World Bank
Human capital	Gross secondary education enrolment rate	Global Competitiveness Report
Technological readiness	Agility with which an economy adopts existing technologies to enhance the productivity of its industries.	Global Competitiveness Report
Prevalence of trade barriers	Tariff and non-tariff barriers significantly reduce the ability of imported goods to compete in the domestic market. Scoring from 1 (strongly disagree) to 7 (strongly agree)	Global Competitiveness Report
Home country: regional sectoral specificity		
Power consumption	Power consumption value /population	National Bureau of Statistics of China
Wastewater sulfur dioxide	(wastewater emission + sulphur dioxide emission)/population	National Bureau of Statistics of China
Subsidy: number of projects	Number of projects subsidized by the government	Ministry of Finance
Subsidy: size of projects	Size of projects subsidized by the government	Ministry of Finance
Host country: Sectoral specificity		
Solar and wind installment	Solar and wind energy Capacity (MW)	Eurostat

[21] See: CEER, CEER Report on Renewable Energy Support in Europe, Ref: C10-SDE-19-04a4-May-2011; CEER, Status Review of Renewable and Energy Efficiency Support Schemes in Europe in 2012 and 2013, Ref: C14-SDE-44-03 15 January 2015.

Subsidies	Weighted average support level by technology	Council of European Energy Regulators
Control variables		
Size	Log of number of employees	Firm's homepage or annual report
Age	Number of years since the founding of the firm	Firm's homepage or annual report
Ownership	1 = SOE, 0 = non-SOE	Firm's homepage or annual report
Entry mode	1 = greenfield, 0 = non-greenfield	MofCom

As for estimation techniques, our choice was determined by two primary attributes of the data: (1) the dichotomous dependent variable, and (2) the dependence among the records comprising each firm investment year.

A fixed-effects logit model is appropriate for data with these attributes (Holburn & Zelner, 2010). The fixed-effects logit model accounts for unobserved heterogeneity among firms, as well as investment year.

V. Results and discussion

We examine the impact of home region and host country factors on Chinese green OFDI in six fixed-effects logit models (Table 6). Because the variance inflation factors are well below the recommended threshold of 10, multicollinearity is not a serious issue in our models.

Model 1 depicts the baseline model, including only the control variables. Model 2 to Model 5 include also the variables of host and home country endowments, institutional and the sectoral specificity variables, respectively. Model 6 shows the full model with all variables included. For easier interpretation and better comparison of the empirical results, coefficients are computed and then converted into quasi-elasticities. The probability of the firm's location choice changes when the regressors increase by one percent (or one unit).

Model 2 looks at the effect of home regional endowments and institutional variables on Chinese OFDI in PV PV and wind sectors, to test RQ1. A statistically significant positive quasi-elasticity of provincial GDP suggests that the large market size of the home region facilitate local firms to go abroad. However, the quasi-elasticity of market affluence (proxied by GDP per capita) is negative and significant, suggesting that PV PV and wind firms from poorer areas are more likely to invest in EU. The quasi-elasticities of the technology level and human capital level are both positive and statistically significant, indicating that firms from areas with active technology market and high level human capital are more capable of investing in EU. PV The statistically significant negative quasi-elasticity for government management suggests that poor governance of home region facilitate Chinese OFDI, confirming the institutional void perspective that also emerged in other studies (Witt & Lewin, 2007). In the case of emerging markets, weak institutional context at home generate higher transaction costs (Hoskisson et al., 2000; Wright et al., 2005), firms therefore try to escape institutional voids in the internal market by investing abroad. Poor governance of home regions can therefore stimulate Chinese investments in the global market (Witt & Lewin, 2007). RQ1 is partially confirmed, with the exception of market affluence and quality of institutions.

Model 3 considers the effect of host country endowments and institutional variables on Chinese OFDI in PV and wind sectors, to test RQ2. A statistically significant positive quasi-elasticity of GDP suggests that the large market size of the host country- as key country endowments factor - is attractive to Chinese firms in PVPV and wind sectors. The statistically significant positive quasi-elasticity of the technology level of host country confirms the importance of endowment of technological assets for Chinese firms in the two sectors. More interesting is the negative and significant influence that the level of human capital has on the investment location decision of Chinese firms in EU. This result seems to contradict with the findings of studies on general Chinese OFDI (Amighini et al., 2013). The negative effect of level of human capital possibly indicates that the investment in countries with high level human capital might be too costly for Chinese firms in the PV PV and wind sectors currently. As for the effects of host country institutional factors on Chinese OFDI, the quasi-elasticity of prevalence of trade barriers is negative and significant, showing that low trade barriers of host country significantly increase the probability of Chinese firms' entry. In this case, institutional interventions in favour of an open and efficient market act as a positive push to OFDI from China. Our findings partially confirm RQ2, with the peculiar exception of the quality of human resources.

Model 4 introduces the core of our analysis, which is related to the specificity of RE sector and possible heterogeneity of government preferential policies (Peng, Kim, 2012), to test RQ3 and RQ4. The quasi-elasticities of four home regional sectoral variables are significant. The quasi-elasticities of power consumption and wastewater sulfur dioxide are significant with positive signs, which suggest that high regional power consumption, high wastewater and sulfur dioxide emission encourage Chinese OFDI in the PV and wind sectors to EU. Chinese firms from areas with high level of environmental stress are stimulated to grow because of urgent internal needs for products. As a result, they might be more mature and competitive or sound to invest abroad. RQ3 is therefore confirmed for home provinces.

However, the quasi-elasticities of number and size of projects subsidized by the government are significant with negative signs. This result indicates that more subsidies by the home government will reduce the propensity of Chinese RE firms' investing abroad. If a Chinese RE firm can get more support from the government, it would tend to grow in domestic rather than investing abroad this result. Surprisingly, RQ4 is not confirmed for home provinces.

As for the effects of two host country sectoral variables, their quasi-elasticities in Model 5 are both positive and significant. This result indicates that countries with good industry development and favourable measures are attractive to Chinese firms in the photovoltaic and wind sectors. This is a relevant outcome of our econometric analysis, which shows the impact of location choice of quality/competitiveness of the industry, as well as of the generosity of domestic incentives. Both RQ 3 and 4 are confirmed for host countries.

With respect to the effects of control variables, the result of Model 1 shows that both the quasi-elasticities of firm size and age are positive and statistically significant, suggesting that the larger or older the firm in the PV and wind sectors, the more probability the firm undertakes overseas investment. These reflect that Chinese large or mature firms are more active in internationalization in EU. However, the quasi-elasticities of firm ownership and entry mode are statistically insignificant.

Table 7 summarizes all the empirical results.

Table 6 - Estimated quasi-elasticity from fixed-effects logit models

Variable	Mode 1	Mode 2	Mode 3	Mode 4	Mode 5	Mode 6
Size	0.370***	0.108***	0.145***	0.389***	0.208***	0.101***
Age	0.006***	0.010***	0.002***	0.006***	0.003***	0.001***
Ownership	0.226	-0.197	-0.342	-0.085	0.106	-0.203
Entry mode	-0.358	-0.218	-0.314	0.242	-0.177	-0.038
Home country: Regional endowments and institutions						
GDP		0.661***				0.319***
GDP per capita		-0.944**				-0.631
Human capital		0.052***				0.009
Technological readiness		1.466***				0.927
Government Management		-3.258**				1.444
Host country: Endowments and institutions						
GDP			0.577***			0.726***
GDP per capita			-0.919			-0.226
Human capital			-0.029***			-1.091**
Technological readiness			0.805**			1.542***
Prevalence of trade barriers			-0.698***			-0.388*
Home country: Regional sectoral specificity						
Power consumption				0.005***		0.001
Wastewater sulfur dioxide				0.303**		0.043

Subsidy: number of projects				-0.002^{***}		-0.010
Subsidy: size of projects				-0.201^{*}		-0.335^{**}
Host country: Sectoral specificity						
Solar and wind installment					0.514^{**}	0.421^{***}
Subsidies					0.404^{***}	0.118^{***}
Fixed effect of year	Done	Done	Done	Done	Done	Done
Fixed effect of firm	Done	Done	Done	Done	Done	Done
Pseudo R^2	0.611	0.686	0.636	0.667	0.683	0.691
LR chi^2	5315.9^{***}	5728.0^{***}	5511.3^{***}	5664.8^{***}	5739.9^{***}	5799.7^{***}

Note: $^{***}p<0.01$, $^{**}p<0.05$, $^{*}p<0.1$.

Table 7 - Summary of empirical results: effect on location choice

	Home country (Chinese provinces) push factors		Host countries (European States) pull factors	
Country endowments and institutions	GDP	+	GDP	+
	GDP per capita	-	GDP per capita	-
	Human Capital	+	Human Capital	-
	Technological readiness	+	Technological readiness	+
	Government Management	-	Prevalence of Trade barriers	-
Sectoral specificity	Power Consumption	+	Solar and wind installment	+
	Waste water sulfurdioxide	+	Subsidies	+
	Subsidy: number of projects	-		
	Subsidy: size of projects	-		

"+"Positive effect on location choice

"-"Negative effect on location choice

VI. Conclusions and implications

The expansion of Chinese investments in the European energy sector, over the past years, is significant. It involves both RE technologies, as well as fossil fuels (Conrad & Konstka, 2017).

The main purpose of this study was to explore the influence played by RE sources' supportive measures introduced by EU member states on the attractiveness of EU countries, as destination target for Chinese firms investing abroad. At the same time, we intended to see the role played by asymmetries between EU and Chinese industry supportive policies. Those asymmetries have caused tensions, in the past, as also witnessed by anti-dumping cases; the suspect that Chinese investments had a tariff jumping nature has fuelled the political debate.

From a scientific point of view, the paper contributes to the literature on determinants of Chinese investments, by looking in detail at the role of selective policies, which can affect competition and markets dynamics, among other institutional and economic factors. As highlighted by Park and Park (2015) "empirical studies may answer well why MNEs go abroad in general but not why MNEs go to a specific host". The paper also provides evidence to sectorial specificity, which is quite rare in the literature on Chinese OFDI compared to inward FDI (Lin & Kwan, 2011).

Our analyses show the impact of home and host country factors on location choice.

With regards to home regional endowments and institutional variables, we found that while large market size of the home region facilitate local firms to go abroad, PV and wind firms from poorer areas are more likely to invest in EU. Also, firms from province with active technology market and high level human capital are more capable of investing in EU. Lastly, poor governance of home region facilitates Chinese OFDI, confirming the institutional void perspective. The first research

As for effect of host country endowments and institutional variables, large market size of the host country, as well as endowment of technological assets are attractive to Chinese firms. On the contrary, the level of human capital has a negative impact on the investment location decision of Chinese firms in EU: probably, the high costs of human capital discourage Chinese firms.

The impact of industry specificity is clear, both at home and host country level. Chinese firms from areas with high level of environmental stress are stimulated to grow, because of urgent internal needs for products. As a result, they might be more mature and competitive or sound to invest abroad. However, Chinese government subsidies might have had a crowding out effect on Chinese firms willingness to invest abroad. More generous production subsidies seem to have discouraged Chinese investments abroad. Focusing on host country RE sector, it is clear that a good industry development and favourable supportive measures act as catalyst for Chinese firms in the PV and wind sectors. This means that location choices are affected by the quality/competitiveness of the industry, as well as of the generosity of domestic incentives.

The findings of the paper can contribute to the knowledge of determinants and dynamics of Chinese OFDI in the European RE industry. The increasing number and size of Chinese investments in the energy sector in Europe has fuelled the debate "about whether they are a blessing or a curse for Europe" (Conrad & Konstka, 2017). Some acquisitions have triggered the public opinion, as in the case of China National Building Materials Group Corporation's (CNBM) take over of solar PV producers Avancis and CTF Solar in 2012 and German Solibro's acquisition by Hanergy in 2014. In the wind industry, Xinjiang Goldwind bought a 70% stake in the German wind-turbine manufacturer Vensys in 2008 (Gippner & Rabe, 2016).

On one side, economic benefits of Chinese investments in the RE sectors are clear.

They include the long-term opportunity to reactivate the growth patterns of the RE industry in those countries that suffered the most during the financial crisis (Hanemann & Huotari, 2015). In several cases of acquisitions, Chinese firms rescued European companies from bankruptcy and saved jobs (Rabe et al., 2017). In some EU countries, especially in the former Soviet Union area, the Chinese investments in the RE offered the possibility to diversify and widen foreign ownership of domestic firms. As in the case of Poland, Chinese OFDIs offer an alternative to the predominance of Germany and Russia (Turcsányi, 2017). Eventually, partnering with Chinese firms can help European companies create backward linkages to improve their access to the Chinese restricted (Conrad, Konstka, 2017). In this regard, it is relevant to think to the dependence of the European Union's solar and wind industries on Chinese supply of some critical raw materials (Rabke et al., 2016).

On the other side, political concerns are also evident.

Chinese investments are unevenly distributed in Europe, as our study revealed, with some countries becoming more and more dependent on Chinese resources for internal growth, as in the case of Greece (Horowitz & Alderman, 2017) or Czech Republic (Mazumdaru, 2017). Those countries might not be neutral and impartial on EU-China policy matters to be discussed at European level. In this sense, there is the need for a strong coordination action to maximize benefits of Chinese investments and reduce the risks for fragmentation of positions within Europe.

Another key point relates to the fact that China has been developing a very intense industrial policy, which intends to gain control in the near future over the key phases of global supply chains. As it is clear with the "Made in China 2025" policy[22], the Government supports international ventures (Wübbeke et al., 2016) to have access to technology leaders' know how and expertize. This applies also to the RE sector where technological catch up is favoured by international "technological leap frogging" (Wübbeke et al., 2016). "Technology leaders in Europe are increasingly worried that such a government-guided and state-supported attack on European technology leadership will hurt Europe's long-term competitiveness and harm competition-driven global innovation dynamics" (Conrad & Konstka, 2017: 646).

With specific reference to policy issues and supportive policies, our findings leave some open questions to be further investigated and discussed.

First: Europe has become a challenging market for foreign and domestic firms. The region is changing the structure of subsidies, transitioning from feed-in-tariff incentives to tenders and feed-in premiums for large-scale systems, and to the use of solar panel for self-consumption in residential,

[22] See: http://english.gov.cn/2016special/madeinchina2025/

commercial and industrial sectors. Further, the more that solar PV penetrates the electricity system, the harder it is to recover project costs. So an important shift is under way: from the race to be cost-competitive with fossil fuels to the focus on the remuneration of solar PV in the market. In addition, electricity demand is low and conventional utilities are lobbying to maintain their position. As a consequence, electricity market design is increasingly important, and there is a need for new business models (REN21, 2016, p. 61).

In this scenario, it is interesting to see *which influence will play the competition of Chinese firms' in forcing European companies to move towards new business models? Is the value chain of European wind and solar industry going to be affected by this shift in business models?*

Second: selective policies have increased solar PV capacity in China, leading to congestion problems in the network and interconnection delays in the country, due to insufficient network capacity (REN21, 2016, p. 18).

It was a significant obstacle for development of new plants, and investors were increasingly worried for delays in subsidy collection and problems with solar panel quality (REN21, 2016, p. 20). To address challenges related to curtailment, China has urged top solar-producing provinces to prioritise transmission of RE capacity and attract more energy-intensive industries to increase local consumption. At the same time, recently, selective policies were shifted: from production led to consumption oriented. This new model is driving China towards the adaptation of a more symmetric incentive system compared to Europe. This convergence is also highlighted by Gippner & Torney (2017): while the EU started with a strong emphasis on ethical management of environment and moved to a focus on affordability and availability of resources, China started with a strong emphasis on availability and later shifted to environmental stewardship. In this scenario, *Will FDI from Chinese firms be affected from the shift of selective policies? How will the value chain of wind and solar industry in China going to be affected by those trends?*

Third: China has committed to strengthen cooperation with the EU to launch a nationwide carbon emission trading market in 2017 (Xinhua, 2015). Cooperation should involve discussion on symmetries in national policies and supportive measures to boost net zero emission targets. Furthermore, the future of Chinese investments in RE in the EU might be affected by the new structure and mechanisms of the international carbon market, including the 2015 EU-ETS reform (introducing the Market Stability Reserve) (CEC, 2014b). The new US position towards climate change policies is putting even more emphasis and pressure on such EU-China cooperation and on the need to formalize a comprehensive Bilateral Investment Agreement. Nevertheless, the knots to melt are still many and involve, most of all, the lack of reciprocity. Large parts of the European energy sector are open to FDI from non-European investors, while in China energy-related industries still suffer of several limitations. This situation prevents a fair and equal treatment for European firms when confronting with Chinese companies.
Considering that in the recent years the negotiations for Bilateral investment treaty was stagnating, will this *new situation boost dialogue and force the parties to reach an agreement? Which role will play the need to have a coordination of supportive policies and state aid at industry or firm level considering the effects brought by asymmetries in the past?*

At the end of our analysis, some limitations can be identified. Due to lack of data from Chinese side, it was not possible to identify symmetric measures for incentives in the RE industry compared to EU countries. Also it was not possible to include information on the number of installation for Chinese provinces. Limitation in availability of data prevented us from having a complete set of information on supportive policies.

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Appendix

Number of projects and size of the project subsidy in China for electricity generation from RES

	Number	Size (MW)
Beijing	16	347.732
Tianjin	17	452.501
Hebei	353	19460.25812
Shanxi	202	9889.7012
Neimenggu	687	40710.23745
Liaoning	267	13012.855
Jilin	140	8626.5304
Heilongjiang	199	9241.165
Shanghai	83	1089.878809
Jiangsu	357	14129.26
Zhejiang	543	3676.796375
Anhui	100	2539.29837
Fujian	90	3052.3704
Jiangxi	58	1175.03672
Shandong	406	15164.34031
Henan	54	1525.40442
Hubei	150	2658.50906
Hunan	26	1080.9
Guangdong	95	3604.5941
Guangxi	18	772.5
Hainan	22	767.77
Chongqing	12	301.33484
Sichuan	28	15706.2556
Guizhou	68	4645.6
Yunnan	140	7153.25
Shan’xi	72	3573.3307
Gansu	478	45376.548
Qinghai	293	51172.1548
Ningxia	401	19288.2154
Xinjiang	458	25922.0834
Xizang	25	5543.86

Source: authors’ calculations on statistics from Chinese Ministry of Finance (various years).

In China, the number and size of the project subsidy are published in batches, in the order of approval by related authorities. The table shows the time of six batches of subsidy from Chinese government. The first 3 batches were all released in 2013, and specifically in June, September, December. The bulk of support was concentrated in this first year. Later, only one batch was released in 2013 (in February), one on in 2014 (in August) and one in 2016 (in august).