Department of Business and Management Chair in International Business

# A CONTINGENCY PERSPECTIVE ON MARKET ENTRY MODE CHOICE IN ELECTRIC CAR MANUFACTURING INDUSTRY

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# Introduction

Nowadays automotive industry is experiencing major changes and challenges related to the necessity to find alternatives to common internal combustion engines. Electric cars seem to be the most promising option, but they entail some fundamental differences if compared to common cars powered by internal combustion engines.

Indeed, even if electric cars are easier to build, there are still several hurdles against their development, that will be presented in the following chapters.

In particular, electric cars need different complementary assets and inputs, if compared to common ones. They need a charging infrastructure that is quite different from what is needed for internal combustion engines. This is the main complimentary asset for electric vehicles and the lack of it will threaten the spreading of electric cars. Another one can be, for instance, a network of battery swapping points.

Therefore, it is interesting to analyse international expansion of electric car producers, depending on the conditions of each country related to the charging infrastructure, that is the main complimentary asset for electric cars.

Indeed, existing literature about entry modes did not focus on the impact of complementary assets for internationalization choices, and when this aspect has been considered, it has been done in an unrealistic way. This gap in literature will be explained in the first chapter.

The object of this research is therefore international entry strategy and the determinants of internationalization strategy choices of electric car manufacturers are the subject.

This research aims at answering one research question: Are foreign entry strategies of electric car manufacturers influenced from environmental factors and, in particular, from local complementary assets?

In order to answer this question, in the second chapter some determinants will be chosen as possible factors explaining entry strategy choices of electric car producers and then a correlation analysis will be made. Analysing correlation, it will be already possible to understand if the factors are explicative and the relationships among them. Then, a linear regression model will be built to study the entry mode choices, using data from several countries.

It will be possible to see how international expansion choices vary, and this will be explained in the third chapter.

The research will touch existing literature about entry modes, analysing then the cases of Tesla and CHAdeMO, that are controlling two of the main charging infrastructures in the world.

# 1. Determinants of Entry Mode Choices of Electric Car Manufacturers

Companies often do not operate only in a single domestic market, but internationally in multiple ones. This chapter, analysing existing theory and previous research, aims at understanding what are entry modes, presenting several theories that have been developed about this topic.

## 1.1 Foreign Markets Entry Strategies

Entry strategies refer to the way a company chooses to enter another market in order to operate in it, or even just to sell its products or services there. Unfortunately, there is not a unique definition of it and many theories have been published about this topic.
We can define an entry strategy as the institutional arrangement chosen by a company to organize and conduct international business transactions (McDonald, Burton, & Dowling, 2002).
Firms have the opportunity to choose among several entry modes, that can be grouped in two categories:

1. Equity modes;
2. Non-equity modes.

The first ones guarantee companies with a higher degree of control and often higher returns on investments[1], but they involve a higher resource commitment[2]. On the other hand, the second ones provide lower returns on investments and control, needing also a lower resource commitment and having usually lower exit costs[3], being characterized usually from a lower level of exposure[4] (McDonald, Burton, & Dowling, 2002).

The entry strategies in the first category are:

1. Joint ventures
2. Wholly owned subsidiaries.

[1] The return on investments (ROI) is a measure of the efficiency of an investment compared to the one of other investments. It is computed as the ratio between the net profit and the cost of the investment (Pearce, 2016).
[2] Resource commitment is the willingness to provide all the materials and support that are necessary in order to reach the objectives of an organization (Daugherty, Autry, & Ellinger, 2001).
[3] All the costs related to barriers to exit, such as investments in non-transferrable fixed assets, redundancy costs, closure costs etc. (Johnson, Scholes, & Whittington, 2006).
[4] The extent to which an organization can be affected from something, measured by the amount of funds that it can be obliged to spend (Kerin, Hartley, & Rudelius, 1999).

In particular, joint ventures are an agreement between two or more companies to work together in order to complete a project or to operate in a market settling a new firm there that is jointly owned by all the parties of the agreement. Profits, or losses, risks and control are shared among the partners. There are both equal joint-ventures, when all the partners have the same number of shares, and majority or minority ones, if a member has more control than the others. This entry strategy is commonly used when foreign companies need help from local ones to enter the market, for instance, because they want to acquire local knowledge. On the other hand, it exposes companies to the opportunistic behaviours of their partners (McDonald, Burton, & Dowling, 2002).

Wholly owned subsidiaries are, instead, the main example of Foreign Direct Investment[5] (FDI) in which a company has direct ownership and control of facilities in a foreign country. It is the most expensive way of entering a new market, charging the firm with all the risks, but it provides the higher degree of control (McDonald, Burton, & Dowling, 2002). They can be divided in two main categories:

1. Greenfield Investments;
2. Acquisitions.

Greenfield Investments, also known as Greenfield Operations, take place when a company enters a new market by building new operational facilities from the ground up. It allows companies to build the subsidiary as they want, tailoring it to their needs. This means that the transfer of products, skills, knowledge, and competences is easier (McDonald, Burton, & Dowling, 2002).

On the other hand, acquisitions take place when a company buys at least the majority of the ownership stake of a foreign firm, assuming control over it. Acquisitions are faster to execute than greenfield investments, but the transfer of knowledge, skills, competences and products is slower. In particular, integration between the cultures of the acquired and acquiring firm can be challenging (McDonald, Burton, & Dowling, 2002).

The entry strategies of the second category, non-equity entry modes, are:

1. Exporting;
2. Licensing;
3. Franchising;
4. Strategic Alliance;

[5] Investment made towards a foreign country establishing directly controlled foreign business operations (United Nations Conference on Trade and Development, 2010).

5. Management contract;
6. Turnkey Projects.

Exporting consists in performing marketing and sales operations abroad of goods produced in the domestic country (McDonald, Burton, & Dowling, 2002). It is a way to reach foreign customers quickly, but transportation costs[6] and trade barriers[7] can represent serious problems and make this mode not feasible. It is possible to distinguish two types of it:

1. Direct exporting;
2. Indirect exporting.

The former is the case in which the company directly makes its goods available in foreign markets, selling to customers. The company directly controls every phase of exporting. Instead, the latter takes places when there are intermediaries who buy the product from the company and resell it on a foreign market (McDonald, Burton, & Dowling, 2002).

Licensing is a legal arrangement in which a firm, called licensor, grants the rights to use its intellectual property to another company operating on another specific market, called licensee. The licensee pays royalties to the licensor, that is able also to expand internationally without need for foreign resources. However, there is a serious risk of dissemination of know-how to competitors (McDonald, Burton, & Dowling, 2002).

Franchising is different from licensing because usually the term of the agreement is longer. The franchiser authorizes the franchisee, that is a foreign firm, to use its intellectual property and operating systems on other specific markets. In this case, the franchiser receives royalties as well, usually computed as a percentage of the revenues of the franchisee. The franchiser assists the franchisee in its operations and the latter has to follow the rules imposed by the former. Franchising has the same advantages of licensing, being a quick way to expand internationally. On the other hand, the franchisee may be not completely concerned about quality or it may have different values, affecting franchiser's worldwide reputation (McDonald, Burton, & Dowling, 2002).

A strategic alliance is, instead, a cooperative agreement between two or more companies that decide to share resources in order to undertake a specific project. In a strategic alliance, differently from a joint venture, there is not the creation of a new entity and the companies

[6] All the expenses related to moving goods to different places or warehouses (Nguyen & Dupuis, 1984).
[7] Trade barriers are restrictions on international trade induced by governments. They can be tariffs, when there is a financial burden on imports, and non-tariff barriers, which use other means to restrict imports or exports (Bown & Crowley, 2016).

remain independent. Moreover, strategic alliances usually have a shorter term than joint-ventures (McDonald, Burton, & Dowling, 2002).

A management contract is an arrangement according to which the operational control of a company is given to a separate enterprise, which performs all the necessary activities in return of a payment. It is used only when foreign governments ban other entry modes (McDonald, Burton, & Dowling, 2002).

At last a turnkey project is a project developed completely by a company and then sold to another enterprise when completed. This strategy is useful when foreign direct investments are limited from regulations of foreign countries (McDonald, Burton, & Dowling, 2002).

After this overview of entry modes, in the next subchapter different theories and approaches will be introduced.

## 1.2 Theoretical Approaches to Foreign Market Entry Mode Strategy Choice

Many are the approaches to foreign market entry strategies, and the main ones will be presented in this chapter. For instance, some researchers considered entry modes as a taxonomy of various determinants of foreign direct investments (Itaki, 1991), or as a paradigm for internationalization (Cantwell, 1988).

At first, some basic theories on which approaches are based should be explained:

1. Internationalization Theory
2. The Resource-Based View of the Firm Theory
3. The Transaction Cost Theory
4. Property Rights Theory.

Later, from these theories several approaches to entry modes have been developed and they will be presented afterwards.

Internationalization theory, also known as International Trade Theory, is a fundamental theory that needs to be explained. It analyses international business behaviour of companies. Actually, internationalization theory is made of the contributions of many different authors. In order to present many different contributions and, in order to review the main ones, this thesis follows Krugman's work, which summarizes the most significative ones about internationalization (Krugman, Obstfeld, & Melitz, 2012). He starts from the Absolute Cost Advantage Theory developed by Adam Smith. According to him countries export commodities in which they have an absolute advantage, that exists when a commodity can

be produced in a country at a lower cost per unit that in its trading partners. So, imported goods are those in which countries have an absolute disadvantage (Smith, 1776).

Then, the Comparative Cost Advantage Model, also known as Ricardian model, criticised the Absolute Cost Advantage Model. It demonstrates in which way differences between countries bear trade and gains from trade, stating that countries do not need an absolute advantage but a relative one. In this model, labour is the only factor of production (Ricardo, 1817). Therefore, countries differ only for the productivity of labour in different industries. In the model, countries export goods that they are able to produce in a relatively efficient way and import goods that they produce in a relatively inefficient way, according to their labour. In other words, comparative advantage determines production patterns of countries. Indeed, trade as an indirect method of production. A country can produce a good and trade it for another one that it desires. The model proves that when a good is imported, its importation requires less labour than direct production. Moreover, trade increases a country's consumption opportunities, implying gains from trade, which are distributed depending on relative prices of the goods produced by countries. In order to determine these prices, it is necessary to look at the relative world supply and demand for goods (Ricardo, 1817).

Therefore, the basic prediction of the Ricardian Model is that countries export goods in which they have relatively high productivity (Ricardo, 1817).

Then, the Gravity Model of Trade is briefly studied from Krugman. According to it, bilateral trade is based on sizes of countries, computed basing on Gross Domestic Product (GDP), and distance. The model is also used to study the impact of trade agreements (Isard, 1954).

However, much more attention is devoted to the Factors Proportions Development Model, also known as Heckscher-Ohlin Model. Starting from Comparative Advantage Theory, it states that countries export goods which use massively those inputs that are abundant and cheap for them. Therefore, imports are constituted mainly of products that need as factors those resources that are scarce in that country (Blaug, 1992).

According to the researchers of the Uppsala School of Scandinavia, entering a new market is a slow process, based on expanding from country to country and on changing entry mode following a specific path. This is clearly a very sequential view of it and entails that, when firms expand from a country to another, then they can use the knowledge acquired in doing so to do it again. The earliest research about this topic was indeed focused on firm's acquisition of specific knowledge through the extension of its operations to international markets (Johanson & Vahlne, 1977).

Market knowledge can be divided into two dimensions. On one hand, the objective one, that can be taught, and, on the other hand, the experiential one, that can be learnt only through experience (Penrose, 1959). In this case, the focus is on the latter.

Internationalization theory is indeed focused on imperfections that happen in intermediate product markets. In particular, the focus is on the flow of knowledge, but also on the one of components and raw materials (Johanson & Vahlne, 1977).

Internationalization theory considers firm's ability to transfer knowledge from country to country, that is beneficial for lateral expansion, that is the growth of a firm based on acquiring similar enterprises in order to increase efficiency and achieving economies of scale and scope. According to the theory, firms create their specific internationalization knowledge that is fundamental for their international expansion.

Moreover, internationalization theory considers market failures as the reason why companies and multinational enterprises[8], that are business entities conducting their operations in more than one country (OECD, 2011), need to expand internationally through direct investment and, in particular, not licensing. Indeed, a firm with specific know-how has a company-specific advantage that is protected in its domestic market and licensing, that is an entry mode mainly used by late entrants, entails the risk of losing its know-how on the foreign market. Therefore, companies should choose between exports and direct investments, considering that the latter takes place when the benefits deriving from internationalization are more relevant than the related costs. However, direct investments allow companies to internalize their foreign market activity, protecting also on foreign markets firm-specific advantages and know-how. For this reason, direct investments should be the preferred method of international expansion (Fina & Rugman, 1996).

On the other hand, according to other researchers, who criticised internationalization theory, it seems that the most common pattern of foreign market entry strategies consists in starting with exports through agents in the foreign new market and then there are two main options. The first consists in setting a wholly owned subsidiary or a manufacturing plant directly in that market, whereas the second is about licensing (Fina & Rugman, 1996).

These researchers, therefore, consider exports as an important tool and licensing as a valid alternative to direct investment. Moreover, internationalization theory has been criticized because of being too simplistic and not always true, considering some cases in which companies proceeded just increasing and improving communication with distributors, in

[8] A corporation which owns or controls the production of goods or the provision of services in at least a foreign market (Krugman, Obstfeld, & Melitz, 2012).

order to be more efficient. In response, internationalization theorists argued that the evolutionary theory is no more appropriate today and that their theory better explains our times. According to Johansson and Mattson, the evolutionary theory is complementary to the internationalization one. Indeed, they create a model that presents different conditions of internationalization as parameters of the process, considering also the actual degree of international expansion of the firm. Moreover, they stated that according to both theories organizational learning happens in multinational enterprises and that this represents an intangible and firm-specific advantage (Fina & Rugman, 1996).

According to the researchers of the Reading School, foreign market entry strategy goes slowly through six phases: licensing, exporting, establishing local warehouses and direct local sales, local assembling and packing, forming a joint-venture and, finally, investing directly (Rugman, 1981). Differently, the Uppsala School perceived internationalization as made of phases, each one related to a specific entry method, from joint ventures to wholly owned subsidiaries.

The Resourced-Based View is a theory that provides a framework to determine which strategic resources can led the firm to a competitive advantage, meaning a situation in which it outperforms competitors. A firm has a competitive advantage, in particular, when it implements a value creating strategy that no other companies, both current and potential competitors, are implementing. Moreover, when other firms are not even able to duplicate the effects of this strategy, the competitive advantage is sustainable (Barney, 1991).

Specifically, resources have the opportunity to deliver a sustainable competitive advantage to the company, that happens when they have all the characteristics of the VRIN Framework (Barney, 1991). This framework is a way to evaluate resources, depending on four dimensions. Indeed, they can be:

1. Valuable;
2. Rare;
3. Imperfectly imitable;
4. Non substitutable.

Resources are valuable when they can help firms improving efficiency[9] and effectiveness[10], rare when they are not available to competitors, imperfectly imitable when it would be difficult for competitors to implement them and non-substitutable when it is not possible to reach the same results with other resources (Barney, 1991). Only when resources have all these four characteristics they led to a sustainable competitive advantage, that will lead the company to outperform its competitors in the long term. Otherwise, firms can reach a competitive advantage but, when resources are substitutable, competitors will sooner or later reach them (Barney, 1991).

So, firms are different because they have heterogenous resources and their strategy concerns how these should be implemented and mixed (Penrose, 1959). The Resource-Based View is, in particular, focused on internal assets, capabilities and competencies that can led the company to a competitive advantage. Therefore, it implies that each company can succeed exploiting its differences to other firms, rather than imitating.

Applying this theory to international expansion, companies should choose to enter markets in which their internal resources can allow them to reach a sustainable competitive advantage (Barney, 1991).

Moreover, according to the resource-based theory, knowledge is a resource for companies and their potential to gain a competitive advantage depends on their ability to create strategies that are able to increase effectiveness and efficiency. Therefore, internationalization knowledge is a valuable resource in any internationalization strategies because it represents a fundamental competitive and strategical asset for internationalization (Fletcher, Harris, & Glenn Richey, 2013). It is possible to distinguish three kinds of it: market entry, localization, and international enterprise internationalization knowledge. The first is about finding the right entry method, the second concerns gathering information about environments and local market conditions, whereas the third one allows companies to manage their internal functions through different countries and territories and is about, for instance, cross-border transaction knowledge (Fletcher, Harris, & Glenn Richey, 2013).

Transaction Cost Theory is, instead, focused on transactions, starting from the assumptions of bounded rationality and opportunism of individuals. Its roots are in the theory developed

[9] Efficiency is a measure of how well an organization uses its resources, comparing what it produces with what else can be produced or achieved with the same consumption of resources (Beaujean, Kristes, & Schmitt, 2008).

[10] Effectiveness of a business is a mesure of the degree to which organizational goals are achieved (Guimares, Owen, & Armstrong, 2006).

by Ronald Coase in 1937, a member of the Neo-Classical School. According to him, firms bear when transaction costs[11] related to coordinating production on the market are higher than costs of integrating activities within an organization, considering market imperfections (Coase, 1937). In fact, integrating activities is a method to avoid transaction costs, such as those related to negotiations and gathering information. Indeed, international expansion, or organizational growth, is based on the fact that there are some conditions under which it is more efficient for companies to create an internal international market, rather than entering foreign ones having transactions with other companies. These conditions are related to transaction costs of foreign activities (Coase, 1937).

Later, this theory, that is based on the idea that cost minimization is the core problem of organizations, has been extended by Williamson, a researcher of the New Institutional Economics School. According to him, the existence of firms is explained from asset specificity in production, meaning that the asset has much less value if used in its second possible best use in a production process (Williamson, 1975).

Therefore, it is possible to choose between spot transactions[12] and internalization, depending on transaction costs. If these, that are influenced from specificity of goods or services, uncertainty, limited rationality[13] and opportunistic behaviour[14], are high it is more convenient to internalize the process rather than recurring to repetitive spot transactions. Otherwise, spot transactions are more cost efficient (Williamson, 1975). Later, the researchers of the "Reading School" in England, such as Buckley, Casson, Dunning, Rugman, and Hennart gave their contribution to the theory.

Then, there is Property Rights Theory, which states that in response to the economic problem of the allocation of scarce resources, property rights arise, being the rights of people to use resources, legally enforced by states and affecting economic behaviours and outcomes. According to this theory, norms of behaviour allow people to use resources in not prohibited

[11] All the costs related to making trade transactions. They can be divided in: Information costs, bargaining costs, policy and enforcement costs (North, 1992).

[12] A spot transaction is a contract in which the parties agree to trade a good or a service for immediate settlement on the spot date, usually two business days after the trade date (Krugman, Obstfeld, & Melitz, 2012).

[13] The concept of bounded rationality, or limited rationality, is linked to the fact available information is limited, human's evaluation capacities are limited, as well as time. Therefore, in complex situations rational individuals are bound to make satisficing choices, without covering every contingency (Krugman, Obstfeld, & Melitz, 2012).

[14] Opportunism is an assumption made by many theorists, according to which humans are self-interested and take advantage of others when possible (Krugman, Obstfeld, & Melitz, 2012).

ways. Then, resources can be divided in partitions, being this a possible configuration of property rights as resources (Jongwook & Mahoney, 2006).
Partitions are efficient only when they are grouped in appropriate bundles and assigned to the transacting party who is most capable of efficient production. Therefore, this theory suggests that in any kind of arrangement between parties, there is a transfer of control at least over some attributes of resources. The economically efficient way to do that is to transfer control to the party that can be more efficient in production (Jongwook & Mahoney, 2006).

The last one is Institutional Theory, that is often applied to studying multinational enterprises, since it states that organizations need to conform to the environment, in particular to the system of norms and beliefs. Companies are affected from isomorphism, meaning that the adoption and diffusion of business models and strategies is established as a standard in the sector in which those organizations operate (Kostova, Roth, & Dacin, 2008).
When this is applied to corporate strategy and to foreign entry modes, this means that companies chose the strategy basing on the environment and imitating other firms. However, there is evidence that multinational enterprises react differently to different institutional systems (Kostova, Roth, & Dacin, 2008).

Now that these basic theories have been explained, it is possible to present the main theoretical approaches to foreign market entry mode choices, that have their basements in those fundamental theories.
The first of these is the Chain of Establishment Approach. This has been one of the first frameworks developed about the way in which companies expand internationally. According to it, firms follow some specific stages in developing internationalization strategy (Johanson & Vahlne, 1977).
First of all, there are irregular exports. This is the earliest stage of internalization, in which firms start entering other markets and having international clients, but not regularly. It is possible to say that, at this phase, even if the firm is already expanding internationally, it is not yet an international company or a multinational enterprise because international transactions are just based on irregular exportations.

The next step consists in setting independent representatives or agents in other countries in order to export goods or services there. In this way, the company starts to be tied to international markets and it concretely starts its international expansion.

Then, according to this approach, enterprises create sales subsidiaries in the target countries of internationalization. This is a method to increase the presence of the company in a given market and to assume direct control of sales operations there. Indeed, when companies reach this stage, it means that their presence in that market is becoming relevant for them.

The last step consists in building production or manufacturing plants in the target country of internationalization. It is clear that if companies choose to do so, it means that the market is now so important for their business that it is convenient to produce there. In some cases, this choice can also be pushed from the regulatory framework of that country (Johanson & Vahlne, 1977).

Even if it has not been declared explicitly, this approach relies on the resource-based theory and on internationalization theory. Indeed, increased commitment to resources and to the market leads to higher market knowledge and vice versa. Considering that the latter emphasizes how the contribution of human resources can change depending on their own activities (Penrose, 1959), which means that employees can change the way in which they supply services to the company due to the specific market knowledge related to their activity in it, market knowledge is unique (Nelson & Winter, 1982). So, there is a basic assumption that internal assets of companies, like experimental knowledge, are created from firms' performing activities (Porter M. E., 1991). Moreover, researchers agree on the fact that knowledge allows companies to create a competitive advantage, that predicts the entry mode chosen by multinational enterprises (Kogut & Zander, 1993).

The Chain of Establishment Approach considers decisions related to entry modes as a time-dependent process (Zaltman, Pinson, & Angelmar, 1973). Indeed, according to it, the reason behind a specific entry mode used by a company can be found in the precedent situation of that firm in that markets or from a sequence of prior situations.

Therefore, the unit of analysis of the Chain of Establishment Approach is the firm itself and the variable that explains entry mode choice is company knowledge. The main behavioural assumption on which it is made is bounded rationality, having this approach its roots in the Resource-based Theory.

Moreover, according to this approach the main decision criteria is just the trade-off between growth and risk, but the only explanatory variable of entry mode choice is firm's knowledge.

To recap, according to the Chain of Establishment Approach there are four subsequent modes of entry.

1. No exports;
2. Exports via independent representatives;
3. Sales subsidiaries;
4. Manufacturing abroad.

The theorists of this approach did not include those entry strategies that are based on cooperation in their framework and this represents a missing aspect that they did not consider (Andersen, 1997).

Moreover, this model has been criticised because it seems very deterministic and this means that firms' ability to make choices about modes of entry and internationalization is not really taken into account (Reid, 1983). That's only one of the reasons why this approach has been largely criticised. Other reasons can be found in the fact that there were empirical pieces of evidence against it in some industries and in services and in the lack of other variables, apart from knowledge (Turnbull, 1987).

In the nineties another approach arose and became very popular, it is called Transaction Cost Approach. This seems to be very viable in explaining vertical integration and has been used to predict entry strategy choices for manufacturing and service firms (Erramilli & Rao, 1993). Transactions are the unit of analysis of this approach and the main dimensions on which these are based consist in the frequency of exchange, the level of uncertainty that concerns the operation and the specific assets involved (Williamson, 1975). These dimensions are fundamental to analyse the way in which the transaction is performed. Moreover, an assumption is made in this approach. Indeed, the decision maker is characterized by bounded rationality and opportunistic behaviour (Andersen, 1997).

This approach finds it roots in Transaction Cost Theory and, to apply it to entry modes, it is necessary to consider also all those costs that are not directly related to the transaction and all the benefits of it (Erramilli & Rao, 1993). For instance, higher market power, more integration and coordination of international operation and obtaining shares of a foreign company are all possible benefits that should be considered from a realistic model.

Applying this approach, it is possible to see that the more an asset is specific, the more companies choose entry strategies that will guarantee them high, or even complete, control of it. Some factors in particular influence this choice. These consist in external and internal

uncertainty and in firm's size (Erramilli & Rao, 1993). In particular, the decision criterion is transaction costs minimization and companies can choose three kinds of modes of entry:

1. Contractual transfer;
2. Joint-Venture;
3. Wholly-owned operation.

The first one consists in any form of contract or agreement which has as its object the transfer of the right to produce or sell a product or service in a market. Also, licensing belongs to this category. A Joint-Venture is instead a business entity created by two or more parties with a common aim. There are several types of it depending on ownership, returns and risks. In particular, depending on ownership we can distinguish equal joint-ventures, when all the parties control the same number of shares, and majority or minority joint ventures, when the shares are not equally distributed between the parties (Grant, 2010).

At last, a wholly owned operation, also called wholly owned subsidiary, is a company settled in a foreign market and controlled completely from the motherhouse in the home country. It can perform only a specific operation, like a sales subsidiary, or multiple ones (Grant, 2010).

The Transaction Cost Approach has been criticised because, according to it, decision criteria are benefits and value, and not cost minimization, that is the basic assumption of the Transaction Cost Theory, but changing the criteria the result also changes (Madhok, 1997).

On the other hand, this approach considers also hybrid modes of entry but does not distinguish carefully between them, just grouping them in categories.

The next approach is one of the famous ones about entry modes. It is the Eclectic Framework, that is also known as OLI Framework. It states that some specific factors influence the entry strategy choice of companies. First of all, a factor consists in ownership advantages, if they are unique and sustainable, and therefore not shared with others and can be held in the long-term, so that the multinational enterprise will be able to rely on a sustainable competitive advantage in the entry mode selection (Dunning, 1988). According to this framework, firms recur to foreign production when the ownership advantage of the foreign investor cannot be rented, licensed or sold to local firms and it can be exploited better if combined with local productive factors and assets.

These factors, that are local inputs and assets, are called location advantages. These also reflect the degree of attractiveness of a given country for a company, considering its market

potential and investment risk[15] as well (Root, 1994). Moreover, this kind of advantages are present also when the target country of internationalization has similar dimensions, such as culture, regulatory framework or market infrastructure, and when there are lower production costs that in the home country (Dunning, 1988).

Finally, internationalization advantages are considered from the framework. These are linked to the choice of the mode of operation, between a hierarchical one and an external one, and to transaction costs (Dunning, 1988).

Later, some researchers added more variables to the Eclectic Framework, in particular, strategic ones. However, the interesting point of it consists in the fact that it is not based only on one theory. Indeed, the Eclectic Framework relies on internationalization theory, resource-based theory and transaction cost theory. In this way, this becomes the strongest theory and paradigm of entry modes, stating that the choice of the foreign market in which the company should enter depends strictly on the trade-off between risks, benefits, returns, control and resource availability.

The OLI Framework has the same behavioural assumptions of the Transaction Cost Approach, but its unit of analysis is the firm, like for the Chain of Establishment Approach. The explanatory variables of the entry mode choice are ownership, location and internationalization advantages (Dunning, 1988).

According to it, entry modes can be divided in three categories:

1. Independent modes;
2. Cooperative modes;
3. Integrated modes.

The first ones are those ones in which companies choose to enter foreign markets without strong control, for instance, licensing, franchising, setting an agency or contracting (Dunning, 1988).

Cooperative modes are, instead, those ones in which companies choose to share risks and returns with other entities. A typical example are Joint-Ventures and Strategic alliances (Dunning, 1988).

At last integrated modes, that are acquisitions and greenfield investments, are those ones in which companies want to keep a stronger control, even integrating more operations in a subsidiary abroad (Dunning, 1988).

[15] It is the risk that an investment may result in a loss for an organization (Krugman, Obstfeld, & Melitz, 2012).

One of the problems related to this framework consists in the influence that locational advantage has on the international market selection. Indeed, many authors recognized a direct relation between these two elements, but the nature of this interrelationship is still unknown. It is also interesting that the majority of literature about entry modes assumes that companies have the opportunity to unilaterally choose any strategy of entry for every market. This seems very far from reality. In fact, many are the countries that close the access to some industries to foreign companies if they do not establish a subsidiary on their territory and very often foreign companies are obliged to build joint-ventures with local firms. Therefore, assuming that the choice of the entry strategy can be made by companies as an independent decision from the international market selection, and vice versa, seems to be highly unrealistic.

Moreover, other researchers stated that ownership advantage is a redundant concept and that the framework is too complex (Itaki, 1991).

However, the eclectic framework is the only one that seriously takes into account local inputs and complementary assets, that are those assets, infrastructures or capabilities that are needed in order to support the successful commercialization and marketing of technological innovations, aside from those ones that are fundamentally associated to that specific innovation (Hennart, Hsia, & Pimenta, 2015). The role played by local inputs and complementary assets in entry strategy choice and in international expansion has been neglected from literature and, albeit the eclectic framework takes them into account, it states that they are freely available to both local and foreign firms (Hennart, Hsia, & Pimenta, 2015).

This, however, seems to be highly unrealistic as well, representing a gap in literature.

There is also another approach that explains entry modes and it is the Organizational Capability Perspective Approach. It is based on the assumption of bounded rationality, it has its roots in the Resource-Based Theory, and its unit of analysis is the firm, like the Chain of Establishment Approach. It has been viewed both as complementary and alternative to the Transaction Cost Approach (Madhok, 1997).

According to the Organizational Capability Perspective, a company is a group of relatively static and transferable resources, that dynamic and interactive firm-specific processes transform in capabilities where personal skills, organization and technology are strongly linked together (Madhok, 1997).

This approach has interesting implications in corporate strategy and in business strategy because firms need to distinguish between those resources that can be useful in order to reach a sustainable competitive advantage and those that are not.

It is based on five propositions, depending on firm's capabilities, that are the explanatory variable of this theory. The first one states that companies having a high embedded-to-generic know-how ratio have a better performance in internationalization. In fact, intangible resources, like competencies and skills, are made of an embedded component and of a generic one. This means that those companies who have a higher component of embedded know-how will have more success in expanding internationally. Actually, this agrees with the ownership advantage effect of the Eclectic Framework (Madhok, 1997).

According to the second proposition of the theory, when a firm has a high embedded-to-generic market knowledge ratio, it will more likely choose to collaborate. In fact, as for know-how, also market knowledge is made of an embedded component and of a generic one (Dunning, 1988).

About choosing a foreign location for operations, some researchers stated that when companies try to exploit and keep an existing competitive advantage, in which the potential decrease of firm-specific know-how linked to the ownership effect is higher than the potential decrease of it related to the locational effect, they will more likely internalize. On the other hand, if the potential decrease of firm-specific know-how related to the locational effect is greater than the one linked to the ownership effect, companies tend to collaborate. (Madhok, 1997)

Therefore, this approach distinguishes only two kinds of entry modes:

1. Internalization;
2. Collaboration.

Internalization happens when companies choose to enter foreign markets without signing agreements with local partners, instead collaboration includes all entry modes that entail partnerships with local companies (Madhok, 1997).

When speaking about resources, it is fundamental to consider the environment in which firms operate. Ideally, they should find a balance between exploitation and development of resources and capabilities. In fact, exploitation and development are part of the activities of firms that are more important in a dynamic environment than in a stable one (Madhok, 1997).

It is interesting that the Transaction Cost Approach and the Organization Capability Perspective recommend different entry modes in these environments. Indeed, in dynamic environments, the ownership advantage of a company can be not strong enough for the

creation of future value and it may be necessary to increase it with the one deriving from another firm. The organization capability perspective answers to this with the fourth proposition, saying that when the development-exploitation ratio is high in those activities in which the capability development for the realization of future value is the main motivation, companies prefer collaborations to operations based on economizing on transaction costs (Madhok, 1997).

Another difference between these two approaches consists in the fact that the Transaction Cost Approach considers as the key factors in choosing the entry strategy value and benefits, whereas the organization capability perspective focuses only on the value of firm-specific capabilities. The fifth proposition states that when operations are motivated from value-based reasons there is a higher probability that companies choose collaboration than in the case in which operations are based on the cost minimization assumption of the Transaction Cost Approach (Madhok, 1997).

However, when speaking about capabilities and resources we should remember that they can be tangible and intangible and that the latter can be very difficult to analyse and value. Direct or indirect measurement methods can be used to do so, but both have some weaknesses.

In the next subchapter, the determinants of foreign entry mode choice will be investigated.

## 1.3 Determinants of Foreign Market Entry Mode Choice

This subchapter aims at explaining which the determinants of entry mode choices are, meaning what affects these choices in different situations (Cambridge University, 2019). In particular, after general theory there will be an analysis of specific factors that influence electric car[16] manufacturers. The determinants that influence foreign market entry mode choice can be found in the foreign environment of the target market of internationalization. Considering that the foreign environment is a mixture of internal and external factors that influence company operations (Calof & Beamish, 1995), it is possible to group the determinants in two categories:

1. Internal factors;
2. External factors.

The former ones are related to company's internal environment and they are:

[16] An electric car is an automobile that uses an electric engine for propulsion (European Alternative Fuels Observatory, 2019).

1. Firm Size;
2. International Experience;
3. Technological Capability;
4. Product Characteristics.

Firm size can be defined as the dimension of the firm, that can be analysed under different points of view, such as capital invested[17], value of the product[18], number of employees, power consumed[19], amount of raw material consumed, volume of output[20] and overall productive capacity[21] of the plants (Trigueiros, 2000). Anyways, this is a very important factor that influences entry strategy choices. Indeed, small and medium enterprises[22] (SME), have limited resources, in particular under a financial point of view. This means that, when internationalizing, they are more exposed to risks and their insolvency risk is higher, meaning that the probability that they will not be able to meet their financial obligations is greater (Mańko, 2013). Following the same logic, big businesses, that can be defined as companies exceeding SME limits, can rely on more resources, higher market power[23], greater knowledge and economies of scale[24].

For this reasons, big businesses usually recur to equity entry modes, whereas SMEs to non-equity ones.

International experience is another very important factor because, as explained also in some theories about entry modes, companies gain knowledge in dealing with foreign environments and economies. Indeed, it is the knowledge that companies gain while having contacts with different international environments. Therefore, firms become more and more able to understand environments and the opportunities that there are for foreign companies. Moreover, firms with less experience feel more uncertainty when expanding internationally

[17] Invested capital is the total amount of money that a firm is able to raise by issuing debt to bondholders and securities to shareholders. It can be computed adding total debt and capital lease obligation to the amount of equity and its equivalents issued to investors, without non-operating cash investments (Brealey, Myers, & Allen, 2016).

[18] Product value is an assessment of the worth of a good or a service. It depends on many factors, such as production costs, taxes and market value (Shaikh, 1974).

[19] In electrical engineering, it is the electrical energy usage per unit time (Miloshevich, 2016).

[20] It is the amount of goods or services produced by a firm in a given period of time (Deardorff , 2018).

[21] It can be defined as the maximum possible output of a plant (Sombroek, 2011).

[22] Small and medium enterprises are companies whose characteristics fall below certain limits, that depend from country to country. In the European Union, SMEs have less than 250 employees, less than € 50 million turnover and the total of the balance sheet is lower than € 43 million (Centre for Strategy and Evaluation Services, 2012).

[23] It can be defined as the ability of a firm to increase the market price of its goods or services over the marginal cost in a profitable way (Vatiero, 2010).

[24] Cost advantages that firms can obtain due to the decrease of the cost per unit of output related to an increase in the scale of production (Färe, 1986).

and usually they choose non-equity entry modes, to reduce their exposure. Instead, firms with a good international experience will more likely choose equity entry modes (Grant, 2010).

Technological capability, that is the ability to apply knowledge to develop technological products and processes (Christiansen, 2014), is an important factor, in particular for manufacturing companies and for high-tech firms. Indeed, enterprises facing high R&D capabilities face the risk of leaking their technology to competitors if they choose non-equity entry modes, that is the reason why they usually prefer equity entry modes (Grant, 2010).

Product characteristics are the last internal factor. They provide the company with the opportunity to differentiate its product from the one offered by the competitors. It depends on the degree of uniqueness of the product, the extent of product establishment, training needs of salesforce, degree of maintenance and service requirements of the product (Grant, 2010).

Those products that are service intensive[25], for instance, are difficult to serve from far markets. Therefore, greenfield investments may be appropriate.

On the other hand, innovative products need specialized training programs for employees in the market. In general, it is possible to say that when the product is differentiated companies tend to choose equity entry modes (Krugman, Obstfeld, & Melitz, 2012).

Instead, external factors are:

1. Cultural distance;
2. Market size and growth;
3. Country risk;
4. Legal barriers.

Cultural distance is one of the most important external factors affecting entry strategy choice. It is the difference that there is among countries and organisations, basing on some dimensions (Hofstede, 1997). The dimensions of cultural distance are:

1. Uncertainty avoidance;
2. Power Distance;
3. Orientation to collectivism or individualism;
4. Orientation towards tasks or relationships;
5. Time perception;

[25] Service intensity is a measure of the operational inputs that a company needs in order to provide a service. When the intensity is high, the service can be defined “service intensive”.

6. Masculinity or femininity;
7. Emotionality;
8. Orientation towards the long-term or towards the short term.

Uncertainty avoidance, in cross-cultural psychology, is the way in which cultures differ in tolerating unpredictable events (Hofstede, 1997). Usually high uncertainty avoidant countries are against risks, being risk adverse. This, of course, has an impact also on business decisions. On the other hand, low uncertainty avoidant countries are risk prone. The United Kingdom is a typical example of a low uncertainty avoidant country, whereas Japan is an example of a high uncertainty avoidant nation.

Instead, power distance is a measure of the strength of social hierarchy in a culture. It is about to which extent individuals that are at the lower levels of society expect that power is distributed equally (Hofstede, 1997). This impacts on company structure and on the relationships between employees and managers.

Individualism is the social framework in which individuals are expected to take care only of themselves or of their families, whereas collectivism is the framework in which people expect others to look after them in change of loyalty (Hofstede, 1997). This impacts business relationships and the commitment that employees feel to the company in which they are working.

Then, cultures can be oriented more on tasks or relationships. The first ones tend to give priority to completing activities and to reach the goals that have been set, whereas the others consider relationships as a priority (Hofstede, 1997). This entails that in business relationship-oriented cultures will spend a lot of time on building relationships, creating loyalty and confidence, before completing activities.

Time perception is another interesting cultural difference, based on the fact that some people have a rigid idea of time, whereas others have a flexible or fluid idea of it (Hofstede, 1997). The first ones tend to strictly respect schedules and do not easily accept changes. On the other hand, people who have a fluid idea of time do not see schedules as specific, but more as approximate.

Masculinity is, instead, about the preference of a group for personal achievement, assertiveness, and material rewards, whereas femininity is the preference for cooperation, modesty, caring of other people and of quality of life (Hofstede, 1997). This impacts on companies and on their corporate social responsibility strategies.

Emotionality is about how people act in social contexts (Hofstede, 1997). They can show their emotions clearly or be reserved. This, of course, has an impact on business relationships.

At last, cultures can have a long-term mentality or a short-term mentality when making choices (Hofstede, 1997). In business, this clearly affects choices related to strategy.

Moreover, greater cultural distance between home country and the host ones entails higher uncertainty and higher costs related to communication and collecting information. This is the reason why when there is high cultural distance, companies prefer non-equity entry modes.

Market size[26] and growth[27] are other parameters that can affect entry mode choice. Indeed, greater market size entails greater potential growth[28] for the company (Keller, 1993). This means that the firm will be ready for a higher resource commitment and it will be prone to choose equity entry modes. On the other hand, non-equity entry modes will be chosen for smaller markets characterized from a lower sales potential[29].

Country risk is another very important factor. It is the risk of investing or lending money in a country related to possible changes in the environment that can have a negative impact on the value of assets in that nation and on operating profits (Fitzpatrick, 1983). It depends from political and economic aspects, that can influence doing business in a country. In particular, companies choose entry strategies that do not require high resource commitment, like non-equity entry modes, when countries are unstable. Instead, when countries are stable, have free market[30] mechanisms and good macroeconomic indicators, firms are more prone to adopt equity entry modes.

Legal barriers are the last important factors that should be considered. These are barriers imposed from the legal framework of a country, such as tariffs and import quotas (Krugman, Obstfeld, & Melitz, 2012).

These, as well as excessive trade regulations incentivize firms to produce locally, choosing equity entry modes. On the other hand, restrictions on foreign ownership encourage companies to choose non-equity entry modes.

[26] It consists in the number of potential buyers or sellers of a product or a service (Lauri & Pia, 2006).
[27] Market growth consists of an increase in demand over a period of time (Deshpandé & Farley, 1998).
[28] It is the ability of an organization to reach in the future higher profits, increase workforce and production (Damodaran, 2009).
[29] It is the highest market share that a product is expected to reach in a given time frame (Farris, Bendle, Pfeifer, & Reibstein, 2010).
[30] Economic system in which prices are determined by consumers on the open market (Popper, 1962).

Anyways, when studying which environmental factors play an important role in choosing entry strategies, it is necessary to combine multiple sources, since it is very difficult to find literature that analysed specifically that topic.

Indeed, it is now necessary to give a broad view of what car producers take into consideration when choosing if and how they should enter a foreign market. Hence, only general factors, that every company takes into consideration while expanding internationally, have been explained. Now, it is necessary to focus on electric car producers.

Existing literature about entry modes used by manufacturers presents different reasons that influence the choice of the strategy, even if this literature is quite poor for electric cars manufacturers and it seems that the general factors are in common between producers of cars, besides engine technology.

So, an important factor is related to ownership and control. Automotive is, indeed, a capital-intensive[31] industry and usually high capital investments[32] are needed to establish a direct presence in a new market or geographical area.

Therefore, car producers are very often pushed to choose foreign direct investments. In fact, the establishment of subsidiaries, greenfield investments, and joint-ventures have usually been successful modes of entry in the automotive industry (Hennart, Hsia, & Pimenta, 2015).

Another fundamental factor consists in the location. Indeed, transportation costs can have a very high impact, in particular for economic and low-end cars. Therefore, it can be necessary to avoid exports, in order to build facilities directly near the customers (Hennart, Hsia, & Pimenta, 2015).

Hence, costs are a fundamental factor that influences the choice of the entry strategy.

One more factor that should be underlined consists in the fact that some car manufacturers need to preserve their reputation, that can be related to the place of production.

This is usually the example of sport or luxury cars, with high brand equity[33], that cannot produce in locations that are different from the original and traditional one (OECD, 2011).

In this case, companies usually recur to exports, signing agreements with distributors in foreign countries.

[31] Industries which need large amounts of investments to produce goods or services, having therefore a high amount of fixed assets (Berk & De Marzo, 2017).

[32] The amount money invested into a business to reach its goals and expecting an income. It is recovered, indeed, from earnings generated from the business (Berk & De Marzo, 2017).

[33] Brand equity can be defined as the value that derives from the perception that customers have of the brand of a product or a service, and not from the product or service itself (Keller, 1993).

When choosing to enter a new market, obviously, also electric car producers analyse the legal framework in the country, with special attention on laws related to electric automobiles. Indeed, an important factor that has already been underlined is the legal one. When companies are interested in entering a new market, entry strategy choice is for sure influenced by the legal norms of that country.

Some nations can provide incentives to firms who localize their production within their territory or can oblige foreign companies to sign agreements with local partners or even to conduct in that country part of research and development functions (Hennart, Hsia, & Pimenta, 2015).

Furthermore, some countries have even decided to ban the sales of new cars with an internal combustion engine[34] since 2030. This means that the market, even if still not ready for electric cars, will be obliged to prepare itself in the next ten years and that investing there before other companies can give to firms a competitive advantage and higher market shares than competitors in the future (European Alternative Fuels Observatory, 2019).

On the other hand, also specific, economic and market aspects are considered, as well as political ones. In particular, the presence in a country of incentives to buy electric cars should be interpreted as an opportunity to gain market shares[35] in that market and justifies investments, such as the creation of a sales subsidiary. Some countries provide subsidies also for the construction of infrastructures for electric cars, like charging piles[36]. Another interesting element is the average oil price for customers in that country. If it is high, they will find electric cars very convenient and they will be more prone to buy them (Hennart, Hsia, & Pimenta, 2015).

Also, social and cultural aspects are taken into account by companies. Indeed, there are cultures that are more aware of environmental problems than others.

This aspect should not be underestimated, because electric automobiles' buyers are usually environmentally aware and if people do not care about environmental problems, it could be difficult to grow in that market, considering that usually the price of an electric car is still higher than the one of a car with an internal combustion engine. However, this is also connected with the perception of pollution levels in a country. In countries where there are

[34] An internal combustion engine is a heat engine which generates motive power by burning fuel (Van Basshuysen & Schaefer, 2004).
[35] Market share is the percentage of total sales in an industry that is attributable to a company (Keller, 1993).
[36] A charging pile is a part of a charging station that, by plugging a cable in the outlet, allows to charge electric cars (Murray, 2019).

high pollution levels, usually customers are aware of environmental problems created from internal combustion engines (European Alternative Fuels Observatory, 2019).

Then, a very significant aspect that is usually underestimated is technology. Indeed, electric cars are based on a completely different technology than normal ones and they need different infrastructures. In particular, charging infrastructures are needed (Zhang, et al., 2018).

Unfortunately, at the moment electric cars lack of worldwide standards and this means that some companies may find difficult to penetrate some markets without adopting different standards from the ones they usually have (Hennart, Hsia, & Pimenta, 2015).

Adaptation to standards also entails costs, in particular, if many different ones are spread over different markets. This is directly related to the lack of a charging standard for charging networks, that are often not compatible among them.

Indeed, market entry strategy choice is influenced also from complementary assets. As already underlined, it is peculiar that only the OLI Framework considers these aspects among many approaches.

Indeed, among location advantages, complementary assets, like the charging infrastructure, are the most interesting one. This asset has been studied in the Bundling Model, that suggests the optimal arrangement for a firm entering a foreign market (Hennart, Hsia, & Pimenta, 2015), having the OLI Framework as its basement. The Bundling Model assumes that the successful entry in a target market necessitates the bundling of two elements:

1. Intangible inputs from the foreign investors;
2. Local inputs and assets brought by local companies.

In particular, the model is focused on knowledge as an intangible, that can be easy to transact or difficult to transact, depending on whether it is protected by property rights or not. Local resources can be easy or difficult to transact as well (Hennart, Hsia, & Pimenta, 2015). The model, that is based also on the Property Rights Theory and on the Institutional Theory, states that the most efficient arrangement is the one that minimizes monitoring costs. Meaning that when the behaviour or the output of a party is difficult to assess or measure, this party will invest directly. On the other hand, when all the parties have this characteristic, they choose a joint-venture.

| Bundling model of entry (Hennart, Hsia, & Pimenta, 2015) | | Knowledge assets held by the foreign investor | |
|---|---|---|---|
| | | Easy to transact | Difficult to transact |
| Complementary assets held by local companies | Easy to transact | Indeterminate | Wholly-owned subsidiary of the foreign investor |
| | Difficult to transact | Wholly-owned operations of local firms | Joint venture between foreign investor and local firm |

Table 1

It is therefore clear that complementary assets can affect entry mode choices. Considering this, the charging infrastructure operating in a market should be a significative characteristic of its specific environment for electric car manufacturers. Therefore, we can hypothesise that the number of charging stations operating in a country is one of the determinants of entry strategy choices of electric car producers.

Moreover, being charging stations the most important complementary asset for electric cars, the conditions of the market for local assets can have an impact on entry strategies as well. Indeed, as already explained, several electric car producers have decided to enter also this market and it is interesting to understand the reasons behind this choice. In particular we hypothesise that the conditions of the market for local assets affect entry strategy choices of electric car producers. Hence, two hypotheses are made in this thesis.

Finally, searching which factors influence something reminds of causality. It is important to remember that correlation is different from causality. Indeed, to prove causality between independent variables and a dependent one, it is necessary to consider four things (Handy, Cao, & Mokhtarian, 2005):

1. Statistical association between cause and effect;
2. The cause precedes the effect in time order;
3. There are no other factors creating accidental or spurious relationships between variables;
4. The causal mechanism by with the cause influences the effect is known.

Correlation is an evidence of statistical association, that is part of causality. This always has a level of reliability that is almost never maximum. Moreover, when looking at causality links, it is normal to consider an error or that something can be impossible to prove completely (Nielsen, 2012). Anyways, the scope of each causality check is to reach the highest understanding possible of the causality link.

The next chapter studies deeper charging infrastructures as a possible determinant of foreign market entry mode choices and how the conditions of the market of local assets can affect strategic choices of electric car manufacturers, studying statistical association through correlation.

# 2. Empirical analysis of the determinants of foreign entry mode strategies of electric car manufacturers by the example of Tesla and CHAdeMO

## 2.1 Overview of the electric car industry

Before presenting empirical analysis, it is necessary to have an overview of the electric car industry.

Nowadays, a large percentage of the petrol consumed all around the world is intended to be used to power means of transportation. For instance, in the United States of America the 70% of the oil consumed is destinated to transportation (Todd, Chen, & Clogston, 2013). Moreover, the number of cars in the world is increasing rapidly, especially because of the impact of developing countries, such as China and India.

Unfortunately, petrol is not an unlimited resource and burning it is not safe for the environment. Therefore, it is clear that a new technology is necessary in order to reduce pollution and to guarantee transportation services in the future. In this scenario, electricity represents a good source of power for transports that can improve quality of life, lessen refuelling expenses and free the western world from its dependence from those countries that provide petroleum.

Unluckily, even if electric cars were common in the late XIX century, they have rapidly been replaced by those with an internal combustion engine. Actually, these engines were much different, in particular in the powertrain. In fact, electric cars are simpler, needing only an electric motor and a battery pack, they can be used without a transmission and they are generally smaller. However, the development of the internal combustion engine and the difficulty of engineering a stable battery with a high capacity, led to the supremacy of heat engines.

Only in the second half of the XX century, when fuel prices raised steeply, some manufactures started having interest in electric cars again. Moreover, in the last years a serious progress has been possible in engineering and now electric cars can rely upon Lithium-Ion batteries (Todd, Chen, & Clogston, 2013). These have been firstly introduced in mobile phones and laptops in the nineties and are now used also in electric cars. Indeed, batteries are certainly the most challenging component in an electric car, and they are also the most expensive, even if the cost is dropping year by year, thanks, also, to learning economies (Todd, Chen, & Clogston, 2013).

It seems that electric engines are going to replace the internal combustion ones in the future, due to the fact that they are fully environmentally friendly. In fact, many governments are focusing on environmental issues, supporting the spreading of electric automobiles with direct tax subsidies and planning to shut down the sales of cars with internal combustion engines powered by premium petrol or diesel.

In any case, there are several kinds of electric cars and it is necessary to define the main ones that are produced by manufacturers at the moment.
At first, there are Battery Electric Vehicles (BEV) that are all those cars equipped with batteries aimed at powering an electric engine. These automobiles can be purely electric or hybrid, since there are also Hybrid Electric Vehicles in which the engine is powered by both petrol and electricity, and the battery, that helps using efficiently the fuel, is charged by the internal combustion engine or by plugging the car into an external source of electricity. In the last case they are called Plug-In Hybrid Electric Vehicles (PHEV) (European Alternative Fuels Observatory, 2019).
Moreover, there are Extended Range Electric Vehicles (EREV) in which there is a little generator that has solely the scope of recharging the battery using petrol and the powertrain is fully electric. However, this generator supplies only emergency recharging, since these cars are basically Plug-In Electric Vehicles, that are all automobiles equipped with an electric powertrain in which the batteries are charged by plugging the car into an external source of electricity (European Alternative Fuels Observatory, 2019).
Each one of these types of electric cars has different specifics and this means that different complementary assets are needed. Indeed, the charging infrastructure introduced in the first chapter is necessary for all Plug-In Electric Vehicles, but not for hybrid cars that charge the battery pack only from the internal combustion engine and which cannot be charged by plugging them into an external source of electricity. These cars can rely upon the existing refuelling infrastructure.
Therefore, this thesis is focused in particular on manufacturers of any kind of Plug-In Electric Vehicles.

Furthermore, charging stations are not all the same (Todd, Chen, & Clogston, 2013). There are Level 1 charging stations that work with standard household plugs and that can charge a car to move for 2 to 10 km in an hour. The Level 2 ones can charge from 15 to 30 km in one hour but need the installation of a special charging equipment to work safely. Lastly, the

Direct Current Fast Charging can charge from 80 to 130 km in an hour and usually cannot be installed in a house. The first ones cost about USD 360, the second ones about USD 490 and the last ones approximately USD 19,000 (Todd, Chen, & Clogston, 2013).

Being a new technology, electric engines are experiencing some obstacles in their adoption and one of these is that the infrastructures for electric cars are still immature in many parts of the world.

Indeed, electric cars need an infrastructure of charging stations, but many countries all over the world have not built it yet. This instigated anxiety in customers that are afraid that they will not be able to charge their cars, considering that usually the autonomy of an electric vehicle is lower or much lower than the one of those based on an internal combustion engine. Moreover, some car producers still do not have a line of electric cars or even do not offer electric versions of their models. In particular, producing an electric engine requests a different engineering and a different production process from an internal combustion one, technical know-how needed can differ under some aspects and many components vary (Todd, Chen, & Clogston, 2013).

At last, the importance of the infrastructure has to be underlined. Indeed, actually the drivers of electric vehicles are facing constraints that can be substantial in some countries or parts of the world. Nowadays, the charging infrastructure is incomplete in several countries. Therefore, this represents a huge challenge for the producers of electric cars. In order to buy them, customers need to know that there is a proper infrastructure of charging stations in their country, or at least in their area (Todd, Chen, & Clogston, 2013). Otherwise, they will choose to buy cars based on different technologies.

Moreover, to have a clear overview of the international electric car industry it is possible to recur to Porter's five forces analysis. First of all, it shows that there is a moderately high threat of substitutes due to cars based on different technologies, not only the ones related to internal combustion engines, but also to hybrid or hydrogen engines.

Unfortunately, it seems that the literature actually existing does not consider hydrogen cars as substitutes. However, these cars based on alternative technologies increase the threat of substitutes because, being based on a powertrain that uses hydrogen as a fuel, their real advantage is that they do not just provide the same benefits to customers but they are really similar to normal cars with internal combustion engines powered by premium petrol, diesel or natural gas. Indeed, when an innovation is launched it experiences a period in which customers need to adapt to the usage of it, because it can be different from the one that has

been used previously (European Alternative Fuels Observatory, 2019). Electric vehicles need to be charged overnight at home, and it takes several hours, or at a charging station, where the car has to be left for some hours or minutes. In the best cases it takes 20 minutes, like for the Tesla Model S (Todd, Chen, & Clogston, 2013). However, it takes much more time than refilling the tank of an internal combustion car and it has to be done in a completely different way. Instead, hydrogen cars have an autonomy that is comparable to the one of premium petrol or diesel ones and it takes only a few minutes to fill the tank in a way that is absolutely similar to the one used for common cars.

Hence, it is reasonable that customers will find easier to switch from premium petrol or diesel cars to hydrogen cars, than to electric ones, more or less as they do when they turn from premium petrol automobiles to diesel ones or vice versa. Furthermore, it is important that the selling price of electric, hybrid or hydrogen vehicles is usually higher than the one of common cars. This means that at the moment these technologies are not as affordable as common cars, at least considering the initial price. Instead, the price of hydrogen or electricity is certainly lower than the one of oil, in many countries (Todd, Chen, & Clogston, 2013).

Another force consists in the bargaining power of suppliers, that is moderately high, since electric car industry is still at its early stages and many components are not standard yet. This entails that electric car manufacturers have less bargaining power than producers of common cars against suppliers.

Instead, the bargaining power of customers is moderately low, because on the one hand there are not many electric car producers and models through which they can choose, while on the other hand they can obtain the same benefits from vehicles powered by internal combustion engines, that can rely upon an established and widespread refuelling network, or from the environmentally friendly hybrid ones.

From international researches, it seems that the average buyer of these products is a well-educated person with a higher than average income, who wants to free herself or himself from oil prices that are much higher than energy ones (Woodyard, 2012). Moreover, it seems that these customers are males, who range in age from 18 to 34, usually married and with an income above average (Ipsos, 2017). Furthermore, studies show that the most important factors are charging (81%), long range on full electric driving (77%) and tax incentives (67%) (Ipsos, 2017). In addition, to understand customers' profile a test of the most important concepts has been led, comparing Chevrolet Bolt and Tesla Model 3 in the United States of America (Ipsos, 2017). The first one is preferred by both men and women and in

both urban and suburban areas, whereas the other is chosen by males in urban areas. In both cases the household income is higher than average in the USA, being USD 67,630 for Chevrolet Bolt's customers and USD 102,040 for Tesla Model 3's ones. It also seems that electric vehicles' manufacturers should target millennials, who are prone to adopt early, have a wide knowledge of contemporary technologies and are willing to use green means of transportation.

Moreover, the threat of new entrants is moderate, since even if high capital and expert engineers are needed, many groups in the automotive industry are presenting electric cars or have publicly stated that they will offer electric versions of their models in the next years.

Therefore, considering electric vehicles as an industry, it seems that the rivalry is moderate.

The deployment of electric cars is facing different obstacles, as already said. The main ones are (Todd, Chen, & Clogston, 2013):

- High costs connected to Electric Vehicles;
- Consumer Misperceptions;
- Supply of raw materials;
- Limited charging infrastructure.

The first hurdle can be overtook using both demand and supply side strategies. Among the former, it is possible to plan incentives for the purchase of electric vehicles, as many countries are doing, or to reduce the battery ownership risk or encouraging utility rate discounts. Instead, from the supply side it is possible to plan public investments in R&D, to educate a specialised workforce, to provide business financing and to support the development of the supply chain. Moreover, to go beyond customer misperceptions it is necessary to educate customers about electric automobiles, for instance establishing public demonstrations (Todd, Chen, & Clogston, 2013).

In addition, the supply of some raw materials, such as cobalt, that are needed to produce batteries may impact negatively their prices (Bloomberg New Energy Finance, 2018).

However, the main problem is represented by the limited presence of charging stations. There are many ways in which countries can solve this issue. They can invest in a network of chargers, that can be placed on the sides of the streets or incentivise those who install chargers (Bloomberg New Energy Finance, 2018).

The lack of a proper charging network is a barrier in many countries. Moreover, it would be necessary to inform people about the location of these chargers, in particular when the network is not widespread. This can be done also collaborating with private companies and energy providers.

The last hurdle is the one on which this thesis is focused. As already said, a proper charging infrastructure is fundamental for the diffusion of electric vehicles. Indeed, this technology constrains drivers to an autonomy range that is generally quite short.

Moreover, there are some technical problems linked in particular to the possibility that charging electric cars during the peak hours of electricity demand can overload the network. Therefore, some changes in local electric networks may be necessary.

In addition, it is interesting to analyse the differences in infrastructure development around the world. In the USA, Tesla's home country, there are many different ways to charge electric vehicles depending on the State. Moreover, it is very common that charging stations are concentrated in the centres of the main cities, without any coverage in the other areas. To overtake these limitations, the American Recovery and Recruitment Act financed the installation of 1,500 charging stations placed all around the territory of the USA. Unfortunately, this seems quite insufficient for a country with one of the widest territories in the world and populated by 328 million people.

The situation in Europe is quite different depending on the nation. Norway, for instance, is one of the most advanced nations in that continent. In 2017 there were more than 9,000 (European Alternative Fuels Observatory, 2019) charging stations in the country. In 2016 the 30% of all the cars sold in the country was electric and it seems that 2017 has been even better. Also, the United Kingdom has already built a good infrastructure, with more than 17,000 connectors all over the country. France is building a network through its electric companies and now has more than 10,000 stations. Then, the situation is very immature in eastern and southern Europe, with some nations having a good coverage in some regions and almost nothing in the rest of the country. For example, Italy has a good charging network in the northern area of the country, but the situation changes dramatically in the south and in the islands (European Alternative Fuels Observatory, 2019).

In Asia, the governments of many developing countries are willing to create a wide network of charging stations to spread electric vehicles. A clear example is India, that is willing to have six million electric cars until 2020. However, the clear leader in Asia and in the world is China. In 2018 in that country more than 800,000 electric cars have been sold and it seems that the target of the Chinese government to reach 5 million electric vehicles in 2020 will be easily overtook (Bloomberg New Energy Finance, 2018). It is interesting that the 21% of the global sales of electric vehicles takes place in six Chinese cities that have restricted internal combustion engines because of excess in pollution. Indeed, China has also a good plan for its charging infrastructure. It is planning to place 100,000 electric stations on the most

important routes of the country (Bloomberg New Energy Finance, 2018). This plan seems coherent with their target and China actually seems to be the only country that is installing a proper number of charging stations if compared to its objective. However, all over the world the networks are more developed within cities and basically non-existent in rural areas. This is clearly connected with the number of electric vehicles sold in a certain region. Indeed, as already said, people are subject to a sort of range anxiety and the fact that in some areas there are not charging stations is carefully considered during the customer journey.
It is now necessary to analyse which are the entry strategies that companies operating in the automotive industry are more likely to choose. This can be done studying previous research and data.

## 2.2 Tesla and CHAdeMO: Profile and entry modes

It has been underlined that the supply of complementary assets, specifically of the charging infrastructure, is one of the main hurdles to the spreading of electric vehicles and one of the most important differences between different countries and different environments, since there are some developed countries that are providing or investing to provide efficient complementary assets for electric vehicles and other nations that are very backward under this aspect.
This is related to the chicken-and-egg dilemma of infrastructure development for electric vehicles. Indeed, customers are reticent to buy electric vehicles if the coverage of the charging infrastructure is not extensive enough but, on the other hand, suppliers of charging services are reluctant to invest on charging infrastructures if the demand for electric cars is not significant (Hennart, Hsia, & Pimenta, 2015).
In order to solve this problem, electric car producers often need to start building their own networks of charging facilities.
This means that companies need to invest strategically deciding where and in which way they should build this infrastructure and these decisions can be related to their international expansion strategy (Bloomberg New Energy Finance, 2018).
In particular, there are two main facilities that electric vehicles producers need to provide, that are charging adaptors for charging stations, that allow users to recharge cars, and swapping stations, where customers can swap batteries when needed (Hennart, Hsia, & Pimenta, 2015). Several electric car producers decided to supply directly charging services.

Therefore, it is necessary that electric car producers make strategic network decisions before observing demand, often without knowing adoption rate of electric cars, market share of charging service providers and other relevant information.
This is what Tesla and CHAdeMO are doing. They both build charging infrastructures for electric vehicles, a fundamental complementary asset for electric car manufactures.

Tesla Inc, formerly Tesla Motors Inc, has been founded in 2003 in California, in the United States of America, by a South African entrepreneur, Elon Musk. The company rapidly grouped engineers and experts from the car industry with the mission of constructing electric cars (Tesla Inc, 2019).
The firm grew fast and became internationally famous, working also with prestigious partners, such as Panasonic Corporation, formerly Matsushita Electric Industrial Co, and Lotus. These partnerships led the company to the development of better batteries and to their first successful car, Tesla Roadster (Tesla Inc, 2019).
Tesla has been able to position itself as a producer of sport and luxury electric cars, developing the Model S and competing with BMW and Mercedes-Benz in the high-end automobile segment.
However, the real mission of the company was to spread electric cars, considering them as the future of automobile industry. At this point, Tesla understood the main hurdle for electric cars, that has been analysed in the first chapter. The charging infrastructure was lacking and, being it a fundamental complementary asset, it was a big threat to the diffusion of electric cars and to Tesla's growth (Tesla Inc, 2019).
This led Tesla Inc to the decision of creating its own charging infrastructure, called Supercharger network. It started from the United States of America, but soon it built it also in other nations, selling its cars to other countries and building there also its charging network.
Now, their strategy will be analysed but there is a consideration that should be made. The development of electric cars, and of chargers as well, is a very capital-intensive activity. As explained in the first chapter, this pushes companies to choose entry strategies that allow to keep control.
Tesla is directly present in 27 countries that have substantial differences in infrastructure development. Indeed, some of these countries present a developed infrastructure, whereas others do not.

The first interesting difference between Tesla and CHAdeMO is that the former is a single producer of electric vehicles, whereas CHAdeMO is an association created by Japanese manufacturers, in particular Nissan-Renault, Subaru, Mitsubishi and Toyota, which decided to unify their forces for electric cars. They decided to build their own shared charging infrastructure as well, called CHAdeMO Network.

Therefore, this information is already very interesting, because it denotes a different approach to the problem and a different solution. On one hand, there is a manufacturer that is directly operating also in the market of complementary assets and, on the other hand, we have a partnership between different producers with the same objective. This thesis compares the example of Tesla with the one of CHAdeMO's members. The latter ones tend to choose the same strategies for each market in which they offer their electric cars and this is related to the fact that they all share the same charging infrastructure through CHAdeMO (Drucker, 1971). This helps to simplify the analysis.

Hence, it is interesting to study the importance of charging stations as a factor determining entry strategy choices of electric car manufacturers, which offer also charging services, since they are controlling a proprietary charging infrastructure. This is the reason why in this thesis Tesla will be compared to CHAdeMO's members. Moreover, these companies are among the most state-of-the-art electric car producers worldwide.

Regarding to entry modes, it seems that Tesla tends to choose integrated modes, such as greenfield investments, whereas CHAdeMO's members choose cooperative modes as well, like Joint-Ventures. In the next chapter this will be shown clearly.

To do so, it is necessary to focus which strategies have been implemented from different manufacturers depending upon some factors.

## 2.3 Determinants of Tesla's and CHAdeMO's entry mode choices

One of the aims of this thesis is to discover the significance of charging infrastructure as a determinant for entry mode choices of electric car producers. To understand that it is necessary to analyse charging infrastructures and to understand which other determinants can be linked to entry mode choices of electric car producers.

According to recent research charging infrastructures are influenced by some specific factors, that can be direct and indirect (Zhang, et al., 2018). The first ones are those that have a direct impact on charging infrastructure and the most difficult ones to study because of the

lack of literature about them. Indeed, in the large majority of cases, charging infrastructures are still in their early stages.

First of all, charging price and capacity[37] are two main factors that give an insight into it. Indeed, operators make profits from electricity price margin[38] and from government subsidies, if present. These two factors are strictly connected to another important one, that is charging demand[39] from drivers of electric cars. This is one of the most complex factors. In fact, it is related to charging price, because operators should find a balance between profits from charging stations[40] and charging demand (Zhang, et al., 2018). On the other hand, it is influenced by the location of charging infrastructures, that is another factor. Indeed, charging stations are usually located in urban areas and also their density should be considered. In fact, when it is high, it entails higher maintenance and operating costs, that are another factor. This explains also why there are fewer charging stations in rural areas (Zhang, et al., 2018). However, operating and maintenance costs[41] are mainly determined by two other factors, ground rent[42], that is, of course, higher in urban areas, and electricity price.

A very important factor is, according to the model, the number of plug-in electric cars[43] in the market. Indeed, charging demand depends on it and it influences the profitability of charging networks. When there are not many plug-in electric cars, charging demand is low and therefore network profitability is low too (Zhang, et al., 2018).

The number of electric vehicles influences also national regulations because governments can choose to provide subsidies for construction and operation of electric charging networks, that represent another factor that is taken into account (Zhang, et al., 2018).

Moreover, charging price is also related to another direct factor, that consists in construction costs[44] of charging units. Indeed, the price should not cover just operating and maintenance

[37] From the battery point of view, it is the maximum amount of energy that can be stored in it. Instead, under the infrastructure point of view it is the maximum amount of energy that can be provided at a given moment to charge batteries (European Alternative Fuels Observatory, 2019).

[38] The amount that is added to electricity price in order to reach the final charging price charged to customers (European Alternative Fuels Observatory, 2019).

[39] The demand for charging services for electric cars (European Alternative Fuels Observatory, 2019).

[40] A charging station is an element of an infrastructure aimed at supplying electric energy to electric cars (European Alternative Fuels Observatory, 2019).

[41] All costs and expenses related to the administration of a business and to keeping items in good conditions (Berk & De Marzo, 2017).

[42] Cost related to the rent paid by the owner of the charging infrastructure to the owner of the land on which it is built (European Alternative Fuels Observatory, 2019).

[43] Any car that can be recharged from an external source of electricity (European Alternative Fuels Observatory, 2019).

[44] Expenses incurred by a contractor for, labour, equipment, materials etc. with the aim of building something (Berk & De Marzo, 2017).

costs, but also capital cost[45]. This factor is related in turn to another one, that is the number of charging piles. Indeed, it has an impact on other costs.

So, direct factors are charging demand, charging price, subsidies for construction and operation, number of charging piles, construction costs of charging units, ground rent, maintenance and operating costs, electricity price, number of plug-in electric vehicles and location (Zhang, et al., 2018).

However, there are also indirect factors that are underlined, as well as their influence on other factors.

One of this is for sure technologies for plug-in electric vehicles because it is clear that the design of charging infrastructures should be determined by technologies for cars. Therefore, it influences technologies for charging infrastructures, policies and customer behaviour. In fact, there are psychological factors linked to autonomy range[46], that are related to the infrastructure (Zhang, et al., 2018).

Another indirect factor is battery technologies, that also have impacts on the same sides as technologies for electric vehicles. Moreover, they will allow customers to rely on higher autonomy ranges, reducing charging demand, and faster charging.

However, the most interesting indirect factors consist in customers' behaviour, psychological factors and policy. Indeed, driving behaviour is highly related to range, that is also related to technologies for charging infrastructures. This is strictly related to range anxiety[47] and other psychological factors than can make it difficult for some people to accept electric cars (Zhang, et al., 2018).

At last, policies for electric vehicles play an important role, according to the model because they can promote the development of technologies, for both cars and infrastructure.

Therefore, indirect factors are technologies for plug-in electric vehicles, battery technologies, charging infrastructure technologies, policies for electric vehicles, behaviour of customers and psychological aspects.

Starting with direct factors, we can present them as formulas, in order to simplify their explanation (Zhang, et al., 2018). In order to do this, we should start analysing the economics

[45] Fixed and one-time expenses in which a company incurs when purchasing something in order to produce goods or provide services (Berk & De Marzo, 2017).

[46] Number of kilometres that an electric car can travel with one full charge (European Alternative Fuels Observatory, 2019).

[47] Concern of customers related to the fact that many electric cars still offer low autonomy range (European Alternative Fuels Observatory, 2019).

behind the factors and this can be done starting from the profit of charging stations, that can be expressed as:

$$Profit = Income - Imvestment - Operating\ and\ Maintenance\ Costs$$

The factors presented before are mainly related to income, so it is convenient to start from it. It is basically made of two components:

$$Income = Charging\ Fee + Subsidy^{48}$$

Where:

$$Charging\ Fee = Charging\ Demand \times Charging\ Price$$

and therefore

$$Charging\ Price = \frac{Charging\ Fee}{Charging\ Demand}$$

$$Charging\ Demand = \frac{Charging\ Fee}{Charging\ Price}$$

From these formulas, it is already possible to see that two of the direct factors are positively and directly related to charging fee. This means that higher charging demand or charging price increase the charging fee and that higher charging demand reduces charging price and vice versa, since there is a negative direct relation between charging price and demand (Zhang, et al., 2018).

As already explained, subsidies can be provided for both construction and operation and they are related to the size of the charging station.

$$Total\ Subsidy = Subsidy\ for\ Construction + Subsidy\ for\ Operation$$

Where

$$Subsidy\ for\ Construction = Unit\ Subsidy\ for\ Construction\ Subsidy \times number\ of\ Charging\ Units$$

And

$$Subsidy\ for\ Operation = Unit\ Subsidy\ for\ Operation \times Charging\ Demand$$

Therefore

$$Number\ of\ Charging\ Units = \frac{Subsidy\ for\ Construction}{Unit\ Subsidy\ for\ Construction}$$

[48] A subsidy is a form of financial support for an economic sector that aims at the promotion of economic and social policies (Rubini, 2009).

Then, it is necessary to study investment costs, that are usually related to capital needed to build charging stations. Indeed:

$$Investment = Charging\ Station\ Construction\ Cost + Cost\ of\ Charging\ Units$$

Where

$$Construction\ Cost = Unit\ Construction\ Cost\ of\ Charging\ Units \times Number\ of\ Charging\ Units$$

At last, it is necessary to consider electricity costs, ground rent and other costs in operating and maintenance costs:

$$Operating\ and\ Maintenance\ Costs = Electricity\ Cost + Ground\ Rent + Maintenance\ Costs$$

Where

$$Electricity\ Cost = Charging\ Demand \times Price\ of\ ELectricity$$

At last, we can express charging demand as a function of the number of plug-in electric cars in a market. Indeed:

$$Charging\ Demand = \alpha \times Number\ of\ Plugin\ Electric\ Cars$$

Alfa is a coefficient that depends on the location of charging stations and on customers' behaviour (Zhang, et al., 2018).

Therefore, it seems that among the determinants we can find charging demand, charging price, subsidies for construction and operation, number of charging piles, construction costs of charging units, ground rent, maintenance and operating costs, electricity price, number of plug-in electric vehicles and location.

In order to investigate entry mode choices of companies it is necessary to gather and analyse data from several countries. In this way, it is possible to study which strategies electric car manufacturers implement in different environments.

Gathering data for many different countries and comparing them it is possible to see which the basic relationships between them are. At first, it is interesting to study correlation among couples of these variables.

Unfortunately, some of these factors are difficult to quantify and they vary even within the same market. This entails that the significance of this factors or of an estimation of them in the analysis would be low. Moreover, in particular for emerging countries it is difficult to find some of these measures.

Therefore, in order to conduct the analysis, we consider the following factors:

1. Income (I)

2. Population (P)
3. Average Age (AA)
4. Dimension (D)
5. PEV Number (PEV)
6. PEV/Dimension (PEV/D)
7. Number of Charging Stations (CS)
8. Density of Charging Stations (DCS)
9. Charging Price (CP)
10. Market Share of Newly registered electric cars (MS)
11. Subsidies (S)
12. Developing (DV)

In particular, income is a measure of the average income of the population living in each of the countries considered. Population is a measure of the total number of people living in a country, whose age is measured by the Average Age variable. These variables have been included since, as explained before, it seems that there is a precise profile of customers of electric cars.

Then, there are specific variables, such as the number of charging stations and their density, that is a measure of the number of charging points in a range of 100 km. The charging price is the average price among the ones charged to customers by the three main charging services in each country. Then, the market share of newly registered electric cars is taken into account as well.

At last, two dummy variables are added. The first one is about the existence of subsidies[49], whereas the other is about the status of developing economy[50].

Of course, also entry modes (EM) are considered, since the aim is to study the link between those factors, in particular charging stations, and entry strategies. This variable assumes a specific value depending on the entry mode chosen in each country. In particular, mostly cooperative modes and integrated modes are taken into account, since independent modes, as already explained, are not commonly used from electric car producers, apart from exports.

[49] It assumes values 1 if subsidies for charging stations are provided for charging infrastructures and 0 if not.
[50] It assumes values 1 if the country has the status of developing economy and 0 if not.

| Entry Strategies according to the OLI Framework | | Value |
|---|---|---|
| Integrated modes | Greenfield Investment | 5 |
| | Acquisition | 4 |
| Cooperative modes | Strategic Alliance | 3 |
| | Joint-Venture | 2 |
| Independent modes | Export | 1 |

Table 2

Therefore, a table containing all data gathered has been built and it is shown in appendix 1, as well as all the countries and the relative sources.

From this data, a correlation matrix has been built and presented in appendix 2.

Data show that the number of charging stations is almost perfectly correlated to the number of plug-in electric vehicles sold in a country, meaning that there are more electric vehicles where there are more charging stations. The number of charging stations is also positively correlated to other variables, but the ones with which the analysis shows higher correlation are population, dimension and entry modes. This means that also the basic characteristics of countries, like dimension and population are related on charging stations. The market share of newly registered electric cars presents high correlation to charging station density, that gives information about the number of charging points in 100 km. Market share is also positively correlated to income, but negatively correlated to developing countries. This is interesting and gives information about developing countries and about the fact that many of them need to put more efforts in spreading electric vehicles. A similar situation exists for charging price and charging stations density, both being positively correlated to subsidies, but negatively to developing countries. Subsidies show to be positively correlated to both charging stations number and PEV number, meaning that they can help nations in spreading electric vehicles.

It is clear that both charging stations and PEV number have positive correlation to entry modes, as well as subsidies and charging stations. However, it is interesting to see that there is a negative correlation with developing countries. Meaning that the more a country is developed, the more companies choose integrated modes, such as greenfield investments or acquisitions.

Indeed, the choice of countries is not casual but based on the fact that is necessary to analyse nations that have different cultures, socio-political environments and policies about electric cars and foreign investments. In fact, developed countries, like the United States of America

or the ones in western Europe, are usually open to foreign investments and access to local assets is usually not difficult. On the other hand, developing countries may impose limitations to access local complementary assets for foreign investors (Bloomberg New Energy Finance, 2018). Moreover, some of them protected local companies using high import tariffs, allowing the growth of giants that are very strong in those markets. It is also common in these countries that companies that were controlled by the government, or that still are, kept a monopolistic position.

Another difference entails legal enforcement. Usually, it is poor in developing countries, if compared to developed ones. This is often connected also to the importance of personal relations to do business, that is usually higher in developing countries (Hennart, Hsia, & Pimenta, 2015).

The countries that have been selected are those ones about which it has been possible to find data. Indeed, in particular for developing countries, it is difficult to find reliable sources about electric cars and charging stations. These countries have been excluded.

In order to study which entry mode companies choose, a regression analysis has been performed.

The aim of this regression model is to investigate the entry mode choice. In particular, it analyses what can determine the choice.

In order to reach the scope of the model, several explicative variables have been identified. First of all, the total number of electric cars (PEV) has been excluded from the model, because its high correlation with the number of charging stations made it redundant and not significant. However, the presence of a high number of PEVs in a market seems to push the charging network to grow. This is interesting when thinking about the chicken-and-egg dilemma, because it shows that the growth of the number of electric cars is linked to the increase in the number of charging facilities. This may be due to a cause-effect relation.

Then, also population and dimension have been identified as variables connected to the charging infrastructure. In particular, they are useful because they allow to consider two fundamental characteristics of countries. Indeed, bigger countries need a different infrastructure than smaller ones, and population plays an important role as well. In fact, the number of people living in a country or in an area influences the number of potential users of the infrastructure.

In order to analyse deeper these aspects, it has been introduced in the model also the ratio between the number of PEVs and the dimension of the country.

Moreover, some countries provide subsidies for electric vehicles and for charging infrastructures and, as already said, these can have an impact and that is why subsidies have been considered as a dummy variable.

Then, the efficacy of the infrastructure may also be related to charging prices. It is indeed interesting to study how these prices influence electric car market and the supply of charging services.

Another significant variable is the density of charging stations on roads. It is basically the number of charging stations per 100 km of distance.

At last, the developing countries dummy variable has been included in the model, because of its interesting possible link to entry mode choices.

This model explains the relationship between the choice of entry mode and all these variables.

Now, it is necessary to answer to the second hypothesis. In order to do that data gathered for the correlation matrix can be used again.

According to Hennart, Hsia and Pimenta, three are the conditions of the market for local complementary assets that should be taken into account (Hennart, Hsia, & Pimenta, 2015). These are:

1. Barriers to entry;
2. Concentration;
3. Number of suppliers.

Indeed, we can build different scenarios basing on these conditions of the market for local complementary assets. First of all, firms should look at barriers to access to local assets, trying to understand how challenging can be for a foreign company or investor to access these. In particular, these barriers can be legal, political or economic. Particular attention needs to be focused also on suppliers and automotive industry in that country. Specifically, what is important is to look at the number of suppliers and at the greater difficulties in entering the market and low competition between the incumbents. Therefore, there are three factors that play a direct role in understanding the condition of the market for local complementary assets (Hennart, Hsia, & Pimenta, 2015).

These allow to distinguish three different scenarios. The first scenario is the one in which there are no barriers for foreign companies to access local assets, concentration is low (HHI is lower than 1500) in the industry on that market and there are more than five suppliers of complementary assets. The opposite scenario is the one in which it is challenging to access to local assets, since there are strong barriers against foreign investors, concentration is high

(HHI is greater than 2500) and there less than three suppliers of local asset. Instead, in the middle there is the scenario in which there are some barriers, but moderate, concentration is medium (HHI between 1500 and 2500) and the number of suppliers of local assets or inputs is between 3 and 5 (Hennart, Hsia, & Pimenta, 2015).

Hence, data about these three conditions have been gathered and the correlation with entry modes has been studied to understand if there is a link between these two. Moreover, the conditions have been added as a variable (CMCLA) to the regression analysis, that assumes values presented in the table below.

| Scenario | Value |
|---|---|
| First Scenario | 3 |
| Second Scenario | 2 |
| Third Scenario | 1 |

Table 3

The results will be presented in the next chapter.

Now, having a model that describes entry mode choices in different development conditions of charging infrastructures, that are the main complementary asset to electric cars, and a framework that allows to understand the conditions of the market of complementary inputs, it is possible interpret the results of the analysis.

# 3. Findings and recommendations

## 3.1 Findings

After the theoretical review and the analysis performed in the previous chapters, it in now possible to look at the results and interpret them.

The new correlation matrixes build for Tesla and CHAdeMO, show that there is a link between charging stations and entry mode choice of electric car manufacturers. It seems that companies tend to choose entry strategies represented from the top values of the scale when there is a high number of charging stations.

This is clearer for Tesla than for CHAdeMO, as shown from the matrixes below. The cells are coloured according to the following criteria:

1. in green when the absolute value of correlation is greater or equal to 0,700;
2. in yellow when the absolute value of correlation is greater than 0,200 and lower than 0,700;
3. in red when the absolute value of correlation is lower or equal to 0,200.

The first matrix has been computed using Tesla's data about entry strategies.

| *CORRELATION MATRIX TESLA* | *EM* | *I* | *P* | *AA* | *D* | *PEV/D* | *CS* | *CSD* | *CP* | *S* | *DV* | *C* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **EM** | 1 | | | | | | | | | | | |
| **I** | 0,445 | 1 | | | | | | | | | | |
| **P** | 0,025 | -0,317 | 1 | | | | | | | | | |
| **AA** | 0,043 | 0,203 | -0,405 | 1 | | | | | | | | |
| **D** | -0,086 | -0,147 | 0,395 | -0,237 | 1 | | | | | | | |
| **PEV/D** | 0,384 | 0,435 | -0,087 | 0,169 | -0,180 | 1 | | | | | | |
| **CS** | 0,686 | -0,115 | 0,673 | -0,016 | 0,304 | 0,117 | 1 | | | | | |
| **CSD** | 0,175 | 0,480 | -0,088 | -0,005 | -0,115 | 0,185 | 0,015 | 1 | | | | |
| **CP** | 0,155 | 0,385 | -0,220 | 0,512 | -0,244 | 0,163 | 0,075 | -0,010 | 1 | | | |
| **S** | 0,639 | 0,675 | -0,026 | 0,274 | -0,046 | 0,368 | 0,262 | 0,296 | 0,440 | 1 | | |
| **DV** | -0,639 | -0,691 | 0,245 | -0,308 | 0,168 | -0,351 | 0,039 | -0,290 | -0,464 | -0,908 | 1 | |
| **CMCLA** | 0,661 | 0,415 | -0,524 | 0,620 | -0,386 | 0,177 | -0,119 | 0,201 | 0,345 | 0,425 | -0,508 | 1 |

Matrix 3

For CHAdeMO, the situation seems to be slightly different, as shown by the next matrix.

| CORRELATION MATRIX CHAdeMO | EM | I | P | AA | D | PEV/D | CS | CSD | CP | S | DV | CMCLA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EM | 1 | | | | | | | | | | | |
| I | 0,348 | 1 | | | | | | | | | | |
| P | -0,486 | -0,300 | 1 | | | | | | | | | |
| AA | 0,531 | 0,174 | -0,426 | 1 | | | | | | | | |
| D | -0,157 | -0,091 | 0,412 | -0,241 | 1 | | | | | | | |
| PEV/D | -0,015 | 0,420 | -0,095 | 0,156 | -0,183 | 1 | | | | | | |
| CS | 0,564 | -0,097 | 0,680 | -0,048 | 0,350 | 0,099 | 1 | | | | | |
| CSD | 0,160 | 0,496 | -0,066 | -0,009 | -0,056 | 0,179 | 0,047 | 1 | | | | |
| CP | 0,264 | 0,373 | -0,222 | 0,489 | -0,220 | 0,149 | 0,064 | -0,002 | 1 | | | |
| S | 0,236 | 0,676 | -0,011 | 0,238 | 0,009 | 0,350 | 0,274 | 0,319 | 0,425 | 1 | | |
| DV | -0,355 | -0,693 | 0,229 | -0,273 | 0,105 | -0,333 | 0,023 | -0,313 | -0,449 | -0,908 | 1 | |
| CMCLA | 0,664 | 0,416 | -0,512 | 0,611 | -0,332 | 0,166 | -0,108 | 0,214 | 0,337 | 0,425 | -0,508 | 1 |

Matrix 4

Indeed, for both Tesla and CHAdeMO correlation between Charging Stations and Entry Modes has a considerable value. Indeed, for Tesla it can be rounded to 0,7 and for CHAdeMO to 0,6. This means that correlation is rather notable in both cases.

Moreover, in both cases there is moderate positive correlation between income and entry modes, even if it is slightly higher for Tesla. Subsidies and developing countries show a moderate correlation to entry modes, but much more notable for Tesla. In general, it seems that companies do not choose integrated modes in developing countries.

Analysing correlation also between other variables, it is notable the positive correlation between income and subsidies. Moreover, correlation between income and developing countries is highly negative, as expected.

Between the dummy variables there is a high negative correlation, that means that subsidies are more common in developed countries than in developed ones. This is coherent with other results.

Other variables have moderate or low correlation between them, and deeper investigation is needed. Therefore, it is necessary to analyse the results of the regression analysis.

From the linear regression analysis conducted in the previous chapter, it is possible to study the significance of every explanatory variable on the dependent variable. Therefore, linear regression allows to analyse deeper the existing relation between each factor and entry modes.

In the appendixes there are the tables with all the input data and the results of the regression. As well as for correlation matrixes, also linear regression analysis has been conducted two times, once for Tesla and once for CHAdeMO.

The first results that should be discussed are of statistical nature. Indeed, it is important to look at an estimate of the level of reliability of the analysis. This can be done thanks to the $R^2$, which is a measure of the trustworthiness of the regression, that assumes values between 0 and 1, where the higher it is the more the analysis is reliable.

The $R^2$ for the linear regression conducted with Tesla's entry mode data is 0,625, whereas the one of CHAdeMO's regression is 0,556. These values, even if not extremely near 1 tell that the linear regressions conducted are reliable. Indeed, these values of $R^2$ are common in social sciences and should be considered positively.

In the appendixes all the results from the analysis are shown, but the most important one is the p-value, that measures the significance of each explanatory variable that has been included in the model. This value ranges between 0 and 1 and the lower it is the more the variable can be explicative of the dependent one.

Starting from the linear regression conducted on Tesla's data, the most significant variable is charging stations, which has a p-value of 0,005. This means that this variable can represent a serious determinant of entry mode choice. Anyways, another variable has the same p-value as charging stations, it is the one about developing countries. This is a very interesting result, because it underlines that Tesla has a different behaviour in developed and developing countries and that this can interact with entry mode strategy.

In particular, this means that Tesla tends to choose integrated modes in developed countries and other options in developing ones. Looking at the specific cases it seems that Tesla has a preference for greenfield investments in developed countries or in wide markets, such as China.

Then there are two other very significant variables, charging price and subsidies. The explanation to this can be found in the importance of Supercharger network for Tesla, that considers carefully to expand it to countries in which it enters. The significance of subsidies is very good as well, since it shows that also this variable, decided from governments directly to increase the number of electric vehicles, can have an impact on Tesla's entry mode choice. All these variables have a p-value below 0,200.

Specifically, the presence of subsidies incentivized Tesla to enter the market choosing integrated modes, rather than independent modes.

On the other hand, there is only one variable that presents a very high p-value. It is the one about the conditions of the market for complementary assets. From the linear regression analysis, it seems that this variable cannot be considered explicative of entry mode choices made by Tesla.
These results are, of course, linked to the hypotheses made in this thesis and it will be underlined later.

Therefore, it is clear that the main variables that can explain entry mode choices are charging station number, subsidies and whether the country is a developing one or not.
The linear regression model and the data gathered suggest when a charging infrastructure is extended enough and, it helps in understanding which entry strategy companies will more likely choose.
From the linear regression, it is clear that the more there are charging stations, the more companies choose wholly owned subsidiaries, or entry modes described by the higher numbers of the scale.
This is true for Tesla, as showed from the following chart.

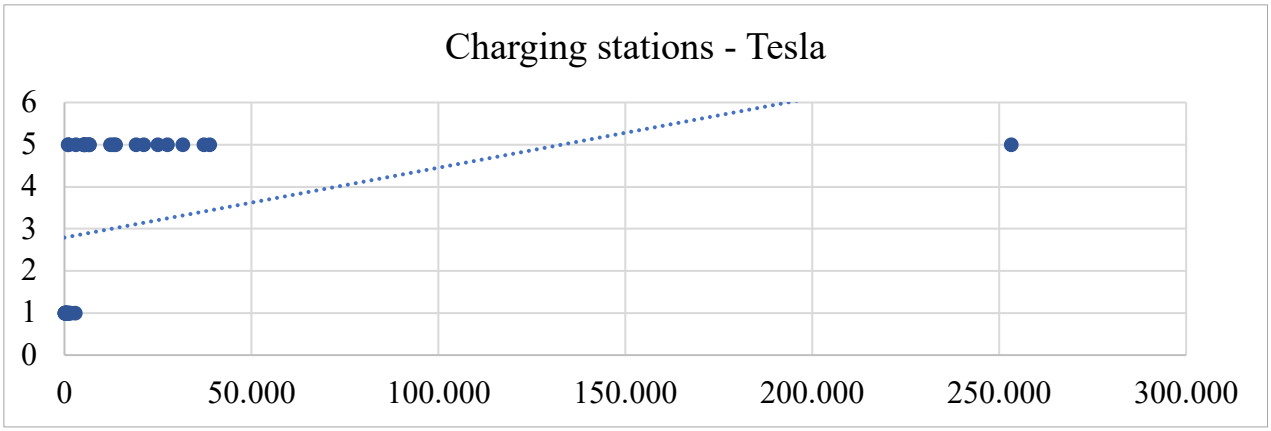


Chart 1

But for CHAdeMO's members the situation seems different:

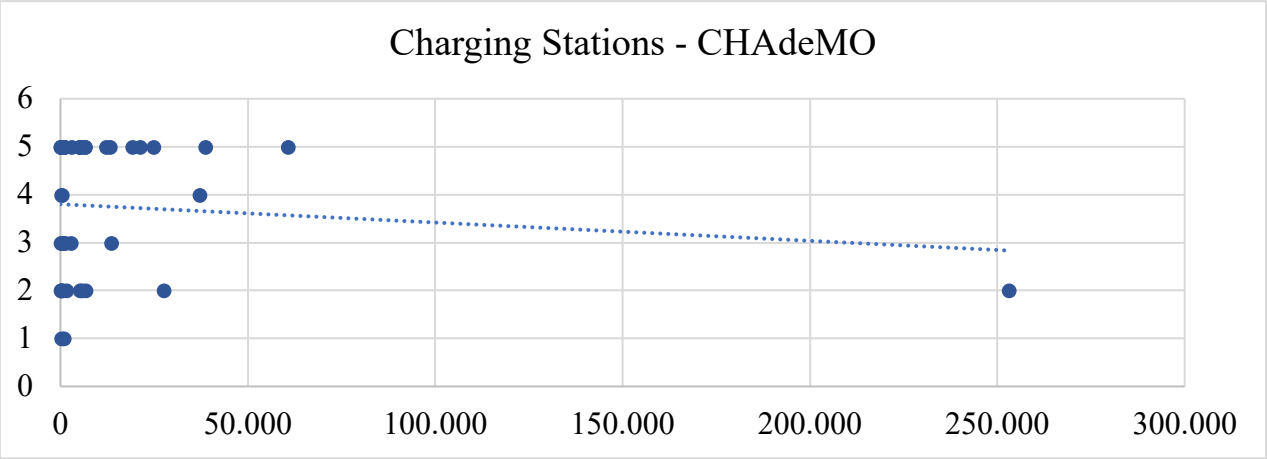


Chart 2

Actually, it is not. Indeed, showing data without China, as in the charts below, the trend is easier to see.

In Tesla's case the trend is even more positive, and it really seems that the company tends to choose greenfield investments when there are many charging stations.

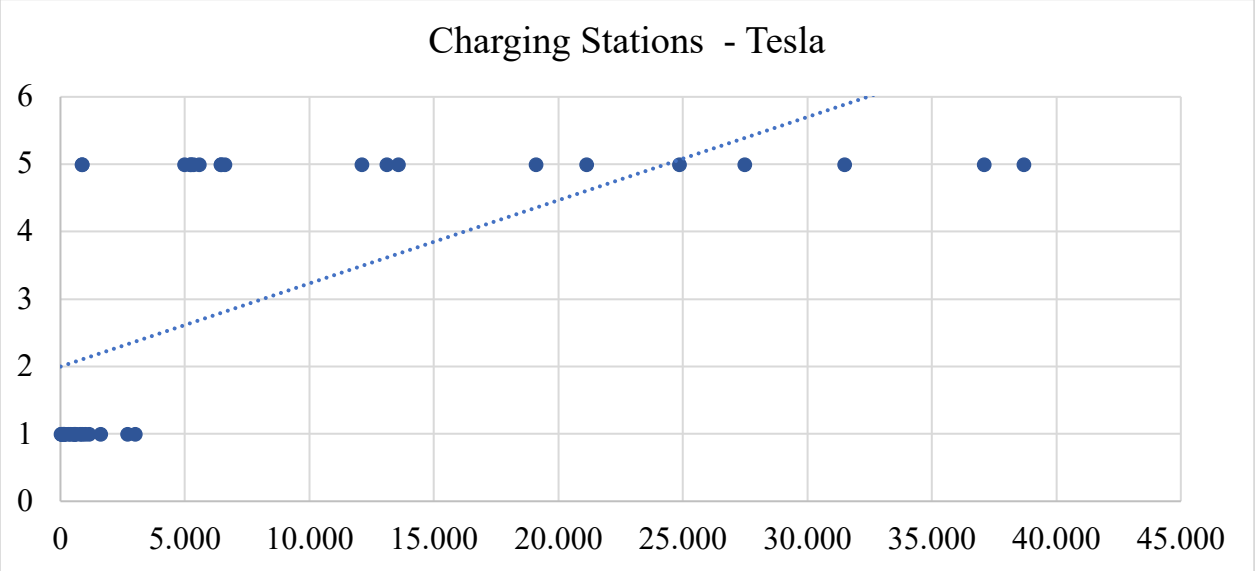


Chart 3

For CHAdeMO's members, plotting the graph without China changes significantly the graph.

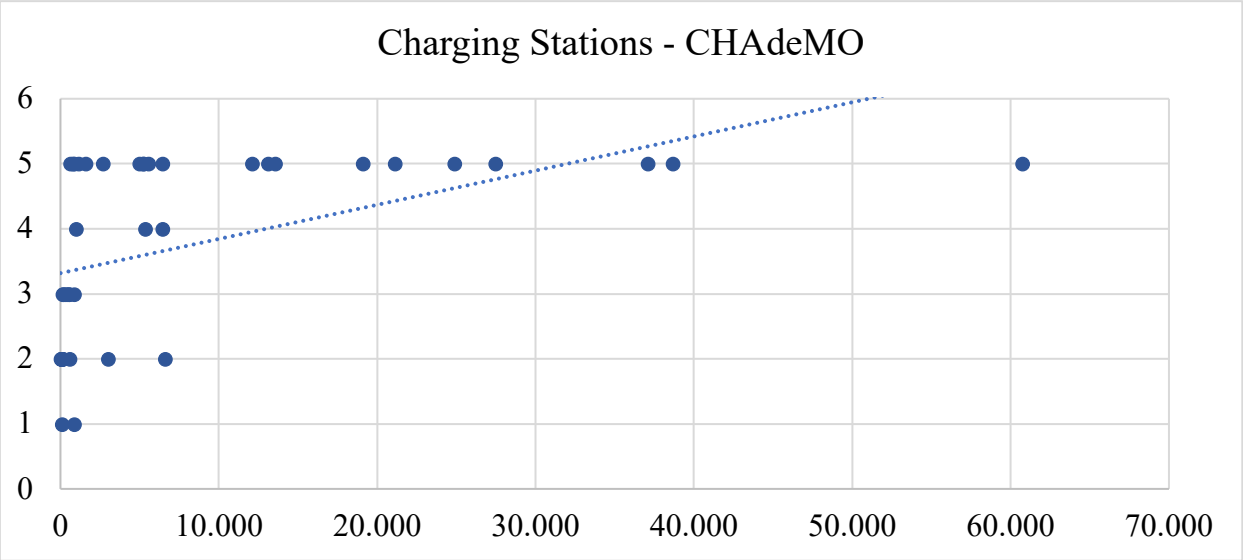


Chart 4

This happens because China is an outlier. Indeed, it has a very high number of charging stations, but CHAdeMO's members are present there with Joint-Ventures. This is due to the fact that until 2017 Joint-Ventures where the only way in which foreign car producers could enter the market and CHAdeMO's members already had relationships with local companies.

Then, it is necessary to look carefully at the conditions of the market for local complementary assets.

It seems that companies tend to choose acquisitions or greenfield investments in the first scenario and exports in the third one. Greenfield investments, actually, seem to be preferred to acquisitions. This can be explained by the fact that when the market for assets is more efficient than the market for firms it is not convenient to choose an acquisition.

On the other hand, when the market for assets is not completely efficient, joint-ventures or acquisitions can be a solution.

Anyways, analysing the p-value of the variable connected to local complementary assets it is possible to understand that this value seems not significant in Tesla's linear regression, but significant for CHAdeMO's. Indeed, the p-value is 0,894 in Tesla's case and 0,019 in CHAdeMO's case.

The meaning of these results will be discussed in the next chapter.

In conclusion, a correlation linear regression analyses have been conducted and results have been presented. From the analyses, we can say that some of the factors included in the model can determine entry mode choices of electric car producers.

## 3.2 Recommendations for companies

The main recommendation that this thesis can give to companies producing electric cars is to always choose entry strategy modes considering, in particular, charging infrastructures and the market for local complementary assets.
Tesla is doing this only partially, since it tends to prefer its own infrastructure than considering other ones, except for Japan where it sells adaptors for CHAdeMO's charging piles.

Anyways, the market for electric cars is still at its early stages in many countries and firms should keep searching for opportunities to enter new markets and Tesla, Toyota, Mitsubishi, Nissan and Subaru should use Supercharger or CHAdeMO networks strategically to do so.

## 3.3 Recommendations for future researchers: concessions and limitations of the thesis

This thesis presents some limitations that should be taken into account. At first, emerging markets and developed ones present many differences among them and when comparing them, these should be considered. In this thesis, in order to simplify the analysis developing and developed countries have been compared without considering specific factors that can determine entry mode choice only in the former ones or in the latter ones.
Even if there is no reason to believe that this leads to wrong results, it would be interesting to perform this analysis only for emerging markets or only for developed ones, adding specific variables that can be meaningful in each case.
Moreover, it is necessary to make some financial considerations about building an infrastructure. In fact, this is for sure very expensive for nations and companies, with developing countries being the ones which will experience more difficulties in doing so. This difference should be considered from future researchers, that may also add financial considerations about countries and about their ability to develop an infrastructure in the future.

Furthermore, the analysis may require more advanced statistical methods and tools, that should be able to underline better the impact of each variable. Also, specific software for statistical analysis can be useful.

Then, it is important to remember that correlation is different from causality. Indeed, to prove causality between independent variables and a dependent one, as explained in the first chapter, it is necessary to consider four things (Handy, Cao, & Mokhtarian, 2005):

5. Statistical association between cause and effect
6. The cause precedes the effect in time order
7. There are no other factors creating accidental or spurious relationships between variables
8. The causal mechanism by with the cause influences the effect is known.

This study gives its contribution to research meeting the first criterion.

The last recommendation that should be given to future researchers is to always consider the importance of environment for foreign entry strategy choice, considering also local actors. Indeed, as explained in the first chapter, the large majority of authors considers international entry strategies choice as something made independently from environment and from considerations about the market.

# Conclusion

Electric cars represent, at the moment, the best alternative to internal combustion engines, since they are completely environmentally friendly, and more and more companies are launching electrified models.
Therefore, the goal of this paper was to analyse whether charging stations, that represent one of the main hurdles to the diffusion of electric vehicles, can be one of the determinants of entry mode choice of electric car manufacturers. To do so we have chosen manufacturers that are also supplying charging services

Two hypotheses have been made in this paper:

1. The number of charging stations operating in a country is one of the determinants of entry strategy choices of electric car producers;
2. The conditions of the market for local assets affect entry strategy choices of electric car producers.

Regarding the first hypothesis, we can state that it has been confirmed. Indeed, data show that there is clear statistical association between charging stations and foreign entry strategies of electric car producers.
Moreover, this is true also other variables, such as subsidies and developing countries, and it is confirmed for bot Tesla and CHAdeMO.
In particular, electric car producers tend to choose entry modes lined to higher numbers of the dependent variable when there is a high number of charging stations in a country. This means that, in this case, they prefer to choose greenfield investments or acquisitions, that are integrated modes in the OLI Framework.

Unfortunately, regarding the second hypothesis, it is not possible to say that it has been confirmed because, even if it seems confirmed from Tesla's analysis, it is not confirmed from CHAdeMO's case.
In particular, the variable is not very significant in the model and this means that it cannot be a determinant of the dependent variable. Anyways, further research is needed.

At last, the goal and the aim of the paper has been achieved, building a linear regression and analysing factors that influence entry mode choices.

Appendices

Appendix 1

Tesla

| TESLA | y | $x_1$ | $x_2$ | $x_3$ | $x_4$ | $x_5$ | $x_6$ | $x_7$ | $x_8$ | $x_9$ | $x_{10}$ | $x_{11}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Countries | EM | I | P | AA | D | PEV/D | CS | CSD | CP | S | DV | C |
| Australia | 1 | $ 62.574,09 | 25.329.000 | 38,7 | 7.692.024 | 0,0003 | 783 | 18 | $ 0,30 | 1 | 0 | 3 |
| Austria | 5 | $ 48.960,15 | 8.859.000 | 44 | 83.871 | 0,3180 | 4.975 | 20 | $ 0,32 | 1 | 0 | 3 |
| Belgium | 5 | $ 48.600,00 | 11.460.522 | 41,4 | 30.528 | 1,4879 | 13.091 | 21 | $ 0,32 | 1 | 0 | 3 |
| Brazil | 1 | $ 13.981,86 | 209.789.000 | 32 | 8.515.767 | 0,0004 | 10 | 0 | $ 0,27 | 0 | 1 | 1 |
| Bulgaria | 1 | $ 8.250,69 | 7.000.039 | 42,7 | 110.879 | 0,0007 | 108 | 6 | $ 0,17 | 0 | 1 | 2 |
| Canada | 5 | $ 52.064,72 | 37.445.500 | 42,2 | 9.984.670 | 0,0082 | 21.104 | 12 | $ 0,33 | 1 | 0 | 3 |
| China (PRC) | 5 | $ 7.258,18 | 1.396.950.000 | 37,4 | 9.596.961 | 0,2341 | 253.074 | 26 | $ 0,29 | 1 | 1 | 2 |
| Croatia | 1 | $ 17.144,91 | 4.105.493 | 43 | 56.594 | 0,0053 | 569 | 9 | $ 0,26 | 0 | 1 | 3 |
| Cyprus | 1 | $ 31.744,44 | 864.200 | 36,8 | 9.251 | 0,0325 | 36 | 5 | $ 0,33 | 0 | 1 | 2 |
| Czech Republic | 1 | $ 29.516,38 | 10.649.800 | 42,1 | 78.865 | 0,0366 | 846 | 20 | $ 0,28 | 0 | 1 | 3 |
| Denmark | 1 | $ 64.638,02 | 5.806.081 | 42,2 | 43.094 | 0,3579 | 2.674 | 41 | $ 0,44 | 1 | 0 | 3 |
| Estonia | 1 | $ 17.874,05 | 1.323.820 | 42,7 | 45.227 | 0,0304 | 395 | 14 | $ 0,26 | 0 | 1 | 3 |
| Finland | 1 | $ 48.415,62 | 5.522.018 | 42,5 | 338.424 | 0,0347 | 973 | 33 | $ 0,27 | 1 | 0 | 3 |
| France | 5 | $ 45.726,35 | 66.989.000 | 41,4 | 640.679 | 0,3194 | 24.850 | 20 | $ 0,27 | 1 | 0 | 3 |
| Germany | 5 | $ 46.153,52 | 82.979.100 | 47,1 | 357.114 | 0,5509 | 27.459 | 34 | $ 0,45 | 1 | 0 | 3 |
| Greece | 1 | $ 28.425,47 | 10.741.165 | 44,5 | 131.990 | 0,0016 | 50 | 0,4 | $ 0,27 | 0 | 1 | 3 |
| Hungary | 1 | $ 16.411,00 | 977.100 | 42,3 | 93.028 | 0,0401 | 597 | 6 | $ 0,26 | 0 | 1 | 3 |
| Iceland | 1 | $ 49.884,48 | 357.050 | 36,5 | 103.000 | 0,0783 | 127 | 235 | $ 0,33 | 1 | 0 | 3 |
| India | 1 | $ 1.856,76 | 1.346.100.000 | 27,9 | 3.287.263 | 0,0010 | 21 | 0 | $ 0,12 | 0 | 1 | 1 |
| Ireland | 5 | $ 52.977,72 | 4.857.000 | 36,8 | 70.263 | 0,0750 | 5.557 | 18 | $ 0,33 | 1 | 0 | 2 |
| Israel | 5 | $ 31.687,46 | 9.019.740 | 29,9 | 20.770 | 0,2252 | 2.987 | 3 | $ 0,23 | 0 | 1 | 2 |
| Italy | 5 | $ 36.850,67 | 60.375.749 | 45,5 | 301.339 | 0,0768 | 13.562 | 11 | $ 0,34 | 1 | 0 | 3 |
| Japan | 5 | $ 51.662,65 | 126.220.000 | 47,3 | 377.973 | 0,6809 | 31.476 | 21 | $ 0,36 | 1 | 0 | 3 |
| Latvia | 1 | $ 12.777,74 | 1.917.300 | 43,6 | 64.559 | 0,0082 | 296 | 28 | $ 0,26 | 0 | 1 | 3 |
| Lithuania | 1 | $ 13.741,76 | 2.970.842 | 43,7 | 65.300 | 0,0061 | 153 | 21 | $ 0,23 | 0 | 1 | 3 |
| Luxembourg | 5 | $ 118.021,37 | 613.894 | 39,3 | 2.586 | 1,2421 | 841 | 7 | $ 0,28 | 1 | 0 | 3 |
| Malta | 1 | $ 21.550,95 | 475.701 | 41,8 | 316 | 1,0380 | 100 | 10 | $ 0,34 | 0 | 1 | 2 |
| Mexico | 5 | $ 11.812,75 | 126.577.691 | 28,3 | 1.964.375 | 0,0003 | 5.320 | 2 | $ 0,10 | 0 | 1 | 3 |
| Netherlands | 5 | $ 51.102,45 | 17.321.300 | 42,6 | 41.850 | 3,4858 | 37.093 | 45 | $ 0,28 | 1 | 0 | 3 |
| New Zealand | 5 | $ 36.510,26 | 4.956.210 | 37,9 | 270.467 | 0,0377 | 6.423 | 8 | $ 0,28 | 1 | 0 | 3 |
| Norway | 5 | $ 94.138,17 | 5.328.212 | 39,2 | 323.802 | 0,9148 | 12.096 | 553 | $ 0,20 | 1 | 0 | 3 |
| Poland | 5 | $ 15.888,27 | 38.433.600 | 40,7 | 312.696 | 0,0098 | 836 | 14 | $ 0,33 | 0 | 0 | 3 |
| Portugal | 1 | $ 22.425,95 | 10.291.027 | 42,2 | 92.090 | 0,1776 | 1.596 | 10 | $ 0,34 | 1 | 0 | 3 |
| Romania | 1 | $ 12.663,63 | 19.523.621 | 41,1 | 238.397 | 0,0057 | 125 | 4 | $ 0,20 | 0 | 1 | 2 |
| Russia | 1 | $ 18.110,77 | 146.793.744 | 39,6 | 17.098.246 | 0,0001 | 1.139 | 3 | $ 0,10 | 0 | 1 | 2 |
| Slovakia | 1 | $ 20.572,17 | 5.450.421 | 40,5 | 49.037 | 0,0289 | 507 | 28 | $ 0,28 | 0 | 1 | 3 |
| Slovenia | 1 | $ 29.107,25 | 2.076.595 | 44,5 | 20.273 | 0,0868 | 540 | 29 | $ 0,29 | 0 | 1 | 3 |
| South Korea | 5 | $ 27.606,33 | 51.811.167 | 41,8 | 100.210 | 0,0718 | 38.670 | 14 | $ 0,20 | 1 | 0 | 3 |
| Spain | 5 | $ 33.067,02 | 46.673.038 | 42,7 | 505.992 | 0,0567 | 5.209 | 5 | $ 0,33 | 1 | 0 | 3 |
| Sweden | 5 | $ 63.485,90 | 10.246.901 | 41,2 | 420.295 | 0,1893 | 6.420 | 183 | $ 0,28 | 1 | 0 | 3 |
| Switzerland | 5 | $ 71.741,66 | 8.542.323 | 42,4 | 41.284 | 0,8183 | 5.197 | 57 | $ 0,30 | 1 | 0 | 3 |
| Taiwan (ROC) | 5 | $ 25.992,36 | 23.589.192 | 40,7 | 36.193 | 0,5898 | 6.578 | 18 | $ 0,14 | 1 | 0 | 3 |
| Turkey | 1 | $ 13.586,80 | 82.033.882 | 30,9 | 783.562 | 0,0012 | 76 | 0,3 | $ 0,15 | 0 | 1 | 2 |
| United Kingdom | 5 | $ 44.851,74 | 66.040.229 | 40,5 | 244.820 | 0,8663 | 19.076 | 122 | $ 0,31 | 1 | 0 | 3 |
| United States of America | - | $ 55.409,07 | 329.051.000 | 38,1 | 9.833.517 | 0,1145 | 60.723 | 136 | $ 0,28 | 1 | 0 | 3 |

| TESLA | *Regression statistics* | | | |
|---|---|---|---|---|
| Multiple R | 0,79 | | | |
| R Squared | 0,63 | | | |
| Adjusted R Squared | 0,50 | | | |
| Standard Error | 1,44 | | | |
| Observations | 44 | | | |
| *Regression* | *Coefficients* | *Standard Error* | *Stat t* | *p-value* |
| Intercept | 10,408 | 3,001 | 3,468 | 0,002 |
| I | 0,0000154 | 0,0000168 | 0,920 | 0,365 |
| P | -0,000000001 | 0,000000001 | -0,838 | 0,408 |
| AA | -0,082 | 0,072 | -1,142 | 0,262 |
| D | -0,00000007 | 0,00000007 | -0,947 | 0,351 |
| PEV/D | 0,277 | 0,425 | 0,651 | 0,520 |
| CS | 0,00003 | 0,00001 | 3,028 | 0,005 |
| CSD | -0,003 | 0,003 | -1,123 | 0,270 |
| CP | -6,604 | 3,972 | -1,663 | 0,106 |
| S | -2,118 | 1,602 | -1,322 | 0,196 |
| SV | -4,543 | 1,509 | -3,012 | 0,005 |
| CMCLA | 0,088 | 0,655 | 0,134 | 0,894 |

CHAdeMO

| CHADEMO | y | $x_1$ | $x_2$ | $x_3$ | $x_4$ | $x_5$ | $x_6$ | $x_7$ | $x_8$ | $x_9$ | $x_{10}$ | $x_{11}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Countries | EM | I | P | AA | D | PEV/D | CS | CSD | CP | S | DV | C |
| Australia | 5 | $ 62.574,09 | 25.329.000 | 38,7 | 7.692.024 | 0,0003 | 783 | 18 | $ 0,30 | 1 | 0 | 3 |
| Austria | 5 | $ 48.960,15 | 8.859.000 | 44 | 83.871 | 0,3180 | 4.975 | 20 | $ 0,32 | 1 | 0 | 3 |
| Belgium | 5 | $ 48.600,00 | 11.460.522 | 41,4 | 30.528 | 1,4879 | 13.091 | 21 | $ 0,32 | 1 | 0 | 3 |
| Brazil | 2 | $ 13.981,86 | 209.789.000 | 32 | 8.515.767 | 0,0004 | 10 | 0 | $ 0,27 | 0 | 1 | 1 |
| Bulgaria | 2 | $ 8.250,69 | 7.000.039 | 42,7 | 110.879 | 0,0007 | 108 | 6 | $ 0,17 | 0 | 1 | 2 |
| Canada | 5 | $ 52.064,72 | 37.445.500 | 42,2 | 9.984.670 | 0,0082 | 21.104 | 12 | $ 0,33 | 1 | 0 | 3 |
| China (PRC) | 2 | $ 7.258,18 | 1.396.950.000 | 37,4 | 9.596.961 | 0,2341 | 253.074 | 26 | $ 0,29 | 1 | 1 | 2 |
| Croatia | 2 | $ 17.144,91 | 4.105.493 | 43 | 56.594 | 0,0053 | 569 | 9 | $ 0,26 | 0 | 1 | 3 |
| Cyprus | 3 | $ 31.744,44 | 864.200 | 36,8 | 9.251 | 0,0325 | 36 | 5 | $ 0,33 | 0 | 1 | 2 |
| Czech Republic | 5 | $ 29.516,38 | 10.649.800 | 42,1 | 78.865 | 0,0366 | 846 | 20 | $ 0,28 | 0 | 1 | 3 |
| Denmark | 3 | $ 64.638,02 | 5.806.081 | 42,2 | 43.094 | 0,3579 | 2.674 | 41 | $ 0,44 | 1 | 0 | 3 |
| Estonia | 4 | $ 17.874,05 | 1.323.820 | 42,7 | 45.227 | 0,0304 | 395 | 14 | $ 0,26 | 0 | 1 | 3 |
| Finland | 5 | $ 48.415,62 | 5.522.018 | 42,5 | 338.424 | 0,0347 | 973 | 33 | $ 0,27 | 1 | 0 | 3 |
| France | 5 | $ 45.726,35 | 66.989.000 | 41,4 | 640.679 | 0,3194 | 24.850 | 20 | $ 0,27 | 1 | 0 | 3 |
| Germany | 2 | $ 46.153,52 | 82.979.100 | 47,1 | 357.114 | 0,5509 | 27.459 | 34 | $ 0,45 | 1 | 0 | 3 |
| Greece | 5 | $ 28.425,47 | 10.741.165 | 44,5 | 131.990 | 0,0016 | 50 | 0,4 | $ 0,27 | 0 | 1 | 3 |
| Hungary | 3 | $ 16.411,00 | 977.100 | 42,3 | 93.028 | 0,0401 | 597 | 6 | $ 0,26 | 0 | 1 | 3 |
| Iceland | 2 | $ 49.884,48 | 357.050 | 36,5 | 103.000 | 0,0783 | 127 | 235 | $ 0,33 | 1 | 0 | 3 |
| India | 5 | $ 1.856,76 | 1.346.100.000 | 27,9 | 3.287.263 | 0,0010 | 21 | 0 | $ 0,12 | 0 | 1 | 1 |
| Ireland | 2 | $ 52.977,72 | 4.857.000 | 36,8 | 70.263 | 0,0750 | 5.557 | 18 | $ 0,33 | 1 | 0 | 2 |
| Israel | 5 | $ 31.687,46 | 9.019.740 | 29,9 | 20.770 | 0,2252 | 2.987 | 3 | $ 0,23 | 0 | 1 | 2 |
| Italy | 3 | $ 36.850,67 | 60.375.749 | 45,5 | 301.339 | 0,0768 | 13.562 | 11 | $ 0,34 | 1 | 0 | 3 |
| Latvia | 3 | $ 12.777,74 | 1.917.300 | 43,6 | 64.559 | 0,0082 | 31.476 | 28 | $ 0,26 | 0 | 1 | 3 |
| Lithuania | 1 | $ 13.741,76 | 2.970.842 | 43,7 | 65.300 | 0,0061 | 296 | 21 | $ 0,23 | 0 | 1 | 3 |
| Luxembourg | 1 | $ 118.021,37 | 613.894 | 39,3 | 2.586 | 1,2421 | 153 | 7 | $ 0,28 | 1 | 0 | 3 |
| Malta | 4 | $ 21.550,95 | 475.701 | 41,8 | 316 | 1,0380 | 841 | 10 | $ 0,34 | 0 | 1 | 2 |
| Mexico | 5 | $ 11.812,75 | 126.577.691 | 28,3 | 1.964.375 | 0,0003 | 100 | 2 | $ 0,10 | 0 | 1 | 3 |
| Netherlands | 4 | $ 51.102,45 | 17.321.300 | 42,6 | 41.850 | 3,4858 | 5.320 | 45 | $ 0,28 | 1 | 0 | 3 |
| New Zealand | 5 | $ 36.510,26 | 4.956.210 | 37,9 | 270.467 | 0,0377 | 37.093 | 8 | $ 0,28 | 1 | 0 | 3 |
| Norway | 5 | $ 94.138,17 | 5.328.212 | 39,2 | 323.802 | 0,9148 | 6.423 | 553 | $ 0,20 | 1 | 0 | 3 |
| Poland | 5 | $ 15.888,27 | 38.433.600 | 40,7 | 312.696 | 0,0098 | 12.096 | 14 | $ 0,33 | 0 | 0 | 3 |
| Portugal | 2 | $ 22.425,95 | 10.291.027 | 42,2 | 92.090 | 0,1776 | 836 | 10 | $ 0,34 | 1 | 0 | 3 |
| Romania | 5 | $ 12.663,63 | 19.523.621 | 41,1 | 238.397 | 0,0057 | 1.596 | 4 | $ 0,20 | 0 | 1 | 2 |
| Russia | 3 | $ 18.110,77 | 146.793.744 | 39,6 | 17.098.246 | 0,0001 | 125 | 3 | $ 0,10 | 0 | 1 | 2 |
| Slovakia | 3 | $ 20.572,17 | 5.450.421 | 40,5 | 49.037 | 0,0289 | 1.139 | 28 | $ 0,28 | 0 | 1 | 3 |
| Slovenia | 5 | $ 29.107,25 | 2.076.595 | 44,5 | 20.273 | 0,0868 | 507 | 29 | $ 0,29 | 0 | 1 | 3 |
| South Korea | 5 | $ 27.606,33 | 51.811.167 | 41,8 | 100.210 | 0,0718 | 540 | 14 | $ 0,20 | 1 | 0 | 3 |
| Spain | 5 | $ 33.067,02 | 46.673.038 | 42,7 | 505.992 | 0,0567 | 38.670 | 5 | $ 0,33 | 1 | 0 | 3 |
| Sweden | 5 | $ 63.485,90 | 10.246.901 | 41,2 | 420.295 | 0,1893 | 5.209 | 183 | $ 0,28 | 1 | 0 | 3 |
| Switzerland | 2 | $ 71.741,66 | 8.542.323 | 42,4 | 41.284 | 0,8183 | 6.420 | 57 | $ 0,30 | 1 | 0 | 3 |
| Taiwan (ROC) | 2 | $ 25.992,36 | 23.589.192 | 40,7 | 36.193 | 0,5898 | 5.197 | 18 | $ 0,14 | 1 | 0 | 3 |
| Turkey | 5 | $ 13.586,80 | 82.033.882 | 30,9 | 783.562 | 0,0012 | 6.578 | 0,3 | $ 0,15 | 0 | 1 | 2 |
| United Kingdom | 5 | $ 44.851,74 | 66.040.229 | 40,5 | 244.820 | 0,8663 | 76 | 122 | $ 0,31 | 1 | 0 | 3 |
| United States of America | 5 | $ 55.409,07 | 329.051.000 | 38,1 | 9.833.517 | 0,1145 | 19.076 | 136 | $ 0,28 | 1 | 0 | 3 |
| Japan | - | $ 51.662,65 | 126.220.000 | 47,3 | 377.973 | 0,6809 | 60.723 | 21 | $ 0,36 | 1 | 0 | 3 |

| CHAdeMO | *Regression statistics* | | | |
|---|---|---|---|---|
| Multiple R | 0,75 | | | |
| R Squared | 0,56 | | | |
| Adjusted R Squared | 0,40 | | | |
| Standard Error | 0,90 | | | |
| Observations | 44 | | | |
| *Regression* | *Coefficients* | *Standard Error* | *Stat t* | *p-value* |
| Intercept | -0,792 | 1,903 | -0,416 | 0,680 |
| I | 0,0000098 | 0,0000106 | 0,921 | 0,364 |
| P | -0,00000000004 | 0,000000001 | -0,050 | 0,960 |
| AA | 0,071 | 0,046 | 1,540 | 0,133 |
| D | 0,00000004 | 0,00000004 | 0,842 | 0,406 |
| PEV/D | -0,313 | 0,267 | -1,171 | 0,250 |
| CS | -0,000004 | 0,00001 | -0,571 | 0,572 |
| CSD | 0,0003 | 0,002 | 0,138 | 0,891 |
| CP | -0,417 | 2,499 | -0,167 | 0,869 |
| S | -0,510 | 0,996 | -0,512 | 0,612 |
| SV | -0,392 | 0,940 | -0,417 | 0,680 |
| CMCLA | 1,010 | 0,409 | 2,468 | 0,019 |

Appendix 2

Initial correlation matrixes for Tesla and CHAdeMO

| *TESLA* | EM | I | P | AA | D | PEV | PEV/D | CS | CSD | CP | MS | S | DV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EM | 1 | | | | | | | | | | | | |
| I | 0,445 | 1 | | | | | | | | | | | |
| P | 0,025 | -0,317 | 1 | | | | | | | | | | |
| AA | 0,043 | 0,203 | -0,405 | 1 | | | | | | | | | |
| D | -0,086 | -0,147 | 0,395 | -0,237 | 1 | | | | | | | | |
| PEV | 0,260 | -0,082 | 0,682 | -0,037 | 0,330 | 1 | | | | | | | |
| PEV/D | 0,384 | 0,435 | -0,087 | 0,169 | -0,180 | 0,077 | 1 | | | | | | |
| CS | 0,686 | -0,115 | 0,673 | -0,016 | 0,304 | 0,981 | 0,117 | 1 | | | | | |
| CSD | 0,175 | 0,480 | -0,088 | -0,005 | -0,115 | 0,102 | 0,185 | 0,015 | 1 | | | | |
| CP | 0,155 | 0,385 | -0,220 | 0,512 | -0,244 | 0,083 | 0,163 | 0,075 | -0,010 | 1 | | | |
| MS | 0,213 | 0,462 | -0,063 | 0,065 | -0,126 | 0,132 | 0,246 | 0,071 | 0,889 | 0,022 | 1 | | |
| S | 0,639 | 0,675 | -0,026 | 0,274 | -0,046 | 0,242 | 0,368 | 0,262 | 0,296 | 0,440 | 0,364 | 1 | |
| DV | -0,639 | -0,691 | 0,245 | -0,308 | 0,168 | 0,061 | -0,351 | 0,039 | -0,290 | -0,464 | -0,345 | -0,908 | 1 |

Matrix 1

| *CHADEMO* | EM | I | P | AA | D | PEV | PEV/D | CS | CSD | CP | MS | S | DV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EM | 1 | | | | | | | | | | | | |
| I | 0,348 | 1 | | | | | | | | | | | |
| P | -0,486 | -0,300 | 1 | | | | | | | | | | |
| AA | 0,531 | 0,174 | -0,426 | 1 | | | | | | | | | |
| D | -0,157 | -0,091 | 0,412 | -0,241 | 1 | | | | | | | | |
| PEV | -0,233 | -0,028 | 0,667 | -0,080 | 0,427 | 1 | | | | | | | |
| PEV/D | -0,015 | 0,420 | -0,095 | 0,156 | -0,183 | 0,043 | 1 | | | | | | |
| CS | 0,564 | -0,097 | 0,680 | -0,048 | 0,350 | 0,954 | 0,099 | 1 | | | | | |
| CSD | 0,160 | 0,496 | -0,066 | -0,009 | -0,056 | 0,159 | 0,179 | 0,047 | 1 | | | | |
| CP | 0,264 | 0,373 | -0,222 | 0,489 | -0,220 | 0,072 | 0,149 | 0,064 | -0,002 | 1 | | | |
| MS | 0,036 | 0,444 | -0,079 | -0,010 | -0,129 | 0,079 | 0,233 | 0,036 | 0,929 | -0,039 | 1 | | |
| S | 0,236 | 0,676 | -0,011 | 0,238 | 0,009 | 0,270 | 0,350 | 0,274 | 0,319 | 0,425 | 0,329 | 1 | |
| DV | -0,355 | -0,693 | 0,229 | -0,273 | 0,105 | 0,007 | -0,333 | 0,023 | -0,313 | -0,449 | -0,308 | -0,908 | 1 |

Matrix 2

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Table of acronyms

AA: Average Age of the population
BEV: Battery Electric Vehicles
CP: Charging Price
CS: Number of Charging Stations
CSD: Density of Charging Stations
D: Dimension of the country
DV: Developing countries
EREV: Extended Range Electric Vehicles
I: Average Income
MS: Market Share of Newly registered electric cars
P: Population
PEV: Plug-In Electric Vehicles
PEV/D: Ratio between the number of Plug-In Electric Vehicles and the Dimension of the country
PHEV: Plug-In Hybrid Electric Vehicles
S: Subsidies
USD: Dollars of the United States of America

Summary

Chapter 1

Electric cars represent one of the possible alternatives to internal combustion engines and are powerfully becoming the future of the automotive industry. Anyways, there are many obstacles to their spreading, such as the lack of a proper charging infrastructure, that is a fundamental local complementary asset for electric automobiles.

This research aims at answering one research question: Are foreign entry strategies of electric car manufacturers influenced from environmental factors and, in particular, from local complementary assets?

To answer to this question, we can define an entry strategy as the institutional arrangement chosen by a company to organize and conduct international business transactions (McDonald, Burton, & Dowling, 2002).

Firms have the opportunity to choose among several entry modes, that can be grouped in two categories:

1. Equity modes;
2. Non-equity modes.

The first ones guarantee companies with a higher degree of control and often higher returns on investments, but they involve a higher resource commitment. On the other hand, the second ones provide lower returns on investments and control, needing also a lower resource commitment and having usually lower exit costs, being characterized, usually, from a lower level of exposure (McDonald, Burton, & Dowling, 2002).

The entry strategies in the first category are:

1. Joint ventures
2. Wholly owned subsidiaries.

In particular, joint ventures are an agreement between two or more companies to work together in order to complete a project or to operate in a market settling a new firm there that is jointly owned by all the parties of the agreement.

Wholly owned subsidiaries are, instead, the main example of Foreign Direct Investment (FDI) in which a company has direct ownership and control of facilities in a foreign country. They can be divided in two main categories:

1. Greenfield Investments;
2. Acquisitions.

Greenfield Investments, also known as Greenfield Operations, take place when a company enters a new market by building new operational facilities from the ground up (McDonald, Burton, & Dowling, 2002).

On the other hand, acquisitions take place when a company buys at least the majority of the ownership stake of a foreign firm, assuming control over it (McDonald, Burton, & Dowling, 2002).

The entry strategies of the second category, non-equity entry modes, are:

1. Exporting;
2. Licensing;
3. Franchising;
4. Strategic Alliance;
5. Management contract;
6. Turnkey Projects.

Many are the approaches to foreign market entry strategies. For instance, some researchers considered entry modes as a taxonomy of various determinants of foreign direct investments (Itaki, 1991), or as a paradigm for internationalization (Cantwell, 1988).

At first, some basic theories on which approaches are based should be explained:

1. Internationalization Theory
2. The Resource-Based View of the Firm Theory
3. The Transaction Cost Theory
4. Property Rights Theory.

Internationalization theory, also known as International Trade Theory, is a fundamental theory that needs to be explained. It analyses international business behaviour of companies. Actually, internationalization theory is made of the contributions of many different authors. In order to present many different contributions and, in order to review the main ones, the thesis follows Krugman's work, which summarizes the most significative ones, starting from Adam Smith (Krugman, Obstfeld, & Melitz, 2012).

The Resourced-Based View, instead, is a theory that provides a framework to determine which strategic resources can led the firm to a competitive advantage, meaning a situation in which it outperforms competitors. A firm has a competitive advantage, in particular, when it implements a value creating strategy that no other companies, both current and potential competitors, are implementing. Moreover, when other firms are not even able to duplicate the effects of this strategy, the competitive advantage is sustainable (Barney, 1991).

Differently, Transaction Cost Theory is focused on transactions, starting from the assumptions of bounded rationality and opportunism of individuals. Its roots are in the theory developed by Ronald Coase in 1937, a member of the Neo-Classical School. According to him, firms bear when transaction costs related to coordinating production on the market are higher than costs of integrating activities within an organization, considering market imperfections (Coase, 1937). In fact, integrating activities is a method to avoid transaction costs, such as those related to negotiations and gathering information. Indeed, international expansion, or organizational growth, is based on the fact that there are some conditions under which it is more efficient for companies to create an internal international market, rather than entering foreign ones having transactions with other companies. These conditions are related to transaction costs of foreign activities (Coase, 1937).

Property Rights Theory, which states that in response to the economic problem of the allocation of scarce resources, property rights arise, being the rights of people to use resources, legally enforced by states and affecting economic behaviours and outcomes. According to this theory, norms of behaviour allow people to use resources in not prohibited ways. Then, resources can be divided in partitions, being this a possible configuration of property rights as resources (Jongwook & Mahoney, 2006).

Partitions are efficient only when they are grouped in appropriate bundles and assigned to the transacting party who is most capable of efficient production. Therefore, this theory suggests that in any kind of arrangement between parties, there is a transfer of control at least over some attributes of resources. The economically efficient way to do that is to transfer control to the party that can be more efficient in production (Jongwook & Mahoney, 2006).

At last, Institutional Theory, that is often applied to studying multinational enterprises, since it states that organizations need to conform to the environment, in particular to the system of norms and beliefs. Companies are affected from isomorphism, meaning that the adoption and diffusion of business models and strategies is established as a standard in the sector in which those organizations operate (Kostova, Roth, & Dacin, 2008).

When this is applied to corporate strategy and to foreign entry modes, this means that companies chose the strategy basing on the environment and imitating other firms. However, there is evidence that multinational enterprises react differently to different institutional systems (Kostova, Roth, & Dacin, 2008).

Now that these basic theories have been explained, it is possible to present the main theoretical approaches to foreign market entry mode choices, that have their basements in those fundamental theories.

The first of these is the Chain of Establishment Approach. This has been one of the first frameworks developed about the way in which companies expand internationally. According to it, firms follow some specific stages in developing internationalization strategy (Johanson & Vahlne, 1977).

According to the Chain of Establishment Approach there are four subsequent modes of entry.

1. No exports;
2. Exports via independent representatives;
3. Sales subsidiaries;
4. Manufacturing abroad.

In the nineties another approach arose and became very popular, it is called Transaction Cost Approach. This seems to be very viable in explaining vertical integration and has been used to predict entry strategy choices for manufacturing and service firms (Erramilli & Rao, 1993). Transactions are the unit of analysis of this approach and the main dimensions on which these are based consist in the frequency of exchange, the level of uncertainty that concerns the operation and the specific assets involved (Williamson, 1975). These dimensions are fundamental to analyse the way in which the transaction is performed. Moreover, an assumption is made in this approach. Indeed, the decision maker is characterized by bounded rationality and opportunistic behaviour (Andersen, 1997).

This approach finds it roots in Transaction Cost Theory and, to apply it to entry modes, it is necessary to consider also all those costs that are not directly related to the transaction and all the benefits of it (Erramilli & Rao, 1993). For instance, higher market power, more integration and coordination of international operation and obtaining shares of a foreign company are all possible benefits that should be considered from a realistic model.

Applying this approach, it is possible to see that the more an asset is specific, the more companies choose entry strategies that will guarantee them high, or even complete, control of it. Some factors in particular influence this choice. These consist in external and internal uncertainty and in firm's size (Erramilli & Rao, 1993). In particular, the decision criterion is transaction costs minimization and companies can choose three kinds of modes of entry:

1. Contractual transfer;
2. Joint-Venture;
3. Wholly-owned operation.

The next approach is one of the famous ones about entry modes. It is the Eclectic Framework, that is also known as OLI Framework. It states that some specific factors influence the entry strategy choice of companies. First of all, a factor consists in ownership advantages, if they are unique and sustainable, and therefore not shared with others and can be held in the long-term, so that the multinational enterprise will be able to rely on a sustainable competitive advantage in the entry mode selection (Dunning, 1988). According to this framework, firms recur to foreign production when the ownership advantage of the foreign investor cannot be rented, licensed or sold to local firms and it can be exploited better if combined with local productive factors and assets.

These factors, that are local inputs and assets, are called location advantages. These also reflect the degree of attractiveness of a given country for a company, considering its market potential and investment risk as well (Root, 1994). Moreover, this kind of advantages are present also when the target country of internationalization has similar dimensions, such as culture, regulatory framework or market infrastructure, and when there are lower production costs that in the home country (Dunning, 1988).

Finally, internationalization advantages are considered from the framework. These are linked to the choice of the mode of operation, between a hierarchical one and an external one, and to transaction costs (Dunning, 1988).

According to it, entry modes can be divided in three categories:

1. Independent modes;
2. Cooperative modes;
3. Integrated modes.

The first ones are those ones in which companies choose to enter foreign markets without strong control, for instance, licensing, franchising, setting an agency or contracting (Dunning, 1988).

Cooperative modes are, instead, those ones in which companies choose to share risks and returns with other entities. A typical example are Joint-Ventures and Strategic alliances (Dunning, 1988).

At last integrated modes, that are acquisitions and greenfield investments, are those ones in which companies want to keep a stronger control, even integrating more operations in a subsidiary abroad (Dunning, 1988).

There is also another approach that explains entry modes and it is the Organizational Capability Perspective Approach. It is based on the assumption of bounded rationality, it has its roots in the Resource-Based Theory, and its unit of analysis is the firm, like the Chain of

Establishment Approach. It has been viewed both as complementary and alternative to the Transaction Cost Approach (Madhok, 1997).

Therefore, this approach distinguishes only two kinds of entry modes:

1. Internalization;
2. Collaboration.

Internalization happens when companies choose to enter foreign markets without signing agreements with local partners, instead collaboration includes all entry modes that entail partnerships with local companies (Madhok, 1997).

The determinants that influence foreign market entry mode choice can be found in the foreign environment of the target market of internationalization. Considering that the foreign environment is a mixture of internal and external factors that influence company operations (Calof & Beamish, 1995), it is possible to group the determinants in two categories:

1. Internal factors;
2. External factors.

The former ones are related to company's internal environment and they are:

1. Firm Size;
2. International Experience;
3. Technological Capability;
4. Product Characteristics.

Instead, external factors are:

1. Cultural distance;
2. Market size and growth;
3. Country risk;
4. Legal barriers.

Anyways, a very significant aspect that is usually underestimated is technology. Indeed, electric cars are based on a completely different technology than normal ones and they need different infrastructures. In particular, charging infrastructures are needed (Zhang, et al., 2018).

Unfortunately, at the moment electric cars lack of worldwide standards and this means that some companies may find difficult to penetrate some markets without adopting different standards from the ones they usually have (Hennart, Hsia, & Pimenta, 2015).

Adaptation to standards also entails costs, in particular, if many different ones are spread over different markets. This is directly related to the lack of a charging standard for charging networks, that are often not compatible among them.

Indeed, market entry strategy choice is influenced also from complementary assets. As underlined in the thesis, it is peculiar that only the OLI Framework considers these aspects among many approaches.

Indeed, among location advantages, complementary assets, like the charging infrastructure, are the most interesting one. This asset has been studied in the Bundling Model, that suggests the optimal arrangement for a firm entering a foreign market (Hennart, Hsia, & Pimenta, 2015), having the OLI Framework as its basement. The Bundling Model assumes that the successful entry in a target market necessitates the bundling of two elements:

1. Intangible inputs from the foreign investors;
2. Local inputs and assets brought by local companies.

In particular, the model is focused on knowledge as an intangible, that can be easy to transact or difficult to transact, depending on whether it is protected by property rights or not. Local resources can be easy or difficult to transact as well (Hennart, Hsia, & Pimenta, 2015). The model, that is based also on the Property Rights Theory and on the Institutional Theory, states that the most efficient arrangement is the one that minimizes monitoring costs. Meaning that when the behaviour or the output of a party is difficult to assess or measure, this party will invest directly. On the other hand, when all the parties have this characteristic, they choose a joint-venture.

It is therefore clear that complementary assets can affect entry mode choices. Considering this, the charging infrastructure operating in a market should be a significative characteristic of its specific environment for electric car manufacturers. Therefore, we can hypothesise that the number of charging stations operating in a country is one of the determinants of entry strategy choices of electric car producers.

Moreover, being charging stations the most important complementary asset for electric cars, the conditions of the market for local assets can have an impact on entry strategies as well. Indeed, as already explained, several electric car producers have decided to enter also this market and it is interesting to understand the reasons behind this choice. In particular we hypothesise that the conditions of the market for local assets affect entry strategy choices of electric car producers. Hence, two hypotheses are made in this thesis.

Finally, searching which factors influence something reminds of causality. It is important to remember that correlation is different from causality. Indeed, to prove causality between independent variables and a dependent one, it is necessary to consider four things (Handy, Cao, & Mokhtarian, 2005):

1. Statistical association between cause and effect;

2. The cause precedes the effect in time order;
3. There are no other factors creating accidental or spurious relationships between variables;
4. The causal mechanism by with the cause influences the effect is known.

Correlation is an evidence of statistical association, that is part of causality. This always has a level of reliability that is almost never maximum. Moreover, when looking at causality links, it is normal to consider an error or that something can be impossible to prove completely (Nielsen, 2012). Anyways, the scope of each causality check is to reach the highest understanding possible of the causality link.

Chapter 2

Since there are several kinds of electric cars and it is necessary to define the main ones that are being produced by manufacturers at the moment.

At first, there are Battery Electric Vehicles (BEV) that are all those cars equipped with batteries aimed at powering an electric engine. These automobiles can be purely electric or hybrid, since there are also Hybrid Electric Vehicles in which the engine is powered by both petrol and electricity, and the battery, that helps using efficiently the fuel, is charged by the internal combustion engine or by plugging the car into an external source of electricity. In the last case they are called Plug-In Hybrid Electric Vehicles (PHEV) (European Alternative Fuels Observatory, 2019).

Moreover, there are Extended Range Electric Vehicles (EREV) in which there is a little generator that has solely the scope of recharging the battery using petrol and the powertrain is fully electric. However, this generator supplies only emergency recharging, since these cars are basically Plug-In Electric Vehicles, that are all automobiles equipped with an electric powertrain in which the batteries are charged by plugging the car into an external source of electricity (European Alternative Fuels Observatory, 2019).

Each one of these types of electric cars has different specifics and this means that different complementary assets are needed. Indeed, the charging infrastructure introduced in the first chapter is necessary for all Plug-In Electric Vehicles, but not for hybrid cars that charge the battery pack only from the internal combustion engine and which cannot be charged by plugging them into an external source of electricity. These cars can rely upon the existing refuelling infrastructure.

Therefore, this thesis is focused in particular on manufacturers of any kind of Plug-In Electric Vehicles.

Furthermore, charging stations are not all the same (Todd, Chen, & Clogston, 2013). There are Level 1 charging stations that work with standard household plugs and that can charge a car to move for 2 to 10 km in an hour. The Level 2 ones can charge from 15 to 30 km in one hour but need the installation of a special charging equipment to work safely. Lastly, the Direct Current Fast Charging can charge from 80 to 130 km in an hour and usually cannot be installed in a house. The first ones cost about USD 360, the second ones about USD 490 and the last ones approximately USD 19,000 (Todd, Chen, & Clogston, 2013).

The deployment of electric cars is facing different obstacles, as already said. The main ones are (Todd, Chen, & Clogston, 2013):

- High costs connected to Electric Vehicles;
- Consumer Misperceptions;
- Supply of raw materials;
- Limited charging infrastructure.

Therefore, it is necessary that electric car producers make strategic network decisions before observing demand, often without knowing adoption rate of electric cars, market share of charging service providers and other relevant information.

This is what Tesla and CHAdeMO are doing. They both build charging infrastructures for electric vehicles, a fundamental complementary asset for electric car manufactures.

In particular, Tesla Inc, formerly Tesla Motors Inc, has been founded in 2003 in California, in the United States of America, by a South African entrepreneur, Elon Musk. The company rapidly grouped engineers and experts from the car industry with the mission of constructing electric cars (Tesla Inc, 2019).

The firm grew fast and became internationally famous, working also with prestigious partners, such as Panasonic Corporation, formerly Matsushita Electric Industrial Co, and Lotus. These partnerships led the company to the development of better batteries and to their first successful car, Tesla Roadster (Tesla Inc, 2019).

However, the real mission of the company was to spread electric cars, considering them as the future of automobile industry. At this point, Tesla understood the main hurdle for electric cars, that has been analysed in the first chapter. The charging infrastructure was lacking and, being it a fundamental complementary asset, it was a big threat to the diffusion of electric cars and to Tesla's growth (Tesla Inc, 2019).

This led Tesla Inc to the decision of creating its own charging infrastructure, called Supercharger network. It started from the United States of America, but soon it built it also in other nations, selling its cars to other countries and building there also its charging network.

The first interesting difference between Tesla and CHAdeMO is that the former is a single producer of electric vehicles, whereas CHAdeMO is an association created by Japanese manufacturers, in particular Nissan-Renault, Subaru, Mitsubishi and Toyota, which decided to unify their forces for electric cars. They decided to build their own shared charging infrastructure as well, called CHAdeMO Network.

Therefore, this information is already very interesting, because it denotes a different approach to the problem and a different solution. On one hand, there is a manufacturer that is directly operating also in the market of complementary assets and, on the other hand, we have a partnership between different producers with the same objective. This thesis compares the example of Tesla with the one of CHAdeMO's members. The latter ones tend to choose the same strategies for each market in which they offer their electric cars and this is related to the fact that they all share the same charging infrastructure through CHAdeMO (Drucker, 1971). This helps to simplify the analysis.

Hence, it is interesting to study the importance of charging stations as a factor determining entry strategy choices of electric car manufacturers, which offer also charging services, since they are controlling a proprietary charging infrastructure. This is the reason why in this thesis Tesla will be compared to CHAdeMO's members. Moreover, these companies are among the most state-of-the-art electric car producers worldwide.

Regarding to entry modes, it seems that Tesla tends to choose integrated modes, such as greenfield investments, whereas CHAdeMO's members choose cooperative modes as well, like Joint-Ventures. In the next chapter this will be shown clearly.To do so, it is necessary to focus which strategies have been implemented from different manufacturers depending upon some factors.

One of the aims of this thesis is to discover the significance of charging infrastructure as a determinant for entry mode choices of electric car producers. To understand that it is necessary to analyse charging infrastructures and to understand which other determinants can be linked to entry mode choices of electric car producers.

According to recent research charging infrastructures are influenced by some specific factors, that can be direct and indirect (Zhang, et al., 2018). The first ones are those that have a direct impact on charging infrastructure and the most difficult ones to study because of the

lack of literature about them. Indeed, in the large majority of cases, charging infrastructures are still in their early stages.

Therefore, it seems that among the determinants we can find charging demand, charging price, subsidies for construction and operation, number of charging piles, construction costs of charging units, ground rent, maintenance and operating costs, electricity price, number of plug-in electric vehicles and location.

Unfortunately, some of these factors are difficult to quantify and they vary even within the same market. This entails that the significance of this factors or of an estimation of them in the analysis would be low. Moreover, in particular for emerging countries it is difficult to find some of these measures.

Therefore, in order to conduct the analysis, we consider the following factors:

1. Income (I)
2. Population (P)
3. Average Age (AA)
4. Dimension (D)
5. PEV Number (PEV)
6. PEV/Dimension (PEV/D)
7. Number of Charging Stations (CS)
8. Density of Charging Stations (CSD)
9. Charging Price (CP)
10. Market Share of Newly registered electric cars (MS)
11. Subsidies (S)
12. Developing (DV)

In particular, income is a measure of the average income of the population living in each of the countries considered. Population is a measure of the total number of people living in a country, whose age is measured by the Average Age variable. These variables have been included since, as explained before, it seems that there is a precise profile of customers of electric cars.

Then, there are specific variables, such as the number of charging stations and their density, that is a measure of the number of charging points in a range of 100 km. The charging price is the average price among the ones charged to customers by the three main charging services in each country. Then, the market share of newly registered electric cars is taken into account

as well. At last, two dummy variables are added. The first one is about the existence of subsidies[51], whereas the other is about the status of developing economy[52].

Of course, also entry modes (EM) are considered, since the aim is to study the link between those factors, in particular charging stations, and entry strategies. This variable assumes a specific value depending on the entry mode chosen in each country. In particular, mostly cooperative modes and integrated modes are taken into account, since independent modes, as already explained, are not commonly used from electric car producers, apart from exports.

Therefore, a table containing all data gathered has been built and it is shown in appendix 1, as well as all the countries and the relative sources.

From this data, a correlation matrix has been built and presented in appendix 2.

The aim of this regression model is to investigate the entry mode choice. In particular, it analyses what can determine the choice.

In order to reach the scope of the model, several explicative variables have been identified. First of all, the total number of electric cars (PEV) has been excluded from the model, because its high correlation with the number of charging stations made it redundant and not significant. However, the presence of a high number of PEVs in a market seems to push the charging network to grow. This is interesting when thinking about the chicken-and-egg dilemma, because it shows that the growth of the number of electric cars is linked to the increase in the number of charging facilities. This may be due to a cause-effect relation.

Then, also population and dimension have been identified as variables connected to the charging infrastructure. In particular, they are useful because they allow to consider two fundamental characteristics of countries. Indeed, bigger countries need a different infrastructure than smaller ones, and population plays an important role as well. In fact, the number of people living in a country or in an area influences the number of potential users of the infrastructure.

In order to analyse deeper these aspects, it has been introduced in the model also the ratio between the number of PEVs and the dimension of the country.

Moreover, some countries provide subsidies for electric vehicles and for charging infrastructures and, as already said, these can have an impact and that is why subsidies have been considered as a dummy variable.

Then, the infrastructure may also be related to charging prices. It is indeed interesting to study how these prices influence electric car market and the supply of charging services.

[51] It assumes values 1 if subsidies for charging stations are provided for charging infrastructures and 0 if not.
[52] It assumes values 1 if the country has the status of developing economy and 0 if not.

Another significant variable is the density of charging stations on roads. It is basically the number of charging stations per 100 km of distance.

At last, the developing countries dummy variable has been included in the model, because of its interesting possible link to entry mode choices.This model explains the relationship between the choice of entry mode and all these variables.

Now, it is necessary to answer to the second hypothesis. In order to do that data gathered for the correlation matrix can be used again. According to Hennart, Hsia and Pimenta, three are the conditions of the market for local complementary assets that should be taken into account (Hennart, Hsia, & Pimenta, 2015). These are:

1. Barriers to entry;
2. Concentration;
3. Number of suppliers.

Indeed, we can build different scenarios basing on these conditions of the market for local complementary assets. First of all, firms should look at barriers to access to local assets, trying to understand how challenging can be for a foreign company or investor to access these. In particular, these barriers can be legal, political or economic. Particular attention needs to be focused also on suppliers and automotive industry in that country. Specifically, what is important is to look at the number of suppliers and at the greater difficulties in entering the market and low competition between the incumbents. Therefore, there are three factors that play a direct role in understanding the condition of the market for local complementary assets (Hennart, Hsia, & Pimenta, 2015).

These allow to distinguish three different scenarios. The first scenario is the one in which there are no barriers for foreign companies to access local assets, concentration is low (HHI is lower than 1500) in the industry on that market and there are more than five suppliers of complementary assets. The opposite scenario is the one in which it is challenging to access to local assets, since there are strong barriers against foreign investors, concentration is high (HHI is greater than 2500) and there less than three suppliers of local asset. Instead, in the middle there is the scenario in which there are some barriers, but moderate, concentration is medium (HHI between 1500 and 2500) and the number of suppliers of local assets or inputs is between 3 and 5 (Hennart, Hsia, & Pimenta, 2015).

Hence, data about these three conditions have been gathered and the correlation with entry modes has been studied to understand if there is a link between these two. Moreover, the conditions have been added as a variable (CMCLA) to the regression analysis, that assumes values 3, 2 or 1 depending on the scenario.

The $R^2$ for the linear regression conducted with Tesla's entry mode data is 0,625, whereas the one of CHAdeMO's regression is 0,556. These values, even if not extremely near 1 tell that the linear regressions conducted are reliable. Indeed, these values of $R^2$ are common in social sciences and should be considered positively. In the appendixes all the results from the analysis are shown, but the most important one is the p-value, that measures the significance of each explanatory variable that has been included in the model. This value ranges between 0 and 1 and the lower it is the more the variable can be explicative of the dependent one. Starting from the linear regression conducted on Tesla's data, the most significant variable is charging stations, which has a p-value of 0,005. This means that this variable can represent a serious determinant of entry mode choice. Anyways, another variable has the same p-value as charging stations, it is the one about developing countries. This is a very interesting result, because it underlines that Tesla has a different behaviour in developed and developing countries and that this can interact with entry mode strategy.

In particular, this means that Tesla tends to choose integrated modes in developed countries and other options in developing ones. Looking at the specific cases it seems that Tesla has a preference for greenfield investments in developed countries or in wide markets, such as China. Then there are two other very significant variables, charging price and subsidies. The explanation to this can be found in the importance of Supercharger network for Tesla, that considers carefully to expand it to countries in which it enters. The significance of subsidies is very good as well, since it shows that also this variable, decided from governments directly to increase the number of electric vehicles, can have an impact on Tesla's entry mode choice. All these variables have a p-value below 0,200.

Specifically, the presence of subsidies incentivized Tesla to enter the market choosing integrated modes, rather than independent modes.

On the other hand, there is only one variable that presents a very high p-value. It is the one about the conditions of the market for complementary assets. From the linear regression analysis, it seems that this variable cannot be considered explicative of entry mode choices made by Tesla.

These results are, of course, linked to the hypotheses made in this thesis and it will be underlined later.

Therefore, it is clear that the main variables that can explain entry mode choices are charging station number, subsidies and whether the country is a developing one or not. The linear regression model and the data gathered suggest when a charging infrastructure is extended enough and it helps in understanding which entry strategy companies will more likely choose.

## Conclusion

From the linear regression, it is clear that the more there are charging stations, the more companies choose wholly owned subsidiaries, or entry modes described by the higher numbers of the scale.It seems that companies tend to choose acquisitions or greenfield investments in the first scenario and exports in the third one. Greenfield investments, actually, seem to be preferred to acquisitions. This can be explained by the fact that when the market for assets is more efficient than the market for firms it is not convenient to choose an acquisition. On the other hand, when the market for assets is not completely efficient, joint-ventures or acquisitions can be a solution.

Anyways, analysing the p-value of the variable connected to local complementary assets it is possible to understand that this value seems not significant in Tesla's linear regression, but significant for CHAdeMO's. Indeed, the p-value is 0,894 in Tesla's case and 0,019 in CHAdeMO's case.

Regarding the first hypothesis, we can state that it has been confirmed. Indeed, data show that there is clear statistical association between charging stations and foreign entry strategies of electric car producers. Moreover, this is true also other variables, such as subsidies and developing countries, and it is confirmed for bot Tesla and CHAdeMO.

In particular, electric car producers tend to choose entry modes lined to higher numbers of the dependent variable when there is a high number of charging stations in a country. This means that, in this case, they prefer to choose greenfield investments or acquisitions, that are integrated modes in the OLI Framework.

Unfortunately, regarding the second hypothesis, it is not possible to say that it has been confirmed because, even if it seems confirmed from Tesla's analysis, it is not confirmed from CHAdeMO's case.

In particular, the variable is not very significant in the model and this means that it cannot be a determinant of the dependent variable. Anyways, further research is needed.