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Small companies facing the mobility policy in Spain: Is it profitable to remain in the market?

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ABSTRACT

The parking sector in Spain has experienced a growing trend in recent years. At the same time, the level of market concentration has increased. One of the main reasons behind this phenomenon is due to the mobility policy established both at the national (Spain) and supranational (European Union) levels, which is based on environmental sustainability criteria. Increasingly, the possession of environmental certificates, widespread among large companies but not among small ones, is increasingly decisive to obtain a public parking tender. The objective of this work is to analyze whether small companies, which are a large number in the sector, have possibilities of continuing their activity in the market in the face of an increase in the degree of sustainability in mobility policies. For this purpose, the Real Options methodology will be used, applying an abandonment option for a period of 10 years. The results provide a high NPV value (€598,491.2) and a Real Options value, together with the exit option, of €630,341.9. The exit option contributes a growth of only 5.32% with respect to the NPV. Therefore, the option to stay in the market is an appropriate choice for decision-makers.

1. Introduction

Climate change is a serious threat to the sustainability of the economic models of developed economies (Cheng et al., 2015). The fight against global warming is a reality due to the agreement reached at the United Nations Climate Change Conference (COP 21) and, particularly, the European Union (EU) has been a decisive actor in approving this agreement (Du et al., 2019; Rhodes, 2016; Oberthür and Groen, 2017, 2018). The environmental policy of the EU has been distinguished by its longevity, active for more than five decades, and its holistic nature, extending across all social and economic areas of its member countries (Knill and Liefferink, 2013).

A key focus of EU environmental policies is the reduction of CO_2 emissions (Bekun et al., 2019; Dogan and Seker, 2016; Neves et al., 2020). CO_2 is the most abundant greenhouse gas (GHG) as well as one of the most harmful, with the transport sector being one of the leading industries in CO_2 emissions on a global scale (Grondys, 2019; Santos, 2017). In Spain, an EU member country, the transport sector is the leading industry in CO_2 emissions in 2019. A total of 90.9 million tons of the 313.5 million tons of gross CO_2 emissions in Spain, were generated by transport-related activities (Ministerio para la transición ecológica y el reto demográfico, 2020).

Against this background, the competent agencies of the European Union have encouraged Spanish policy makers to incorporate actions to reduce the increasing levels of pollution, the consumption of non-renewable fuels, and the levels of congestion and accident rates resulting from the current road transport model (Berggren and Magnusson, 2012; Brodny and Tutak, 2021; Nowakowska-Grunt and Strzelczyk, 2019). In Spain, parking policies are being essential to achieve the greenhouse gas reduction targets set by the EU (Klementschitz et al., 2012). Sustainable Urban Mobility Plans (SUMPs), implemented at the local level, are crucial to reduce road traffic with active policies such as park-and-ride facilities and the establishment of pay-per-hour parking zones (Castro-Nuño et al., 2018; Diez et al., 2018; Mozos-Blanco et al., 2018).

Therefore, parking management is a key element in the regulation of urban mobility, rebalancing the costs of traveling in a private vehicle by paying for parking and restricting its use (Nuzzolo et al., 2016). However, along with the increase in the number of parking spaces in Spain, there has been another phenomenon: the increase in the concentration of the sector. In 2019, the top five parking companies in Spain held 52% of the market share of the sector (DBK, 2021). Besides taking advantage

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of economies of scale, the leading companies have the advantage of having greater access to environmental requirements (such as ISO 50001 certificates for energy management or ISO 14001 certificate for environmental management), which are positively valued to obtain contracts with the Public Sector on parking management (EMPARK, 2020; SABA, 2019). Given this scenario, the survival of the follower companies has been compromised.

The objective of this article is to analyze the investment attractiveness of one of the market followers' companies through the valuation of its financial data. This provides the necessary information to support strategic investment decisions and defines the time scenario to characterize the best moment to make an investment or to abandon the project. For this purpose, two complementary methodologies will be used: the Net Present Value and Real Options approach. Based on the results analyzed, it will be determined if the company is likely, or not, to continue its activity in the sector. In order to assess more exhaustively the viability of the company, through the various scenarios in which it could conduct its activity, the abandonment option is included in the real options approach used for this case study. This methodology makes it possible to maximize the value of the project in the period under study by adopting a flexible and more complete view of the project that classical models do not address. The analysis will be conducted for a 10-year period (2019–2029). The choice of this time horizon is since, from the investment perspective, this period includes a short, medium, and long-term period. This provides the investor with sufficient information to make decisions in different scenarios.

This article is structured as follows. Section 2 presents the evaluation of mobility policies, with special attention to parking policies, in Spain. Section 3 describes the methodology used for the analysis conducted in this article. Next, section 4 will present the results reached and, finally, section 5 will discuss the main conclusions reached.

2. Mobility policies in Spain and the evolution of the parking sector

The current governance of the parking sector is not only based on economic criteria. The sustainable approach has guided the design of the institutional framework for the parking sector in the EU (Bart, 2010). (Bart, 2010) This is due to the need to balance economic growth with environmental protection to ensure present and future social welfare. Therefore, multilevel and polycentric management has been adopted that incorporates ecological, biological, political, and legal criteria (Čuljković, 2018; Parra, 2010).

The member countries of the European Union, such as Spain, have multilevel governance in the parking sector. The EU, from the first level, which corresponds to it as a supranational body, establishes the central institutional issues and approves the framework laws that guide parking management. At a second and third level are the national and regional bodies, which execute and specify actions to achieve efficiency in parking management. This governance system is complementary and provides continuous feedback, creating meeting spaces for the design and evaluation of the measures implemented.

At the European level, parking policies are linked to urban mobility planning. Free parking, or parking at an excessively low price, means that the demand for parking exceeds the supply. This leads to increased congestion and urban pollution as there is a greater number of cars in search of parking space (OECD, 2019). Therefore, the promotion of paid parking lots, whether structure parking lots or regulated surface parking lots, has proliferated in the last decade.

The operating concession for a privately managed parking lot is conditioned by environmental constraints. The European Transport White Paper establishes the need to create a sustainable management framework for European mobility, a concept that was concretized in the 2013 Urban Mobility Package and materialized with the establishment of the Sustainable Urban Mobility Plans (SUMPs) (European Commission, 2011, 2013). SUMPS are packages of measures for efficient and sustainable mobility management (Glotz-Richter, 2016). This is a holistic regulation that also includes parking policies. Over the last decade, the parking policy embodied in SUMPS has varied from a restrictive view of parking space and time, through the implementation of restrictions linked to price increases, to the current policy focused on environmental sustainability (Bencekri et al., 2019).

At the national level, in Spain, the design of SUMPs is elaborated following the guidelines contained in Spain's 2012–2024 infrastructure, transport, and housing plan (PITVI) which, in turn, follows the sustainable mobility approach adopted in the EU (Diez et al., 2018). The PITVI includes the importance of parking services as an effective, and even dissuasive, tool to promote sustainability in transport. Therefore, the two main institutional pillars for mobility in Spain, the PITVI and the SUMPs, recognize the value of parking as a strategic infrastructure (May et al., 2017; Plasencia-Lozano, 2021).

The importance of the PITVI and the SUMPs, with around two hundred SUMPs approved in Spain, has led to the evolution of the specific legislative framework for parking lots, progressively incorporating environmental issues (ELTIS, 2021). The main legislation governing the sector is Law 40/2002, of November 14, 2002, regulating the vehicle parking contract, which was partially amended by Law 44/2006, of December 29, 2006, to improve the protection of consumers and users.

However, there are other national laws that are of vital importance for the Spanish parking sector. Law 9/2017, on Public Sector Contracts, is one of them. This law establishes the guidelines for the realization of contracts between the Spanish public administration and the private sector seeking to maximize the quality-to-price ratio. Nevertheless, the criteria for seeking the best offer are not only economic, but the law establishes that environmental aspects will also be considered to conclude the bidding process (Parlamento de España, 2017). Much of the activity of the parking sector is developed through public contracting, so it is important that the environmental profile of companies in this industry is oriented towards sustainability.

Law 9/2006, on the assessment of the effects of certain plans and programs on the environment, is another regulation that is having an increasing effect on the parking sector. As specified above, parking management is an important piece in the PITVI 2012–2024 and the SUMPs. These plans, as stipulated in Law 9/2006, must achieve a positive environmental assessment periodically (Parlamento de España, 2006). This requirement implies that all public contracts executed under these plans must be governed by the principle of sustainability with the environment, including those made with companies in the parking sector.

Given this institutional framework, Spanish companies dedicated to parking services identified the need to improve their sustainability strategies, as their competitiveness in public tenders depends on it. Spanish legislation stipulates a formal procedure by which compliance with environmental standards is accredited and this is through the presentation of environmental certifications. As a result, obtaining these types of certifications, specifically ISO 14001 Environmental Management and ISO 50001 Energy Management, has proliferated among parking companies. However, the distribution of these certificates is very uneven across the industry. It is the large companies that have obtained these certificates more quickly and in higher percentages. In this way, the larger companies have an additional factor to increase their comparative advantage with respect to small and medium-sized companies, strengthening their position in the market.

The parking sector in Spain has grown over the last five years, apart from 2020 because of low mobility due to the lockdown by Covid-19 (Table 1). This positive trend in the sector has led to increasing aggregate turnover in the sector, exceeding €1 billion in 2019 and 2021 (DBK, 2020, 2021). However, these gains have been distributed among an increasingly smaller number of companies due to the growing degree of market concentration (Table 2). While large companies are strengthening their position through new public tenders, acquisition and merger

Table 1
Variation in the growth of the Spanish parking market. Source: Own elaboration based on (DBK, 2022, 2021, 2020, 2019, 2018, 2017, 2016).

	% var. 2015/ 2014	% var. 2016/ 2015	% var. 2017/ 2016	% var. 2018/ 2017	% var. 2019/ 2018	% var. 2020/ 2019	% var. 2021/ 2020
Market variation	+2.2	+4.2	+3.0	+2.9	+3.5	−33.9	+22,0
Structure parking lots	+2.0	+5.6	+4.1	+3.8	+4.7	n.a.	n.a.
Regulated surface parking lots	+2.5	+1.0	+0.3	+0.7	+0.3	n.a.	n.a.

policies, and heavy capital investments, small and medium-sized companies, most of which are family-owned, are finding it very difficult to be profitable.

In 2021, the parking sector grew to recover its post-pandemic turnover. The general elimination of mobility restrictions for the population, the generalization of face-to-face work, and the recovery of the economy and private consumption have been factors with a positive impact on the sector. However, certain socio-economic trends, such as the rise in fuel prices, the progressive expansion of teleworking, and the increased use of public transport, represent threats to the growth of the parking industry in the short and medium term (DBK, 2022).

3. Methodology

In order to perform the financial analysis of a small Spanish parking company, the SABI database has been used. The financial statements of the company have been obtained from this database for their study and projection. The variable that has been extracted from this database to perform the relevant analysis is cash flow. The company analyzed is well established in the parking industry, operating in this sector since 1997, and focuses its activity on the leasing and management of parking spaces, as well as the construction of parking structures. To analyze the profitability of continuing or ceasing its activity in the market, two methodologies have been used: Net Present Value (NPV) and Real Options (RO).

NPV is a business valuation model widely used in the private sector to analyze the viability of a company or investment project. However, the rigidity of NPV, by not incorporating uncertainty and removing different management options, has been a constant criticism of this approach (Hu and Zhang, 2015; Wang and Du, 2016). In a volatile scenario such as the one presented by modern Western economies, a financial analysis model that offers flexibility in the presence of changes in social, political, economic, or legal factors is needed (Wang et al., 2014).

For this reason, the RO methodology emerged, establishing itself as a complementary model to NPV and overcoming its shortcomings. This methodology has its origin in the article published by Stewart Myers (1977) in which the possibility of using financial option valuation models to estimate non-financial assets is exposed. The application and improvement of these models materialized in the creation of another investment valuation technique with high uncertainty: the RO approach for the valuation of real assets (Kester, 1984). The RO model reduces the uncertainty to which companies are subjected through the incorporation of managerial flexibility (Mayer et al., 2017). Thus, an approach for the application of the theory of financial options to strategic decisions was developed.

In our case study, an RO analysis with an abandonment option was conducted. The choice of the abandonment option is due to the adverse conditions that small companies currently face in the Spanish parking sector. The growing importance of sustainability, materialized through environmental certificates that small companies do not generally have, as well as the trend of increasing market concentration, highlights the importance of assessing the survival of a parking company in Spain.

3.1. Net Present Value

Net present value is defined as the present value of the cash flows, that is, the difference between the current value of the cash outflows and cash inflows that will be generated over a period, minus the initial cost of the investment. Mathematically:

$$NPV = -I + \sum_{t=1}^{T} \frac{CF_t}{(1+r)^t} \tag{1}$$

Where:

I: initial investment
CF_t: cash-flows
r: discount rate (WACC)
t: numbers of periods

3.2. Real options

Real Options methodology is an approach utilized to complement NPV. Several scholars claim that the valuation through this model is the sum of NPV and the value of the options available to the company in the market to implement its project, regardless of their nature (Fig. 2) (Trigeorgis, 1996; Hernández-García et al., 2018).

$$Strategic\ NPV = NPV + option\ value \tag{2}$$

To determine the Strategic NPV, binomial option pricing model proposed by Ross et al. (1979) is employed. In our case study, an abandonment option linked to a parking company is valued. To conduct the valuation, it is necessary to calculate the following parameters:

$$u = e^{\sigma\sqrt{dt}} \tag{3}$$

$$d = e^{-\sigma\sqrt{dt}} = \frac{1}{u} \tag{4}$$

Table 2
Evolution of the parking sector in Spain. Source: Own elaboration based on (DBK, 2022, 2021, 2020, 2019, 2018, 2017, 2016).

	2015	2016	2017	2018	2019	2020	2021
Number of companies	835	825	820	800	775	765	n.a.
Number of parking spaces	1,505,000	1,500,000	1,510,000	1,520,000	1,500,000	1,515,000	1,520,000
Structure parking lots	780,000	765,000	775,000	780,000	780,000	785,000	780,000
Regulated surface parking lots	725,000	735,000	735,000	740,000	720,000	730,000	740,000
Market (million euros)	950	990	1020	1050	1097	725	915
Structure parking lots (million euros)	663	700	729	757	803	n.a.	n.a.
Regulated surface parking lots (million euros)	287	290	291	293	294	n.a.	n.a.
Concentration (combined market share in value)							
Top five companies (%)	52.00	52.30	52.60	52.90	52.20	46.50	48.0
Top eight companies (%)	63.80	63.60	64.60	65.30	65.00	n.a.	n.a.

$$\sigma = ln\left(\frac{\sum_{i=1}^{n} S_i}{\sum_{i=0}^{n} S_i}\right) \tag{5}$$

$$CF_{i,j} = u^i d^{|i-j|} CF_{0,0} \tag{6}$$

$$p_u = \frac{e^{r_f dt} - d}{u - d} \tag{7}$$

$$p_d = 1 - p_u \tag{8}$$

Where u and d represent the upward and downward movements of cash flows; σ volatility; the value of cash flows in each period; p_u and p_d the risk-neutral probability linked to the increase or decrease of cash flows, respectively.

The abandonment option provides the company the possibility of selling or liquidating any asset or equity when market conditions are not appropriate, or the project is not profitable (Rogers, 2002). In this case, the company recovers a part of the investment, specifically the residual value, through the sale of certain assets or of the enterprise itself. Therefore, the abandonment option is considered as a put option. The exercise price is represented as the liquidation value of the company at each time node. Moreover, the liquidation value, $VL_{i,j}$, is calculated as the difference between the total assets of the firm and the debts due.

The incorporation of the valuation of an abandonment option leads to the creation of two binomial trees: (i) the binomial tree relative to the underlying asset (NPV); (ii) the binomial tree relative to the value of the firm with the abandonment option. NPV binomial tree is obtained by applying formulas (3) and (4) to the NPV. The next step is to construct the binomial tree that captures the value of the firm with the abandonment option. The creation of this binomial tree is composed of two stages. The first stage corresponds to the calculation of the final nodes (year 2029). The value of each final node is calculated as follows:

$$FN_{i,10} = max\left(CF_{i,10}; VL_{i,10}\right) \tag{9}$$

Where $FN_{i,10}$ represents the value of the end nodes.

The second stage is implemented through recursive backward induction technique, and it calculates the value of the intermediate nodes (Loncar et al., 2017). The value of the firm at each node is defined as the maximum value between the continuation of its activity without the abandonment option or the value of the firm with the abandonment option. The calculation of these nodes is defined by:

$$IN_{i,j} = \begin{cases} max\left(CF_{i,j}; VL_{i,j}; \frac{p_u IN_{i+1,j+1} + p_d IN_{i,j+1}}{\left(1+r_f\right)^{\delta t}}\right) & j \leq 8 \\ max\left(CF_{i,j}; VL_{i,j}; \frac{p_u FN_{i+1,\ 10} + p_d IN_{i,10}}{\left(1+r_f\right)^{\delta t}}\right) & j = 9 \end{cases} \tag{10}$$

Where $IN_{i,j}$ is the intermediate value of the nodes, $i, j = 0, 1, 2, \ldots, n$ and. $j \geq i$

4. Results

The valuation of the company was performed for a period of 10 years (2019–2029). According to the time range of the analysis, two ten-node binomial trees have been calculated, representing each node the end of every year analyzed. This section presents the results of the study, as well as the resulting binomial tree figures.

First, the estimated cash flows have been calculated by projecting the profit and loss account (Table 3). In the last year, 2029, the continuation of the cash flows of the company is calculated. After applying formula (1), the NPV result is €598,491.2.

To apply the Real Options approach, the parameters shown in Table 4 have been estimated. Next, in Table 5, the liquidation values of the company for the estimated time range are presented.

Table 3
Cash-flows estimation.

Year	Cash-Flows (€)
2019	−220,022.00
2020	−6427.95
2021	2714.47
2022	9942.06
2023	18,533.68
2024	22,466.77
2025	31,516.54
2026	40,860.62
2027	51,708.88
2028	64,281.48
2029	1,253,696.11

Table 4
Parameters real options.

Parameter	Value
u	1.3972
d	0.7157
pu	0.4233
pd	0.5767
rf (Spanish bond 27-09-2021)	0.42%
t	1
σ	33.45%
WACC	5.47%

Fig. 1 represents the calculation of the binomial tree relative to the underlying asset, NPV. Equation (6) has been applied for its realization. In the last year of the study, 2029, a range of values is relatively high, which is due to the high volatility of the market where the company operates. This is an important factor in the analysis, since it conditions the fluctuations in the value of the company (Hu et al., 2021).

The binomial tree relative to the company, which includes the value of the abandonment option, is shown in Fig. 2. Its calculation is derived from the application of the equation for the value of the final nodes (equation (9)) and the formula for the value of the intermediate nodes (equation (10)).

Finally, the value of the abandonment option is defined by:

$$Option\ abandon\ value = 630,341.93 - 598,491.2 = €31,850.73$$

The flexibility option, through the valuation of the abandonment option, confers a value of €31,850.73. Despite the increase in the value of the company, the liquidation option is maximized in four scenarios. These scenarios are represented in the final nodes, year 2029, provided that the company has a continued sharp fall in value.

5. Discussion

The parking industry in Spain is a growing sector. Except for the figures corresponding to the year 2020, which corresponds to the lockdown derived from Covid-19, this sector has shown an average year-

Table 5
Liquidation value.

Year	Liquidation value (€)
2019	205,571.00
2020	193,194.89
2021	181,591.95
2022	172,732.30
2023	167,755.34
2024	167,345.43
2025	170,725.76
2026	177,593.59
2027	188,347.69
2028	203,434.79
2029	223,347.38

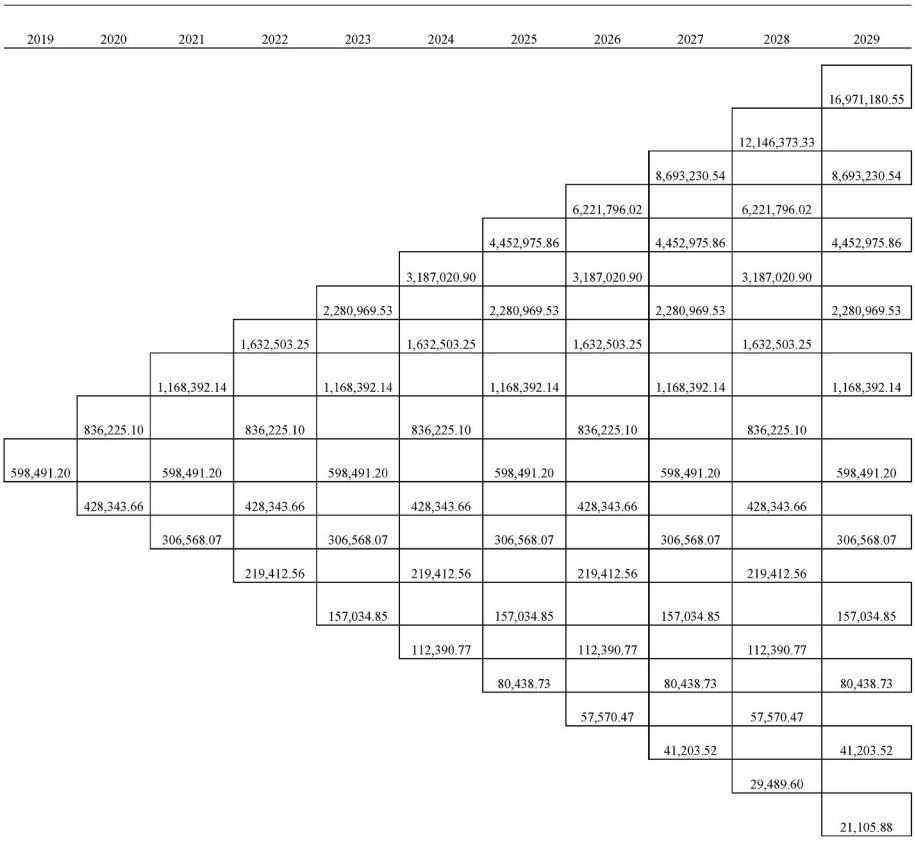

Fig. 1. Binomial tree Net Present Value (NPV).

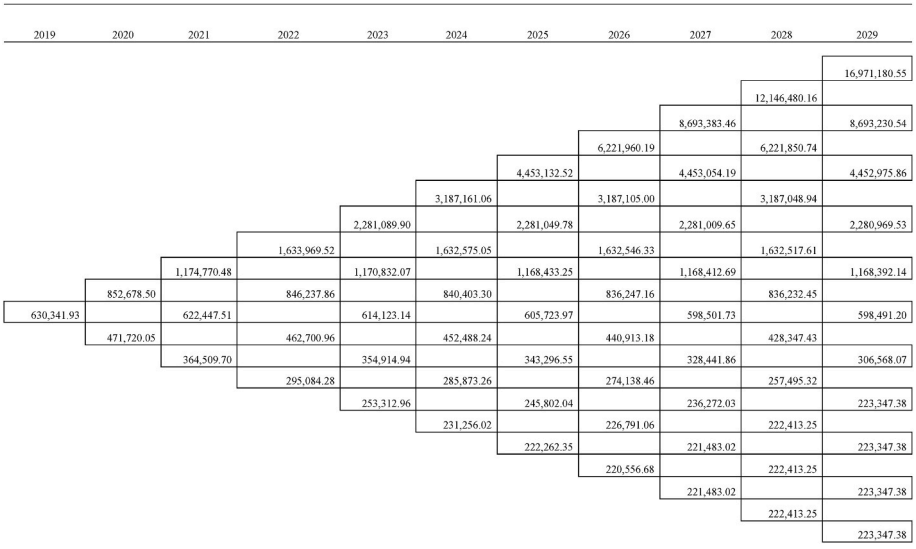

Fig. 2. Binomial tree NPV + option to abandon.

on-year growth of 3% in the last five years, a much lower figure than in underdeveloped countries but a high rate compared to other nearby countries (Ardeshiri et al., 2021). Structure parking lots, as opposed to regulated surface parking lots, have been the fastest growing type of parking space (DBK, 2021). This is no coincidence. Urban planning has tended to create park-and-ride and urban parking lots in areas where land availability is limited, making vertical parking lots the solution.

The fact that the growth of the sector is based on structure parking lots has attracted large companies to the parking sector. Some of these companies are involved in construction activities, and they entered the parking sector attracted by its growth, considering it as a sector-refuge from the decline of the construction industry due to the economic crisis that began in Spain in 2007. The structure parking lots involve the creation of a new structure, an activity dominated by construction companies, which in turn entails a higher investment and therefore a larger public contract. For all these reasons, the incursion of large construction companies into the Spanish parking lot sector has become firmly established. This trend, involving the incursion of construction companies into the parking sector, has also been identified in another research (Biyik et al., 2021; Nuwagaba et al., 2022; Simpeh and Amoah,

2021).

The incorporation of large companies into the sector resulted in an increase in the degree of market concentration. In 2019, the top five companies in the sector accumulated 50% of the market share, and the remaining 50% was distributed among the remaining 770 companies, figures very similar to those of the Portuguese parking sector (Leal Da Silva Gomes, 2019). At the same time, the number of companies in the market decreased. This is mainly because of two reasons. The first reason is that the high initial investment to enter this sector is a strong barrier to entry for small companies. The second reason is based on the policy of acquisitions and mergers conducted by large companies. In addition, there is a third factor that consolidates this situation: the legislative framework whose main elements are the PITVI 2012–2024 and the SUMPs.

Urban mobility policies have focused their development on sustainability. The EU, of which Spain is a member, has established the ecological management of mobility as a priority. The polluting effect of private travel must be reduced to achieve a low ecological footprint. From the first European transport strategies to the recent Green Deal plan, the EU has considered transport policies as a main element in the fight against climate change (Werland, 2020). In this sense, SUMPs have become the flagship of EU mobility policies while influencing the creation of national policies of Member States. Spain, with the approval and implementation of the PITVI 2012–2024 has followed this line drawn by the EU, encouraging sustainable behaviors in the governance of mobility (Mukhtar-Landgren and Paulsson, 2021).

Pollution is a widespread negative externality in urban mobility. For this reason, active mobility policies in Spain have materialized the solution to this problem, among other actions, through the valuation of environmental certificates in public tenders for the management of parking lots. The possession of ISO certificates gives companies a comparative advantage over their competitors and, in Spain, most of these companies are large firms. Thus, large companies that already had factors that positioned them in a better position in the market, such as economies of scale and greater access to technological advances, have strengthened their hegemony in the sector. By attempting to internalize a negative externality, a state failure has been incurred.

6. Conclusions

This study focuses on the field of urban mobility management and proposes a methodology for assessing the feasibility of investment projects of small and medium-sized companies in the parking sector in Spain. In this industry, companies with a lower financial capacity are the ones that face more uncertainty in the face of the tightening of environmental requirements.

In this article a case study has been conducted to find out whether small companies, which are a large number in the sector, have possibilities to continue their activity, in a sustainable scenario, in the market. For this purpose, an average small company in the sector has been chosen and the binomial model used in the Real Options approach has been implemented. The results obtained in this study provide a high NPV value (€598,491.2). On the other hand, the Real Options approach, which maximizes the NPV value together with the abandonment option, still shows higher profitability of the company (€630,341.9). The exit option brings a growth of only 5.32% with respect to the NPV. Therefore, the option to remain in the market is an appropriate decision for the decision-makers.

These results show that, for the small companies in the market, the option of continuing their activity is, with a high probability, profitable. Despite the small market share of small companies, the growing market trend offers opportunities for them. As Bannerman (2020) discussed, European mobility policy will promote the creation of parking lots, in the face of the prioritization of city pedestrianization and the increase in public and collective transport. However, the fact that some of the Spanish small parking firms have not yet obtained environmental certifications, or obtained them later than large companies, reduces their opportunities to compete in the market. As stated by Boiral et al. (2018) bureaucracy, organizational resistance, and lack of resources can make it difficult for small companies to obtain environmental certificates. This situation may prolong the high level of concentration already present in the market. Environmental sustainability policies are undoubtedly necessary for the transport sector, but incorrect design and implementation, in whole or in part, can create new problems. Policymakers must therefore opt for decisions that combine economic, social, and environmental sustainability, but also ensure free competition in the markets.

This analysis is limited by the difficulty of generalizing its results to any small or micro-sized company. Although it was selected for this study a company whose economic and financial variables present average values for the subset of small companies, the heterogeneity of these companies makes it difficult to extrapolate the results. In addition, there is another limitation about the degree of uncertainty related to the external and internal factors that affect the economic performance of the company. Predicting and planning for all possible eventualities is very complex and costly so the characterization of the performance of the company in the market is incomplete. Despite this contingency, the scenario of relative probabilities exposed through the RO approach assigns a reliable probability to the eventualities, higher than that derived from the NPV estimation.

In this sense, future research efforts should focus on completing the variables that determine the framework of action in which the analyzed company conducts its activity. This would further reduce uncertainty about the investment decisions of business agents in such a dynamic sector. Part of this lack of market characterization is due to the lack of literature on the application of RO to urban mobility. This article has shown the suitability of applying this methodology to the study of the sector, so we hope that this analysis will generate discussion and encourage the application of RO to more case studies of the sector.

Author statement

Conceptualization, R.F.G. and M.I.P.P.; methodology, R.F.G.; validation, F. P-G. and R.F.G.; formal analysis, R.F.G.; investigation, R.F.G.; resources, F. P-G. and R P–V.; data curation, F. P-G. and R P–V.; writing—original draft preparation, R.F.G.; writing—review and editing, M.I.P.P.; visualization, R P–V. All authors have read and agreed to the published version of the manuscript.

Data availability

Data will be made available on request.

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References

Ardeshiri, A., Safarighouzhdi, F., Hossein Rashidi, T., 2021. Measuring willingness to pay for shared parking. Transport. Res. Pol. Pract. 152, 186–202. https://doi.org/10.1016/j.tra.2021.08.014.

Bannerman, L.A., 2020. The future of parking management : the view from the industry. Park. Regul. Manag. 159–179. https://doi.org/10.4324/9780429278846-12.

Bart, I.L., 2010. Urban sprawl and climate change: a statistical exploration of cause and effect, with policy options for the EU. Land Use Pol. 27, 283–292. https://doi.org/10.1016/J.LANDUSEPOL.2009.03.003.

Bekun, F.V., Alola, A.A., Sarkodie, S.A., 2019. Toward a sustainable environment: nexus between CO_2 emissions, resource rent, renewable and nonrenewable energy in 16-EU countries. Sci. Total Environ. 657, 1023–1029. https://doi.org/10.1016/j.scitotenv.2018.12.104.

Bencekri, M., Ku, D., Sungyong, N., Shinhae, L., Seungjae, L., 2019. Parking policies review: europe study case. Int. J. Transp. 7, 1–10. https://doi.org/10.33832/ijt.2019.7.2.01.

Berggren, C., Magnusson, T., 2012. Reducing automotive emissions-The potentials of combustion engine technologies and the power of policy. Energy Pol. 41, 636–643. https://doi.org/10.1016/j.enpol.2011.11.025.

Biyik, C., Allam, Z., Pieri, G., Moroni, D., O'Fraifer, M., O'Connell, E., Olariu, S., Khalid, M., 2021. Smart parking systems: reviewing the literature, architecture and ways forward. Smart Cities 4, 623–642. https://doi.org/10.3390/smartcities4020032.

Boiral, O., Guillaumie, L., Heras-Saizarbitoria, I., Tayo Tene, C.V., 2018. Adoption and outcomes of ISO 14001: a systematic review. Int. J. Manag. Rev. 20, 411–432. https://doi.org/10.1111/ijmr.12139.

Brodny, J., Tutak, M., 2021. The analysis of similarities between the European Union countries in terms of the level and structure of the emissions of selected gases and air pollutants into the atmosphere. J. Clean. Prod. 279, 123641 https://doi.org/10.1016/j.jclepro.2020.123641.

Castro-Nuño, M., Castillo-Manzano, J.I., Fageda, X., 2018. The role of road safety in a sustainable urban mobility: an econometric assessment of the Spanish NUTS-3 case. Int. J. Sustain. Transp. 12, 205–217. https://doi.org/10.1080/15568318.2017.1346733.

Cheng, Y.H., Chang, Y.H., Lu, I.J., 2015. Urban transportation energy and carbon dioxide emission reduction strategies. Appl. Energy 157, 953–973. https://doi.org/10.1016/j.apenergy.2015.01.126.

Čuljković, V., 2018. Influence of parking price on reducing energy consumption and CO_2 emissions. Sustain. Cities Soc. 41, 706–710. https://doi.org/10.1016/J.SCS.2018.06.015.

DBK, 2016. Aparcamientos (Mercado Ibérico) | Nota de prensa 2016 | DBK Observatorio Sectorial [WWW Document].

DBK, 2017. Aparcamientos (Mercado Ibérico) | Nota de prensa 2017 | DBK Observatorio Sectorial [WWW Document].

DBK, 2018. Aparcamientos (Mercado Ibérico) | Nota de prensa 2018 | DBK Observatorio Sectorial [WWW Document].

DBK, 2019. Aparcamientos (Mercado Ibérico) | Nota de prensa 2019 | DBK Observatorio Sectorial [WWW Document].

DBK, 2020. Aparcamientos (Mercado Ibérico) | Nota de prensa 2020 | DBK Observatorio Sectorial [WWW Document]. URL. https://www.dbk.es/es/detalle-nota/aparcamientos-mercado-iberico-2020, 5.17.2021.

DBK, 2021. Aparcamientos (Mercado Ibérico) | Nota de prensa 2020 | DBK Observatorio Sectorial [WWW Document]. URL. https://www.dbk.es/es/detalle-nota/aparcamientos-mercado-iberico-2020, 5.17. 2021.

DBK, 2022. Aparcamientos (Mercado Ibérico) | Nota de prensa 2021 | DBK Observatorio Sectorial [WWW Document]. URL. https://www.dbk.es/es/detalle-nota/aparcamientos-mercado-iberico-2022, 7.17. 2022.

Diez, J.M., Lopez-Lambas, M.E., Gonzalo, H., Rojo, M., Garcia-Martinez, A., 2018. Methodology for assessing the cost effectiveness of sustainable urban mobility plans (SUMPs). The case of the city of burgos. J. Transport Geogr. 68, 22–30. https://doi.org/10.1016/j.jtrangeo.2018.02.006.

Dogan, E., Seker, F., 2016. Determinants of CO_2 emissions in the European Union: the role of renewable and non-renewable energy. Renew. Energy 94, 429–439. https://doi.org/10.1016/j.renene.2016.03.078.

Du, H., Chen, Z., Peng, B., Southworth, F., Ma, S., Wang, Y., 2019. What drives CO_2 emissions from the transport sector? A linkage analysis. Energy 175, 195–204. https://doi.org/10.1016/j.energy.2019.03.052.

ELTIS, 2021. España -Observatorio de la movilidad urbana [WWW Document]. URL. https://www.eltis.org/mobility-plans/member-state/spain. accessed 10.13.2021.

EMPARK, 2020. Política de Calidad, Medio Ambiente y Seguridad de la Información Alcance · Compromisos · Sociedades · [WWW Document]. URL. https://www.empark.com/uploads/mundo-empark/POLITICA DE CALIDAD- MA - SI_1611843471.pdf. (Accessed 6 February 2021).

European Commission, 2011. EUR-Lex - 52011DC0144 - EN - EUR-Lex [WWW Document]. WHITE Pap. Roadmap to a Single Eur. Transp. Area. URL. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52011DC0144. (Accessed 10 October 2021).

European Commission, 2013. ANNEX - A CONCEPT for SUSTAINABLE URBAN MOBILITY PLANS to the COMMUNICATION from the COMMISSION to the EUROPEAN PARLIAMENT. THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Together towards competitive and resource- [WWW Document]. URL. https://eur-lex.europa.eu/resource.html?uri=cellar:82155e82-67ca-11e3-a7e4-01aa75ed71a1.0011.02/DOC_4&format=PDF. (Accessed 10 October 2021).

Glotz-Richter, M., 2016. Reclaim street space! – exploit the European potential of car sharing. Transport. Res. Procedia 14, 1296–1304. https://doi.org/10.1016/J.TRPRO.2016.05.202.

Grondys, K., 2019. The impact of freight transport operations on the level of pollution in cities. In: Transportation Research Procedia. Elsevier B.V., pp. 84–91. https://doi.org/10.1016/j.trpro.2019.06.010

Hernández-García, R.D., Güemes-Castorena, D., Ponce-Jaramillo, I.E., 2018. A real option based model for the valuation of patent protected technological innovation projects. World Patent Inf. 53, 24–38. https://doi.org/10.1016/j.wpi.2018.05.002.

Hu, Q., Zhang, A., 2015. Real option analysis of aircraft acquisition: a case study. J. Air Transport. Manag. 46, 19–29. https://doi.org/10.1016/j.jairtraman.2015.03.010.

Hu, H., Wang, X., Gao, Z., Guo, H., 2021. A real option-based valuation model for shared water saving management contract. J. Clean. Prod. 289, 125442 https://doi.org/10.1016/j.jclepro.2020.125442.

Kester, W.C., 1984. Today's options for Tomorrow's growth. Harv. Bus. Rev. 62 (2), 153–160.

Klementschitz, R., Hössinger, R., Roider, O., 2012. Results of the implementation process evaluation of CIVITAS II funded measures for sustainable urban transport. Procedia - Soc. Behav. Sci. 48, 64–74. https://doi.org/10.1016/j.sbspro.2012.06.988.

Knill, C., Liefferink, D., 2013. The establishment of EU environmental policy. In: Jordan, A., Adelle, C. (Eds.), Environmental Policy in the EU: Actors, Institutions and Processes. Routledge, New York, pp. 13–31. https://doi.org/10.4324/9780203109823.

Leal Da Silva Gomes, M. do C., 2019. Parking in Lisbon [WWW Document]. Nova School of Business and Economics (NSBE). URL. https://run.unl.pt/bitstream/10362/68752/1/Gomes_2019.pdf, 7.26.2022.

Loncar, D., Milovanovic, I., Rakic, B., y Radjenovic, T., 2017. Compound real options valuation of renewable energy projects: the case of a wind farm in Serbia. Renew. Sustain. Energy Rev. 75, 354–367. https://doi.org/10.1016/j.rser.2016.11.001.

May, A., Boehler-Baedeker, S., Delgado, L., Durlin, T., Enache, M., van der Pas, J.-W., 2017. Appropriate national policy frameworks for sustainable urban mobility plans. Eur. Transp. Res. Rev. 9, 7. https://doi.org/10.1007/s12544-017-0224-1.

Mayer, C., Breun, P., Schultmann, F., 2017. Considering risks in early stage investment planning for emission abatement technologies in large combustion plants. J. Clean. Prod. 142, 133–144. https://doi.org/10.1016/j.jclepro.2016.05.089.

Ministerio para la transición ecológica y el reto demográfico, 2020. Inventario nacional de Gases de Efecto invernadero (GEI) [WWW Document]. URL. https://www.miteco.gob.es/es/calidad-y-evaluacion-ambiental/temas/sistema-espanol-de-inventario-sei-/Inventario-GEI.aspx. accessed 5.20.2021.

Mozos-Blanco, M.Á., Pozo-Menéndez, E., Arce-Ruiz, R., Baucells-Aletà, N., 2018. The way to sustainable mobility. A comparative analysis of sustainable mobility plans in Spain. Transport Pol. 72, 45–54. https://doi.org/10.1016/j.tranpol.2018.07.001.

Mukhtar-Landgren, D., Paulsson, A., 2021. Governing smart mobility: policy instrumentation, technological utopianism, and the administrative quest for knowledge. Adm. Theor. Prax. 43, 135–153. https://doi.org/10.1080/10841806.2020.1782111.

Myers, S.C., 1977. Determinants of corporate borrowing. J. Financ. Econ. 5, 147–175. https://doi.org/10.1016/0304-405X(77)90015-0.

Neves, S.A., Marques, A.C., Patrício, M., 2020. Determinants of CO_2 emissions in European Union countries: does environmental regulation reduce environmental pollution? Econ. Anal. Pol. 68, 114–125. https://doi.org/10.1016/j.eap.2020.09.005.

Nowakowska-Grunt, J., Strzelczyk, M., 2019. The current situation and the directions of changes in road freight transport in the European Union. In: Transportation Research Procedia. Elsevier B.V., pp. 350–359. https://doi.org/10.1016/j.trpro.2019.06.037

Nuwagaba, I., Molokwane, T., Nduhura, A., Tshombe, L.M., Muhwezi, R., 2022. Do stakeholders matter? Nexus of public private partnership projects for city street parking in Uganda. Int. J Sup. Chain. Mgt 11.

Nuzzolo, A., Comi, A., Ibeas, A., Moura, J.L., 2016. Urban freight transport and city logistics policies: indications from Rome, Barcelona, and Santander. Int. J. Sustain. Transp. 10, 552–566. https://doi.org/10.1080/15568318.2015.1014778.

Oberthür, S., Groen, L., 2017. The European Union and the Paris Agreement: leader, mediator, or bystander? Wiley Interdiscip. Rev. Clim. Chang. https://doi.org/10.1002/wcc.445.

Oberthür, S., Groen, L., 2018. Explaining goal achievement in international negotiations: the EU and the Paris Agreement on climate change. J. Eur. Publ. Pol. 25, 708–727. https://doi.org/10.1080/13501763.2017.1291708.

OECD, 2019. The Environmental and Welfare Implications of Parking Policies (No. 145). Environment Working Papers, Paris.

Parlamento de España, 2006. BOE-A-2006-7677 Ley 9/2006, de 28 de abril, sobre evaluación de los efectos de determinados planes y programas en el medio ambiente. Congreso de España, Madrid.

Parlamento de España, 2017. BOE-A-2017-12902 Ley 9/2017, de 8 de noviembre, de Contratos del Sector Público, por la que se transponen al ordenamiento jurídico español las Directivas del Parlamento Europeo y del Consejo 2014/23/UE y 2014/24/UE, de 26 de febrero de 2014. Congreso de España, Madrid.

Parra, C., 2010. Sustainability and multi-level governance of territories classified as protected areas in France: the Morvan regional park case. J. Environ. Plann. Manag. 53, 491–509. https://doi.org/10.1080/09640561003737341.

Plasencia-Lozano, P., 2021. An ex ante analysis of the planned transportation network in the region of extremadura (Spain) by using physical parameters. Sustainability 13, 5947. https://doi.org/10.3390/SU13115947.

Rhodes, C.J., 2016. The 2015 Paris climate change conference: COP21. Sci. Prog. https://doi.org/10.3184/003685016X14528569315192.

Rogers, J., 2002. Strategy, Value and Risk – the Real Options Approach. Palgrave Macmillan, New York, Estados Unidos.

Ross, S.A., Rubinstein, M., Cox, J.C., 1979. Option pricing: a simplified approach. J. Financ. Econ. 7, 229–263.

SABA, 2019, 2018 Informe Anual [WWW Document]. URL. https://saba.eu/informeanual2018/pdf/IA-Saba-2018_CAST.pdf. accessed 6.2.2021.

Santos, G., 2017. Road transport and CO_2 emissions: what are the challenges? Transport Pol. 59, 71–74. https://doi.org/10.1016/j.tranpol.2017.06.007.

Simpeh, F., Amoah, C., 2021. Assessment of measures instituted to curb the spread of COVID-19 on construction site. International Journal of Construction Management 1–19. https://doi.org/10.1080/15623599.2021.1874678.

Trigeorgis, L., 1996. Real Option: Managerial Flexibility and Strategy in Resource Allocation. MIT Press, Cambridge, MA, USA.

Wang, X., Du, L., 2016. Study on carbon capture and storage (CCS) investment decision-making based on real options for China's coal-fired power plants. J. Clean. Prod. 112, 4123–4131. https://doi.org/10.1016/j.jclepro.2015.07.112.

Wang, X., Cai, Y., Dai, C., 2014. Evaluating China's biomass power production investment based on a policy benefit real options model. Energy 73, 751–761. https://doi.org/10.1016/j.energy.2014.06.080.

Werland, S., 2020. Diffusing sustainable urban mobility planning in the EU. Sustainability 12, 8436. https://doi.org/10.3390/su12208436.