Department of Business and Management

Master's Degree in Strategic Management

Chair of Management of Innovation

"Corporate innovation and political donations: an empirical analysis."

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1. INTRODUCTION

The aim of this work is to deepen the effect that political connections can have on the innovation strategy of the company that carries them out.

In a dynamic and competitive market like the current one, the goal of each company is to search for the best strategies to offer a unique value proposition to the customer and capturing value. Many scholars believe that innovation is the main path that allows a company to reach this goal, which is why it plays a priority role in the agenda of many CEOs. Economic literature is rich in theories and models related to innovation and optimal strategies to pursue it (e.g. Porter, 1996; Hoberg and Philips, 2016), but this challenge is often extremely costly and complex to achieve, suggesting that there is still space for reflection and deepening.

The existence of a link between companies and politics is well known in literature. Companies establish political connections through contributions made by Political Action Committees (PACs) and individual employees and use them as real investments to obtain benefits (e.g. Ovtchinnikov et al., 2020; Stuckatz, 2022). The importance of donations is such that employers push and compel their employees to promote the political goals of their companies, a practice in which the United States leads (Stuckatz, 2022).

While it is well established that the innovation strategy is one of the essential tools that companies must promote to pursue profits in the long term, on the other hand, political donations can be considered as a relevant and expanding phenomenon. Evaluating how these two phenomena relate is valuable both for companies, as it provides them with additional evaluation elements to make consistent decisions functional to achieving their innovation objectives, and for institutions, as it allows them to identify the most suitable ways to regulate this activity.

Many studies have already delved into the positive impacts of political donations on the company that carries them out, starting from the fact that they allow it to reduce certain types of risk. In fact, with political connections, the company can mitigate its market risk, as it could know in advance the developments of regulatory scenarios and strategically steer its investments in innovation (Bhattacharya et al., 2017; Ovtchinnikov et al., 2020). Furthermore, there is an expected reduction in financial risk, thanks to easier access to credit and increased probability of receiving a corporate bailout, as well as bureaucratic risk, given the ability to accelerate the registration times of a patent due to the favoritism

they enjoy (e.g. Johnson and Mitton, 2003; Cull and Xu, 2005; Claessens et al., 2008; Cooper et al., 2010). Moreover, an improvement in compliance risk is noted, as by knowing in advance the regulations that will come into force, the company can comply with them and avoid sanctions (Meznar and Nigh, 1995; Blumentritt, 2003). In addition to the risk mitigation aspect, it has been found that the presence of political donations improves the company's stock price and future returns on investments (e.g. Faccio et al., 2006; Jerke, 2010; Nagy and Painter, 2012).

Looking at the issue from another perspective, politically connected companies run the risk of paying a high price in terms of reputation. In fact, shareholders and investors often do not see it as a favorable investment, as political ties may have been established for purely personal purposes by company executives (e.g. Guerrera, 2007). Another negative impact to consider is the increase in legal risk, due to the possibility of corruption for political interests, and operational risk, as politically connected companies seem to be characterized by poor governance and worse financial indicators (Claessens et al., 2008; Faccio, 2010; Aggarwal et al., 2012).

In addition, previous studies have investigated how the political orientation of CEOs can influence corporate performance, considering that it is a key figure in defining the strategic orientation of the company from the perspective of innovation and the choice to invest in political donations. Interestingly, the CEO's membership in a democratic party increases the company's propensity to innovate (Kashmini et al., 2017).

The contributions highlighted so far consider the positive and negative effects that impact the company, without delving deeply into a specific strategic choice undertaken by it. Investigating and analyzing the impacts of political activity with a specific focus on innovation strategy is valuable, as political decisions constitute one of the main determinants of the competitive environment in which companies operate and the ability to steer them in its favor can be crucial to achieve higher performance levels.

Recent literature has found that political contributions stimulate innovation (Ovtchinnikov et al., 2020) but has not defined which specific innovation strategy is pursued by these companies. In other words, this work would like to verify what changes in the innovation strategy between companies that make political donations and those who don’t.

To fill this gap, a literature review was conducted within section two aimed at analyzing the impact of technological differentiation, one of the strategies through which a company can pursue innovation, on a company's performance and the possible positive and negative impacts that political donations can have on the company's business. Section three presents the methodology adopted in this study, describing the variables and specifications of the regression models. The analysis was carried out using an unbalanced panel composed of 200 companies observed from the year 1980 to 2020. Four regression models were developed, considering fixed effects, including both firm and time fixed effects. The amount of political donations from corporate PACs represents the independent variable of the model, while the dependent variable is the firm's technological performance, measured through quantitative and qualitative dimensions. In fact, starting from the assumption that innovation is a key driver of performance improvement, the number of firm patents was used as an indicator of a quantitative nature, while the average value of patents, the average number of citations, and the level of technological differentiation were used as qualitative measures. The first model is developed using a Poisson regression analysis, as the dependent variable considered is the number of patents and it is a count variable, while the other three models are implemented using a linear regression analysis. In the models where the dependent variables are the total number of patents, the average value of patents, and technological differentiation, the result is significant, and a positive effect of donations on the first variable is found, with a negative effect on the other two. The effect related to the model with the dependent variable "Average number of citations" is also negative, however, the coefficient is not significant. Finally, section four presents the results of the analysis, while section five discusses the limitations of the analysis, contributions to the literature, and implications for management and institutions. The analysis shows that companies that invest more in political donations appear on the market with a high number of patents whose value is on average lower. Furthermore, technological differentiation does not seem to be a particularly exploited strategic lever by these companies, as they tend to invest in the same technological area as others present in the market.

2. RELATED LITERATURE

In this section I will present the academic contributions that form the basis of this work. The aim is to show how firm performance, and the search for the optimal strategy to increase it, are central topics of interest in the academic field, starting from the pillars of economic literature, considering the works of Michael Porter, up to more recent publications. To provide an overview of the topics, I will elaborate on how firm performance can be affected by choosing to pursue a technology differentiation strategy (see section 2.1) and by making political donations. Regarding the latter, I will discuss the positive effects (see section 2.2) and the negative effects (see section 2.3).

2.1 Technological differentiation and firm performance

The primary goal of any enterprise is to survive in the marketplace and maintain a high and satisfactory level of profitability over the long term. This challenge is as fundamental as it is complex, considering that the factors that influence a company's performance are multiple and it is necessary to define a competitive strategy that can develop them in a manner consistent with the company's core business in order to create a lasting and sustainable competitive advantage. The main risk that company's interface with, in today's dynamic and complex environment, lies in making strategic decisions that are deemed advantageous, such as total quality management, outsourcing, partnering, reengineering, change management, without being able to translate these activities into a sustainable competitive advantage.

Micheal Porter has addressed in many of his contributions the business strategies a firm must adopt to achieve a sustainable competitive advantage over time, arguing that to be profitable a firm must create a permanent difference from its rivals (Porter, 1996). The firm therefore must differentiate itself from its competitors and assert its uniqueness by offering a set of activities that generates a unique value mix for the customer, such that it offers him or her greater value that justifies a higher unit price than competitors, comparable value at a lower price, or both (ibid.).

In the past, product differentiation was considered as one of the main strategies that a company can gain a competitive advantage in the market and maintain high levels of performance. This strategy is supported by factors such as brand identification, innovation in marketing techniques, control of distribution channels, advertising campaigns, technological developments, and high-quality products (Dess and Davis, 1984; Posavac,

2004). Economics and strategy literature have always recognized the importance of assessing a firm's competitive position correlated with its differentiation in the product market (Hoberg and Philips, 2016).

Since the last years of the last century, technological evolution has disrupted the functioning of traditional markets in all sectors of the economy, making it increasingly urgent for businesses to find new and effective ways to understand and evaluate the digital economy environment and its progressively complex challenges. For this reason, more recent studies are empirically showing the growing relevance of differentiation within the technology space.

Technological differentiation consists of a strategic choice for a company to distinguish itself from others present in the market, especially its direct competitors, who are investing in a specific technological area, that has become too common, and invest in a new technological space already consolidated or emerging (Arts et al., 2021). A firm's position and differentiation in technology space relative to other firms are arguably key drivers of firm performance in line with differentiation in product market space (Hotelling, 1929; Shaked and Sutton, 1982; Hoberg and Philips, 2016). Among the numerous arguments in the literature supporting this assumption, for the purposes of this study, we have chosen to focus on the impact that technological differentiation has on performance through the development of technological capabilities, product innovation, and the innovation process considered as a whole. In addition, we will specify some necessary conditions to ensure that the contribution to performance is positive.

The starting point of this perspective is to consider that the technological differentiation can add value to the company by allowing it to develop its technological capabilities, defined by Teece et al., (1997), as the ability to perform any relevant technical function or volume activity within the company, including the ability to develop new products and processes and to manage structures effectively. These are considered by the literature of the last decade a fundamental strategic resource to gain a competitive advantage in their sector, especially in high-tech ones (Duysters and Hagedoorn, 2000). In fact, McEvily et al. (2004) argue that companies tend to be more innovative and therefore achieve higher levels of performance due to the presence of advanced technological competencies. The Resource-Based View theory also agrees that a company must possess unique and difficult to replace or imitate resources to increase its levels of performance and obtain a

competitive advantage in the market, such as proprietary technologies (Barney, 1991; Wernerfelt 1984, Peteraf 1993), developed thanks to its technological capabilities and supported by significant expenses in R&D. The presence of a unique and proprietary technological portfolio is an example of a unique and difficult-to-replace or imitate resource that contributes positively to the company's performance. Furthermore, technological differentiation acts positively on company performance, as it intervenes in favoring two important forms of innovation, product and process. Indeed, it allows the company to differentiate itself from its competitors by innovating products in response to market variations and to achieve efficiency gains through process innovation (Teece et al., 1997; Verona, 1999; Teece and Pisano, 2003).

To enhance technology differentiation, companies have the option to either internally create or externally procure new or emerging technologies that set them apart from the rest, or they can develop or acquire less innovative technologies that still differentiate them from their competitors within the same technology sector (Arts et al. 2021, 2023). The first benefit of technological differentiation derived from product innovation is certainly the positive impact it has on company revenues, as the presence of new highly technological and high-quality products increases customers' willingness to pay, strengthens their loyalty, and improves brand reputation (Dess and Davis, 1984; Posavac, 2004). Sutton, Hoberg, and Philips (1991; 2016) stress that companies with a proprietary and differentiated technological portfolio can develop unique products or processes that attract customers, create market power, and make it harder for rivals to enter the same product market space. In fact, in addition to positively affecting revenues, technological differentiation and the resulting product innovation constitute an effective barrier to entry for new entrants, as it reduces the threat of substitute products and supplier power (Porter, 1997; 2011). A company that effectively operates a process of technological differentiation could specialize in a new and complex technology that many of its competitors do not know or have not yet developed, allowing it to develop a product or service that is difficult to imitate. The company could leverage this strategic lever to successfully enter a new market or adopt a "blue ocean" strategy, creating a new market itself. Such a strategy brings multiple competitive advantages, as the company that is the first to enter the market with a new product can more quickly achieve and leverage economies of scale and scope than others, gaining cost reduction benefits. Moreover, it

will have more time to analyze the market, nurture supplier relationships, evaluate appropriate distribution channels, understand customer preferences, and adapt marketing strategies and product/service features to increase sales and therefore company revenues. According to Bain (1956), the widest and most common barrier to entry concerns the advantage that an established seller accumulates over the knowledge of its buyers' preferences compared to those of a potential entrant. Building on Bain's empirical studies, Schmalensee (1982) states that the benefits a company can gain by being the first to enter the market with a customer-satisfactory product stem from the fact that this product becomes the new industry standard. In fact, during the industry life cycle, there is an initial phase in which companies have not yet matured sufficient awareness of their consumers' preferences and innovate by seeking a product that can meet the needs of the customer segment and allow them to achieve good profits. This process continues until a product or service is launched that, better than others, demonstrates the ability to reflect customer needs and meet them, becoming the industry standard. The "leader" company that developed this product will obtain a competitive advantage determined by economies of scale and scope and accumulated experience, while all other "followers" will be forced to conform to it. Therefore, product innovation strengthens a company's competitive position compared to its rivals, as it allows it to increase its profits, which will remain high until other companies on the market are able to successfully imitate this innovation and reduce margins (Geroski et al., 1993). The more unique products the company can develop, thanks to the technological differentiation and product innovation achieved, the more sustainable benefits it will be able to derive in the long term (Grant, 1991).

In these circumstances, it’s important to consider that follower companies have the advantage of being able to imitate the industry standard in a shorter time and at lower costs compared to those incurred by the leader, with the consequent possibility of offering the same product at a lower price and taking market share away from the leader. In fact, many marketing experts support this view and recognize the success of "me too" brands, which consist of low-price imitations of private label products. Although this circumstance is often verified, Bond and Lean (1977, 1979) in their studies on the important and lasting advantages of pioneers in prescription drugs, recognize how pricing leverage is often not sufficient to take market share away from the leading company and it is rather necessary to offer a product with distinct advantages compared to the already

established one. In addition, studies on cigarette market segments by Whitten (1979) and cross-sectional analysis of marketing costs because of market entry order conducted by Buzzell and Farris (1976) reach the same conclusions. Therefore, technological differentiation and the product innovation to which it leads, can allow a company to enter a market first and gain competitive advantages that are difficult to imitate by other competitors. Furthermore, a company that adopts a technological differentiation strategy requires numerous and several components and knowledge for the development of its products and services, allowing them to have distinct options for choosing their supplies. This condition places them in a position of supremacy over their suppliers, who will have less bargaining power as they are aware of how easily the company can find a similar one in case of dissatisfaction or delays in supplies (Porter, 1997, 2011). Obviously, this competitive advantage does not apply to highly technological products for which there is a limited number of producers, such as graphene, which is a complex material widely used within the technology industry. Moreover, when a highly technologically differentiated company develops particularly specific innovations for its products, it is less likely that this knowledge can be successfully used by other less specialized companies in case of spillover (Geroski et al., 1993). In fact, formal theory models indicate that companies tend to differentiate their technology from that of others in order to reduce the risk of technology spillovers and competition in the product market. (Kamien and Zang, 2000; Aghion et al., 2005; Gil Molto et al., 2005).

When it comes to innovation, an essential requirement is the presence within the company of a pool of skills and knowledge capable of implementing it. Moreover, a company adopting a technological differentiation strategy must ensure a type of internal capability that, in addition to being specific and sought after, is extensive and varied to meet the different innovative areas it intends to develop for its products and services. These intangible resources constitute an essential and transformative asset typical of the technologically innovative and differentiated company, allowing it to consolidate its competitive advantage whenever it manages to accumulate superior skills compared to those possessed by competitors (Geroski, 1993). In this sense, general and technological knowledge, appear as key elements of the innovative process, whose relevance equals that of acquiring appropriate raw materials for production in building a competitive advantage (ibid).

The innovation process makes the firm less sensitive to adverse economic shocks and consequently more competitive than firms that do not innovate, as it deploys its tangible and intangible resources in order to make its processes more streamlined, flexible, and adaptable to the external environment, fostering the development of internal capabilities within the firm, effectiveness in implementation of new technologies, and the ability to align demand characteristics with its technological capabilities (ibid). So, the innovation process, which the firm can implement through a technological differentiation strategy, can give the firm a lasting and sustainable advantage over time, as it increases the efficiency of business processes by reducing costs and production time and facilitates the survival of the firm within today's dynamic and competitive market. Among the various authors who argue that both the product of innovation and the innovation process itself enable the firm to improve its profitability, Geroski et al. (1993) show that there are substantial and permanent differences in profitability between innovating and non-innovating firms, in addition to the margins generated by the specific innovations that are introduced. These differences in profitability could be due to the competitive capabilities developed by innovative companies discussed earlier and provide an explanation for why highly innovative companies have larger market shares than non-innovative ones and, at the same market shares, have higher profitability.

This first part of the literature review suggests that technological differentiation can have a positive impact on firm performance. This increase in profitability is due to its impact on increasing company revenues, primarily through product innovation, and reducing costs through process efficiency enabled by innovation process. Among the numerous empirical studies on these issues, the results of Arts et al. (2021, 2023) also agree in recognizing that technology differentiation presents a strong positive and long-lasting relationship with firm profitability and its market value. In addition, technological differentiation also improves forecasts regarding both sales and profits that the company will be able to achieve in the future, contributing further to increasing its effect on market value in the early years of implementing such a strategy. In the long term, forecasts are likely to stabilize and gradually reduce this improvement effect.

When considering the positive effects of technological differentiation on performance, it is important to evaluate the requirements that companies must meet for this condition to be satisfied. Indeed, the ways and intensity in which companies implement technological

differentiation vary depending on the industry and company characteristics. Technological differentiation is greater for young, small-sized companies that are more R&D-intensive and technology-specialized (Arts et al., 2021, 2023). Looking historically across different sectors, companies that have pursued the highest degree of technological differentiation have been, for example, Pioneer Hi-Bred International in 1997 or Monsanto in 2011, while those that have managed to maintain a high level of technological differentiation in their respective sectors have been, for example, Tesla (vehicles and bodies), Monsanto (agricultural production and crops), Olin (inorganic chemicals), or First Solar (semiconductors and related devices) (ibid). A company that seeks to benefit from its technological differentiation in terms of performance must pay particular attention to maintaining a prominent level of investment in R&D and the size of its technological portfolio, measured through patents (Simeth and Cincera, 2016; Bellstam et al., 2021). Moreover, as highlighted by Arts et al. (2021, 2023), possessing a differentiated technological portfolio can be a significant competitive advantage for a company only if it operates in a market with important levels of R&D and strong product competition. This occurs in industries that heavily focus on research and development, as companies make significant R&D investments because creating innovative and unique technology is crucial for a company's competitive edge and financial success. Additionally, in sectors with intense product market competition, such as computer hardware and fabricated metal products manufacturing, companies are driven to continuously push technological boundaries to stay ahead of competitors. This differs from industries with lower product market competition, like beverages, tobacco, and musical instruments, where companies may not feel as compelled to innovate as aggressively. When multiple companies offer comparable products to the same customer base, there is a higher risk of losing customers to competitors with more distinctive and advanced technology.

2.2 Corporate political donations and innovation: a positive perspective

The characteristics of legal systems and institutional market contexts are considered among the main drivers of business innovation (e.g. Acharya and Subramanian, 2009; Fan and White, 2003; Aghion et al., 2013; He and Tian, 2013). Political decisions play a fundamental role in determining the operating environment of innovative businesses,

considering the relative impact of legislation on climate issues, fiscal and energy policies, foreign trade, patents, and federal budget spending areas such as research funding, healthcare, and defense.

A substantial body of literature agrees that many companies choose to allocate part of their funds to political activity, making recurring donations to establish long-term ties with politicians (Ovtchinnikov et al., 2020). This practice is widespread among businesses and has significant effects on both individual companies and the internal institutional system, as demonstrated by Krueger's analysis (1974), which shows that the economic rents obtained by politically involved companies contribute to a significant percentage of the GDP in some developing countries. Furthermore, political donations are not specific to a particular sector but are similarly present in highly regulated sectors like the financial industry, basic industries such as construction, sectors with high government concessions like the oil industry, and sectors where state aid is less frequent, such as equipment manufacturing industries (Claessens et al., 2008).

A company's political involvement can take explicit forms, such as when a prominent political figure assumes a role within the company or its board of directors, or implicit forms, when the company contributes to election campaigns (e.g. Zardkoohi, 1985; Kroszner and Stratmann, 1998; 2005).

First and foremost, the benefits that political donations can bring to the donating company are evaluated. The main assumption is that political expenditures can contribute to improving the company's market value by influencing strategic factors such as reducing political uncertainty, accessing credit, and increasing stock returns. These listed advantages will enable the company to increase its profitability and be more attractive to investors, in order to accumulate substantial resources for R&D investments and obtain the essential resources and capabilities to support business innovation.

The first benefit to highlight is the strong incentive that political donations provide to business innovation, as involved companies gain valuable information to reduce political uncertainty (Bhattacharya et al., 2017; Ovtchinnikov et al., 2020). This uncertainty is defined as uncertainty about the government's future economic policy and significantly hinders business innovation, as it generates a high political cost for companies (Coate, 2004; Pastor and Veronesi, 2012). This factor can be particularly relevant in the context of innovation investments, which are characterized by a high level of uncertainty and

irreversibility, being long-term, very costly, and with uncertain outcomes (Davis, 2016; Dixit and Pindyck, 1994; Holmstrom, 1989; Aghion and Tirole, 1994). Dixit and Pindyck (1994) demonstrate that an investment that is at least partially irreversible is characterized by a high level of uncertainty regarding its future return or investment cost. This condition depresses investment in innovation and discourages companies from making it, as it increases the volatility of their future cash flows and the value of the waiting option (Bernanke, 1983; Bertola and Caballero, 1994; Abel and Eberly, 1996). Conversely, the increased information obtained through political donations reduces companies' uncertainty, decreases the volatility of expected cash flows from their innovations, reduces the value of the waiting option, and stimulates their investments in innovation.

This benefit falls within the increasingly substantial literature on the value of political intelligence, which companies can leverage in their investment decisions to achieve higher returns (Jerke, 2010; Bainbridge 2013; Nagy and Painter, 2012). According to Ovtchinnikov et al. (2020), the positive relationship between political donations and the level of business innovation is greater when contributions are made to winning politicians or those belonging to congressional committees with jurisdiction over the industry of the company being examined. This effect is entirely concentrated during non-election years when appointments to congressional committees are unexpected (ibidem).

To provide empirical evidence of the significance of political activism in reducing a company's uncertainty, reference is made to the episode of the dinner organized by Bill Clinton's defense secretary, Les Aspin, at the Pentagon in 1993 as reported by Nocera (2011). Fifteen CEOs of major defense contractors and major political contributors, such as Boeing, General Electric, McDonnell Douglas, and Northrop, attended the dinner. The goal of high-ranking Pentagon officials was to communicate that following the fall of the Berlin Wall, the dissolution of the Soviet Union, and the stagnation of the Pentagon budget, it was necessary for defense contractors to start investing in more intelligent activities to enhance their operational efficiency and reduce costs borne by the Department of Defense. Additionally, numerous private communications were noted after this dinner, during which Pentagon officials privately revealed to defense contractors the type of investment decisions the Department would accept, for example, a preference for innovative companies providing services to the Pentagon rather than weapons systems.

In addition to reducing political uncertainty, political contributions act through additional channels beneficial to the company to obtain stimul for innovation and performance improvements. Weidenbaum (1980) analyzed the different strategies companies use to respond to changes in government policy, identifying one known as "positive anticipation," which involves investing in anticipating commercial regulations before they come into force. This result is consistent with what Ovtchinnikov et al., (2020) documented regarding the fact that changes in the innovation of politically active companies are driven by forecasts of future legislative changes. Moreover, companies may use political donations to pressure and obtain favorable legislation or lucrative public contracts, allowing them to remove any regulatory obstacles and increase revenue flow, thus fostering innovation (ibidem). Meznar and Nigh (1995) and Blumentritt (2003) highlight a "buffering" attitude within the political behavior of companies, which involves taking proactive political actions such as lobbying to influence legislation, and "bridging," which involves monitoring regulatory developments to ensure compliance with them when regulations come into force.

To further understand the stimulus that political donations can provide to corporate innovation, it is worth considering that the expenses associated with it constitute "sunk costs," since the company will not be able to recover them once incurred. In fact, R&D expenses are necessary for the company to develop and analyze new technologies and functionalities to introduce products/services or streamline its internal processes and represent a high cost to bear in the medium/long term before it can lead to the desired results, with the real risk of burning resources without obtaining any actual benefit. If R&D activities lead to positive outcomes, the company will need to acquire resources and capabilities to translate new discoveries into profitable innovations, often involving very scarce and expensive human, tangible, and intangible resources in the market. In some cases, significant expenses will have to be incurred to protect innovation from potential competitors through patents.

Given the considerations made, it is evident that a crucial requirement for innovative companies is the availability of substantial financial resources. Political donations act in this sense, as they guarantee the company preferential access to external financing, the possibility of maintaining high levels of indebtedness, achieving higher stock returns, and high probabilities of receiving corporate bailouts in case of difficulties.

Several authors have found improvements in corporate value and favoritism in accessing external financing for companies with strong political connections, a condition verified even within widely diversified institutional contexts such as Brazil, Indonesia, Thailand, and India (e.g. Fisman 2001; Faccio, 2006; Faccio and Parsley, 2006; Claessens et al., 2008).

The costs of corporate innovation may be difficult to sustain, especially when the company is forced to face periods of increased financial strain, due for example to macroeconomic shocks, or during periods of lower profitability, typical of so-called "cyclical" sectors. In this regard, Claessens et al. (2008) document an increase in the bank leverage of Brazilian companies that had contributed to the election of subsequently elected candidates, supporting the theory that political donations intervene in favor of the company by providing it with a preferential channel of access to credit. Even if the company finds itself in financial distress, the presence of political connections will increase the likelihood of receiving a bailout more quickly than similar companies not connected (Roberts, 1990; Fisman, 2001).

In fact, Faccio et al. (2006) conducted a study on 450 companies with strong political ties in 35 countries worldwide from 1997 to 2002 and demonstrated that politically connected companies listed in the stock market are more likely to be rescued than similar organizations without such connections, despite having higher leverage ratios (Cull and Xu, 2005; Johnson and Mitton, 2003). This seemingly paradoxical condition is explained by creditors' trust in the fact that politicians will come to the aid of companies that support them in case of financial difficulties (Faccio et al., 2006). Furthermore, the probability of benefiting from a corporate bailout is higher in those companies where the company executive or majority shareholder holds an important government position (ibidem). In addition to receiving the benefit of actual funding, the companies involved will benefit from more favorable interest rates compared to those obtained otherwise, as they will be evaluated with a good level of solvency (Khwaja and Mian, 2005).

Continuing the analysis, the presence of political donations leads to an increase in the company's stock returns, improving its reputation in the eyes of a range of key stakeholders to support innovation (Claessens et al., 2008). Firstly, it will be more attractive to investors and shareholders, who will provide new risk capital to the company to improve its technologies, hire new professionals with specific expertise, increase

research activities even in collaboration with universities and institutes, evaluate the possibility of mergers and acquisitions with cutting-edge companies, or expand into new sectors. Moreover, it will improve the opinion of banks regarding the company's solvency level, with further facilities for financing, and consumers, who play a fundamental role in ensuring the profitability of product innovations.

Numerous contributions in the literature have investigated how unexpected news related to a political figure seem to have a clear and immediate impact on the stock prices of companies related to them, confirming the assumption that political donations can be a strategic lever for company innovation to enhance its market value and appear more attractive to investors. To cite some contributions, Faccio (2006) documented a 2% increase in a company's value following the news that one of its shareholders had obtained a political position, and a 2% decrease in the value of companies that had supported legislators following the announcement of their sudden death (Faccio and Parsley, 2009). Similarly, there was a decrease in the stock prices of Indonesian companies that had strong ties to President Suharto when the market became aware of deteriorations in his health (Fisman, 2001). In addition, Roberts (1990) notes a reduction in the value of companies that had supported U.S. Senator Henry Jackson following news of his death, while Goldman et al. (2006) found an increase in the market value of individual companies connected to the Republican Party following the victory in the 2000 presidential elections. Further contributions in the literature show that companies with political ties are more likely to win public tenders, subsidies, and other types of aid (Tahoun, 2014; Goldman et al., 2013; Johnson and Mitton; 2003), consequently increasing their income flows and with cascade advantages to increase levels of innovation and performance.

Indeed, an increase in a company's political donations corresponds to an improvement in its future returns, to a greater extent the greater the number of candidates supported in the same State as the company, their political influence, and the duration of the established connection (Cooper et al., 2010). It is interesting to note how this benefit seems to favor companies that finance Democratic candidates and members of the House of Representatives, perhaps because such figures may approve favorable bills for the companies that support them and contribute to improving their market value (ibid).

So far, the benefits that political donations can bring to the company have been analyzed, influencing key factors to support innovation. However, the choice to establish strong ties

with political figures may be undertaken not so much to obtain benefits at the corporate level, but more to receive personal favoritism. Indeed, high-level decisions, such as the allocation of company funds to finance an electoral campaign, are made with the decisive opinion of the Chief Executive Officer (CEO), who is responsible for the company's governance and general strategic direction. Coates' (2012) investigation conducted on the CEOs of the S&P 500 highlights that, following political elections, more than one out of ten former CEOs belonging to large public companies and government-dependent companies have obtained political positions and cabinet-level appointments, suggesting that career progressions and the resulting social prestige may be an important motivation for companies' political involvement.

Therefore, the CEO constitutes a key figure in determining the level of political donations made by a company and the impacts that will follow. For this reason, in addition to investigating the personal benefits for those who govern politically active companies, an increasing number of authors are focusing on analyzing how their political orientations can influence the company's performance. It has been shown that the decisions made by CEOs are influenced by their demographic characteristics (e.g. Farag e Mallin, 2018; Bertrand and Schoar 2003) and their personal values, which also include political ideologies (Kashmini et al., 2017). Studies in political science, psychology, and behavioral economics agree on the "theory of behavioral consistency," according to which people tend to behave consistently in their private and professional lives (e.g. Pellecchia et al., 2015). Supporting this theory, Hutton et al. (2014) demonstrated that Republican managers tend to prefer more conservative corporate policies on average than Democratic managers, due to their personal inclination towards conservative ideologies. In line with this, politically liberal CEOs show a greater risk propensity, which is manifested in significant investments in R&D, higher capital expenditures, and high levels of indebtedness (ibid). Furthermore, liberal executives tend to invest in particularly risky initiatives, such as those in CSR, even when companies do not have optimal financial performance levels (Chin, Hambrick and Trevino, 2013).

On the contrary, politically conservative CEOs show a greater aversion to risk in financing, evident in their choices of corporate leverage (Cronqvist et al., 2012). Finally, the likelihood of involvement in securities fraud is particularly high for liberal CEOs, as it is a risky behavior, while it is demonstrated that executives oriented towards the

Republican Party are less likely to be involved in evasion activities compared to Democrats (Hutton et al., 2015; Christensen et al. 2015).

Based on this conceptual framework, Kashmini et al. (2017) conducted an analysis on a sample of 421 US publicly traded companies, which showed how the level of liberalism of CEOs, understood as adherence to the Democratic Party rather than the Republican Party, can positively influence a company's propensity for innovation, measured as the rate of introduction of new products. This positive impact is reinforced when the CEO has high power, when their compensation is less tied to corporate equity, if top management is autonomous from the marketing department, and when the economy is in recession (ibid). However, it should be considered that the higher market value of the company, associated with the described innovation propensity, could lead to increased volatility in stock performance (ibid).

For the reasons just stated, the presence of political donations from the company and the political inclination of CEOs, which could influence them, could be strategies to bring important benefits to the company, as long as certain conditions are met, and appropriate considerations are made.

Despite the benefits just discussed and the literature supporting them, it is necessary to recognize that the presence of political donations can be evaluated from a dual perspective. Below, an analysis of possible negative impacts of political donations on the company's level of innovation and performance is presented, opening up the space for reflection in which this paper is situated.

2.3 Corporate political donations and innovation: a negative perspective

Despite the numerous benefits that a company can obtain through political donations, this type of strategy can have conflicting effects on its level of innovation depending on the circumstances, as discussed in reference to the influence of the CEO's political orientation on business results (see section 2.2). The negative perspective presented below highlights some of the negative aspects that choosing to make political donations could entail for the company making them, generating additional costs and loss of credibility in the market that could penalize its innovation strategy.

Furthermore, a key variable in defining the positive or negative effects of political contributions is the purpose that guides their implementation. In fact, they may be

promoted by the company in order to obtain legislation favorable to innovation and to record improvements in business performance, as analyzed in the previous paragraph (see section 2.2). Conversely, such contributions may be made with the aim of obtaining personal benefits for the CEO or managers, and in this second scenario, business returns may be affected. In fact, empirical evidence found by Aggarwal et al. (2012) shows that politically involved companies are characterized by agency problems, as their high availability of cash flows is not used for strategic purposes such as investments or R&D expenses, but rather to gain favoritism from politicians and derive personal benefits.

Additionally, it should be noted that the political issue is particularly controversial and debated by the public opinion, and companies do not always make their donations in an atmosphere of total transparency and control, both essential conditions for investors who tend to prefer companies without political ties (Guerrera, 2007).

Furthermore, companies with high political expenses in their budget are not positively evaluated by shareholders either, as this operation can reduce the value available to them. In fact, as documented by the Center for Political Accountability (2012), 73% of surveyed shareholders believe that political contributions do not promote the well-being and growth of the company, as they are given to satisfy the private interests of corporate executives. It is important to consider the fact that the value reduction discounted by shareholders has a much greater impact than the value that political donations can generate for the company that carries them out (Yermack, 2006). To support this theory, consider the results of Coates (2012), according to which political donations are negatively associated with share ownership concentration, company stock value, and shareholder rights, while being positively related to agency costs. These results are valid for sectors that are not government-dependent, such as defense, and are not highly regulated, such as the telecommunications industry, but are still strongly engaged in political activities (Coates, 2012; Claessens et al., 2008).

A company without the support of shareholders and investors will experience strong repercussions in terms of reputation and will have less financial support, both essential conditions to support innovation (see section 2.2). These considerations may explain why Aggarwal et al. (2012) found that between 1991 and 2004, 89% of publicly traded US companies did not make political donations.

Continuing the analysis of the negative effects of political contributions, in academic literature some peculiar characteristics of companies that make them have been observed. First, Aggarwal et al. (2012) found that companies with poor governance, defined as having a large board of directors, disproportionately high CEO compensation, lower block ownership, and lower institutional ownership, tend to make higher levels of political contributions, compared to companies with opposite characteristics. A symptom of this poor governance is evidenced by the fact that the value of large investments by companies with strong political ties is lower than those conducted by similar unconnected companies, suggesting that senior managers of the former undertake value-destroying projects (Faccio, 2010). Consistent with these results, companies making political donations have worse financial indicators, despite may have greater market power, high levels of debt, and lower taxes (Claessens et al., 2008; Faccio, 2010). Additionally, the gap compared to companies without connections is even larger the stronger the established link, being greater if the company is linked through the owner rather than the manager and if the political figure of reference is a minister rather than a parliamentarian. In addition, the study by Aggarwal et al. (2012) highlights how politically connected companies tend to carry out a greater number of acquisitions, but of poor quality, emphasizing the likely presence of incompetent managers or those too distracted by political activities.

However, regardless of the peculiarities of governance, empirical evidence shows a negative association between political contributions and future business returns, emphasizing how the presence of donations to both winning and losing parties is associated with worse returns compared to choosing not to donate at all (ibidem).

The analysis conducted has highlighted how political donations constitute a strategic choice for corporate innovation that must be made with caution, as its effects on the level of innovation and business performance may be controversial. An essential prerequisite for the positive effect of donations on innovation is that this decision be made with the aim of obtaining benefits for the entire organization and not just for a few chosen ones. Furthermore, it is essential that politically active companies strive to ensure high levels of transparency and control, appearing reliable in the eyes of potential investors, and can provide adequate returns to their shareholders.

2.4 Research question

The objective of this study is to investigate whether companies that make political donations tend to innovate more than others or not. The impact of political donations on firms' innovation strategy is analyzed because both corporate innovation and political connections are strategic factors in determining a firm's performance.

It is often particularly burdensome for an enterprise to establish strong political connections while simultaneously pursuing an innovation strategy, due to business and target market conditions. In this regard, it is appropriate to make some qualitative considerations regarding whether these can be considered as substitute rather than complementary strategies for improving business performance.

The two approaches can complement each other, as described in paragraph 2.2. In fact, a company that aims to maintain a high level of innovation can benefit from political connections to anticipate politicians' decisions regarding future resource allocation, sector regulations and future incentives. The company, enriched with this knowledge, has the advantage of being able to make targeted investments, reducing innovation costs and maximizing benefits. Furthermore, political contributions can facilitate access to external funding and provide a safety net during times of corporate crisis. Another aspect to consider is that political donations may help the company defend its innovations more effectively, speeding up the process and simplifying patent release procedures.

Despite the advantages of integrating both strategies, it's important to consider that maintaining a high level of innovation can be challenging and costly for the company, and political contributions may not always have a positive impact on the company (see section 2.3). A firm that intends to maintain a high level of innovation may not find it advantageous to make political donations, as they may be perceived as undue influence or favoritism towards certain political parties or candidates, compromising the company's reputation, undermining customer and investor trust. In addition, political contributions could be a source of distraction for managers and executives and promote poor governance, especially if these figures benefit personally. This condition would create internal tensions and conflicts that could compromise employee satisfaction and intensify corporate turnover, negatively impacting team cohesion and collaboration and, consequently, the company's results. In addition to the above, it is important to consider

that high political donations may violate political finance laws or company regulations, exposing the company to legal risks and sanctions from regulatory authorities.

Looking at it from a different perspective, there may be conditions under which the company may be incentivized to abandon the innovation strategy and channel its resources solely into political contributions. Indeed, every company must contend with limited financial resources, which constrain spending and require defining priorities within its budget. First, the company may prefer political contributions if the cost of making them is lower than supporting the entire innovation process, especially if the resources and capabilities needed to implement it are particularly expensive. Furthermore, a key feature to ensure the success and uniqueness of innovation is the presence of a fit between those resources and capabilities, meaning the condition in which a competitor can obtain the same advantage as the innovative company by replicating the entire business model and not just some aspects. Although this strategy is extremely effective in ensuring the success of innovation, the company needs time, expertise, and resources to implement it, and in this sense, political contributions could be a quicker and more effective way to improve its performance. In addition, donations could reduce entry barriers and allow the company to enter a market without the need for disruptive innovation or a complex and costly strategy to implement.

Given the complexity of the issue, to answer the research question an analysis was conducted regarding four regression models, in which the amount of political donations is considered as the independent variable and firm technological performance, investigated in its multiple dimensions, as the dependent variable. Starting from the assumption widely supported in the literature that innovation is a key driver of performance improvement, we chose to consider the number of firm patents as an indicator of a quantitative nature, while the average value of patents, the average citations of patents and the level of technological differentiation as qualitative variables.

3. METHODOLOGY

3.1 Sample

The final dataset I used for the purposes of this thesis consists of a merger of several existent datasets, that I will mention below next to the variable(s) of interest. The dataset consists of about 200 companies observed from year 1980 to 2020.

3.2 Data

3.2.1 Dependent variables

The dependent variable of the models will be firm technological performance, measured in different ways, as reported below.

Total number of patents. First, I will consider firms' total number of patents. The data concerning the dependent variable "Total number of patents", was extracted from the study by Arora et al. (2019), specifically from the dataset DISCERN: Duke Innovation & Scientific Enterprises Research Network. This variable represents the number of patents the company has registered in a specific year and is used in the study as measure of corporate innovation. The aim of the work is to examine the relationship between the production of scientific research by American firms and the application of discoveries in product invention by a specific company, as well as the positive effects these advancements can have on competitors. The dataset created by the authors contains data on 800.000 scientific publications from 4.090 American companies and patent citations related to these articles, thanks to the combination of company and accounting information from S&P Compustat, scientific publications from Web of Science (WoS), patent citations and non-patent literature (NPL) citations from PatStat, branch data extracted from ORBIS, and acquisition data from SDC platinum. The selection of companies was made by selecting among North American Compustat records all companies with active records and positive R&D expenses for at least one year between 1980 and 2015, removing those without patents and those located outside the United States.

The total number of patents is calculated by matching over 1.3 million patents to the companies identified in the Compustat database and their subsidiaries, considering information on company name changes and changes of ownership due to mergers and acquisitions from SDC and ORBIS. It is essential to consider these changes, as in the case of publications and patents, when the ownership of the entity depositing the patents changes, they are transferred to the new owner.

Average value of patent and Average number of citations. As patents greatly vary in their quality, I will also consider two measures that relate to patent quality. These variables were taken from Kogan et al. (2017). In particular, "Average value of patent" was constructed as the ratio between the total economic value of patents in a given year and the number of patents, both extrapolated from this study. It introduces a new aggregate innovation index in the literature, with the aim of deepening the relationship between innovation and economic growth. The results from the study show that profits obtained by companies through their innovations are linearly correlated with aggregate improvements in output and Total Factor Productivity. The new innovation measure implemented in the study is based on stock market reactions to the news of patent grants, integrating a dataset on patent grants from 1926 to 2010 with stock market information.
Regarding the value of patents, it is assumed that it can be calculated by examining how stock prices react when a patent is granted. Authors examined the trading volume of a company's stock around the patent grant date, considering a two-day window to ensure stock prices fairly reflect the effect of the patent grant. Stock market reaction was calculated using the following formula:

$$V_j = (1-\pi_j)\,\xi_j$$

V represents the stock market reaction to the patent j grant date, π_j is the market's ex ante assessment of the probability of a successful patent application, and ξ_j is the dollar value of patent j. Subsequently, the stock price reaction to the patent issuance compared to the total sector return was isolated to measure its specific impact on the company. The economic value of the patent was calculated by considering the company's idiosyncratic return, defined as the difference between the company's return and the market portfolio. The formula used is:

$$R_j = v_j + \varepsilon_j.$$

R represents the idiosyncratic stock return of a given firm at the time of the issuance of patent j, v_j is the value of patent j as a fraction of the firm's market capitalization, and ε_j denotes the component of the firm's stock return that is not related to patent j.

The variable “Average number of citations” was obtained by extrapolating citations from two sources. Citations for patents granted between 1976 and 2011 refer to official USPTO data and were extracted from text files downloadable from Google. The citations of patents granted before 1976 were detected by OCR text generated from the patent files. Specifically, the authors recognized the presence of citations by identifying within the text of each the six- or seven-digit numbers followed by the corresponding date of grant of the patent and verifying the correctness of that date. Finally, the citation data collected by Google were integrated with those collected by hand in Nicholas's (2008) work.

Technology differentiation. An additional, and perhaps main measure of firm technological performance for the purposes of this study is technology differentiation. As discussed in section 2.1, this measure is related also to an increase in the company's Tobin’s Q and profitability, as it enables it to create market power through the development of new unique products and processes and gain competitive advantages that are difficult for other competitors to imitate. The dependent variable of the model is "Technology differentiation" collected from Arts et al. (2023). The authors exploit the fact that U.S. law requires companies to disclose their inventions in written form and in detail to obtain legal patent protection to build a new measure of technological differentiation, based on the textual content of patents. This choice has allowed for a more accurate and detailed mapping of the competitive position of companies compared to what is possible through traditional patent classifications and to measure the overall differentiation of the company's technological portfolio compared to others within the same technological space.

The analysis was conducted on a panel of U.S. public companies from R&D-intensive sectors characterized by strong product rivalry during the period from 1980 to 2015, although the authors demonstrate how this approach is also valid for companies with a small number of patents. The results of the study show a positive correlation between technological differentiation and company performance, strengthened using patent text as a measurement of differentiation.

First, the competitive position of each company within its technological space was defined by representing its technological portfolio as a vector of 1.030.335 dimensions, where each dimension corresponds to a technical word taken from a complete list of

patents, and each value in the vector indicates the number of patents the company has containing the keyword in that particular year. The authors calculated the cosine of the distance between the vectors to obtain technological similarity between each pair of companies, using term frequency-inverse document frequency to account for how many times a keyword appears in a company's patents relative to the total.
Once a measure of similarity was obtained, the technological differentiation of company i in year t was calculated using the following formula:

$$Tech\ differentiation_{it} = 1 - \frac{1}{n-1}\sum_{j=1,\, j\neq i}^{n} tech\ similarity_{ijt}$$

The variable n represents the number of active companies in year t, and the tech similarity variable identifies the technological similarity between companies i and j in year t. It has been chosen to consider only the technological similarity of the 10% of companies most similar in technological terms to the one under examination, as the authors assume technological competition exists between companies sharing the same technological space. However, the results and robustness checks appear consistent even when narrowing the percentage to 5% or considering the total sample.

3.2.2 Independent variable

Total amount of donation by PAC. The variable "Total amount of donation by PAC" was used in the regression model as an independent variable, referring to the work of Stuckatz (2022), which aims to investigate the political alignment between the company and the employee by assessing the influence the employer has on its employees' political donations. This study presents an initial analysis of donations by employees and Political Action Committees (PACs) of 12.737 publicly traded U.S. companies toward 6.062 House and Senate candidates between 2003 and 2018, showing that more than twice as many employees' political donations are directed toward corporate-backed candidates. In addition, there is a second analysis conducted on a panel of 9.032 publicly traded companies and 1.089 House and Senate members, which reveals that both executive and non-executive employees contribute 17,4% more dollars to candidates supported by their company's PAC. Finally, the author performs an analysis using the difference-in-

differences (DiD) design, demonstrating that the political preferences of workers from all professions change in conjunction with the changing political position of their company. The variable "Total amount of donation by PAC" was obtained by combining data from various sources: employee donations matched with contributions from their company's PAC come from the Federal Election Commission (FEC), company names are inherited from the Compustat Capital IQ financial database, and occupation names are from the "direct matching files" of the Census Bureau and Bureau of Labor Statistics. These files contain over 20.000 names matched to 850 unique occupations and their respective Standard Occupational Classification (SOC) code, considering common abbreviations such as CEO, VP, or CFO for executive positions. The author used a string distance-based method to address the lack of unique identifiers between the donor's employer and position within the company and calculated the cosine distance between the FEC data and the unique names of firms and occupations.

3.2.3 Control variables

The control variables used within the model are R&D expenditures and employees. Data for these two variables were collected for each company within the sample from the Compustat database.

Table 1 presents the descriptive statistics related to the variables used in the model.

3.3 Regression model

The analysis was conducted on an unbalanced panel of about 200 companies observed between 1980 and 2020. Hypotheses were tested through the construction of four regression models. Each of them used a fixed effects panel, including both firm and time fixed effects. It is believed that the choice to make political donations and their amount can be influenced by variables that vary depending on the entity, such as the individual characteristics of the companies, like size, spending on R&D, and sector, as well as factors that change over time, such as regulations and national policies. For example, a company operating in a highly regulated sector may be willing to increase its investments in R&D,

Table 1 – Descriptive statistics

Variable	Mean	Std. Dev.	Min	Max
Total number of patents	1.12,09	250,77	1	2749
Technological differentiation	0,92	0,04	0,79	1,00
Average value of patents	19,81	30,92	0,01	372,51
Average number of citations	12,95	23,36	0	474
Total amount of donations by PAC	0,10	0,15	0	1,41

Note: Average value of patents and Total amount of donations by PAC are counted in millions of USD.

only if its political connections have allowed it to reduce existing regulatory barriers and have ensured that future legislation will favor this strategic choice. On the other hand, a young and highly innovative company may be able to increase its expenses in R&D only with the financial support received from shareholders and investors, and may prefer to avoid political connections in order not to compromise its reputation. At the same time, the legislative aspect is a determining variable for the level of political connections established by the company, considering the great increase in corporate lobbying and PAC activity recorded after the Citizens United case. The use of fixed effects allows controlling for all those unobserved factors specific to a company within the model constant over time, so that they do not influence the predictor. The correctness of this assumption was analytically verified through the Hausman test, where the null hypothesis considers the situation in which the characteristics of single entities or groups do not affect the regressor, and the alternative hypothesis considers the opposite situation. The outcome of the test confirmed the alternative hypothesis. Panel data analysis was conducted using the following entity and time fixed effects regression model:

$$Y_{i,t} = \alpha_i + \beta \text{ total donations}_{i,t} + \beta \text{ expensesR\&D}_{i,t} + \beta \text{ employees}_{i,t} + \delta_t + \mu_i + \varepsilon_{i,t}$$

Within the $Y_{i,t}$ model, Y represents the outcome variable of company i in year t corresponding to the following variables: total number of patents, technological differentiation, average value of patent, and average number of citations within them. The α_i factor represents the unknown intercept, calculated for each company. The coefficient β shows the common effect that donations have on the model's outcome variable, considering the heterogeneity of companies and the year of observation. δ_t represents year dummies, μ_i is the error term related to each entity, and $\varepsilon_{i,t}$ constitutes the overall error term of the model.

Research and development expenses represent the innovation input, as it is believed that the company's level of innovation guides the entire strategic framework of the organization including the decision to make political donations (see section 2). The variable representing the size of the company is the number of employees, as the company's size influences the resources available for making political contributions, as well as the company's exposure in the market that will make politicians inclined to establish a significant connection with it and promote its growth.

The first model was developed considering the number of patents as the dependent variable. I used a Poisson regression analysis, since the number of patents is a count variable. The other models considered technological differentiation, average value of patents and the average number of citations within them as the respective dependent variables. They were implemented by conducting linear regression analyses.

The analysis was conducted using the statistical software Stata, widely used in literature for data analysis, statistical modeling, and creating graphs.

4. RESULTS

Table 2 - Results of regression models

	Total number of Patents	Technological differentiation	Average value of patents	Average number of citations
Total amount of donations by PAC	1,174 ***	-0,008	-30,989 ***	-0,480
	(0,024)	(0,004)	(6,270)	(2,604)
R&D expenses	0,032***	-0,000	-7,587***	-0,825
	(0,002)	(0,001)	(0,761)	(0,316)
Employees	0,585***	-0,007***	5,405**	-1,030
	(0,010)	(0,001)	(1,883)	(0,782)
Year fixed effects	Yes	Yes	Yes	Yes
N° observations	971	1148	1023	1023
R-squared				
		0,122	0,292	0,532
Within		0,284	0,007	0,042
Between		0,227	0,008	0,218
Overall				

Note: Total amount of donations by PAC, Average value of patents and R&D expenses are counted in millions of USD.
***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

Table 2 presents the results of regression models.

Total number of patents. The first regression model implemented considers the total number of patents applied for by the company in a given year as the dependent variable. From the analysis carried out, a positive association of political donations with the total number of patents is evident, the coefficient is 1,174 and it is statistically significant with p=0,000. In fact, the results show that a company obtains 1% more patents for every 10.000 USD in donations it makes, holding constant the number of employees and research and development expenses. Adding one patent would require the company to support political contributions eight times the average level observed within the sample.

Therefore, empirical evidence shows that having political connections may indeed improve the level of corporate innovation, but it is a rather costly strategy. This assumption is even more true when considering the high expenses that the company already must bear to implement an innovation process internally. Considering this aspect, the possibility of making political donations to support the innovation strategy seems to be accessible only to companies with high available cash flows.

Technological differentiation. The second regression model considers technological differentiation level as the dependent variable. From the results, it is evident that political donations are negatively associated with technological differentiation (coefficient= -0,008; p-value=0,064). Focusing on the economic significance, this result implies that moving from the level of donations of companies in the lower, first quartile to that recorded in the upper first quartile decreases technological differentiation by almost one standard deviation.

Although the size of this effect may not seem particularly significant, it could still result in a disadvantage for companies operating in R&D intensive markets with strong product competition. In fact, when companies offer products comparable to the same customer base, a small variation in technological differentiation increases the risk of losing market share to competitors with more distinctive and advanced technologies. This condition is even more true when considering industry leaders, who are generally also the most likely to make political donations.

Given these circumstances, it is worth considering whether the benefits of political contributions are sufficient to bridge the competitiveness gap due to the negative correlation between these two variables observed in the analysis. To make a correct evaluation one must consider that, where there are high political donations, there is not only lower technological differentiation but also more patents, as outlined in the first finding. Therefore, the loss of competitiveness is offset by the fact that the company will be better able to protect its technologies from imitation and avoid providing competitors with useful know-how for the development of new products. Furthermore, the presence of strong political connections allows the company to support its innovation strategy through a variety of factors, as it will know in advance about future regulatory changes and new trends in the sector, to guide its investments optimally. The considerations made

show how, even in sectors where technological differentiation is a key factor in competition, a company may find it advantageous to sacrifice it to a lesser extent if this results in more political connections and more patents.

Average value of patents. Continuing the analysis, we find that companies with a high level of political donations have patents that have a lower average value in the market. This result has a coefficient of -30.989 and is statistically significant with a p-value of 0.000. Specifically, a one standard deviation increase in the level of donations given by the company is associated with a decrease of about 4.8 million in the average value of a patent.

This result is not particularly surprising, considering that, as has already been pointed out, a company must incur very high R&D costs (but not only) to bring a high-value patent to the market, and this is often done over an extended period. Therefore, it is unlikely to be able to ensure the development of quality patents if it invests high financial resources required in the meantime to establish political connections.

The considerations made above make it possible to identify the presence of a trade-off, as the company that establishes political ties records a greater number of patents but pays the price of patents with a lower average value and a greater technological standardization. Considering the results obtained, it is questionable whether it is worthwhile for the company to employ its resources to make political donations or whether it would benefit more from trying to register higher value patents and increasing its levels of technological differentiation. The most cost-effective strategy to implement cannot be defined beforehand, but it is necessary to evaluate the specific conditions of the company under examination.

The negative effect on the average value of patents could be advantageous for the company when the registration of lower value patents is only a stepping stone for future developments and improvements, as in this case political donations could facilitate the company's innovation process. In this regard, the value of a patent depends on factors such as the originality of the content, the potential market applicability and the duration of protection, and politically connected companies have more chances of receiving preferential information regarding investment choices and incentives to ensure longer-lasting patents. For example, a company is more likely to increase the value of its patents

in the future if it knows in advance which technology to invest in to receive government incentives.

Despite the highlighted benefits, it is important to consider that a company's available cash flows may not be sufficient to simultaneously invest in political donations and innovation, and it may need to adopt an alternative strategy.

In summary, it is crucial for a company to have a strong assessment capability in terms of the optimal use of the resources and capabilities at its disposal to evaluate the best strategy for improving its performance.

Average number of citations. The regression model considers the average number of citations within a patent as the dependent variable, which represents its scientific value. The results show a negative association between political donations and the technological quality of the patent, but the model is not significant. However, it is still possible to evaluate the significance of the observed effect. These considerations provide additional elements to assess what kind of innovation strategy a company can pursue when it chooses to invest its resources to build political connections.

The number of citations within the patent influences how the company is perceived in the market, as it captures the technological quality present in it. The author must highlight all the previous contributions and discoveries that have formed the basis for its implementation, and the greater the number of citations, the greater the impact of that patent and its scientific value. The patent also has a market value, measured by fluctuations in stock prices after the announcement of its registration within a specific time period. In the literature, the presence of a positive correlation between the number of citations and the economic value of the patent is widely supported, demonstrating that adding a citation in each company's patent increases its economic value. Additionally, a high-quality patent could contribute to increasing the company's markup due to the originality of its content, attracting more citations and stimulating further innovations. When the technological quality of the patent allows an increase in its market value, our results suggest that it is not convenient for the company to invest in political donations as this choice could affect the quality of its future patents, with negative effects on market value and probably on the levels of innovation pursued. In this case, the company would

get more benefits in terms of innovation by preferring a strategy of technological differentiation.

However, recent studies suggest a trade-off between the technological quality of the patent and its economic value, indicating that the higher the number of citations, the more the economic value of the patents is penalized. In this second case, a company holding high-quality patents fails to capture more economic value in the market, and the choice of establishing political connections may be necessary to protect its innovations and obtain higher profits, even at the expense of technological differentiation and the average value of patents.

The results reported in this section are correlations that do not imply causality, and companies can use them as a tool to ensure that corporate strategies can lead to increased corporate innovation and improved performance. It is important to specify that they consider only a few strategic levers that a company needs to evaluate the appropriateness of making political donations to support its business innovation strategy and the analysis performed is far from complete. A company must plan its innovation strategy taking into consideration a variety of factors, first and foremost its strategic objectives, its specific characteristics, and the structure of the industry.

5. DISCUSSION AND CONCLUSIONS

Given the increasing number of companies that allocate some of their funds to political activity and the crucial role that the integration of corporate PACs and individuals' donations plays in elections outcomes, the purpose of this thesis was to assess how political donations impact the innovation strategy of the companies that make them. Using a dataset composed of 200 companies observed from 1980 to 2020, it was shown that companies that invest more in political donations tend to have a higher number of patents, although the average value of these patents is lower. Furthermore, these companies appear to be more technologically homogeneous, i.e. with lower technological differentiation.

The positive effect on the number of patents registered allows us to recognize the benefits that political donations can bring to corporate innovation. Through their political connections, companies can strategically direct their investments as they will have advance knowledge of the technological areas in which the government will offer greater

incentives and on which future regulations will focus. Additionally, political expenditures enable companies to access more financial resources by facilitating access to credit, increasing the chances of receiving bailouts in case of financial difficulties, and improving the company's stock returns, encouraging shareholders and investors to provide new resources to support the high costs of patent development and R&D investments. The results show that these are less exploratory investments, suggesting that the strategy adopted by firms is not to create competitive advantage through differentiation, but rather by investing in the same technological area as competitors and taking market share from them through the privileges of political connections. Considering this circumstance, they would not benefit from spending resources to research new markets or technologies for which they do not enjoy the same privileges. Finally, the analysis reveals that political contributions have a positive effect on patents from a quantitative perspective, but not from a qualitative one, as there is a reduction in their average value. This result highlights an essential aspect of the analysis, namely that allocating corporate funds to political activity detracts valuable resources from innovation investments and could be a source of distraction for company management, penalizing the quality and value of the patents registered.

The analysis conducted suggest that companies that make political donations do not use innovation as a means of escape competition, as the benefits and protection offered by political connections already allow them to gain a competitive advantage. This assumption would explain why these companies prefer to avoid the risks associated with technological differentiation and direct their innovation strategy toward technological areas where they are certain to be successful, making a safe bet.

The analysis conducted has several limitations. Firstly, the availability of data was limited for some companies or periods of time, which could affect the completeness and reliability of the results. Specifically, the period from 1980 to 2020 refers to the overall investigation but may not be overlapping for all entities: data for some companies is available from 1999 or even 2003, while in other cases information is available up to 2008 or 2015. This aspect is relevant, for example, considering the significant impact of the 2008 crisis on companies' available cash flows, which likely led to a drastic reduction in innovation investments and a loss of trust in institutions. Regarding the sample size of about 200 companies from different sectors, it may not fully represent the market

complexity and significant variations between entities could distort the analysis. Additionally, the results obtained for these specific companies may not be generalizable. Finally, the correlations identified between political donations and innovation levels are correlations with no causal intent and establishing a direct causal relationship would be complex due to omitted variables in the model.

This work is part of the extensive economic literature on corporate innovation, integrating theories already known regarding its role in improving business performance with a less investigated perspective on the influence of political donations on it.

The literature on political contributions has mainly focused on analyzing the factors that guide individual donations made by employees, which constitute the majority of those made (Fremeth et al., 2013). Previous studies have shown that individual contributions often do not reflect the ideologies of individuals but are part of a corporate strategy and are used by the company as actual investments. In this thesis, the impact of this type of investment was further investigated within the context of corporate innovation, to provide more elements for companies to evaluate the effects of making such investments. Furthermore, the considerations made integrate the growing literature on political intelligence, providing companies with a more comprehensive and nuanced framework not only of the opportunities but also of the risks of utilizing political connections as a strategic lever for corporate innovation.

Moreover, investigating the impact of political donations on the levels of technological differentiation within a company is valuable, as it contributes to further understanding the themes of positioning and differentiation of innovation by companies, which have had limited space in the literature until now (Arts et al., 2023). The considerations made in this study shed new light on the negative impacts that political connections could have on technological differentiation, in addition to highlighting the contribution it makes to corporate innovation and performance.

The analysis conducted is rooted in the study by Ovtchinnikov et al. (2020), which found that political donations provide a stimulus to innovation through the reduction of policy uncertainty. The contribution of this paper is to have explored this result further, specifically investigating which innovation strategy is stimulated. Thanks to this work, it has been possible to observe a trade-off for companies that leverage innovation to enhance their performance: establishing political ties and increasing the quantity of patents or

refraining from political activity and focusing on technological differentiation and the quality of patents. This topic certainly deserves further investigation to explore and quantify in more detail the positive and negative effects that political donations can have on innovation. For example, a possible area for future research could involve analyzing the conditions that stimulate a company to prefer one strategy over the other. Additionally, it may be useful to differentiate the analysis based on the industry and specific characteristics of the company, also considering the political orientation of the CEO. Moreover, the amount of political donations that represents the independent variable in the regression models only considers the component derived from corporate PACs, without the contributions of individual company employees. Considering this, future analyses should consider integrating both types of donations to provide a completer and more truthful overview of the actual resources disbursed toward politicians.

In addition to the above, the positive impact of political donations on the number of company patents contributes to numerous studies that have demonstrated the importance of the collaboration between the public and private sectors in promoting innovation (e.g. Arora et al., 2019). In this regard, the analysis carried out in this work can provide useful insights to company managers and political institutions to understand the most effective way to implement such collaboration towards a win-win strategy. Considering that innovation is among the top priorities on the agendas of the CEOs of the most profitable companies, it is important for institutions to promote it by introducing new incentives and facilitations in their political programs to gain more consensus and favor innovation with benefits for the entire economic system.

In addition, this work offers insights to institutions on the need to regulate political donations more effectively to prevent companies with the financial resources to afford such a strategy from becoming overly enriched at the expense of those with fewer resources. It is important to promote greater transparency and accountability in companies' political contributions to detect and sanction instances of political corruption and undue enrichment of CEOs or top managers to the detriment of the company itself and its employees.

Regarding business management, the work delves into an innovation implementation strategy that is certainly less widespread and known compared to others. In a dynamic and competitive environment like the current one, finding unique and differentiated ways

to innovate can be crucial to enable companies to generate and capture value more effectively than their competitors. Furthermore, the analysis of the main risks associated with political connections can be useful for management to seek effective tools to mitigate them. Firstly, the company needs to make donations with an attitude of communication and transparency to demonstrate social responsibility towards external stakeholders. In this regard, it would be useful to include a dedicated section on political donations in the ethical code and report them adequately in the company's financial statements. Additionally, the work highlights the importance of safeguarding the company's reputation in the context of political activities, especially to maintain the trust of shareholders and investors who provide essential resources for the innovation process.
Lastly, the results concerning the reduction in technological differentiation have shown that companies that invest more in political donations tend to prefer an exploitation strategy over exploration. Awareness of this condition can be useful for managers to structure reward and compensation schemes effectively and reap benefits in terms of innovation. In a company focused on exploitation, employees' motivation and the quality of work improve when they are offered rewards and incentives based on the goals achieved. Another useful indication for politically connected companies could be to establish partnerships with young and small companies, which are better able to pursue exploration and promote open innovation, in order to exchange valuable information they possess due to institutional connections with new knowledge useful for innovation.

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