Creative Corporate Culture and Innovation

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Abstract

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Keywords: Corporate Culture, Creative Companies, Creativity, Innovation, R&D, Textual Analysis

JEL Classifications: G23, G32, L25, O31, M14

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Abstract

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1. Introduction

Innovation refers to the introduction of new goods, new methods of production, the establishment of new markets or new forms of supply, and plays a key role in boosting economic growth (Aghion, Van Reenen and Zingales 2013). This is why understanding the determinants of firms' ability to innovate is important for academics and policymakers alike. Corporate culture can potentially catalyse firms' innovation processes since it can boost employees' motivation with a positive effect on stock returns (Edmans, 2011) and improve firms' working environments (Price, 2007). The belief that corporate culture relates to the ability to innovate is also widely held among listed firms: 85% of S&P 500 companies have a section on their websites dedicated to corporate culture, and 80% of those firms advertise innovation as a corporate value (Guiso, Sapienza and Zingales 2014). Intel, for example, states that "passion for innovation helps us maintain our role as a technology leader", and 3M refers to W. McKnight, its iconic chairman (who led the firm from 1949 to 1966), as "a business philosopher, since he created a corporate culture that encourages employee initiative and innovation". There is a growing academic literature on corporate culture addressing issues such as the link between firm performance and the employees' perception of corporate values (Guiso et al., 2014), or the role played by corporate culture in moderating the probability of CEO turnover (Fiordelisi and Ricci, 2014) . Studies in the field of management have examined how a creative environment within an organization could be developed, e.g. by fostering diversity (Kauppila, Bizzi, and Obstfeld, 2018), team work (Aggarwal and Woolley (2018)), or by the collaborative promotion of technology standards (Vakili, K. (2016)). This literature suggests that companies cherishing a creative corporate culture should indeed have a superior ability to innovate (Anderson, Potočnik and Zhou (2014)), but, somewhat surprisingly, few empirical papers do analyse the relationship between innovation and corporate culture. One reason may be that the concept of corporate culture is somewhat nebulous, and raises numerous measurement issues in empirical research (see the review paper by Zingales (2015)). Our paper aims to fill this gap by answering the following research questions: Does a creative corporate culture improve the firms' ability to innovate? Is created company better suited to turn investments in R&D into more valuable investments?

We show that creative companies add more value by investing in innovative projects relative to their peers that are less oriented towards innovation. We document two important results: first, creative companies generate higher innovative output even after controlling for R&D stock. Second, we outline that a creative corporate culture is positively associated to firm value. While these results are economically meaningful and highly statistically significant, a contemporaneous correlation between corporate culture and the investment in R&D may hinder a proper interpretation of the estimated coefficients. We therefore examine the link between creativity, innovative output, and firm value by exploiting variations in the R&D stocks that are unrelated with firms' unobservable characteristics. More specifically, we use the variation over time and across states of tax incentives to invest in R&D to approximate exogenous incentives for firms to undertake innovative projects. We argue that creative companies benefit more from these policies because of their superior ability to innovate, and we show that this is indeed the case. An increase in tax incentives on R&D increases the innovative output and the market valuations of innovative companies relatively more than their peers less oriented toward creativity. Our results are in line with the findings of a recent study by Vakili and Zhang (2018) showing that policies at state level affect the inclination of companies toward innovation by changing their internal culture.

We measure corporate culture by assessing corporate financial statements and assume that words and language (named "vocabulary") used by members of listed firms in their official documents reveal some information on the culture they adhere to (Levinson, 2003). By using the competing values' framework (CVF) (Cameron, De Graff, Quinn and Thakor, 2006; Quinn and Rohrbaugh, 1983) to define four cultural dimensions (create, collaborate, compete, and control), we identify a vocabulary for each cultural dimension by means of the Harvard Psychological dictionary. We then apply textual analysis (Stone, Dunphy, Smith and Ogilvie, 1966) on the 128,489 10-K reports available in the SEC's Edgar database to estimate a firm specific score for each of the corporate cultural dimensions of the CVF.

We approximate firms' innovative output by their patenting activity (Hirshleifer, Low and Teoh 2012), which is the number of patents applied for in each year of our sample from the U.S. Patents and Trademarks Office. We collect our firms' number of patents and patent citations from the NBER patent database, which starts in 1976 and comprises more than 4 million patent grants and 25 million patent citations. As outlined in Griliches, Pakes, and Hall (1987), the patent count proxies for innovation success in an imperfect manner because patents differ substantially in importance. Patent citations are better able to capture the technological and economic significance of patents (Trajtenberg, 1990; Hall, Jaffe, and Trajtenberg, 2005). However, the patent citations variable unavoidably suffers from problems of truncation because for patents granted in years closer to our final sample year, less time is available to accumulate citations. To address this issue, we follow Hall, Jaffe, and Trajtenberg, (2005) who adjust the patent citations multiplying the citations count by a weighting[1] index that is also available in the NBER database. The final database that we will use in this analysis on patenting activity comprises the intersection of the Edgar database, Compustat, CRSP and the NBER patenting data, and consists of 17,088 observations for the period 1995 to 2006, the end year of the NBER database.

The paper proceeds as follows: we describe our measures for corporate culture in section two, and our sample in section three. Section four outlines the relation between corporate culture and innovative output while section five analyses the association between corporate culture and firm value. In section six, we investigate the additional innovative output and firm value generated by creative companies after state-induced tax incentives on R&D, and we conclude in section seven.

2. Theoretical Framework

Corporate culture comprises "a set of norms and values that are widely shared and strongly held throughout the organization" (O'Reilly and Chatman, 1996). Consistent with Deal and Kennedy (1982), Peters and Waterman, (1982), Wilkins and Ouchi (1983) and Schein (1992), the above definition implies out that corporate culture can influence economic outcomes, such as an organization’s effectiveness and value creation. As we focus on the role of corporate culture in affecting firms’ innovation ability, we need to define the culture dimensions in a precise way. We follow Cameron et al. (2006) who draw on Quinn and Rohrbaugh (1983) and we use their competing

[1] We multiply the citations count (the variable “allcites” in the NBER database) with the weighting index (the variable “hjtwt” in the NBER database) to account for the truncation. The weighting index is constructed to account for patent obsolescence and for the 2006 truncation.

value framework (CVF) that distinguishes among four culture dimensions: control, competition, collaboration, and creation, that are also used in e.g. Hartnell et al., 2011; Ostroff et al., 2003; Schneider et al., 2013). The CVF defines corporate culture as internally or externally oriented. An internally oriented firm can have a collaboration-oriented culture (termed “clan culture type” in the CVF), which has an employee focus that aims at developing competencies and strengthening the organizational culture. The intuition is that this cultural dimension engenders employee attitudes that are strengthened by fostering cooperation and the participation of employees in corporate decisions. The “clan culture type” clarifies and reinforces organizational values, norms, and expectations, develops employees’ skills and cross-functional work groups, and implements programmes that enhance employee retention. Companies promoting this culture can be more successful as they can succeed in retaining human resources. An internally oriented culture can also be control-oriented (often called a “hierarchy culture”). This type of corporate culture is structured on clear but rigid mechanisms. The goal of a control-oriented firm is to create value-augmenting efficiency and enhancing the effectiveness of internal processes (e.g. improving systems and technology) by standardized procedures and hinging on rule reinforcement and uniformity.

The CVF also outlines two externally oriented corporate cultures. The first is a competition-oriented culture (labelled “market culture type”) where firms focus on external effectiveness by aiming at enhancing competitiveness and accentuating the importance of fast response and customer focus. Customer and shareholder judgment is fundamental for competition-oriented firms. The second type is the creativity-oriented culture (termed “adhocracy”), which focuses on innovation in products and services. The firm encourages employees to share ideas, to develop a clear vision, and constantly change, e.g., allowing for freedom of thought and action among employees, such that rule breaking and reaching beyond barriers are common characteristics of the organisation's culture. This type of companies usually encourages radical new process breakthroughs and innovations, and develop new technologies that redefine entire industries.

<< INSERT FIGURE 1 >>

We test the intuitive concept that a creativity-oriented corporate culture does indeed improve firms' ability to innovate. Specifically, we posit that creativity-oriented corporations are able to obtain valuable output from their investment in R&D. We also posit that the innovative output produced by creative firms is more valuable that the innovative output produced by companies not oriented towards creativity.

3. Data and Descriptive Statistics

We construct our sample by combining data obtained from four different databases: (1) accounting and financial variables from Compustat, (2) market information from CRSP, (3) 10-Ks from the SEC Edgar Database, used to calculate the corporate culture proxies, and (4) patent information from the NBER patent database. Hence, the sample size is determined by the intersection of the above databases. Financial firms (i.e. firms with four digit SIC code from 6000 to 6999) are excluded from the analysis such that the resulting sample consists of 25,209 observations spanning a time window from 1995 to 2006 (the end year of the NBER database). Variables descriptions are given in Table 1, and the summary statistics are reported in Table 2. Table 2 reports the average Tobin's Q is 2.036 with a standard deviation of 2.22. The sample firms have on average a patent count of 1.1 and the patents granted to each firm on average receive 2.3 citations.

<< INSERT TABLE 1 AND 2>>

3.1 Measuring Corporate Culture

To measure the cultural orientation of companies in the spirit of Cameron et al. (2006), we use textual analysis. We assume that the language used by the employees (named "vocabulary") reveals some information on the corporate culture that has developed over time (Levinson, 2003). We argue that the characteristics of any firm are reflected in its official written documents and that our textual analysis is able to structurally examine the content of firms' official documents, such as 10-K reports (Antweiler and Murray, 2004; Hoberg and Hanley, 2010; Hoberg and Phillips, 2010; Li, 2008; Loughran and McDonald, 2011; Tetlock, 2007; Tetlock et al., 2008). To estimate the prevalence of our cultural dimensions (collaboration, competition, control, and creation), which are defined in Figure 1, we identify for each cultural dimension a large set of key words that is selected by means of a two-step process: first, we start with the synonyms suggested by Cameron et al. (2006) to describe each cultural dimension. Second, the words selected in the first step are then looked up in the Harvard-IV Dictionary in order to identify additional synonyms. Loughran and McDonald (2011) point out that the use of the Harvard dictionary in textual analysis significantly decreases the impact of a researcher's subjectivity in terms of word selection. As an example, words such as "cooperation" are associated with the word "collaboration" in the Harvard Dictionary, and when these words are used at a high frequency in corporate documents, that the company is likely to have a collaboration-oriented culture. Words such as "performance" or "achieve(ment)" are associated with a competition-oriented corporate culture. "Dream, begin, elaborate" are associated with "create", which suggests a creativity-oriented culture. Words such as "boss, efficiency, caution" are considered synonyms for "control" and point at a control-oriented culture. We calculate the prominence and the frequency with which our synonyms are reported in each annual 10-K and we adjust the resulting score for the word commonality in all the analysed 10-K as suggested in Loughran and McDonald (2011). Specifically, to identify creative companies, we focus on the dimension Create: the adjusted score for Create is calculated as the weigthted sum of each word k in the bag of words for Create as reported in panel C of Figure 1. Specifically, the adjusted score for Create is calculated as: $Create\ adjusted\ score_{ik} = \sum_{k=1}^{K} \frac{n_{ki}}{N_i} \log\left(\frac{I}{I_k}\right)$, where n_{ki} is the number of times the word k, in the bag of words of Create, is repeated in the 10-K of firm i, N_i is the average word count in the same 10-K, I is the number of 10-Ks in our sample and I_k is the number of 10-Ks with at least one occurrence of the word k. Finally, we identify as *Creative* companies as those that have a $Create\ adjusted\ score_{ik}$ above the industry median. We then compare the innovation output and the value of creative companies (treated compnies) with that the other companies in our sample (our control companies).

3.2 Other Variables

We argue that a firm's innovation ability is affected by its corporate culture. To test this hypothesis, we follow Bloom et al. (2013) and we control for R&D stock, which is calculated by means of a perpetual inventory method with a depreciation rate (δ) of 20%. The R&D stock, G, in year t is given by the formula: $G_t = R_t + (1 - \delta)G_{t-1}$, where R is the R&D flow expenditure[2] in year t and δ=0.2. We also control for firm size (the natural logarithm of total assets), capital intensity (the net property, plant and equipment by number of employees), the amount of cash held, accounting performance (ROA), and sales growth. Moreover, since a higher innovative output is likely to be

[2] Following Hirshleifer et al. (2013) and Bloom et al. (2013) to construct our measure of R&D stock, we replace missing values by zeros. Following Bloom et al. (2013) in all regression models in which we control for R&D stock, we also add an indicator variable equal to one if the R&D expenditure is equal to zero or missing.

associated with larger stock returns (Hirshleifer et al. (2013)), we control for the buy-and-hold return over the fiscal year.

4. Corporate Culture, Investment in Innovation, and Patenting Activity

We hypothesize that a create-oriented corporate culture is positively associated with a firm's propensity to undertake innovative projects. Specifically, we argue that a creative corporate culture is positively associated with a firm's patenting activities. Model (1) of Table 3 reports the results of a relation between the patent count and creativity firms, and in Model (2), we control for firm size, capital intensity, accounting performance, cash holdings, sales growth, and the buy-and-hold stock return over the fiscal year. We find consistently strong results that creativity is positively associated with the firms' innovation activity as in this type of culture, employees are stimulated to be creative and take risks. They are expected to thrive in a change-oriented environment. In Model (3), we further control for the lagged value of R&D stock and the relation between a creative culture and patent numbers remains statistically significant at the 95% level. In Models (4) to (6), we use the number of patent citations as dependent variable in order to account for truncation (the fact that recently granted patents have had a more limited time period to collect citations). The results of these models confirm our earlier findings: patents granted to creative firms receive on average more citations than the patents granted to their peer companies that are not labelled as a creation-oriented firm.

<< INSERT TABLE 3>>

5. Corporate Culture, Investment in Innovation and Firm Value

We now turn our focus to firm value as expressed by Tobin's Q and posit that creative firms in innovative activities are better able to generate value from their investments. To test this hypothesis, we regress Tobin's Q on a dummy variable identifying creative companies (Model 1) then gradually add control variables. Consistent with our hypothesis, the evidence suggests that creative firms generate more valuable output from their investment in innovation but the effect of creativity on firm value becomes smaller when we control for R&D stock and other firm characteristics (Models 2 and 3), which suggests that our measure of corporate culture may be correlated with firm characteristics. While this result is not surprising as corporate culture may naturally shape different aspects of an organisation, it may be that our results are partially driven by unobservable firm characteristics. To examine this possibility we re-estimate the link between creativity and innovation in a quasi-experimental framework in the next section.

<< INSERT TABLE 4 >>

6. Corporate Culture, Innovative Output and Value: a Quasi-Experimental Framework

While our above results suggest that creative firms are better innovators, our proxy for a *creative* corporate culture may be correlated with unobservable firm characteristics, which in turn may affect our outcome variables and bias our coefficients. We address this identification issue by interacting our variable *creative* with pseudo-random incentives in investing in innovative projects. Following Bloom et al. (2013) we use the state-by-year R&D tax-price to quantify exogenous incentives to undertake innovative projects at state level. More specifically, we use the user cost of R&D capital as quantified in Wilson (2009), which simultaneously takes into account the impact of state and federal level tax credits on R&D capital expenses, depreciation allowances, and corporation taxes.[3] We then construct an indicator variable *treatment* taking the value of one if these incentives in investing in innovative projects increase over time. Specifically, our variable *treatment* is one if the user cost of R&D capital in year t in a specific state is lower than the average user costs in the previous four years[4] in the same state. If these exogenous tax incentives for investing in innovative activities are not correlated with unobservable firm characteristics, under the assumptions listed below, the interaction term between our variable *treatment* and our indicator variable identifying creative firms will not be biased by the omission of relevant unobserved variables in our regression models (Bun and Harrison 2018). More specifically, we can estimate the model: $Y_{it} = a + \beta_1 creative_{it-1} + \beta_2 Treatment_{it-1} + \beta_3 creative_{it-1} \times Treatment_{it-1} + u_{it}$ (1) where Y_{it} is the patent count, the citations count, or firm value, and u_{it} is a function of firms' unobservable characteristics potentially correlated with the variable $creative_{it-1}$. If we assume that the functional form for creative is linear[5] such as:

$creative_{it-1} = \pi_0 + \pi_1 Treatment_{it-1} + \eta_{it-1} \quad (A1)$ and

$Cov(\eta_{it-1}, u_{it}) \neq 0$, $Cov(\eta_{it-1}, u_{it} | Treatment_{it-1}) = Cov(\eta_{it-1}, u_{it})$ and $\mathbb{E}({\eta_{it-1}}^2 | Treatment_{it-1}) = \mathbb{E}({\eta_{it-1}}^2)$ $(A2)$ if $Cov(Treatment_{it-1}, u_{it}) = 0 \quad (A3)$,

then, we can still estimate an unbiased coefficient on the interaction term $creative_{it-1} \times Treatment_{it-1}$. As a result, we can use the parameter estimated on the interaction term in

[3] The actual formula used in Wilson (2009) to calculate the user cost of R&D capital is: $\rho_{st} = \frac{1-s(k_{st}^e+k_{ft}^e)-(\tau_{st}^e+\tau_{ft}^e)}{1-(\tau_{st}^e+\tau_{jt}^e)}$, where subscript s indicates states and subscript f is used for the federal-level, k_{st}^e and k_{ft}^e denote R&D tax credit and τ_{st}^e and τ_{ft}^e denote tax rates. s is the share of "qualified" R&D expenditures and - following the IRS Statistics on Income data - s is approximately 0.5. z represents the discounted value of tax depreciation allowances and is set to one given that labor and intermediate expenses are deductible as are qualified R&D capital expenses.

[4] We use the average across the previous four years to account for the depreciation of the R&D stock, which is assumed to be 0.2. Using a two- or three-year period to calculate the average does not affect our results.

[5] Note that this assumption of linearity holds only in the absence of reverse causality or contemporaneity. If our variable creative is influenced by one of our dependent variables, this connection may still affect our estimates. This concern is relevant for the patenting equations, where our coefficients will be affected if the number of patents is determined by creativity but creativity is also influenced by the number of patents a company applies for. However, the potential bias generated by this feedback, if any, is likely to be small in our setting because the patenting activity of a company is unlikely to strongly influence the prominence of all the words in the bag of words of our cultural dimension create. Furthermore, partialling out any feedback from the patenting activity to the creativity of a company may not only be very difficult but may also lead to an underestimation of the effect of creativity on innovation.

(1) to test our hypotheses that an increase in the tax-credit on R&D has a larger effect on the value and on the innovation output of creative companies. While assumptions (A1, A2 and A3) cannot be tested directly, in the next section we provide evidence suggesting that our variable $Treatment$ is independent from firms' characteristics.

6.1 The Exogeneity of the User Cost of R&D Capital

We discussed above how the independence between the tax incentives on R&D activities and firms' unobservable characteristics may facilitate the interpretation of our interaction term. The remaining concern is then whether or not the changes in the R&D tax credit are correlated with firms' unobservable characteristics. For instance, if states respond to a decrease in the firms' engagement in innovation activity by increasing tax credit, the tax incentives may be correlated with firm unobservable characteristics. This argument is also discussed in Bloom et al. (2013) who outline that the changes in the tax incentives on R&D activities are uncorrelated with state characteristics. More specifically, the level and timing of the introduction of the tax credit on R&D, which provide the basis for our identification strategy, have been shown to be uncorrelated with any observable characteristic of firms after controlling for state and year fixed effects. Several papers have tried to explain the evolution of state-level corporate tax credits and have found that aggregate variables (such as the federal credit rate) partially explain the evolution over time and across state of R&D tax credit, but local economic or political variables do not have any explanatory power (e.g., Chirinko and Wilson (2008, 2017)). One potential explanation is the long-time delay of passing tax credits through state legislature. The costs of these tax credits for states are also quite small and their adoption seems not to be strongly driven by budget concerns or any state features. As a result, while state-level R&D tax credits have been rising since the early 1980s, this has happened at differential rates and levels across states. The variation of the intensity and of the timing of these policies across states should then provide pseudo-random variation to the incentive of firms in undertaking innovative projects. We also provide additional evidence to support the independence between the tax benefits on R&D and firms' unobservable characteristics. We show that the valuation of creative companies and the valuation of companies in the control sample follow a common trend in the three years before the tax incentives on R&D increase. Figure 2 depicts the evolution of the average value of creative companies (solid line) over a three year period before the companies receive the tax incentives to invest in innovative projects. The difference between the value of creative companies and the value of companies in the control sample is stable over the three years before the treatment, suggesting that the evolution of the value of creative companies would have been the same if states would have not provided any incentive to invest in R&D.

<< INSERT FIGURE 2 AND TABLE 5 >>

In Table 5, we also formally test the stability of the difference between creative companies and the control sample over the three years period before the treatment. We expand equation (1) with firm-level control variables and restrict the sample to the three years before the treatment. We create an indicator variable identifying the year immediately before a state increases tax incentives to invest in R&D which we lable "year before the treatment". We then interact this variable with our variable creative to test whether the difference in the outcome variable between creative companies and those in the control sample changes the year before the treatment relative to two and three years before the treatment. Put differently, the estimates in Table 5 represent a test for the stability of the difference in means between creative companies and the control sample before the treatment. If tax incentives are truly independent from firm characteristics, we expect the difference in the conditional mean between creative companies and the control sample to be stable in the years before the treatment. The coefficients estimated for the interaction between *Creative* and the treatment variable in the Models (1) to (3) of Table 5 are not statistically significant, indicating that the difference in the average patenting activities between creative companies and the control companies are stable over the years before the tax incentives on R&D increase. This evidence supports the assumption that tax incentives are independent from firms' unobservable characteristics potentially correlated with our variable creative. In the next section, we then estimate equation (1) to test whether creative companies benefit more from tax incentives on R&D.

6.2 Results from a Quasi-Experimental Framework

We now turn to the interaction term which should not be affected by the omission of relevant factors from our regression models and captures the difference in the outcome variable between creative firms and their peers after an increase in the tax incentives to invest in R&D activities. Models (1) to (3) of Table 6 report the estimation of equation (1) augmented with Industry, State, and Year fixed effects, and Models (4)-(6) add more firm-level control variables. Model (1) shows the difference in the patenting activity of creative firms and their peers after they receive an exogenous incentive to invest in R&D and find that the interaction term is positively and strongly statistically significant indicating that creative firms produce more patents after they receive an incentive to invest in R&D. The coefficient is also significant in Model (4) where we control for the logarithmic transformation of the R&D stock and for other firm characteristics. As fact that the coefficient of the interaction variable is of the same magnitude in Models (4) and (1), indicates that this variable is not correlated with firm characteristics. In Models (2) and (5), we also show that the patents granted to creative firms receive more citations than those obtained by the firms in the control sample after all these firms receive an exogenous incentive to invest in R&D. The results in Models (3) and (6) show the difference in firm value between creative firms and their peers in the control sample after they are incentivized to invest in innovative projects. The results also confirm our main conclusion that creativity increases firm value through the investment in R&D. This result is consistent with Hirshleifer et al. (2013) as it shows that innovative efficiency increases the market value of listed firms. The results reported in Table 5 are also economically meaningful outlining how the value of creative companies increases by 12% more than the value of companies in the control sample after an increase in tax incentives on R&D. Using the average firm value in our sample as a benchmark this represents an average increase of 6%.

7. Conclusion

The majority of firms listed in S&P 500 mention that their innovative capacity largely hinges on their corporate culture. We show that firms with a creativity-oriented corporate culture, which we define by means of the Competing Value Framework and identify by means of textual analysis of firm's 10K reports, is indeed a driver of innovation activity as measured by the number of patents and the patent citation score. We also find that creative firms are able to reach higher Tobin's Q. We address potential endogeneity biases by estimating the additional patents, patent citations, and value generated by creative firms after state-induced tax incentives on R&D in a differences-in-difference framework. The positive relation between a creative corporate culture and firm value explains why firms focus on advertising creativity among their corporate values.

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Figure 1: Competing Value Framework (CVD)

Panel A:

Flexibility and discretion

	Internal focus	External Focus
Flexibility and discretion	**Clan** **Thrust:** Collaborate **Means:** Cohesion, participation, communication **Ends**: Morale, development commitment	**Adhocracy** **Thrust:** Create **Means:** Adaptability, agility, flexibility **Ends**: cutting-edge output
Stability and Control	**Nation** **Thrust:** Control **Means:** Capable process, consistency, measurement **Ends:** Efficiency, timelines, smooth functioning	**Market** **Thrust:** Compete **Means:** Customer focus, productivity, enhancing competitiveness **Ends**: Market share, profitability, goal achievement

Stability and Control

Panel B:

Culture	Assumptions	Beliefs	Values	Artefacts	Effectiveness Criteria
Collaborative (Clan)	Human Affiliation	People behave appropriately when they trust in loyalty to, and membership in the organization.	Attachment, affiliation, collaboration, trust and support	Teamwork, participation, employee involvement and open culture	Employee, satisfaction and commitment
Creative (Adhocracy)	Change	People behave appropriately when they understand the importance and impact of a task.	Growth, stimulation, autonomy and attention to detail	Risk-taking, creativity and adaptability	Innovation
Competitive (Market)	Achievement	People behave appropriately when they have clear objectives and are rewarded based on achievements	Communication, Competition, competence and achievement	Gathering customer information, goal setting, planning, task focus, competitiveness and aggressiveness	Increased market share, profit, product quality and productivity
Control-driven (Hierarchy)	Stability	People behave appropriately when they have clear roles, and procedures are formally defined by rules and regulation	Communication, reutilisation, formalization and consistency	Conformity and predictability	Efficiency timelines and smooth functioning

Competing Value Framework (CVD), continued

Panel C:

Culture Type	***Bag of words***
Control	administrat*, analys*, boss*, burocr*, cautio*, cheap*, chief*, conservat*, consisten*, control*, cost*, cut*, disciplin*, document*, effectiv*, efficien*, enhance*, improv*, logic*, measur*, method*, organize*, outcom*, predictab*, procedur*, process*, productiv*, qualit*, regular*, rule*, standard*, system*, technical*, uniform*
Compete	achiev*, acquir*, acquis*, aggress*, analyst*, attack*, client*, challeng*, compet*, customer*, edge*, excellen*, expand*, expans*, fast*, growth*, market*, perform*, position*, pressur*, profit*, rapid*, result*, revenue*, share*, short-term*, speed*, superior*, value*, win*
Collaborate	balan*, capab*, cohes*, collab*, collectiv*, commit*, commun*, competen*, consens*, contribut*, cooperat*, coordin*, decentr*, dialogue*, employ*, empower*, engag*, facilitator*, help*, hir*, human*, interper*, involv*, long-last*, long-term*, loyal*, mentor*, mutual*, people*, relation*, responsib*, retain*, reten*, reward*, skill*, social*, solidif*, team*, teamwork*, train*, willingness*, work group*
Create	adapt*, chang*, creat*, discontin*, dream*, dynamic*, emerg*, entrepre*, envis*, experim*, fantas*, freedom*, futuri*, idea*, imagin*, inventive*, new*, niche*, origin*, pioneer* uncertain*, unpredictable*, ventur*, vision*, unafra*

Figure 2: Evolution of average Tobin's Q before the treatment.

The solid line represents the creative companies, and the dashed line the peer companies in the control sample.

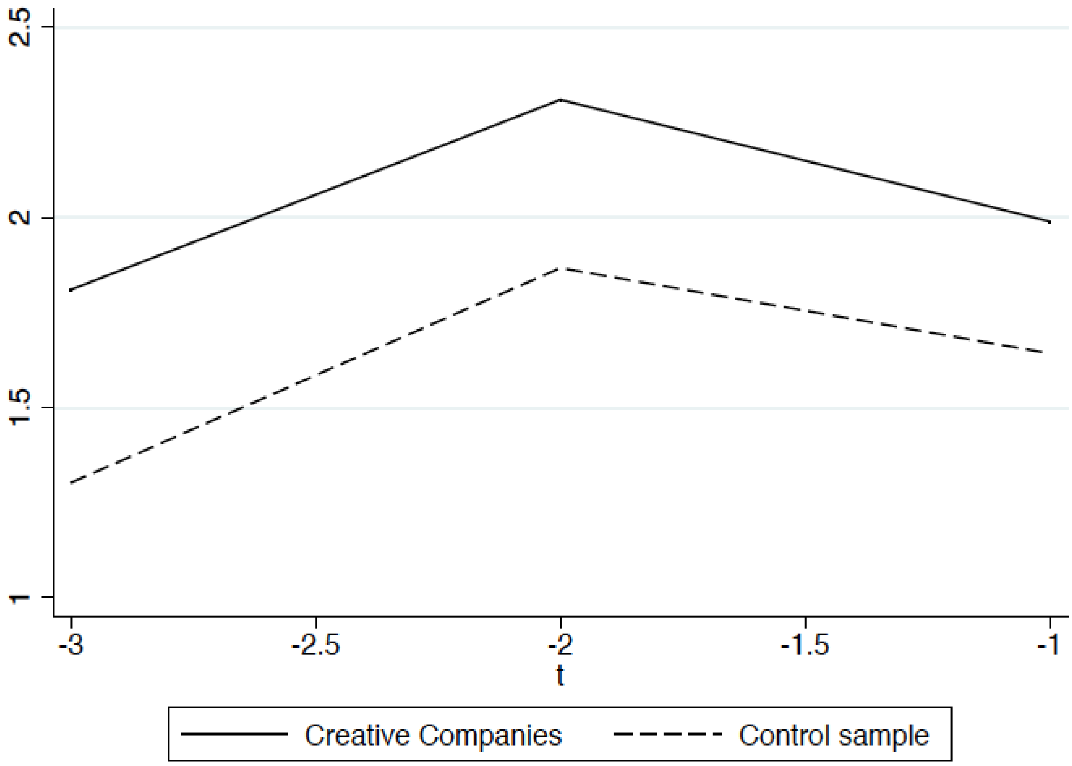

Table 1: Variable Description

This table reports the variable description and data sources.

Dependent Variables	Description	Database
$Tobin's\ Q$	Total liabilities plus market capitalization (outstanding shares multiplied by the market price per share both measured at the end of each calendar year) divided by total assets.	Compustat/CRSP
$\ln(1 + pat)$	The natural logarithm of one plus the number of patents applied for during the year	NBER
$\ln(1 + cit)$	The natural logarithm of one plus the weighted number of citations received by all the patents granted to a firm by newer patents.	NBER
Cultural Variables	**Description**	**Database**
$Creative$	An indicator variable taking the value of one if the $Create\ adjusted\ score$ of a company is above the median of its industry. Creative adjusted score is the relative frequency of words in the 10-K associated with a creativity-oriented cultural dimension and adjusted for the commonality of each word in our sample of 10-K.	Edgar
Control Variables	**Description**	**Database**
$\ln(R\&D\ stock)$	R&D stock (Bloom et al. 2013) calculated by means of perpetual inventory method with a depreciation rate (δ) of 20%. The R&D stock, G, in year t is $G_t = R_t + (1 - \delta)G_{t-1}$, where R is the R&D flow expenditure in year t and δ=0.15	Compustat
$\ln(Total\ Asset)$	Natural logarithm of total asset	Compustat
$\frac{PPE}{Employees}$	Net property plant and equipment per employee	Compustat
ROA	Net income before taxes on total assets	Compustat
$\frac{Cash}{Total\ assets}$	Ratio of cash to total assets	Compustat
$Sales\ return$	The value of total sales divided by the value of total sales in the previous year	Compustat
$Stock\ Return$	The buy and hold return over the fiscal year	CRSP
$Treatment$	An indicator variable taking the value of one when the Hall–Jorgenson state cost of innovation as calculated in Wilson (2009) is below its four years moving average.	Wilson (2009)

Table 2: Descriptive Statistics

This Table reports the summary statistics of all variables.

Dependent Variables	Observations	Mean	Standard Deviation
$\ln(1+pat)$	17,088	0.7212	1.2035
$\ln(1+cit)$	17,088	1.1842	2.1005
$Tobin's\ Q$	25,209	2.0362	2.2275
Cultural Variables	**Observations**	**Mean**	**Standard Deviation**
$Creative$	25,209	0.4976	0.5001
Control Variables	**Observations**	**Mean**	**Standard Deviation**
$\ln(R\&D\ stock)$	25,209	1.5940	1.9594
$\ln(Total\ Assets)$	25,209	5.6569	1.8771
$\frac{PPE}{Employees}$	25,209	134.0688	373.2510
ROA	25,209	-0.0322	0.2350
$\frac{Cash}{Total\ assets}$	25,209	0.1206	0.1480
$Sales\ return$	25,209	1.1859	0.5225
$Stock\ Return$	25,209	1.1728	0.7997

Table 3: Innovative output

This table relates the dependent variables, the number of patents applied for by each firm and the patent citations received by the patents owned by each firm, to our cultural variable Creative. This creative is constructed by means of textual analysis on companies' 10-Ks. Variable definitions are reported in Table 1. In Columns (3) and (6), a dummy variable is included for observations where lagged R&D expenditure is zero. All variables are winsorized at 1% level. We use industry and year fixed effects in all models. Standard errors are reported in parentheses and are clustered at industry level.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	$\ln(1+pat)$	$\ln(1+pat)$	$\ln(1+pat)$	$\ln(1+cit)$	$\ln(1+cit)$	$\ln(1+cit)$
$Creative$	0.2385***	0.2218***	0.0956**	0.4017***	0.3736***	0.1931***
	(0.0537)	(0.0440)	(0.0370)	(0.0802)	(0.0669)	(0.0561)
$\ln(R\&D\ stock)$			0.3360***			0.4235***
			(0.0251)			(0.0307)
$\ln(Total\ Asset)$		0.3435***	0.1363***		0.4708***	0.2059***
		(0.0257)	(0.0162)		(0.0329)	(0.0254)
$\frac{PPE}{Employees}$		-0.0001	-0.0000		-0.0001	0.0000
		(0.0001)	(0.0001)		(0.0001)	(0.0001)
ROA		-0.1801***	0.0966**		-0.2254**	0.1379
		(0.0557)	(0.0461)		(0.0998)	(0.0931)
$\frac{Cash}{Total\ assets}$		0.2772***	0.0929		0.6073***	0.3482***
		(0.0769)	(0.0755)		(0.1377)	(0.1317)
$Sales\ return$		-0.0237*	-0.0145		-0.0264	-0.0171
		(0.0122)	(0.0132)		(0.0255)	(0.0278)
$Stock\ Return$		0.0391***	0.0346***		0.0801***	0.0733***
		(0.0072)	(0.0073)		(0.0151)	(0.0152)
$Constant$	1.2660***	-0.8956***	-0.5347***	2.6036***	-0.4164**	0.1413
	(0.0857)	(0.1278)	(0.0960)	(0.1431)	(0.1626)	(0.1439)
$Industry\ FE$	Y	Y	Y	Y	Y	Y
$Year\ FE$	Y	Y	Y	Y	Y	Y
$Observations$	17,088	17,088	17,088	17,088	17,088	17,088
Adjusted R^2	0.2795	0.4686	0.5369	0.3090	0.4245	0.4769

*** p<0.01, ** p<0.05, * p<0.1

Table 4: Firm Value

This table shows the results of the relation between the dependent variable, Tobin's Q, and creative corporate culture (Creative). The latter is constructed by means of textual analysis on companies' 10-Ks. Variable definitions are reported in Table 1. In Column (3) a dummy variable is included for observations where lagged R&D expenditure is zero. All variables are winsorized at 1% level. Industry and year fixed effects are included in all models. Standard errors are reported in parentheses and are clustered at industry level.

	(1)	(2)	(3)
VARIABLES	$Tobin's\ Q$	$Tobin's\ Q$	$Tobin's\ Q$
$Creative$	0.2648***	0.1613***	0.1054**
	(0.0523)	(0.0509)	(0.0507)
$\ln(R\&D\ stock)$			0.0648***
			(0.0217)
$\ln(Total\ Asset)$		-0.0200	-0.0572***
		(0.0146)	(0.0182)
$\frac{PPE}{Employees}$		-0.0001	-0.0000
		(0.0000)	(0.0000)
ROA		-1.0852***	-1.0171***
		(0.2525)	(0.2518)
$\frac{Cash}{Total\ assets}$		2.1391***	2.0483***
		(0.2444)	(0.2431)
$Sales\ return$		0.2559***	0.2548***
		(0.0353)	(0.0357)
$Stock\ Return$		0.3067***	0.3051***
		(0.0330)	(0.0328)
$Constant$	1.7750***	1.1669***	1.4244***
	(0.0488)	(0.1132)	(0.1323)
Industry FE	Y	Y	Y
Year FE	Y	Y	Y
Observations	25,209	25,209	25,209
Adjusted R^2	0.1154	0.1626	0.1658

*** p<0.01, ** p<0.05, * p<0.1

Table 5: Tax incentives on innovation: a placebo test

This table shows a placebo test for the differential effect of R&D tax incentives on creative firms. The variable year before the treatment is the year before the increase in the tax incentives on R&D. The variable Creative is constructed using textual analysis from the companies' 10-Ks. Variables details are reported in Table 1. In all the models reported below a dummy variable is included for observations for which lagged R&D expenditure is zero. All variables are winsorized at 1% level. The sample is restricted to the three years before the variable year before the treatment has the value of one for the years just before the treatment. Industry year and state fixed effects are included in all models rows. Standard errors are reported in parentheses and are clustered at state level.

	(1)	(2)	(3)
	$\ln(1+pat)$	$\ln(1+cit)$	$Tobin's\ Q$
$Year\ before\ Treatment$	-0.0842	-0.3426	0.1595
	(0.1492)	(0.2326)	(0.3424)
$Creative$	-0.0439	-0.0524	-0.1871
	(0.1974)	(0.2864)	(0.3154)
$Year\ before\ Treatment \times Creative$	0.1779	0.2863	0.1334
	(0.1547)	(0.2932)	(0.3032)
$\ln(R\&D\ stock)$	0.4977***	0.6745***	0.0757
	(0.0487)	(0.0814)	(0.1051)
$\ln(Total\ Asset)$	0.1432***	0.2474***	0.0675
	(0.0328)	(0.0540)	(0.0947)
$\frac{PPE}{Employees}$	-0.0001	-0.0004**	-0.0000
	(0.0001)	(0.0002)	(0.0001)
ROA	-0.0399	-0.3632	-5.2246*
	(0.2011)	(0.4310)	(2.5951)
$\frac{Cash}{Total\ assets}$	0.3390	0.7026	3.9511***
	(0.3673)	(0.6589)	(1.1244)
$Sales\ return$	0.1169*	0.3450**	0.6103
	(0.0628)	(0.1350)	(0.5342)
$Stock\ Return$	0.0267	0.0290	0.3250**
	(0.0648)	(0.1407)	(0.1463)
$Constant$	-1.6488***	-1.5358**	-0.5248
	(0.3181)	(0.6512)	(0.6449)
Industry FE	Y	Y	Y
State FE	Y	Y	Y
Year FE	Y	Y	Y
Observations	1,227	1,227	1,869
Adjusted R^2	0.6322	0.5711	0.1598

*** p<0.01, ** p<0.05, * p<0.1

Table 6: Tax incentives on innovation

This table shows the differential effect of R&D tax incentives on creative firms in terms of firm value (Tobin's Q) and innovative output (number of patents and patent citations). The variable Creative is constructed using textual analysis from the companies' 10-Ks. Treatment captures state tax credit on R&D. Variable definitions are reported in Table 1. In Columns (4), (5) and (6), a dummy variable is included for observations where lagged R&D expenditure is zero. All variables are winsorized at 1% level. All models include industry, year and state fixed effects. Standard errors are reported in parentheses and are clustered at the state level.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	$\ln(1+pat)$	$\ln(1+cit)$	$Tobin's\ Q$	$\ln(1+pat)$	$\ln(1+cit)$	$Tobin's\ Q$
$Treatment$	0.0198	0.0554	-0.0414	0.0134	0.0471	-0.0271
	(0.0393)	(0.0857)	(0.0418)	(0.0404)	(0.0912)	(0.0480)
$Creative$	0.1775***	0.2883***	0.1835***	0.0541	0.1088**	0.0398
	(0.0391)	(0.0633)	(0.0624)	(0.0330)	(0.0494)	(0.0539)
$Treatment \times Creative$	0.0948***	0.1943***	0.1359**	0.0924***	0.1885***	0.1217**
	(0.0282)	(0.0507)	(0.0634)	(0.0267)	(0.0522)	(0.0590)
$\ln(R\&D\ stock)$				0.3284***	0.4103***	0.0600***
				(0.0181)	(0.0261)	(0.0189)
$\ln(Total\ Asset)$				0.1423***	0.2167***	-0.0563***
				(0.0127)	(0.0187)	(0.0197)
$\frac{PPE}{Employees}$				-0.0000	0.0000	-0.0000
				(0.0001)	(0.0001)	(0.0001)
ROA				0.0891***	0.1319**	-1.0108***
				(0.0268)	(0.0587)	(0.1742)
$\frac{Cash}{Total\ assets}$				0.1124*	0.3745***	2.0354***
				(0.0578)	(0.0981)	(0.1868)
$Sales\ return$				-0.0114	-0.0136	0.2530***
				(0.0124)	(0.0244)	(0.0434)
$Stock\ Return$				0.0352***	0.0749***	0.3054***
				(0.0049)	(0.0122)	(0.0396)
$Constant$	1.3710***	2.4069***	1.6890***	-0.3978***	0.0081	1.4125***
	(0.1387)	(0.2076)	(0.1038)	(0.1422)	(0.2368)	(0.1628)
Industry FE	Y	Y	Y	Y	Y	Y
State FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Observations	17,088	17,088	25,209	17,088	17,088	25,209
Adjusted R^2	0.2923	0.3185	0.1181	0.5418	0.4696	0.1671

*** p<0.01, ** p<0.05, * p<0.1

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