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## **Media Sentiment and the Propensity to Patent**

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### **Abstract**

Managers take a wide variety of information into account when making decisions. What information triggers these decisions, however, is a poorly understood process. Many, relatedly, believe that the decision by a firm to patent what new knowledge it has developed is a decision that is taken keeping only technical considerations into account; a decision that is taken as a matter of course. This paper shows that patenting is, however, not just correlated with the business cycle, and how media objectively reports on it. More importantly, we believe, is our finding that ?emotive? or interpretive reporting in the media quite directly affects patent applications by firms. This paper sheds new light on the topic of what determines patenting by looking at the influence of the media on the propensity to patent. Using a database of 987 articles, containing 45,517 unique words, and published in The Economist over the period January

2003 to December 2010, we show that the media's portrayal of economic events – such as, for example, the "credit crunch" – affects the patenting, and indeed the business behaviour of managers. We find, quite surprisingly, that the use of more subjective, emotive terms affects patenting more than the use of objective economic terms in media reporting or the objective economic terms (GDP/capita) themselves. This finding seems to run counter to the economic models of the effects of the sudden entry of "news" into the economic system – these studies typically assume that news shocks reflecting "fundamentals" are what matters.

# MEDIA SENTIMENT & THE PROPENSITY TO PATENT

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**Abstract:** Managers take a wide variety of information into account when making decisions. How managers make decisions about investing in innovation, for instance, and what information triggers these decisions, however, is a poorly understood process. Many, relatedly, believe that the decision by a firm to patent what new knowledge it has developed is a decision that is taken keeping only technical considerations into account; a decision that is taken as a matter of course. This paper shows that patenting is, however, not just correlated with the business cycle, and how media objectively reports on it. More importantly, we believe, is our finding that ‘emotive’ or interpretive reporting in the media quite directly affects patent applications by firms. This paper sheds new light on the topic of what determines patenting by looking at the influence of the media on the propensity to patent. Using a database of 987 articles, containing 45,517 unique words, and published in *The Economist* over the period January 2003 to December 2010, we show that the media’s portrayal of economic events – such as, for example, the ‘credit crunch’ – affects the patenting, and indeed the business behaviour of managers. We find, quite surprisingly, that the use of more subjective, emotive terms affects patenting more than the use of objective economic terms in media reporting or the objective economic terms (GDP/capita) themselves. This finding seems to run counter to the economic models of the effects of the sudden entry of ‘news’ into the economic system – these studies typically assume that news shocks reflecting ‘fundamentals’ are what matters.

**Keywords:** Mass media; business cycle; innovative behaviour; patenting.

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## 1. INTRODUCTION

Managers take a wide variety of information into account when making their decisions. What information triggers managers to make a decision, however, remains poorly understood. This paper aims to shed light on the topic of decision triggers, and considers in particular the influence of changing media sentiment on the strategic patenting behaviour of manager.

Recent developments in the literature support the conclusion that the media – and in particular the business press – can be an important social influence, not just on the behaviour of consumers but also on that of managers (Starr, 2008; Doms & Morin, 2004; Sims, 2003; Carroll et al., 1994; Oh & Waldman, 1990; McCarthy & Dolfsma 2009). The media reports on economic developments, combines objective and subjective data sources with perspective, and by comparing insights from different time periods, different industries and different experts, offers managers ‘generalizable’ conclusions (Hall, 1980). High-end business publications, in particular,

position themselves as impartial ‘filters’ for the flow of complex information that is the twenty-first century, and sell themselves to managers as a tool for condensing the ‘deluge of relevant information’ necessary to make a responsible strategic decision (Starr, 2004).

The media is not neutral, however. And in addition to filtering the news, the media interprets and colours it with its use of descriptive language. Negative language can negatively colour the readers understanding of the state of the economy. And so changes in media sentiment – that is, in the type and tone of the coverage – are likely to influence managerial decisions. Decisions affecting the firm’s long-term position will reflect economic fundamentals more closely. Only the more transitory decisions will be affected by changes in media coverage.

As an indicator of mass media economic reporting, we follow the recent work of Starr (2004), Doms & Morin (2004), McCarthy & Dolfsma (2009), and focus on *The Economist*, as a highly respected weekly magazine, widely read by global ‘movers and shakers’ (Starr, 2004). We build a database of 987 articles, published in *The Economist* over the period January 2003 to December 2010. And we split the coverage into what we define as ‘economic’ and ‘emotive’ coverage, ‘positive’ and ‘negative’. The media selects from the vast bulk of information to inform its audience, but also adds interpretation to it. The interpretation, as we explain, is particularly noticeable in use of ‘emotive’ terms. We control for real changes in the economy (measured by GDP), and then investigate how the media’s portrayal of macroeconomic events – such as, for example, the ‘credit crunch’ – affects the strategic behaviour of firms in the period of analysis.

As an indicator of business behaviour, we employ data on the numbers of patent applications, registered at the US Patent and Trademark Office (USPTO). Patenting not just involves a substantial investment by itself, but also potentially impacts a firm’s long term strategic position. A growing literature documents the strategic use of patents (e.g., Granstrand 2000; Dolfsma 2011), and illustrates how developments in the economy at large affect the patenting decision of firms. In different phases of the business cycle, the prospects for the commercialization of newly developed knowledge are different: patent applications may thus

increase in the expansionary phases of the business cycle. Understanding the phases, and indeed the prospects for the commercialization of a patent can, however, be difficult, for the firm, for its competitors, and for customers. Positive changes in media sentiment, and predictions of ‘good times’ should, we suggest, coincide with an expansion in the number of patent registrations.

In the process, we show that reports in the media influence the strategic choices of firms, and that media power is an important explanatory variable in understanding variations the number of patent applications. In doing so, this paper sheds additional light on the question of how managers make decisions, and what types of information they use. We thus also contribute to the growing literature on strategic patenting by firms (e.g., Granstrand 2000; Dolfsma 2011).

## **2. LITERATURE**

### ***2.1. Non-fundamental Shocks***

Recent developments in the real business cycle literature have shown that models with indeterminate equilibria, which incorporate ‘non-fundamental’ demand shocks – and thus allow for the variable impact of both tangible and intangible, psychological factors over time (Starr, 2008) – can match observed patterns in the macroeconomic data relatively well (see, for example, Farmer and Guo, 1994; Benhabib and Farmer, 1999; Bernhabib and Wen, 2004). Carroll et al., (1994), for example, show that, after controlling for the fundamental determinants of spending, non-fundamental determinants – such as consumer sentiment – can have a significant role in predicting future spending. Matsuaka and Sborbone (1995) estimates that a shift in consumer sentiment may explain as much as 13-26% of output fluctuations. Oh and Waldman (1990) document the same effect in terms of business sentiment, and show that the “false announcement” of key indicators – that is, the announcement of data on leading indicators which are subsequently revised – can explain more than 20% of the fluctuations in growth in industrial production at a quarterly frequency. While Chauvet and Guo (2003) finds that changes in ‘outlook’ – such as the adoption of overly bearish attitudes – may have played a non-trivial role in driving many of the

more recent recessions, and indeed their roads to recovery. Thus, they conclude, ‘non-fundamental’, ‘humanistic’ fluctuations in sentiment can have independent, causal effects on the consumers/investors willingness to spend. And it has been suggested that the media has an important role to play in shaping this sentiment (Starr, 2008; McCarthy and Dolfsma, 2009).

## ***2.2. Media Coverage***

The media is said to be the publics’ primary source of information on the macroeconomic climate (Blinder and Krueger, 2004). And because of this, a considerable amount of work has explored the question of how people – and, by extension, managers – interact with the media<sup>1</sup>.

According to Doms and Morin (2004), the media can affect spending and investment decisions through three channels. Firstly, the media disseminates information on economic statistics and measures, and publishes expert opinions on the interpretation of these. Secondly, readers receive a signal about the strength of the economy through the type and tone of economic reporting and, according to Sims (2003), type and tone have a greater effect on sentiment than economic information<sup>2</sup>. And finally it is suggested that the media influences sentiment by affecting the likelihood that readers will update their expectations. Carroll et al. (2003) suggests that the greater the volume of the coverage the greater its impact, since volume impacts the likelihood that the individuals expectations will be updated, because, as Moscarini (2004) and Reis (2003) explain, the difficulty with which information about the economy can be gathered is lessened when the news coverage is high. Akerloff et al. (2001) and Gabaix et al. (2003) also suggest that people are more likely to read articles with dramatically negative headlines, because they are more likely to think that the information contained therein will be of some relevance.

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<sup>1</sup> Adorno and Horkheimer (1944), for example, suggest that the popular press dulled minds, and inculcate the work and consumption values needed for capitalist growth (cf. Herman and Chomsky 1998). Later work has criticized this view (Kellner, 1995; Storey, 1996; Dolfsma, 2004), however, and suggests that readers “decode” messages in ways that are relevant to them (Hall, 1980).

<sup>2</sup> Stein (1975), Kurtz (1990) and Weinstein (2002) each argue, however, that the tone and volume of the media is likely to be negatively skewed in its representations of economic news because, as Burns (2002) and Harrington (1989) demonstrate, only the most dramatic economic news get covered. Because of this, perceived and actual economic conditions can be misaligned by the media, and relatively mild downturns can be overblown. As a result, real-world spending may be depressed, and the onset of a recovery may be significantly delayed (Kurtz, 1990; Blanchard, 1993). In this respect, the role of the media and its impact on economy is clearly not neutral.

Doms and Morin (2004) and, more recently McCarthy and Dolfsma (2009), show that an increase in the coverage of ‘bad news’ by the media – be it in type, tone or volume – negatively impacts consumer sentiment. Salyer and Sheffin (1998) show that “belief shocks” – that is, the revelation by the media that an important but previously unquestioned belief is false – have incremental predictive power for macroeconomic time series. And Starr (2008) finds that the incidence of “news shock effect” – that is, the revelations of important and unexpected information by the media – strongly predict short term fluctuations in real spending patterns.

### ***2.3. Decoding and Interpreting by the Media***

All highly developed economies – with their interdependencies and uncertainties – are endowed with a well-functioning media (Djankov et al. 2002; Leeson 2004; Sen 1999; Stiglitz 2002).

A considerable amount of work has explored the question of how people interact with the media. Some take a critical view; Adorno and Horkheimer (1944) suggest that the popular press dulls the mind. And Herman and Chomsky (1998) suggest that it inculcates the work and consumption values needed for capitalist growth. Later work criticizes this view, and a number of authors (e.g., Kellner, 1995; Storey, 1996; Dolfsma, 2004) have suggested that readers “decode” messages contained in the media in ways that are relevant to them (Hall, 1980). This means that messages can be read to mean things that there were not originally intended to mean.

With specialty media, however, such as with the UK based weekly magazine, *The Economist*, readers often share basic premises about ‘codes’ (Hall, 1980). So much so that messages ‘encoded’ by the ‘text producers’ may often correspond directly to what is ‘decoded’ by the readers. Furthermore, because *The Economist* is not a popular press, but rather a high-end business publication, *The Economist* is unlikely, it is suggested, to play into the ‘information anxiety’ which afflicts many of the most influential people whose work revolves around the knowledge economy, business and politics (Starr, 2008). According to its circulation statistics, practically all of *The Economist’s* readers have a university degree (over half have a post-

graduate degree), and about one-half have an annual income of \$100,000 or more. The overwhelmingly majority (91%) are male. And the world in which they live in is portrayed as being a rapidly changing place, with a deluge of new information flows permitted by new technologies. For this reason, *The Economist* is also likely to use words in their correct sense, and without hyperbole. *The Economist* sells itself, in fact, as an ‘impartial filter’ for this information flow (Starr, 2004). And because of this, *The Economist* is seen to be an influential publication, whose choice of language can impact the perceptions of many top-level decision makers

By selecting what information is to be seen as relevant, and by relating the different kinds of information, *The Economist* aims to provide its readership with a better understanding of the current state of affairs, and of likely future developments. In doing so, however, *The Economist* not only filters the information but also interprets it. This interpretation is particularly visible in the use of what might be called the ‘emotive terms’. Emotive terms – as will be explained below in the method section – characterize the selected information to give it meaning. For example, by referring to the Great Depression of the 1920’s/30’s, the authors might aim to obliquely tap into the reader’s pre-conceived feelings of uncertainty, and anxiety, surrounding this event. Just as managers – knowingly or unintentionally – add emotive overtones to the messages that they have for the employees in the firms that they are responsible for, and respond to emotive terms they receive in return, and just as they are influenced by the emotions in processes of negotiation, so may they be influenced by the emotive layers in the media messages that they receive.

#### ***2.4. Effects of Media Sentiment on Management Sentiment***

Managers, it is generally agreed, take a wide variety of information into account when making decisions. What information triggers these decisions is, however, a poorly understood process, having received only modest attention from management scholars in a recent past (REF). Some attention is paid to the sources of information that managers have within the firm itself, and this suggests that more diverse sources of knowledge is helpful (REF). Also the managers’ external

sources of information – proxied by his experience of different industries, and sometimes by the actual relations maintained (Volberda et al.) – has received some attention (REF).

Rather than seeing the manager as a fully rational individual, able to obtain whatever information may be needed, to process it in the correct way, and to make the best possible decision, this literature sees the manager, at the very least, as boundedly rational individual, who utilises what economic information he happens to have access to, to come to a conclusion. A decision taken may not be the optimal one, even when one could take a Platonian position. This might but certainly need not be due to hubris that managers can fall victim to (Barney & Hesterly, 2008). Managers might not simply have the time available to them to collect all information, what information is available might be strewn with uncertainties, it might be too complex or too contradictory to base a well-thought through decision on, and the situation might change dramatically in a short amount of time. While managers operate in teams and might thus be likely to, collectively, have more and better information, and to make more ‘rational’ decisions, groups can be just as subject to the same information constraints. In addition, group dynamics might even lead to ‘less’ rational (optimal) decisions as is documented in some studies (REF?).

In situations of uncertainty, managers might reasonable be expected to rely on outside sources of information. The role of the media as an external trigger of managerial behaviour has yet, however, to be explored. And so the effect of the ‘emotional environment’ – as measured by non-fundamental change in media coverage – on the decisions by managers remains unclear.

### ***2.5. Strategic Patenting***

The decision to patent is one that most observers believe is one that is taken as a matter of course. Knowledge is expensive. And a patent is an important way to protect the economic position that newly developed knowledge provides the firm. Without a patent, others can more easily imitate the knowledge that a firm has developed, despite its best efforts to keep such knowledge secret. Thus, if the firm develops new knowledge that can be patented, it will be patented.

Recent literature has indicated, however, that firms in different industries have a different propensity to patent. In some industries the newly developed knowledge may not stand the patent office's test of offering novelty beyond what prior knowledge provides an audience of peers versed in the knowledge field. Some newly developed knowledge may not (yet) offer the promise of an industrial application, and may thus not receive a patent. These criteria are not as strictly defined in the different jurisprudences, to the discontent of many (Jaffe & Lerner 2006).

Even in the same industry, firms of some types are also less likely to patent than others. Small firms, in particular, are less likely to patent than bigger firms. Smaller firms may not have the capital to apply for and defend a patent, in particular when they face a large, well-capitalized firm in their technological neighborhood (Lanjouw & Schankermann 2004; Dolfsma 2011). It is now increasingly recognized that firms face a choice when they have developed new knowledge. They can decide to use active means to protect their knowledge, including the application of one or more patents, for instance. An alternative to the active effort to protect knowledge is to keep the knowledge you have developed a secret, although keeping the knowledge that a firm has developed a secret may involve taking just as an active a stance. Keeping the knowledge secret, may, for example, require clauses added to the firm's employee contracts, or in the customer product contracts, stating that they are responsible for not diffusing the relevant knowledge.

Decisions to protect the knowledge itself – rather than the products or the employees in which it is embodied - go beyond patenting as the work in the area of 'profiting from innovation' since Teece (1986) has indicated. Firms in particular can choose between 'hard' means of protecting knowledge, such as patents and the acquisition or development of key complementary assets, or they can opt for 'soft' means of protection (De Faria & Sofka 2010). The soft means of protecting knowledge include being first to the market with one's product based on the new knowledge, or forming alliances with some competitors, suppliers and buyers.

The element of timing of patent application has received some attention in the literature (Granstrand 2000; Dolfsma 2011), but not much sustained attention. Firms can, of course, decide

to postpone the decision to patent, temporarily or permanently, if the products that the knowledge that such a patent would allow the firm to make will not find an attractive market. The analysis does not go much beyond haphazard observations and indication of what firms might do. Firms are, for instance, known to pace their patent applications pertinent to a single product or tightly connected set of products to lengthen the de facto protection for that product beyond the 20 year term that a patent has. A more thorough empirical analysis of how firms might be affected by the current economic conditions, as they face it, as it is presented to them by the media, and as it is interpreted for them in the media, will provide important clues as to what makes firms decide to patent. Given the nature of the decision to patent or not to patent – a fundamental one, reflecting a substantial investment and related for many firms quite immediately to their long term competitive position – analyzing the circumstances that lead managers of firms to decide about important investment decisions.

### **3. DATA & METHODOLOGY**

#### ***3.1. Sample Data***

We measure the type and tone of the news coverage, based on the frequency with which specific types of words appear in *The Economist* magazine. We assume that *The Economist* can be used as a proxy for media sentiment in general (Starr, 2004), and that this will impact the decisions of managers in a significant way. *The Economist* is an appropriate resource for such a study because: (1) it is widely held to be an objective and credible source of news and information<sup>3</sup>; (2) it has operated since 1843, has a circulation in excess of 1.3 million copies per issue<sup>4</sup>, and a readership of ‘movers and shakers’; and because (3) it is aimed at ‘the educated layperson’, it is likely to use the terms of interest to our study in an appropriate way (Starr, 2004). Consequently, we create a database of articles published in *The Economist*. We take the first edition of each month over the period Jan 2003 to Dec 2010. This period covers a full economic cycle starting with the dotcom-

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<sup>3</sup> See, e.g., <http://www.guardian.co.uk/uk/2000/dec/08/monarchy.comment>

<sup>4</sup> <http://www.npr.org/templates/story/story.php?storyId=5250996>

crisis recovery of 2002/2003, and ending with the ‘credit crunch’ of 2008/2009, and its aftermath. As *The Economist* is published on a weekly basis, we include one in every four issues, for each of the 96 months in the period. Because *The Economist* is an international magazine, however, which reports on stories from all around the globe, each issue contains a certain level of ‘noise’.<sup>5</sup> To minimise this, we only consider articles included in *The Economist*’s ‘Finance and Economics’ section. This section, we suggest, is relevant, for its focus on the world of business and finance, and for the fact that it is the most likely to affect the manager’s perceptions of change. Taken together, and because there are 8-10 articles in this section in every issue, the result of our refinement is the creation of a database of 987 articles.

### **3.2. Coding for Key Words**

We use Unix software to turn this database of articles into a dataset of word. We begin by preparing a list of the 45,517 unique words in the full database, and code these as being one of five ‘types’ (see *Table 1*) of words. *Cons(tants)* are ‘general economics and business terms’ such as, for example, ‘market’(s), ‘bank’(s), ‘capital’ and ‘credit’. These we identify for reasons of robustness, because if our method is reliable, the frequencies of these words should be relatively constant over time. By contrast, *N(Econ)* and *P(Econ)* words – that is, ‘negative economics and business terms’ (*N(Econ)*) and ‘positive economics and business terms’ (*P(Econ)*) respectively – should demonstrate more substantial variance over time. *N(Econ)* words, such as ‘recession’, ‘slowdown’, and ‘downturn’, should be clearly counter-cyclical in their usages, while *P(Econ)* words, such as ‘growth’, by contrast, should vary in a pro-cyclical manner. The same effects should be seen with *N(Emo)* and *P(Emo)* words – that is, the ‘negative emotional terms’ (*N(Emo)*) and ‘positive emotional terms’ (*P(Emo)*). *N(Emo)* words includes terms like ‘pressure’, ‘anxiety’, ‘worry’ and ‘scared’, but also what can be argued to be ‘emotive references’ such as,

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<sup>5</sup> A discussion of the ‘crisis in Gaza’ in the ‘Middle East’ section is, for example, unlikely to impact managerial investment decision, but will produce a ‘false positive’ when studying the usage of negative terminology.

for example, reference to the Depression of the 1920s/30s. By contrast, *P(Emo)* words include terms like ‘confidence’, ‘optimism’, and ‘enthusiasm’. Because manually identifying and categorising words is a somewhat subjective task, all three authors checked the word lists independently, and only words that at least two of the three authors had identified as being unambiguously important were included in the final set. References to the ten most commonly used words (see *Table 2*) are, for example, of little consequence to our study, and are therefore dropped from the analysis. All three authors categorised the remaining 764 words together, and a fourth person – not connected to the study – was consulted when a consensus could not be had.

**Table 1 - Key Words**

<b>Cons</b>	<b>N(Econ)</b>	<b>P(Econ)</b>	<b>N(Emo)</b>	<b>P(Emo)</b>
Bank Company Firm	Downturn Recession Slowdown	Boom Upturn Expansion	Scared Worried Panic	Optimistic Upbeat Relieved

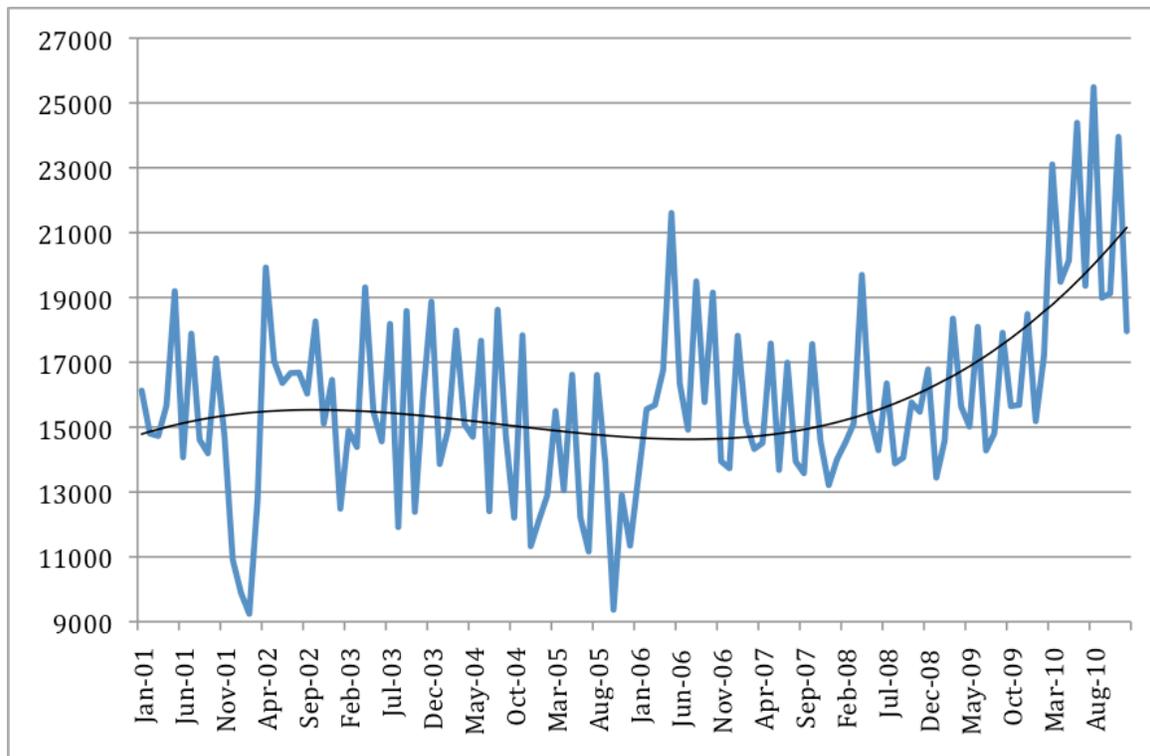
**Table 2 - Most Commonly Used Words**

<b>Words</b>	<b>Frequency</b>
the	46,294
of	24,901
to	24,245
a	20,024
in	18,878
and	17,000
is	11,307
that	10,508
for	8,556
it	7,069

### 3.3. Independent Variables

Together, we describe the negative ( $N(Econ)$ ) and positive economic ( $P(Econ)$ ) words as the ‘Economic’ terms. And the negative ( $N(Emo)$ ) and positive emotional ( $P(Emo)$ ) words as the ‘Emotive’ words. Following from the discussion of Section Two, we consider the effects of each.

**Figure 1 – US Patent Applications: Jan 2001-Dec 2010**



### 3.4. Dependent Variables

Several measures can be used to study the effects of a change in sentiment on the behaviour of firm. In this study we use data the number of patent applications, as one of the more widely used measures of innovation (Kleinknecht *et al.* 2002), even if they have their shortcomings<sup>6</sup>. Patents

<sup>6</sup> For example, the propensity to patent differs widely across industries (Arundel 2001). Of all patents granted in the US, 55-75 percent lapse through failure to pay maintenance fees; if litigation against a patent’s validity is a sign of commercial value of that patent, the fact that only 1.5% of patents are litigated and only 0.1 percent litigated to trial does not bode well (Lemley & Shapiro 2005). Many patents thus are applied for only for strategic reasons (cf. Granstrand 2000; Griliches 1990) and do not have any commercial value for firms (Kleinknecht *et al.* 2002; Carlsson *et al.* 2002). Small firms are thus reluctant to patent in the technological or economic (market) ‘neighborhood’ of patents

are used to protect new products, services or processes, and there is evidence to suggest that the number of patents announced varies with macroeconomic cycles (see e.g., Granstrand 2000; Dolfsma 2011). As such, an increase in the number of patent applications can be used as an indicator of business optimism. Patent data is readily available for the US, from the website of the US Patent and Trademark Office (USPTO). This is appropriate, we suggest, for both US and international firms alike, because for many firms the US market is the most important market, either directly -- because of a presence there -- or indirectly -- as a leading indicator. Figure 1 documents the per month number of patent applications made in the period Jan 2001 – Dec 2010.

### 3.5. Control Variable

Finally, and to control for real economic change – as opposed to the changes in media sentiment – we employ figures on the gross domestic product (GDP) of the US. Quarterly figures for the US GDP are provided by the US Bureau of Economic Analysis (BEA). And using a process of linear interpolation, we transform this to monthly data, for the period 2001-2010.

### 3.6. Model Specification

We model the effects of media sentiment on the behaviour of the firm, controlling for real changes in the economic climate, using the following base specification:

$$Business\ Action_t = a + \beta_j (REmotive)_{j\ t(-x)} + \beta_j (REconomic)_{j\ t(-x)} + \beta (Real\ Economy)_{t(-x)} + \varepsilon_i$$

Where:  $Business\ Action_t$  = the propensity to patent in period  $t$ ;  $\beta (REmotive)_{j\ t(-x)}$  = emotive media indicator  $j$  in period  $t$ , or lagged  $(t-x)$ ,  $j=1..2$ ;  $\beta (Economic)_{j\ t(-x)}$  = economic media indicator  $j$  in period  $t$ , or in a lagged period  $(t-x)$ ,  $j=1..2$ ;  $\beta (Real\ Economy)_{t(-x)}$  = real economic change in period  $t$ , or in a lagged period  $(t-x)$ ; and  $\varepsilon_i$  = a normally distributed error term. We use a straightforward OLS estimation procedure for the calculation of the alpha and betas.

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held by large companies for fear of expensive law suits (Lanjouw & Schankerman 2004). Obviously, patents need not be used in the further development process towards new products, services or processes.

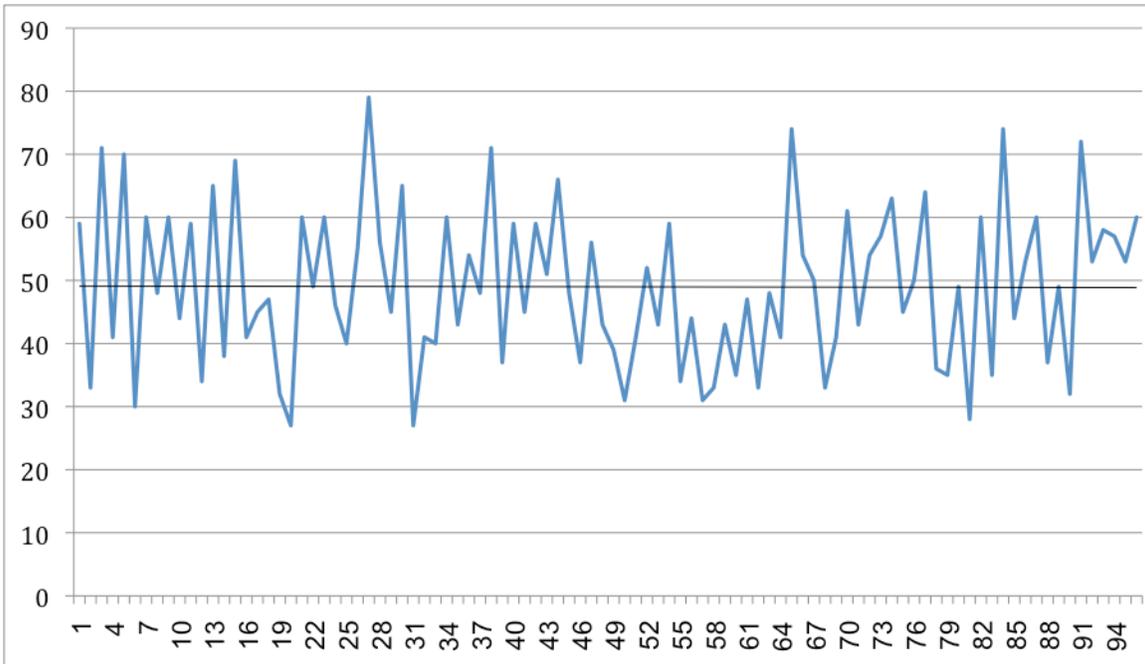
We assume that the various independent variables will be related to the dependent with a time lag. Neither theory nor previous practice from other research domains suggests, however, how long time lags should be. To arrive at the time lags to include in our analysis, aiming to be as consistent in the use of time lags as is feasible, our strategy has been twofold. Theoretically, and most importantly, we argue which time lags make most sense from the perspective of the extent to which firms can affect outcomes targeted by decisions. Statistically we employ a stepwise procedure. First, the dependent variable is correlated with GDP with various time lags. The GDP time lag that shows the highest correlation with the dependent variable is selected. Next, the partial correlation between the dependent variable and the various word variables is determined, correcting for GDP with the selected time lag. The time lag that shows most significant correlations between the word variables and the dependent variables is selected as the proper time lag for the word variables. In case of multiple time lags leading to a similar number of significant word variables, we estimate multiple regressions and select the equation with most significant independent variables and the highest adjusted  $R^2$ . Results from regression analyses not presented in this paper, as well as the underlying data, are available upon request from the authors.

## **4. RESULTS**

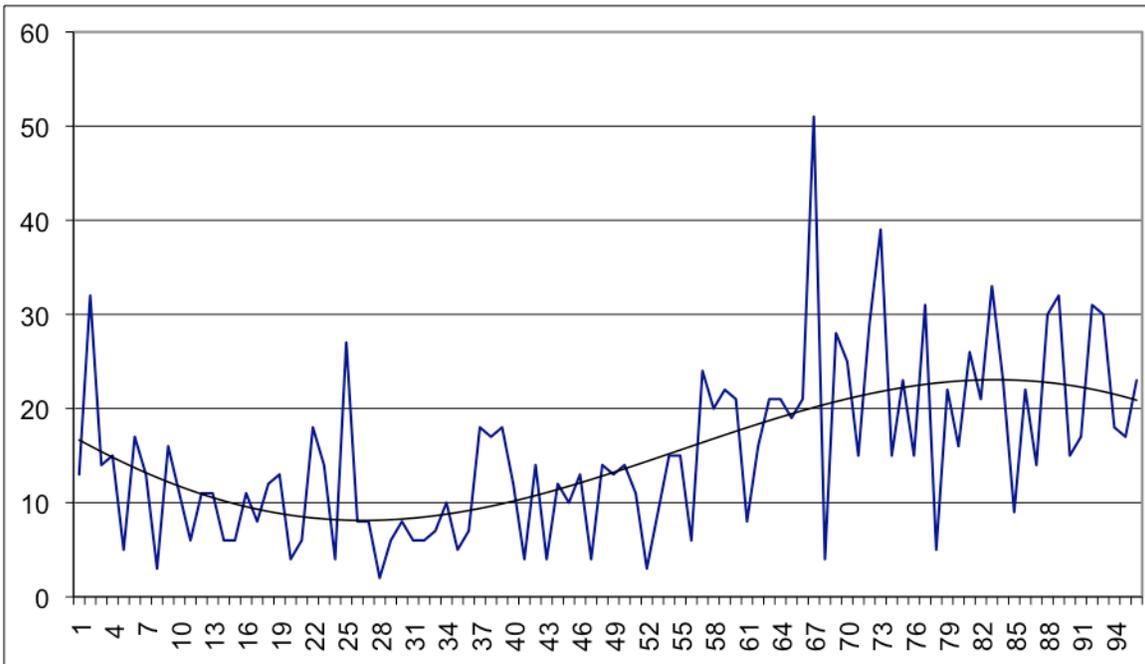
### **4.1. Methodological**

*Figure 2* shows the variance in the use of ‘Constants’ – that is, words such as ‘bank’, ‘capital’ and ‘market’ – overlaid with a linear trend for all 96 months of the analysis. In doing so, *Figure 2* confirms the suggestion that the use of these terms is relatively stable over time. In an average month, there are between 30 and 70 references to these types of terms. This, ‘partly’, illustrates the robustness of the ‘content analysis’ techniques that we employ in the paper.

**Figure 2** – Variance in the Constants



**Figure 3** – Variance in the use of Negative Economic Terms



*Figure 3* completes the task of demonstrating robustness. It shows the variance in the negative economic terms – again overlaid with a trend line – and evidences a far more cyclical pattern. This same pattern is to be found in the positive and negative economic and emotive terms. In

doing so, it is clear that to see variance in the types of words we would expect to see variance in, and stability in those we would expect to be constant. This supports the logic of our methods.

#### **4.2. Substantive**

While developing new knowledge may be seen by many as an autonomous process, unaffected by economic circumstances, let alone by something as intangible as fleeting changes in the type, tone and volume of the media's coverage, a somewhat different picture arises from our analysis.

Figure 1 above illustrates the number of patent applications made in the US during the period Jan 2001 to Dec 2010. And Table 3 presents the result of our regression analysis. In the US, and during the period of analysis, patents were granted to the party who can prove to be the first-to-invent a piece of knowledge that is otherwise novel, non-obvious and has an industrial application. As illustrated graphically by Figure 1, and empirically by the positive significance of the GDP variable on Table 3, it is clear that patent application behavior follows the business cycle quite closely. Applications increase in expansionary periods, and decrease in periods of decline. Applying for a patent, it appears, can be skipped or postponed to save costs – secrecy can be used instead (Dolfsma 2011). And strategizing through the use of patents (Granstrand 1999; Lemley & Shapiro 2005), it appears, may be less common when the economy is in recession. This shows that the development of new knowledge is not an autonomous process, but a strategic one.

Turning the role of the media, the results from Table 3 suggest that the increased use of positive or negative economic terms in the media does not affect patenting behaviour in a statistically significant way. This is perhaps a counter-intuitive result, given the suggestions of the literature described in section 2 above. Combined with the positive and significant results on the fundamental GDP indicator, this shows that managers, and firm do not respond to the fundamental changes described in the media, but rather to the fundamental changes themselves.

#### **Table 3 – Regression Results**

	Patent Applications
GDP <sub>t</sub>	0.608 (6.968)***
Economic Reporting	
Positive <sub>t-1</sub>	0.066 (0.668)
Negative <sub>t-1</sub>	0.098 (0.988)
Emotive Reporting	
Positive <sub>t-1</sub>	0.212 (2.247)**
Negative <sub>t-1</sub>	-0.186 (-2.015)**
R <sup>2</sup>	0.440
Adj R <sup>2</sup>	0.409
Overall F	13.999
Df.	58994

t Values in parentheses;

\*, \*\*, \*\*\* significant at 10%, 5%, and 1% respectively.

Turning to the emotive coverage, however, we observe a somewhat different story. As reported on Table 3, the use of emotive terminology has a statistically significant effect on the firm's propensity to patent, in the case of the positive and negatively coloured messages. An increase in the usage of positive emotive reporting, we find, will lead to an increase in the number of patent applications, while an increase in the use of negative emotive reporting will lead to fewer applications. As the time between applying for a patent on the one hand, and seeing the patent granted to develop and market a product based on the patents on the other hand can be quite long, the 'objective' economic reporting may not be as compelling as the emotive reporting. While a negative tone in media reporting is generally thought to have a stronger effect than a positive tone, this is not true for the case of management decision regarding patenting. Controlling for fundamental changes in the economic environment of the firm, this result suggests that managers, and the decisions that they make, are indeed susceptible to non-fundamental changes in the 'emotional' environment within which they operate. This seems to suggest that

managers are, at the very least, boundedly rational individuals, who are as susceptible to the same changes in media sentiment as the general public (McCarthy & Dolfsma, 2009).

## **5. DISCUSSION**

### **5.1. Key Findings**

The purpose of this paper is to shed light on the topic of managerial decision triggers. Describing the coverage as being positive and negative, economic and emotive, we consider, in particular, the influence of changing media sentiment on decisions of managers. Using strategic patenting as a measure of managerial decision making, we come to a number of important conclusions:

1. Developing new knowledge may be thought to be an autonomous process, unaffected by fundamental -- let alone by non-fundamental changes -- in the macroeconomic environment. Our results, however, show that the number of patents applications made to the US PTO ebbs and flows, and changes with the business cycles. Our analysis shows that patenting behaviour is strongly related to real changes in US GDP.
2. Using patents as a measure of strategic action, and *The Economist's* coverage of the period January 2003 to December 2010 to measure media sentiment, we show that the decision to patent by firms is determined by real changes in the business cycle, and not by how those change are 'objectively' reported on in the media. We use changes in the frequency of both positive and negative economic terms -- terms such as 'recession', 'boom', 'depression' and 'growth' -- to measure changes in *The Economist's* objective reporting. And controlling for real changes, as measured by US GDP, we show that managers remain unaffected by objective changes in the medias coverage.
3. We find, however, that managers and the decisions that they make are affected by changes in the 'emotive' characterizations of the economy in the media. Controlling for real changes in the macroeconomic environment, and tracking changes in the use of both

positive and negative ‘emotive terminology’ to track changes in media sentiment, we show that how the media’s portrays macroeconomic events significantly affects the business behaviour of managers. This effect is distinct from changes in the economic fundamentals, and shows that the media’s portrayal of economic events influences managerial perceptions, and indeed decisions.

## **5.2. Implications**

The implication of this study is that media sentiment affects business behaviour in an important way. By studying patenting – a decision that will affect the firm’s competitive position for the long term – we suggest that words matter. But we also suggest that managers may not be more rational than society at large. While developing new knowledge is thought to be an autonomous process, unaffected by economic circumstances, or fleeting reports in the media, the contribution of this paper is to paint a slightly different picture: patent applications cycle with cycles in sentiment. Manager are affected by the general mood as reflected in the media. While we find that managerial behaviour does change with change in the real economy (as measured by GDP) and does not significantly alter with changes in the economic outlook (as illustrated by the insignificance of the results on the objective economic words used in the media), we find that managerial decisions do change with changes in the perception of the economy, as measured in the significance of the emotive words. Managers seem to use the media not to keep abreast of what is going on in the economy globally. But also use it to interpret what is going on.

Interestingly, we see that managers respond to the types of emotive words differently, however. The managers propensity to patent increases more significantly in the face of good news, than it decreases in the face of bad news. This seems to suggest that managers have a positive bias, unlike the general populace, which is claimed to have a negative bias. This is in line with findings on entrepreneurial orientation. Given that large firms are much more likely to patent than smaller ones, it is perhaps disheartening to see how short the time lag is between media

reporting and patenting behavior. An erroneous decision by the manager of a large firm, following media reporting, will affect many more players than the erroneous decision of the owner of a start-up.

## **6. CONCLUSIONS**

This study indicates that much more research is needed to learn about management decision making. Obviously, given the idiosyncratic circumstances that management teams operate in, case study analysis, possibly longitudinal may have to be resorted to (Volberda et al. ). Recent studies have employed a content analysis or close reading of the linguistic content that management produces itself, for instance in annual reports, and this has been revealing too (Van Der Steen). Our study has developed and employed a comprehensive Content Analysis to understanding Managerial behaviour at a higher abstraction level. Content of the journal *The Economist* was studied to see if reporting in it affected management decision making. Obviously coarse, we are able to present some interesting findings, consistent with the theory (Starr, 2008; Doms & Morin, 2004; Sims, 2003; Carroll et al., 1994; Oh & Waldman, 1990; McCarthy & Dolfsma 2009), and suggestive of future research. The number of sources must be enlarged. While firms from all over the world patent (in the US), their managers read more media outlets than *The Economist*. Other parties offer interpretation of economic events beyond the media. More categories of words relevant for management decision making must be determined. For that to be possible, however, more theoretical insights are needed into how groups of highly intelligent and professional individuals, often supported by a trained staff, actually make decisions. Our study suggests a way to move beyond anecdotal evidence.

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