How does the real earnings management affect firms innovative? Evidence from US firms

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Abstract

Purpose – The purpose of this paper is to examine the effect of R&D intensity on the real earnings management index.

Design/methodology/approach – The authors proceed with dividing the full sample into two sub-samples, in accordance with the R&D associated intensity median. The final test sample proves to involve 73 firms along with 949 relating observations, while the control sample appears to enclose 65 firms and 845 relevant observations for the period 2000-2012.

Findings – The main finding of this study is the great influence of R&D intensity on the real earnings management index on the test sample. Accordingly, the proposed hypothesis stipulating that the innovative firms engage in upward real earnings management turns out to be strongly supported.

Research limitations/implications – The study was conducted using robust methods to test the effect of R&D intensity on the real earnings management index. The generalized least squares method was used to fit panel data and overcome heteroscedasticity and autocorrelation problems. The aim of the study was to prove the great effect of R&D intensity on the real earnings management index. As this study was based on data from American companies, the results cannot be generalized to all contexts.

Originality/value – This paper differs from previous work and tests the effect of innovative firms, the market-to-book ratio on real earnings management. The findings of this study will enrich the literature on real earnings management by suggesting R&D intensity that can significantly enhance the real earnings management index. Therefore, these findings will be helpful to investors, managers and regulators because they have implications for the interactive decision-making process.

Keywords Market value, Real earnings management, Innovative firms, Research and development intensity

Paper type Research paper

1. Introduction

Real earnings management procedure is a practice that involves an intricate manipulation of the company's cash flows. It is actually closely associated with the firm's three relevant cash flow models, namely, those emanating from investing, from financing or even operating activities. In fact, managers detain various techniques available at their disposal, whereby these flows can be managed. Among these techniques, it is worth citing the real or artificial sale approach fit for manipulating investment flows, the securitization associated mode, which is relevant to managing the financing-related cash flows/earnings and discretionary

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expenses reduction procedure, as applied to manipulate the entire business-related cash flows. In this respect, Roychowdhury (2006) considers discretionary spending as including the sum of advertising, research and development (R&D) and also, more generally, the entirety of recorded sales and administrative expenses (e.g. employee training, maintenance, etc.). He also states that executives may resort to reducing these discretionary spending in a bid to adjust reported profits toward an increasing trend and especially, when these expenses do not seem to generate immediate incomes. As these expenses are generally represented in the form of liquidity, their reduction might engender a reduction in cash outflows, and consequently an increase in abnormal operating cash flows regarding the income management period. Roychowdhury (2006) defines sales management as being attempts made by managers to temporarily increase sales, relevant to the current fiscal year, by offering price reductions or more flexible credit terms. He specifies that this technique consists of accelerating the timing of sales and/or generating unsustainable additional sales mainly through two action levers: handling discounts and granting more favorable credit terms. As far as the first lever is concerned, price reductions are limited over time as this sales management mode ceases as soon as the company decides to restore the old price policy. He also argues that these price reductions will generate abnormally high production costs relative to sales, which would, in turn, lead to lower corporate profit margins while raising the company's total results.

As for the second lever, i.e. providing customers with rather flexible credit terms, it serves to generate lower operating cash flows and higher production costs in relation to the sales level. Additionally, there is also the overproduction technique of producing greater surpluses of goods than the level deemed necessary to meet the expected demand (Roychowdhury, 2006). Such a technique is usually intended to display a lower cost of goods sold, and accordingly managing earnings in accordance with an upward-oriented trend. According to Roychowdhury (2006) and following the overproduction strategy, generally fixed costs turn out to be spread over greater amounts of produced units, thus reducing fixed unitary costs. He also underlines that the company will incur extra production and storage costs on surplus units recoverable during the same period through sales, which is likely to generate reduced operating cash flows.

Over the recent decades, however, a significant shift has been noticed in the nature of the investment, marked with an intangible asset rather than a tangible asset-oriented tendency. In a bid to adapt to such a trend and maintain its sustainability, several companies, especially those pertaining to the high-tech industry, are enticed to allocate remarkable resources to promote their intangible assets, mainly the R&D (Chandrasekaran and Linderman, 2015; Chen and Gavious, 2016). In this way, innovation turns out to stand as an important source of economic growth (Romer, 1990). As an outcome of the R&D-related activities, innovation appears to be a specific process that helps in kindling the persistent issue of information asymmetry between managers and shareholders (Aboody and Lev, 2000; Mülbert, 2009; Grougiou *et al.*, 2014). Thus, firms engaged in such an activity are likely to encounter some kind of external financial reporting difficulties. Moreover, and for the sake of reducing interest conflicts, as well as information and knowledge asymmetry issues, executives could appeal to undertaking certain choices relevant to investment and project financing decisions that sound conform with the shareholders' interests (Hall, 2002; Heal, 2008).

In this regard, executives may resort to using their discretion to report their privately detained information concerning the expected business R&D success and future market benefits (Cassiman and Veugelers, 2002; Dinh *et al.*, 2016). Therein, accounting as an information system is involved in consolidating such as information proceeding relevant to highlighting these specifically advantageous assets.

In this context, Adam *et al.* (2015) and Francis *et al.* (2016) document that leaders and directors, who are considered as an opportunist, may profit from the informational privilege over the other users to maximize their wealth and sustain their positions. Similarly, executives try to benefit from the information asymmetry status *vis-à-vis* the associated shareholders on managing the firm earnings either to the upward or downward. In this sense, they can interfere with the formulation of accounting results through implicating options pertaining to investment, financing and operating decisions. Additionally, managers may also appeal to developing R&D strategies as a means to render their substitution a highly expensive process and increase their power within the firm (Shleifer and Vishny, 1989; Hall *et al.*, 2015).

Nevertheless, a relevant question may arise concerning the convenience relevance of such accounting choices in a company that accords too much importance to innovative investment projects. Even though these may stand valuable, they may turn out to be risky and kindle conflicts among the company partners. However, such projects may be considered as a means whereby the business survival and persistence process can be sustained (OECD, 2005).

Furthermore, it is worth noting that executives can exert a noticeable impact on making the R&D investment projects stand as successful undertakings through their accounting choices implemented in this area. Indeed, this procedure comes to be dubbed as the concept of the real earnings management (REM). The earnings management pertaining studies stand as part of the research area dealing with the positive theory of accounting which aims to treat and investigate the accounting choices analyzed and observed within companies. Similarly, the manager can play a decisive and active role in shaping the company's innovation policy and strategy through accounting choices (Stata, 1989; Tushman *et al.*, 1997; Dooley and O'Sullivan, 2003). In this way, innovation represents a kind of commitment whereby the excessive managerial confidence is expected to stand as a valuable potential.

Owing to the fact that the innovative projects are usually characterized by increased uncertainty in the long temporal horizon, monetary flows might even generate greater risks which differ remarkably from the company systematic risk. This would certainly enhance and enrich REM actual status in my ways. Thus, managers in the innovative firms would find in these projects an additional means whereby they could increase their discretionary margins on REM. So, it would be very difficult for shareholders to detect the source behind such a handling of the accounting income. In this regard, the shareholder is faced with a moral risk and an unfavorable selection emanating from an unknown source. In short, the firms engaged in innovating practices seem very difficult to manage, owing mainly to the specificities characterizing their credits, especially with regard in accounting income-handling matters. Managers usually rely on real-life practices, which are in their entirety, closely related to the innovative activities. Hence, the question that is worth raising at this level is:

> Do firms engaged in innovative activities carry out the management of their earnings?

In fact, this work aimed at examining innovation activities influence on REM. The remainder of the paper is organized as follows. Section 2 is devoted to display the theoretical background and hypotheses development process. Section 3 exposes the applied research methodology. In Section 4, we present and discuss the major empirical results. Finally, Section 5 outlines the major concluding remarks.

2. Theoretical background and hypotheses development

2.1 Theoretical background

On defining earnings management, Healey and Wahlen (1999) state that: "earnings management occurs when managers use judgment in financial reporting and in structuring

transactions to alter financial reports to either mislead some stakeholders about the underlying economic performance of the company or to influence contractual outcomes that depend on reported accounting numbers". According to the agency theory, a special relationship proves to persist between the principal and the agent characterized by the prevalence of interest between both parties (Vafeas and Theodorou, 1998). A possible solution whereby these conflicts can be attenuated lies in the introduction of restrictive clauses, in the form of accounting ratios to limit the transfer and accumulation of wealth to the detriment of creditors. In fact, executives are most often enticed to increase earnings figures for the purpose of meeting these covenants (Labelle, 1990). Actually, the conflict gets intensified once directors appear to withhold the incentives to increase their paper wealth (e.g. through the maximization of bonuses) at the expense of the shareholders (Jensen and Meckling, 1976). This is most predominant in the USA and Canada. In this regard, Breton and Schatt (2003) claim that, for the sake of benefiting from bank financing at a reduced cost, managers may appeal to making up the accounting data. However, very few empirical studies appear to validate such a hypothesis. In conjunction with the agency theory, the economic theory of the political process puts forward that accounting procedures are but the result of political pressure emanating from different groups affected by the company's published annual reports. According to Jensen and Meckling (1976), it may be in the manager's interest to favor the relation of a satisfactory result to the detriment of a long-term investment, whose net present value is positive but whose economic advantages will not be visible the medium- to long-term account.

Most of the previous works, as appearing in the relevant literature, analyze the relevance of discretionary R&D capitalization in contrast with the signaling theory's background. It is worth highlighting that discretion implicated with R&D capitalization can be used by managers as a means for signaling their private information regarding the success of their R&D projects to the market. This has made Ahmed and Falk (2006) argue that "when a firm capitalizes expenditure and reports the amount as an asset in its financial statements, it signals good news". In turn, Matolcsy and Wyatt (2006) point out that, in the Australian contexts, where capitalization of intangibles has been routine, analysts expect firms with relatively certain intangibles to signal this information by capitalizing them (Dinh *et al.*, 2016).

Most of the similar studies indicate that managers would not want to invest in R&D-associated projects, for the major reason that the manager's remuneration seems to depend highly on the firm's performance, which is likely to negatively influence the success of R&D investment projects and bring a high-risk rate. Such a state might well culminate in a crisis of confidence and further intensifying managerial problems (Alchian and Demsetz, 1972). As for Baysinger and Hoskisson (1989), they state that shareholders usually tend to judge managerial performance by means of financial objectives, such as returns on investment. Because investment in R&D is most often long-term targeted, its implementation could result in reducing current net income. For this reason, managers are often more inclined to undertake short-term projects with a quick income. This is especially true with regard to former managers. It is also worth mentioning, in this respect, that young managers usually tend to take a greater risk than did former ones (Barker and Mueller, 2002). Fundamentally, managers' behavior and preference are mostly influenced and guided by incentive compensation, supervision and regulatory requirements prevailing in firms (Ang *et al.*, 2001; Dong and Gou, 2010).

Analyzing the effect of ownership marking differences, Munari *et al.* (2005) underline a clear distinction between state ownership, family business and financial institution. A significant proportion of institutional investors are negatively associated with the R&D

intensity marking companies with widely distributed share capital. Lhuillery (2006) uses information, which is collected from an independent rating agency, associated with corporate governance. In this respect, we can recall the positive accounting theory initiated by Watts and Zimmerman (1978 and 1986), which aims to predict and investigate accounting-related practices. This theory justifies managers' frequent appeal to earnings management practices by the remarkable persistence of agency relations (Jensen and Meckling, 1976), as well as the predominance of opportunistic character in the behavior of managers.

In fact, the contractual incentives appear to have a strong association with the agency relationship binding managers and stakeholders, i.e. the creditors and shareholders. Among the factors suggested to explain the earnings management in the context of the politico-contractual theory are the managers' wealth maximization, debt cost minimization and political cost minimization. However, most studies have been conducted to examine the REM impact from the exclusive perspective of debt cost minimization (Bartov, 1993; Roychowdhury, 2006; Kim *et al.*, 2010; Zamri *et al.*, 2013). From a pure agency theory viewpoint, it is suggested that one way whereby the agent's behavior could be monitored is the compensation contract that helps considerably in aligning both of the principal and agent interests (Jensen and Meckling, 1976).

2.2 Real earnings management and innovative activities

Some researchers tend to underline that R&D represents the major source of growth and competitiveness for a wide range of businesses and industries. Indeed, R&D capitalization sponsors suggest that managers can use their discretion to report their private information regarding the firm's R&D expected success, along with the market associated potential benefits (Abrahams and Sidhu, 1998; Oswald and Zarowin, 2007). Based on empirical studies relevant to both of the Australian and US contexts, some researchers tend to stress that R&D capitalization is intended to provide relevant information content to shareholders (Ahmed and Falk, 2006). In other contexts, empirical results have shown that the discretionary power associated with R&D capitalization can be used by opportunistic managers to increase their discretionary scopes (Cazavan-Jeny and Jeanjean, 2006; Markarian *et al.*, 2008). Indeed, the R&D activity is key to the company's competitiveness and continuous substance. Leaders lie at the core of this process. They bear significant risks in the event of failure of such an activity and have a positive influence on innovation policy (James, 2005).

Previous research has shown that the R&D cost capitalization is motivated by several factors (Oswald and Zarowin, 2007; Oswald, 2008), standing as fundamental explanatory elements for the basic differences lying between firms on accounting for R&D expenses. In this respect, Oswald (2008) has asserted that R&D capitalization decision depends highly on the firm-specific factors, such as firm size, result sign and leverage effect for companies in the UK's context. According to International Accounting Standard (IAS38), the capitalization of R&D expenditure is compulsory once the restrictive conditions appear to be satisfied. By imposing these restrictions, the International Accounting Standards Board (IASB) could help mitigate the discretion involved in R&D capitalization (Matolcsy and Wyatt, 2006; Markarian *et al.*, 2008), which should be associated with capturing variables of the different earnings management strategies (Degeorge *et al.*, 1999).

The objective of an agency contract lies in enticing to encourage managers to maximize the performance of their business, and subsequently the shareholders' value. To this end, the agency contract may include a bonus remuneration awarded to executives depending on company performance. In this context, Watts and Zimmerman (1986) indicate that the

accounting result is a performance indicator on the basis of which the bonus is computed. As such, the manager may be enticed to manage the result to the upward trend so as to increase the bonus he/she is likely to be awarded. In this way, earnings management can be recognized as an opportunistic act of the leader (Hettihewa and Wright, 2010), as his/her essential objective would consist in either maximizing his/her own remuneration or minimizing the costs likely to be incurred by the company. From another point of view, the accounting result is considered as an indicator or a proxy of the company's performance as intricately or cutely disseminated to the financial statements readers.

In terms of information asymmetry, the signal transmitter (the manager) transmits privately held information (the result) to a receiver (the investor) (Dumas, 2012). Therefore, the result is an indicator summarizing the company's performance over the last years. This performance can be compared with that of other companies or with the analyst's forecasts (Graham *et al.*, 2005). Beyond the past information, the result may also contain forward-looking information (Graham *et al.*, 2005). In this regard, Subramanyam (1996) reports that accruals may contain information on future cash flows. This makes it possible to determine part of the future result or earnings. Thus, it is possible for investors to take this signal into account to assess the company's potential performance, and thus its value.

As a consequence, and for agency problems to be restrained, the projects' quality to be highlighted and any innovation inherent constraints to be circumvented, we assume that managers in innovative companies are enhanced to manage the accounting results upwardly. According to Affes and Chouaibi (2007), the R&D projects specificities help reinforce managerial latitude and may prompt certain managers to attempt evading the discipline and control associated mechanisms.

The actual management of the business outcome or actual manipulation refers to actual decision-making as undertaken by companies to influence cash flow and profits statuses. Wherever the goal is discovered to be targeted to inflating earnings, managers may then proceed with reducing discretionary spending, such as that pertaining to R&D, sales, advertising, maintenance, etc. They may also offer price reductions or tax credit conditions, with the aim of promotion. These measures are taken to avoid losses, to meet/beat winning benchmarks (Baber *et al.*, 1991; Roychowdhury, 2006; Gunny, 2010; Cohen and Zarowin, 2010) or to avoid covenant debt breach (Bartov, 1993). Companies with a high institutional ownership level (Bushee, 1998) may have recourse to upcoming seasoned (Cohen and Zarowin, 2010) and over-valued (Badertscher, 2011) shares.

Within the same line of tough, one could argue that REM is based on the selection of the optimum decision-making moments/timing in the exploitation phases (sales, R&D expenditure, etc.), financing decisions, borrowing, etc.) and investment decisions (e.g. asset sales, etc.). It encompasses getting involved in deviant transactions throughout normal business operations such as excess production, excessive discounts or price reductions, along with abnormal cuts on R&D. Executives usually aim to achieve short-term objectives or minimum earnings levels. This evokes, of course, the notion of "result threshold". The major techniques applied to manipulate real activity, as cited by Roychowdhury (2006), are mainly sales management, overproduction and discretionary spending cuts. Accounting for R&D expenditure stands as a means of informing investors about the quality of innovative projects (Dumontier, 2003). R&D expenditures are accounted for in two ways. First, they can be listed as fixed assets. This accounting model as dubbed to R&D expenditure activation. An activated expenditure is an expenditure invested in projects regarding which the company is certain to generate future economic benefits. On the other hand, expenditures are expensed when they relate to projects for which future economic benefits are uncertain. As a matter of feat, the financial market has been documented to respond positively to the

activated R&D spending with respect to several earlier achieved results regarding several contexts, such as Australia (Chan *et al.*, 2007), the USA (Aboody and Lev, 1998) and the UK (Shah *et al.*, 2013). In France, however, investors do not often seem to account, or negatively react, to activated R&D expenditure (Cazavan-Jenyand Jeanjean, 2006; Cazavan-Jeny *et al.*, 2011).

More generally, the R&D activities horizon is usually a long-term one with a low success rate is often expected. However, once proved to be successful, R&D run projects will generally yield large profit outcomes, even though the risk remains very high (Dong and Gou, 2010). Thus, investment in R&D generates high returns coupled with high risk (Millet-Ryes, 2004). There are inevitably persistent conflicts prevailing between managers and investors regarding the R&D investment decisions, due mainly to the R&D different interests. Investors are, therefore, in a situation of information deficit insofar as it is difficult for them to appreciate the quality of the innovative projects. Such a situation appears to predominate mainly in the context of listed companies. Indeed, for unlisted companies, the shareholder and the manager are often embodied in the same person (OECD, 2005).

In the context of venture capital financing, contractual arrangements allow the financer to have access to the required information to assess the quality of innovative projects (Casamatta, 2003). However, information asymmetry can be extended to listed companies (Jensen and Meckling, 1976). On the one hand, majority shareholders and "big" investors enjoy the necessary means to learn about the innovative projects' quality with management teams (OECD, 2005). On the other hand, outsiders do not necessarily have the time and the means to bear the cost of obtaining such information. Consequently, some investors turn out to be unable to assess the quality of innovative projects (Dong and Gou, 2010).

So, it follows that the actual persistent management mode generates a direct impact on the company's cash flow status, helping in rendering it too difficult to detect. So, managing outcomes in turn of the actual pursued decisions is rather a limited process. Indeed, the manager is constrained with optimizing decisions by, for instance, take an asset sale date and transferring earnings results from one period to another, or similarly, adjusting production surpluses produced over a financial year by shifting the earnings result previously concluded to fit the following fiscal year's achieved earnings result. Other researchers show that REM can be achieved through sales of R&D expenditures (Bushee, 2001) or asset disposals of assets (Bartov *et al.*, 2002). Graham *et al.* (2005) provide evidence suggesting that managers usually tend to opt for the actual outcome management practice rather than applying the accrual management mode mainly because the actual manipulation activities undertaken may turn out to stand as too hard to distinguish from optimal economic decisions and are, therefore, extremely elusive to recognize. From a similar perspective, Roychowdhury (2006) has provided consistent evidence confirming that executives do often willingly manipulate the actual business concluded earnings with the aim of looking or discarding annual losses by offering discounts to temporarily increased sales, thus engaging in lower-sold goods' overproduction costs sold while aggressively reducing discretionary spending for the purpose of improving margins.

Based on the already stated highlighted ideas, it appears clear that firms engaged in continuous innovation processes seem to display a favorable environment that further promoted the REM-associated practices. Indeed, due to increased uncertainty predominantly characterizing the innovative projects, the long-time horizon cash flows may generate a high risk that differs in nature from the systematic risk facing the company, a situation that would enhance and consolidate all modes and forms of REM behavior and practices. In this way, managers of innovative firms find in these projects a favorable ground to kindle their discretionary margins in regards to REM. It would, therefore, sound

very difficult for shareholders to realize such indicate manipulations of accounting result. In this sense, the shareholder is simultaneously exposed to both a moral hazard and adverse selection related hazards that are difficult to detect due to elusive and intricate practices.

In short, innovative firms are difficult to manage because of the specificities of their assets, especially in a context dominated by manipulation of the accounting earnings resulting from the persistence of practices and maneuver that ax in their entirety, overwhelmingly linked to elusive nature of innovation prospects. On the basis of these developments, the research predominant hypothesis is:

H1 Innovative firms engage in upward trend manipulation of REM.

3.1 Research design

3.1.1 Sample selection and data sources. To extend the relevant research, this study aimed to empirically investigate the influence of innovation activities on the real earnings management index among a sample of 126 American S&P 500 index observed over the period ranging between 2000 and 2012.

In should be noted that the R&D intensity is measured in the form of the annual R&D expenditures to sales ratio. Thus, our R&D intensity measured was depicted by activity sector. In this study, two main firm groups are considered, namely, those characterized with low R&D intensity (below sample median of R&D intensity) and those displaying high R&D intensity (above median rate). To distinguish these two firm categories, the Brown's (1997) devised methodology was adopted. Indeed, Brown (1997) considers companies as marked with a high innovation potential if their R&D intensity proves to exceed the industry average for firms having reported positive R&D spending range.

Furthermore, the computation of the REM index entails the construction of two samples based on the companies' high or low innovative character. Thus, following the steps are undertaken by Djama *et al.* (2013); we proceed with dividing the entire sample into companies with highly innovative potential (sample test) and a control sample that encompassed companies with less intensive innovation potential (sample control). For that reason, we use the control sample assuming, as a normal status, the accounting behavior of low innovative companies, have no incentive to manage their accounting results.

Our initial sample consisted S&P 500 index-listed US firms, observed over the period ranging from 2000 through 2012, relying on both of the DataStream and edgarscan database extracted data, as they detain almost the entirety of documents filed by S&P 500 listed companies.

To facilitate the data retrieval task, DataStream offers the possibility to seek up to eight standard industrial codes (SIC) regarding each company, on the basis of the revenue level as drawn from each single industry. In other words, to retrieve the "SIC 1" on DataStream for a certain company, it proceeds with providing the industry code in conformity with the company's highest share of revenue sources. In a next step, information on the industry classification was extracted from DataStream concerning the entirety of companies making up in the whole Asset 4 ESG Universe and the American firms regarding which some necessary characteristics or information have been eliminated. A total of 138 companies were selected to form the entire study sample subject of observation over the 13-year review period. As illustrated in Table I, below, the final test sample encompassed 73 firms along with 949 related observations, while the control sample consisted of 65 firms and 845 relevant observations. Similarly, the distribution of the sample firms by activity sector along with the observations percentage are shown on in the same table.

Industry name SIC code*	Median RDI	Test sample	Control sample	Total sample
Textiles, printing and publishing	0.0134	7	9	16
Food	0.0234	5	5	10
Mining and construction	0.0902	11	9	20
Durable manufacturers	0.0422	16	14	30
Chemicals	0.0332	8	7	15
Pharmaceutical products	0.0911	6	4	10
Extractive industries	0.0287	13	12	25
Computers	0.0855	7	5	12
Total		73	65	138

*Notes: We define industries according to the following bracketed four-digit SIC codes: mining and construction (1000-1999); food (2000-2111); textiles, printing and publishing (2200-2796); chemicals (2800-2824, 2840-2899); pharmaceuticals (2830-2836); extractive industries (1300-1399, 2900-2999); durable manufacturers (3000-3999); computers (3570-3579, 3670-3679 and 7370-7379)

Table I.
Sample firms' industry distribution by R&D intensity industry-median

3.2 Variables' measurement

3.2.1 Dependent variable measurement: proxy for REM. As part of the present work, detection of the REM index (REMI) was based on the sum of abnormal operating cash flows (AbnCFO), abnormal production costs (AbnPR) and abnormal discretionary expenses (AbnDE).

In that respect, Cohen *et al.* (2008) and on founding works of Roychowdhury (2006) advanced study, we propose a REM-associated index equivalent to the sum of the three REM activity-related measures already calculated by: abnCFO + abnPR + abnDISDEP. Firms with a high REM index display a high level of overall REM.

In this context, we applied Roychowdhury's (2006) model to estimate the firms' REM level in the period ranging from 2000 to 2012. We started by estimating the normal level of cash flows as emanating from operations, production costs and discretionary expenditures by performing the following regression models relevant to each year per industry. Then, we proceed with deriving the regression residuals, in terms of these models, as proxies for abnormal cash flows as emanating from operations, abnormal production costs and abnormal discretionary expenditures inconsistency with the most prominently elaborated research works (Cohen *et al.*, 2008; Cohen and Zarowin, 2010). Most of the study sample subject firms engaging in REM seem to be characterized with low abnormal operation-stemming cash flows along with high abnormal production cost and low abnormal discretionary expenditures.

Cash flow from operations, high abnormal production cost and low abnormal discretionary expenditures.

- The operations' cash flow associated model is as follows:

$$\frac{CFO_{it}}{A_{i,t-1}} = k_1 \frac{1}{A_{i,t-1}} + k_2 \frac{SALE_{i,t}}{A_{i,t-1}} + k_3 \frac{\Delta SALE_{i,t}}{A_{i,t-1}} + \varepsilon_{it}$$

- The production costs' relevant model is:

$$\frac{PROD_{it}}{A_{i,t-1}} = k_1 \frac{1}{A_{i,t-1}} + k_2 \frac{SALE_{i,t}}{A_{i,t-1}} + k_3 \frac{\Delta SALE_{i,t}}{A_{i,t-1}} + k_4 \frac{\Delta SALE_{i,t-1}}{A_{i,t-1}} + \varepsilon_{it}$$

- As for the discretionary expenditures' relating model, it is constituted as follows:

$$\frac{DISX_{it}}{A_{i,t-1}} = k_1 \frac{1}{A_{i,t-1}} + k_2 \frac{SALE_{i,t-1}}{A_{i,t-1}} + \varepsilon_{it}$$

The variables' denotation, as appearing in these models, are the following: t stands for a period indicator, i denotes a firm indicator, CFO designates cash flow from operations, SALE represents the annual sale revenues and △SALE denotes the sales shift relevant to the amount of sales concluded in the previous period. PROD is the sum of the cost of goods sold and the change of inventory cost. DISX is discretionary expenses as measured by the sum of selling and administrative expenses. $A_{i,t-1}$ is total assets in the previous period. Otherwise, to capture a total level of earnings management as a comprehensive proxy, we multiply abnormal CFO and abnormal DISX by –1, and then construct REM by summing abnormal production, abnormal CFO and abnormal DISX.

3.2.2 The independent variable. The independent variable, as represented by R&D intensity, is measured under the form of R&D investments to the firm sales ratio, as expected from the DataStream database, as a proxy of the firm's innovation level (Lundstrom, 2002). This operationalization proves to testify the importance extent allotted to R&D in respect of the firm's overall strategy. This variable is lagged by every single year in the panel structure to allow for temporal manifestations of our advanced presumption effects.

As highlighted in the relevant literature, earnings can be manipulated by appealing either to accounting accruals or to real activities (Cohen and Zarowin, 2010). Accrual-based earnings management has no apparent direct effect on cash flows, while real activity-based earnings management proves to remarkably affect firm cash flows and accruals as well (Jeppson and Salerno, 2017). Considering the elusive nature of innovation and earnings management strategy, innovative firms are more likely to get involved in REM because they just require a low-level cash flow volatility. Inversely, however, R&D-promoting firms are more likely to engage in REM.

3.2.3 Control variables. For empirical analysis purposes, a number of control variables were also been included to ensure greater robustness and validity results. Thus, the control variables as implemented in this study were the firm size (SIZE), the market-to-book ratio (MTB), as well as firm leverage (LEV). In fact, several authors appear to document that these variables might influence the innovative firms' REM process.

3.2.4 Model specification. For an empirical assessment of our major advanced hypothesis, the envisaged relevant regression model is conceived to stand as follows:

$$\mathrm{REM}_{it} = \alpha_0 + \alpha_1 \mathrm{RDI}_{it} + \alpha_3 \mathrm{MTB}_{it} + \alpha_4 \mathrm{SIZE}_{it} + \alpha_5 \mathrm{LEV}_{it} + \varepsilon_{it}$$

Where:

REMI_{it}	= designates REMI of firm i in year t;
RDI_{it}	= represents research and development intensity of firm i in year t;
MTB_{it}	= denotes the market-to-book ratio of firm i in year t;
SIZE_{it}	= represents the log size of firm i of year t;
LEV_{it}	= is the firm's leverage ratio defined as the total debt to total assets ratio relevant year t;
α_0, α_1, α_2, α_3, α_4 and α_5	= are the parameters subject of estimation; and
ε_{it}	= indicates a random error.

Concerning the indices *i* and *t*, they correspond to the study associating firm and period components of the study.

The entirety of applied variables is depicted in Table II, below.

4. Result analysis and discussion

As a first step, we depicted the descriptive statistics relevant to the entirety of variables subject of study. Then, we highlight the main differences marking the variables distinguish the two sub-samples depending on the R&D intensity rate within the company: a high intensity (group 1) and a low intensity (group 2), in accordance with the median of R&D expenditures. In a subsequent step, the multivariate regression analysis was performed on panel data with the aim of empirically testing the above-stated hypothesis.

4.1 Descriptive statistics and mean difference tests

Table III, below, depicts a summary of the statistics of the variables used in our regression. Indeed, the descriptive analysis reveals that the mean (median) REMI is –0.002 (0.067) for the entire sample, 0.033 (0.145) for the test sample and about –0.052 (0.099) for the control sample.

Regarding the remaining control variables, the mean (median) associated with firm size is roughly equal to 8.301 (6.360), and the leverage ratio mean (median) is approximately equal to 0.244 (0.232). A rate of 2.350 (2.125) corresponds to the market-to-book ratio.

Variables	Abbreviation	Measurements	Authors
Real earnings management index	REMI	REMI, which equals the sum of the standardized measure of abnormal cash flows, abnormal over-production inventory and abnormal discretionary expenses	Cohen *et al.* (2008)
R&D intensity	RDI	R&D intensity = R&D/sales	Lundstrom (2002)
Market-to-book ratio	MTB	Market-to-book ratio as measured by dividing the market value of equity by equity book value	
Leverage	LEV	Total debt to total assets	Klein (2002)
Firm size	SIZE	Natural logarithm of total assets	Klockand *et al.* (2004)

Table II. Variables measurement summary

Variables	Statistics	Full sample	Test sample	Control sample
REMI	Mean	–0.002	0.033	–0.052
	Median	0.067	0.145	0.099
SIZE	Mean	8.301	12.245	7.784
	Median	6.360	11.412	7.125
LEV	Mean	0.244	0.230	0.257
	Median	0.232	0.205	0.252
MTB	Mean	2.350	2.750	2.149
	Median	2.125	2.545	2.021
RDI	Mean	0.075	0.087	0.059
	Median	0.065	0.054	0.052

Table III. Descriptive statistics

Leverage is defined in terms of debt as divided by total assets. The mean (median) leverages is equal to 0.244 (0.232). Concerning the variables' distribution, they are identically performed as those documented in the relevant literature (Jeppson and Salerno, 2017). Noteworthy, however, is that the mean size sounds to be large, suggesting that American firms are characterized with a high equity market value.

Table IV illustrates the variables' mean differences distinguishing the noticeably innovative firms and the low innovating one. We conducted a bivariate test to compare tests administered on independent samples to check whether any differences do persist as to the characteristics marking the REMI with respect to both of the high and low innovative firms. The average difference test is administered to both firm groups. The first step to take consists in dividing the sample in to firms groups in terms of the sample median. As highlighted through panels A and B of Table IV, a significant difference in REMI is noticeable between both firm groups at the threshold of 1 per cent. The results also indicate that firms with an R&D intensity exceeding the median value appear to be more remarkably implicated in the REMI (with an average recorded REMI of 0.0339, compared to 0.0255 for the other firms). Throughout observation of the average difference, it is deemed significant on noticing the mean difference implemented test (for unequal variance assumptions, *t*-student = 3.592, *p*-value = 0.000).

The same table also illustrates a significant difference in MTB between both firm groups, noted to persist at the threshold 5 per cent, indicating that firms with an R&D intensity exceeding the median value tend to score higher market-to-book ratio (with an average MTB range of 0.1453), much greater than (0.1223). Nevertheless, the average difference proves to be even more pronounced on examining the mean difference test (for unequal variance assumptions, *t*-student = 1.914, *p*-value = 0.042).

variables	Level of innovative firms	No. of observations (firms-years)	Average
Panel A: The explanatory variables' recorded mean with respect to R&D intensity			
REMI	More R&D intensive 1	949	–0.0339
	Less R&D intensive 0	845	–0.0255
MTB	More R&D intensive 1	949	0.1453
	Less R&D intensive 0	845	0.1223
LEV	More R&D intensive 1	949	0.2088
	Less R&D intensive 0	845	0.2502
SIZE	More R&D intensive 1	949	11.48
	Less R&D intensive 0	845	13.61

Panel B: The independent sample's relevant test

R&D intensity	Hypothesis	Test of Levene on the equality of the variances		*T*-test event to average means equality		
		F	Significance	*t*	Significance	Average difference
REMI	The equal variance assumption	23.286	0.000	1.872	0.084	6.49
	The unequal-variance assumption			3.592	0.000	6.49
MTB	The equal variance assumption	8.550	0.012	0.811	0.419	5.750
	The unequal-variance assumption			1.914	0.042	5.750
LEV	The equal variance assumption	2.537	0.057	1.982	0.058	9.202
	The unequal-variance assumption			1.860	0.079	9.202

Table IV.
Variables' average differences

Regarding the other variables, the statistical tests prove to reveal well the persistence of a significant difference marking both firm groups subject to the sample study.

4.2 Multivariate analysis

The multiple regression models' estimation entails an absolute absence of any multicollinearity problem between the independent variables. The pairwise correlation matrix, as figuring on Table V, indicates that no correlation between the independent and control variables exceeding the value of 0.5 seems to persist. Besides, the variance inflation factors (VIFs) do not appear to exceed a limit of 3. Consequently, one could deduce the absence of bivariate multicollinearity.

Table VI, below, reports the regression analysis results associated with our hypothesis, which tests the relationship between R&D intensity and firm REM activities. As part of this study, a multivariate regression analysis on panel data is used to empirically test this hypothesis. Prior to proceeding with the estimation models, a number of test procedures were implemented. In addition, the sample jointly combines both individual and time-series data. This seems likely to generate a risk of homogeneity on the sample, which might lead to inconvenient estimators on using the MCO regression. Regarding the multivariate analysis, two econometric tests were performed on the model, namely, the homogeneity test and the Hausman test. The former is intended to test the presence of any individual effects, culminating in an "F-Statistic". Thus, once the "*p*-value" proves to be lower than the significance level, an individual effect would then persist. Indeed, the *F*-statistics-associated probability assumption (Table VI) allows us to reject the non-relevance hypothesis of individual effects regarding our applied data, at the 1 per cent significance level. This result does actually confirm the presence of individual effects, testifying the sample's heterogeneous character (full sample, test sample and control sample). Subsequently, a Hausman test was also performed to specify whether a random effect model or rather a fixed effect one needs to be applied. The value provided following administration of the chi-square test (the chi-square *p*-values reached in regard of the full sample, test sample and control sample are, respectively, 0.01, 0.5 and 0.07), allowing us to accept the implementation of the MCO estimator regarding the fixed-effects model while rejecting the MCG estimator as provided by the random-effect model. In a second stage, a panel-level heteroscedasticity test needed be performed through the application of the Breusch–Pagan test, as shown in Table VI. The Breusch–Pagan test, as performed on the study model, detected no heteroscedasticity problem with respect to the three.

The adjusted R^2 relevant to the full sample is of a rate of 9 per cent, which is consistent with the previously elaborated works as documented in the relevant literature, dealing with the R&D influence on earnings management (Shust, 2015; Jeppson and Salerno, 2017). Concerning both the test and control samples, the adjusted R^2 appears to be remarkably different. Indeed, the 8 per cent rate relevant to the REMI variation has its explanation in the

Table V. The Pearson correlations matrix as resultant from the independent and control variables along with the VIF coefficients

	RDI	MTB	LEV	SIZE	VIF
RDI	1				1.20
MTB	0.171[a]	1			1.45
LEV	–0.124[a]	0.235[a]	1		1.52
SIZE	0.452[a]	0.125	–0.156	1	2.50

Notes: All variables are as defined in Table I; [a]Represents significance at the 0.01 level

R&D

Table VI.
Multi-variable estimation regression results

Variables	$REM_{it} = \alpha_0 + \alpha_1 IRD_{it} + \alpha_3 MTB_{it} + \alpha_4 SIZE_{it} + \alpha_5 LEV_{it} + \varepsilon_{it}$(I) Full sample		Test sample		Control sample	
	Coefficient	*T*-student	Coefficient	*T*-student	Coefficient	*T*-student
RDI	0.125	1.45	0.144	2.99***	–0.064	2.07**
MTB	0.513	2.46*	0.008	2.13**	0.051	1.78***
SIZE	0.014	1.12	0.125	1.45	0.011	1.34
LEV	0.164	1.78***	0.020	1.96**	0.037	2.42
Firm fixed effects	Included	Included	Included	Included	Included	Included
Year fixed effects	Included	Included	Included	Included	Included	Included
Number of observations	1,794		949		845	
F	97.125		45.147		35.02	
Prob > F	0.000		0.000		0.000	
Homogeneity test	F = 6.458; Prob > F = 0.000		F = 3.325; Prob > F = 0.001		F = 2.562Prob> F = 0.03	
Hausman test	χ^2 = 22.56; Prob > χ^2 = 0.01		χ^2 = 19.72; Prob **>** χ^2 = 0.05		χ^2 = 18.47; prob > χ^2 = 0.07	
Heteroscedasticity test	χ^2 = 1.56; prob > χ^2 = 0.15		χ^2 = 1.26; prob > χ^2 = 0.18		χ^2 = 1.36;prob > χ^2 = 0.16	
R^2	0.11		0.09		0.08	
Adjusted R^2	0.09		0.08		0.07	

Notes: Where REM stands for the aggregated real earnings management measure through incorporation of abnormal production, abnormal CFO and abnormal discretionary expenses. SIZE designates the total assets' natural log. LEV denotes total debt as divided by total assets. RDI represents the R&D-associated expenses divided by total sales. Model (I) helps in investigating the relationship binding REMI and R&D intensity in the presence of the three other control variables: MTB, SIZE and LEV. The Asterisks ***, ** and * appearing close to a coefficient indicate the significance levels of 1%, 5% and 10%, respectively

intensity along with other control variables related to the innovative firms' case. As for the control sample, the associated adjusted R^2 appears to be equal to only a 7 per cent rate. The R&D intensity's effect on REM is tested separately for each single sample. Table VI reports the regression estimation results. Actually, the coefficient is positive (coef. = 0.144) and significant at the 1 per cent level for the test sample, but negative (coef = –0.123) and significant at 5 per cent level concerning the control sample, while proving non-significant with respect to the entire sample (t-student = 1.230, p-value = 0.154). Accordingly, our hypothesis stipulating that innovative firms engage in upward REM is strongly supported. This finding is consistent with those found by Wang and D'Souza (2006), Dumas (2012), as well as Jeppson and Salerno (2017). Thus, it follows that throughout the start-up phase attached to the innovative investment project, information asymmetries between managers and shareholders along with the investors' perceived risk appear to be highly significant. This situation seems to lead managers to manage the accounting results upwardly in a bid to signal and highlight a satisfactorily good-quality-associated innovative projects, i.e. the higher the R&D expenditure, the stronger the incentives for the REM will be. In sum, it is clear that most companies engaged in an innovative initiative and activities have recourse to an upward management of the accounting results.

Furthermore, the results pertaining to some of the subsample firms' pertinent control variables seem to involve a higher R&D intensity ratio (test sample), in a harmonious conformity with the whole firm-year sample associated results (control sample). Hence, a positive association proves to persist between the leverage ratio and REM in regard of the three samples, at the 0.01 level (the test sample, β = 0.020, t-student = 1.96 and p-value = 0.032; the control sample, β = 0.037, t-student = 2.42, p-value = 0.012 and total sample, β = 0.037, t-student = 2.52, p-value = 0.012). This finding corroborates the argument advancing that most companies witnessing a high leverage state tend to resort to REM-associated practices to avoid the violation of debt covenants.

As for the firm size variable, it proves to positively and non-significantly influence the REMI with regard to the three samples. This finding reveals that this variable turns out to have no explanatory power on our model. Based on Table VI, we can conclude that the MTB variables seem to have a positive and significant level of less than 0.05 for the sample test, while to bear no significance of the total and control samples. As for the market-to-book ratio, it has a noticeable significance in explaining the innovative firm's REM. This finding implies that this variable proves to have a significantly greater influence on the REM process with respect to the high-tech characterized companies rather than the low-tech ones.

5. Conclusion

This work aimed to investigate the impact of innovation activities on REM. The underlying motivation lies in the observation that several empirical studies appear to demonstrate a relationship between REM and the pertinent characteristics of innovative firms. However, little interest has been paid to investigate such a noticeable bi-directional relationship with respect to the influential US innovative firm's case/context. In a bid to fill such a prominent gap in the relevant literature, we carried out this study to investigate the relationship between innovation and REM-associated procedures, as examined through a sample of 73 listed US firms during the period between 2000 and 2012.

The study findings prove to reveal critical information regarding the innovative firm's management strategy and the REMs association concerning the US context. Indeed, innovative firms that usually appeal to manipulated earnings most often tend to intensify their involvement in R&D activities. In this regard, a substantial effort has been made to collect the US firms which are highly or weakly intensive in R&D. Our

basic idea consists in studying the REM procedures as implemented by such innovative firms. For this reason, several statistical tests were applied to evaluate the practiced model. The model-associated results reveal that there is a persistence of a predominant market-to-book ratio that tends to play a critical role in determining the REM optimal/actual level. Finally, firm size along with the leverage seems to have no significant effect on the earnings management index.

As a matter of fact, this study has some limitations, due mainly to data constraints. Second, no robustness tests have so far been implemented to confirm advanced hypotheses in an absolutely effective way. Moreover, only innovation-related output has been adopted by the innovative firm actual status. However, such a limitation should, by no means, significantly influence our results findings. Thus, a future work will investigate the relationship binding the CEO's personal characteristics (age, overconfidence, etc.) and earnings management with regard to innovative firms using more detailed data should that information turn to be available.

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