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Financial Reporting Quality, Information Asymmetry and Investment Efficiency

Calidad de la Información Financiera, Asimetría Informativa y Eficiencia de la Inversión

Dª. Mª Fuensanta Cutillas Gomariz

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CALIDAD DE LA INFORMACIÓN FINANCIERA, ASIMETRÍA INFORMATIVA Y EFICIENCIA DE LA INVERSIÓN

TESIS DOCTORAL

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SUMMARY IN SPANISH (RESUMEN EN ESPAÑOL)

En los últimos años, las consecuencias económicas de la información financiera han sido una de las mayores preocupaciones del mundo económico y de la investigación en Economía Financiera. Una vez estudiados los determinantes que influyen en la elaboración de información por parte de las empresas, el tema más relevante, tanto desde el punto de vista académico como por sus implicaciones en la toma de decisiones económicas, es el papel que desempeña la calidad de la información financiera (*financial reporting quality,* FRQ) en la asignación de recursos, en el acceso a la financiación o en la reacción de los mercados. Además, desde 2005 y como consecuencia de la obligatoriedad de la aplicación de las Normas Internacionales de Información Financiera (NIIF/IFRS) para elaborar estados consolidados por parte de las empresas cotizadas en la Unión Europea, se ha desarrollado una corriente de investigación donde se pretende estudiar el efecto de la nueva normativa en la FRQ, así como sus implicaciones económicas.

El propósito de esta tesis doctoral es contribuir a esta área de investigación con cuatro capítulos en los que se analiza el papel de la calidad de la información financiera sobre los siguientes aspectos: la primera parte, que engloba los Capítulos 1 y 2, estudia los efectos económicos de la FRQ en la asignación de recursos y en el ambiente informativo del mercado. El segundo bloque, que incluye los Capítulos 3 y 4, aborda las consecuencias de la adopción de las NIIF. En particular, el Capítulo 3 analiza si el cambio de normativa nacional a normas internacionales (NIIF) ha tenido consecuencias en el mercado de capitales, en concreto en los niveles de información asimétrica. Y finalmente, el Capítulo 4 examina si el cambio de la estructura en la cuenta de pérdidas y ganancias consecuencia de la adopción de las NIIF, que ha provocado modificaciones en las definiciones de las distintas líneas de resultados, ha tenido consecuencias en la calidad del resultado del ejercicio y sus componentes. Los diferentes estudios que conforman esta tesis han sido llevados a cabo utilizando muestras de empresas cotizadas en el mercado continuo español.

El primer capítulo de esta tesis doctoral versa sobre el efecto de la FRQ en la eficiencia de la inversión, con el objetivo de determinar si la FRQ permite mitigar los problemas de sobreinversión e infrainversión. Este capítulo, a diferencia de trabajos anteriores de eficiencia de la inversión, también analiza el papel del plazo de la deuda en la asignación de recursos. De este modo, contribuye a la literatura mostrando los efectos de la FRQ y del plazo de la deuda en la asignación de recursos en un contexto donde la FRQ es

inferior a la de los países anglosajones y donde el plazo de la deuda está orientado al corto plazo. Estudios previos han desarrollado modelos teóricos que predicen una asociación entre la FRQ, como medida del riesgo de información, y el coste de capital, y a partir de ellos ha habido un incremento en la investigación empírica que ha examinado los efectos económicos de la FRQ sobre las condiciones financieras, tales como el coste de capital y las condiciones de los préstamos: coste de la deuda, plazo de la deuda y garantías ofrecidas. Asimismo, la reducción de asimetría informativa motivada por la FRQ, permitiendo un mejor acceso a la financiación y una mejor monitorización de los directivos, ha llevado a estudios previos a concluir que una mayor FRQ permite mejorar la eficiencia de la inversión. Igualmente, una extensa literatura propone que una mayor deuda a corto plazo minimiza los problemas asociados a las asimetrías informativas, debido a que la renovación continua de deudas permite a las empresas con mejor calidad crediticia conseguir mejores condiciones económicas y a los prestamistas tener un mayor control sobre la actividad de la gerencia.

Los resultados obtenidos en este primer capítulo ponen de manifiesto que una mayor FRQ y un menor plazo de la deuda permiten mejorar la eficiencia de la inversión. Concretamente, si distinguimos entre problemas de sobreinversión e infrainversión, la FRQ ayuda a reducir la sobreinversión, mientras que un mayor uso de deuda a corto plazo ayuda a controlar los problemas de sobreinversión e infrainversión. Además, como extensión al primer análisis, en este capítulo se investiga si la FRQ y el plazo de la deuda son mecanismos sustitutivos o complementarios en la mejora de la eficiencia de la inversión. Los resultados muestran una relación de sustitución entre ambos, es decir, en aquellas empresas con menor deuda a corto plazo, el efecto de la FRQ en la eficiencia de la inversión es mayor que en las empresas con mayor deuda a corto plazo. Sin embargo, en las empresas con menor FRQ, el plazo de la deuda es el mecanismo más importante para controlar las ineficiencias de inversión.

El segundo capítulo se centra en el impacto de la FRQ (medida a través de manipulación real y contable) sobre la información asimétrica. Aunque la mayoría de estudios previos sobre manipulación del beneficio se han centrado en diversas medidas de decisiones puramente contables (ajustes de devengos discrecionales y calidad de los devengos), un enfoque más reciente es el de la manipulación de actividades reales para alcanzar un beneficio objetivo, a partir de los modelos propuestos por Roychowdhury

(2006). En concreto, se consideran como principales actividades de manipulación real: la manipulación de las ventas a través de mayores descuentos de precios o mayores periodos de cobro, con el objetivo de incrementar temporalmente las ventas, y cuya consecuencia es la reducción de los niveles de flujos de caja asociados a las ventas; la manipulación de costes de producción, a través de sobreproducción que permita reducir el coste unitario de producción; y la manipulación de gastos discrecionales.

El presente trabajo aporta a la literatura evidencia empírica sobre la relación entre manipulación real e información asimétrica en el mercado de capitales, extendiendo las consecuencias de la manipulación de beneficios sobre el mercado. Existe una escasa evidencia empírica en esta línea de investigación y la mayoría de estudios anteriores se han centrado en el mercado estadounidense. Asimismo, es el primero que tiene en consideración las distintas interpretaciones de las medidas empíricas de manipulación de actividades reales. Además, a diferencia de otros estudios, este trabajo utiliza medidas de selección adversa basadas en la literatura de microestructura, complementando la investigación que recurre a medidas indirectas de información asimétrica, tales como el coste de capital, las oportunidades de crecimiento, o el seguimiento y la precisión de los pronósticos de analistas.

Los resultados muestran que en aquellas empresas con incentivos a la manipulación de beneficios (alcanzar la cifra de beneficio del año anterior), las estrategias de incrementar el resultado a través de actividades reales están asociadas con mayor información asimétrica. Sin embargo, en aquellas empresas sin incentivos a la manipulación, las desviaciones de las actividades reales se encuentran asociadas con una menor información asimétrica. Estos resultados sugieren que los denominados inversores informados generan información cuando las empresas tienen incentivos a manipular beneficios a través de las actividades reales. No obstante, cuando las empresas no tienen incentivos a la manipulación de beneficios, las desviaciones de las actividades reales pueden estar asociadas a circunstancias de la empresa distintas de la gestión del resultado. De ahí que la generación de información privada por parte de los inversores no sea tan atractiva.

La segunda parte de esta tesis comprende dos estudios centrados en las Normas Internacionales de Información Financiera. El cambio normativo aplicado con carácter obligatorio desde 2005 en los estados consolidados de las empresas europeas, potenció una

línea de investigación basada en las consecuencias e implicaciones de las NIIF. Por tanto, el objetivo de los siguientes capítulos es avanzar y estudiar las posibles implicaciones de las NIIF en la interpretación de la información en el mercado y en la utilidad para la toma de decisiones del resultado del ejercicio y sus componentes. En concreto, el tercer capítulo analiza el efecto de las NIIF sobre la información asimétrica. Este trabajo aporta evidencia sobre la repercusión de las NIIF en los niveles de información entre los distintos usuarios del mercado en un contexto donde existen grandes diferencias entre las NIIF y la anterior normativa contable y donde la aplicación de la normativa legal (*enforcement*) es débil. Estudios previos centrados en analizar la información tras la adopción de las NIIF han utilizado medidas indirectas de información asimétrica, tales como la precisión de los pronósticos de los analistas, medidas de liquidez y de coste de capital. Sin embargo, en este trabajo se utilizan medidas de selección adversa basadas en la literatura de microestructura.

Los resultados obtenidos evidencian una reducción de la información asimétrica entre los inversores tras la adopción de la NIIF. Además, dicho efecto es mayor en las empresas con mayor concentración de la propiedad, entidades caracterizadas por una menor revelación de información. Por tanto, nuestros resultados sugieren que los requerimientos sobre revelación y transparencia que conlleva la adopción de las NIIF han reducido las diferencias de información entre los distintos usuarios de la información.

Por último, el cuarto capítulo se centra en analizar si el cambio en la estructura de la cuenta de pérdidas y ganancias tras la adopción de las NIIF, que ha conllevado una importante reorganización de los resultados no recurrentes entre las distintas líneas de resultado, ha afectado a su utilidad. En particular, se examina si las NIIF han afectado a la relevancia valorativa y a la persistencia del resultado del ejercicio. Para los demás niveles de resultado (resultado de explotación, resultado financiero, resultado extraordinario o de operaciones interrumpidas y otras partidas consolidadas e impuestos), además de su relevancia valorativa y persistencia, también se analiza su capacidad predictiva sobre el resultado del ejercicio. Todo ello, en un contexto donde la calidad del beneficio es menor que en los países anglosajones y donde estudios previos han confirmado el uso de partidas extraordinarias para la manipulación del beneficio. Por tanto, el objetivo de este capítulo es comparar la utilidad de los distintos tipos de resultados antes y después de la adopción de las NIIF. Este estudio viene asimismo motivado por la literatura que estudia el comportamiento de las partidas no recurrentes, ya que se ha demostrado que dichos ítems

pueden ser utilizados para conseguir objetivos de beneficios, como por ejemplo evitar resultados negativos o mantener un resultado estable.

Los resultados obtenidos ponen de manifiesto un incremento en la relevancia valorativa del resultado del ejercicio, mientras que no existen cambios en su persistencia. Respecto a las distintas líneas de beneficios, se observa que los resultados no recurrentes presentaban relevancia valorativa antes de la adopción de IFRS, mientras que el resultado de explotación muestra una mayor relevancia valorativa tras IFRS, lo que sugiere que el incremento en la relevancia valorativa del resultado de explotación podría ser explicado por la inclusión en el mismo, tras la adopción de IFRS, de parte de estos resultados no recurrentes. Además, la antigua sección de resultados extraordinarios era persistente antes de las NIIF, mientras que el resultado de operaciones discontinuas neto de impuestos no muestra relevancia valorativa ni persistencia. En los atributos del resultado financiero no se encuentran cambios significativos, pero sí un incremento en la relevancia valorativa del impuesto de beneficios y partidas consolidadas tras la adopción de IFRS. En definitiva, los resultados muestran que la adopción de las NIIF ha supuesto que las cifras principales dentro de la cuenta de pérdidas y ganancias (resultado de explotación y del ejercicio) sean cifras más relevantes para la toma de decisiones.

La principal implicación para directivos, inversores, académicos, reguladores y otros usuarios de la información financiera de esta tesis doctoral es que demuestra la importancia de la calidad de la información financiera como mecanismo para reducir asimetrías informativas incluso en un país de normativa continental. Estudios previos han puesto de manifiesto la existencia de una menor calidad de las cifras contables y un *enforcement* más débil en países como España respecto a los países anglosajones, entorno en el que se han centrado la mayoría de trabajos para desarrollar las investigaciones sobre FRQ. Sin embargo, nuestros resultados sugieren que incluso en este contexto una mayor FRQ es relevante para la toma de decisiones en la empresa y en el mercado.

A partir de lo analizado en esta tesis doctoral, investigaciones futuras podrían centrarse en examinar las implicaciones de las NIIF en la inversión. Se podría analizar la influencia de las nuevas cifras de beneficios en la asignación de recursos, siendo interesante constatar si el cambio en los atributos de los beneficios que ha conllevado la adopción de las NIIF ha afectado a las decisiones de inversión. Además, es preciso indagar

sobre las consecuencias económicas de la manipulación de beneficios a través de las actividades reales. Dado que dicha manipulación es menos visible que la contable y puesto que la investigación aún es escasa, todavía se desconocen la mayoría de sus implicaciones.

INTRODUCTION

In recent years there has been concern in the academic world about the implications of financial reporting quality (hereinafter FRQ), which has led to extensive research in this field. Financial information is a key issue for monitoring managerial activities, enhancing resource allocation and ensuring the efficiency of contracts. Thus, the role of FRQ in investment decisions, in the access to financial funds, and in capital markets has been regarded as one of the most relevant issues in the accounting area, both from an academic and a practitioner viewpoint.

Additionally, since the adoption of International Financial Reporting Standards (IFRS), which has heralded significant changes in the financial statements in many countries, a growing body of literature on the economic consequences of IFRS on capital markets has generated relevant, but contradictory, insights. Based on this, given the importance of FRQ in corporate decisions and since some of its implications are still unclear, the objective of this doctoral thesis is to contribute to this field of research. To this end, this dissertation is structured in two parts. The first one, which comprises Chapters 1 and 2, analyzes the effects of FRQ on resource allocation and the information environment in the market. In particular, Chapter 1 studies the effect of FRQ on investment efficiency in order to determine whether FRQ enables overinvestment and underinvestment problems to be mitigated. Chapter 2 focuses on the impact of real earnings management on asymmetric information between financial market participants. The second part, Chapters 3 and 4, contributes to the debate surrounding the adoption of IFRS. Specifically, Chapter 3 examines whether the switch from Spanish Accounting Standards (SAS) to International Standards (IFRS), which took place in 2005, has had consequences on the extent of asymmetric information risk in the stock market. Finally, Chapter 4 investigates whether the change in the income statement presentation has affected the attributes of the different line items in the income statement. The different studies have been conducted using samples of listed firms on the Spanish continuous market.

The agency theory predicts that, in a context of information asymmetry, FRQ and disclosure policies are the main instruments that firms can use to reduce moral hazard and adverse selection. Previous empirical research has examined the economic effects of FRQ on financing conditions, such as the cost of equity and debt, debt maturity and debt covenants, and on resource allocation, specifically on investment efficiency. This research has found that FRQ improves investment efficiency, because it reduces information

asymmetry between the firm and external suppliers of capital, and helps to monitor managerial investment decisions. In this sense, Chapter 1 examines the effect of FRQ and debt maturity on investment efficiency in a context where FRQ is lower than in Anglo-Saxon countries and where short term debt is the main source of financing. This chapter contributes to the literature showing that FRQ and shorter maturities reduce overinvestment, while underinvestment is controlled basically through short-term debt.

Firms can manage earnings through two types of activities: accrual earnings management (AEM) and real earnings management (REM). To the extent that the different earnings management techniques are ways to alter reported earnings, rendering them less informative, it is assumed that these managerial decisions reduce FRQ. Although most previous studies in this field are focused on accrual-based earnings management, a recent and growing field of research focuses on earnings management throughout real activities, such as price discounts or lenient credit terms to temporarily boost sales revenues, overproduction to report lower cost of goods sold or reduction of discretionary expenses. As it is more difficult for investors, board, auditors, and regulators to monitor REM activities than it is for them to monitor AEM, and their implications for the firm's future performance are not yet clear, it is interesting to delve deeper into the understanding of its economic consequences. In this line, Chapter 2 analyzes the relation between REM and information asymmetry in the stock market. This study contributes to the informational implications of REM strategies, since the reported findings show that REM techniques increase the level of information asymmetry between market participants for those firms with strong incentives to engage in earnings management.

With the economic internationalization and the globalization of markets, the idea of harmonization and convergence of accounting standards to provide more comparable and transparent information that can help investors in their resource allocation decisions has become widespread. There are numerous studies that investigate the effects of IFRS adoption on accounting quality and its capital market consequences, but their findings are contradictory. The second part of this thesis addresses the impact of IFRS on information asymmetry and earnings quality. Chapter 3 analyzes the association between the mandatory adoption of IFRS and the extent of information asymmetry by using market microstructure measures as adverse selection proxies, something which has not been done in previous similar studies. The main contribution of this chapter is to demonstrate that

disclosure and transparency requirements imposed by IFRS adoption have improved the information environment, which has been reflected in a significant reduction in the differential information between traders and in an improvement in stock liquidity.

Chapter 4 deals with the effect of IFRS on earnings quality. In particular, this chapter examines the value relevance and persistence of the bottom line earnings pre- and post-IFRS in order to assess the impact of IFRS on financial information. In addition, IFRS has involved some changes in the structure of the profit and loss statement: several non-recurring items, considered as extraordinary items according to previous domestic standards, are reclassified under IFRS into continuing operations as operating and financial income; in addition, there is a new section for discontinued operations. Motivated by this change in the location of non-recurring items in the income statement, this chapter also analyzes whether IFRS adoption has influenced the value relevance, persistence, and predictive value of the main income measures. The reported findings contribute to the ongoing debate about the benefits of IFRS showing an increase in the value relevance of net income and non-significant changes in its persistence. It is also found that non-recurring items were value relevant in the pre-adoption period and that the operating income is more value relevant after IFRS adoption.

Finally, a summary of the main conclusions obtained from this thesis and potential future research lines are presented.

PART I

CHAPTER 1

FINANCIAL REPORTING QUALITY, DEBT MATURITY AND INVESTMENT EFFICIENCY

1.1. INTRODUCTION

A large body of literature shows that firms can reduce information asymmetries by enhancing financial reporting quality (Bushman and Smith, 2001; Healy and Palepu, 2001). One line of research (Biddle and Hilary, 2006; Biddle, Hilary and Verdi, 2009; Chen, Hope, Li and Wang, 2011; McNichols and Stubben, 2008) suggests that reducing adverse selection and moral hazard and allowing managers to identify better investment opportunities, higher financial reporting quality increases investment efficiency. Several papers also propose that shorter maturities of debt can be used to mitigate information asymmetry problems (Berger and Udell, 1998; Flannery, 1986; Ortiz-Molina and Penas, 2008). From the perspective of the borrower, because firms signal that they are good firms and may obtain better price conditions in the subsequent renewals of the loans; and from the perspective of the lender, because shorter maturities enable a better control and monitoring of managers (Diamond 1991 and 1993).

Theoretical models (Childs, Mauer and Ott, 2005; Myers, 1977) predict that the higher flexibility of shorter maturities is useful in improving investment inefficiencies, although there is limited evidence for this, especially in relation to overinvestment. Based on these premises, the main purpose of this paper is to combine these two mechanisms and analyze the effect of financial reporting quality (FRQ) and debt maturity on investment efficiency in the context of a code law country where FRQ is lower than in Anglo-Saxon countries (Bhattacharya, Daouk and Welker, 2003; Leuz, Nanda and Wysocki, 2003) and where short-term debt is the major source of external finance. Since Chen *et al.* (2011) examine "boundary conditions" for the effect of FRQ on investment efficiency, and find that FRQ influences investment efficiency in private firms in emerging countries, we also expect to find this association in a sample of listed firms in Spain, where FRQ is expected to be higher. In relation to the role of debt maturity in investment efficiency, to the best of our knowledge this is the first study that empirically examines its effect on both underinvestment and overinvestment. In this sense, Spain is an interesting setting for our research because, due to the less developed capital market than in US and UK and the higher information asymmetry, private debt is the main source of finance for Spanish firms, where banks may play a role in alleviating capital market imperfections (García-Marco and Ocaña, 1999) and the monitoring role of short-term debt is higher (Barclay and Smith, 1995). Actually, the debt maturity structure of Spanish companies presents short-

term orientation. For instance, whereas in our sample the average value of short-term debt to total liabilities is greater than 60%, in US companies this percentage is around 22% (Datta, Iskandar-Datta and Raman, 2005). Since these shorter maturities in Spain play, from the lender's perspective, a role as a control device of management performance, and from the borrower's side they facilitate undertaking positive net present value projects (Myers, 1977), we also expect a positive association between shorter maturities and investment efficiency.

As an extension of our research, we examine how debt maturity moderates the effect of FRQ on investment efficiency, i.e., whether the effect of FRQ on investment efficiency is increasing or decreasing with the level of debt maturity. We could expect both effects: on the one hand, the reduction of information asymmetry and more reliable accounting numbers, due to higher FRQ, could add to better monitoring due to short-term debt and, as a consequence, the effect of FRQ on investment efficiency should be higher for firms with higher FRQ and shorter maturities. On the other hand, in firms with higher FRQ, lenders will have less need for shorter maturities to monitor managers' behavior (Bharath, Sunder and Sunder, 2008; García-Teruel, Martínez-Solano and Sánchez-Ballesta, 2010), so under this assumption we would expect the importance of FRQ to reduce information asymmetries will increase with longer maturities and will decrease with shorter maturities.

In line with previous studies, we consider different proxies for FRQ that focus on the precision of accounting information: (1) the model of discretionary revenues developed by McNichols and Stubben (2008); (2) the model of discretionary accruals suggested by Kasznik (1999); (3) the Dechow and Dichev (2002) model of accruals quality; (4) finally, we use an aggregate measure that includes the previous three proxies. Our results show that FRQ reduces overinvestment, while shorter debt maturity mitigates overinvestment and underinvestment. Our findings also demonstrate that the effect of FRQ on investment efficiency decreases with shorter maturities, suggesting a substitutive role of FRQ and shorter maturities in reducing information asymmetries and monitoring managerial behavior to limit expropriation of creditors and minority shareholders.

Our paper contributes to a growing body of literature providing empirical evidence on FRQ and debt maturity roles in improving investment efficiency in a code law country

where debt maturity is an important device in controlling managerial behavior. Our findings suggest that in this context the main concern of creditors is overinvestment, because it is through overinvestment that managers expropriate creditors and minority shareholders, and that this inefficiency can be reduced with both higher FRQ and shorter maturities. With regard to underinvestment, our results suggest that the positive effect of shorter maturities on reducing this inefficiency may be more associated to internal decisions of the firm (Myers, 1977) than to monitoring by creditors. Moreover, this is the first study that analyzes the interaction effect between FRQ and debt maturity on improving investment efficiency and our findings suggest that both mechanisms may play a substitutive role in reducing overinvestment, whereas, unlike previous studies in the US and emerging markets (Biddle *et al.*, 2009; Chen *et al.*, 2011) that find that FRQ can solve underinvestment problems, in Spain, short-term debt is the main mechanism used to control underinvestment, and FRQ is only relevant when short-term debt level is low (higher maturities).

The remainder of the paper proceeds as follows. Section 2 reviews the existing literature on investment efficiency and the role of FRQ and debt maturity in investment decisions, and develops our testable hypotheses. Section 3 describes in detail the research design, with the models, measures of variables and the sample. Section 4 shows the results and the final section presents the main conclusions of this paper.

1.2. PREVIOUS LITERATURE AND HYPOTHESES DEVELOPMENT

1.2.1. Determinants of investment efficiency

Under neo-classical theory, firms invest until the marginal benefit equals the marginal cost of this investment in order to maximize their values (Abel, 1983; Hayashi, 1982; Yoshikawa, 1980). However, in the Keynesian framework (Crotty, 1992; Gordon, 1992), where expected investment will be determined by the preference for growth or for financial security, and in the agency framework (Myers, 1977), which considers information asymmetry problems, firms may deviate from their optimal investment levels and hence suffer from underinvestment (lower investment than expected) or overinvestment (greater investment than expected).

In perfect financial markets, all positive net present value projects (NPV) should be financed and carried out. Nevertheless, there is a significant body of literature that contradicts this assumption (for example, Bertrand and Mullainathan, 2003; Hubbard, 1998). Market imperfections, as well as information asymmetries and agency costs can lead to negative NPV projects being carried out (overinvestment) and to the rejecting of positive NPV projects (underinvestment). According to agency theory, both overinvestment and underinvestment can be explained by the existence of asymmetric information among stakeholders. Jensen and Meckling (1976), Myers (1977) and Myers and Majluf (1984) develop a framework for the role of asymmetric information in investment efficiency through information problems, such as moral hazard and adverse selection. With regard to moral hazard, discrepancy of interests between shareholders and a lack of monitoring of managers may lead to management trying to maximize its personal interests by making investments that may not be suitable for shareholders (Jensen and Meckling, 1976), with the consequence of managerial empire building and overinvestment (Hope and Thomas, 2008). Under adverse selection, better informed managers may overinvest if they sell overpriced securities and achieve excess funds. To avoid this, suppliers of capital can ration the capital or raise its cost, which will lead to the rejection of some profitable projects due to fund constraints (Biddle *et al.*, 2009; Lambert, Leuz and Verrecchia, 2007; Stiglitz and Weiss, 1981) with subsequent underinvestment.

1.2.2. Investment efficiency and financial reporting quality (FRQ)

From the agency theory perspective, there are various control mechanisms to attenuate information asymmetries and information risk and to enable better supervision of managerial activity that mitigates the opportunistic behavior of managers, such as financial reporting quality and disclosure (Bushman and Smith, 2001; Healy and Palepu, 2001; Hope and Thomas, 2008). Several studies have analyzed some of these implications, such as the reduction of the cost of capital and cost of debt (Francis, LaFond, Olsson and Schipper, 2004 and 2005) and access to the debt market and the effect on its conditions (Bharath *et al.*, 2008), i.e., lower cost, higher debt maturity and lower guarantees in bank financing.

Recently, a line of research has been developed on the effects of FRQ on investment efficiency. Since higher FRQ makes managers more accountable by allowing

better monitoring, and it may reduce information asymmetries and, consequently, adverse selection and moral hazard, it could also diminish overinvestment and underinvestment problems. On the other hand, FRQ could also improve investment efficiency by allowing managers to make better investment decisions through a better identification of projects and more truthful accounting numbers for internal decision makers (Bushman and Smith, 2001; McNichols and Stubben, 2008). Empirically, prior literature argues and finds evidence that FRQ relieves investment-cash flow sensitivity (Biddle and Hilary, 2006) and that earnings management leads to overinvestment because it distorts the information used by managers (McNichols and Stubben, 2008). Based on this discussion, Biddle *et al.* (2009), for US listed firms, and Chen *et al.* (2011), for private firms from emerging markets, examine the effect of FRQ on two inefficient scenarios, overinvestment and underinvestment, and report that higher FRQ helps underinvestment companies to make investments, and overinvestment companies to decrease their investment level. Consistent with this, García Lara, García Osma and Penalva (2012) find that conservatism reduces both overinvestment and underinvestment, because it reduces investment-cash flow sensitivity in overinvestment firms and facilitates access to external financing in underinvestment firms.

The institutional context in our sample is different from those of Biddle *et al.* (2009) and Chen *et al.* (2011), which affects the role played by FRQ. Previous studies have found that FRQ is higher in public firms than in private firms (Ball and Shivakumar, 2005; Burgstahler, Hail and Leuz, 2006) and in countries with higher investor protection and enforcement (Holthausen, 2009; Leuz *et al.*, 2003). Since Spain is a code law country with a less developed capital market than US, and where FRQ, enforcement and investor protection are lower, the level of FRQ in Spanish listed firms is lower than in the US firms analyzed by Biddle *et al.* (2009) although Spain does show higher levels of enforcement (La Porta, Lopez-de-Silanes, Shleifer and Vishny; 1998) and FRQ than the sample of private firms in emerging countries used by Chen *et al.* (2011). Besides, the Spanish case of listed firms constitutes an interesting set to study because, in contrast with the US, the main agency conflict is not the typical one between managers and shareholders, but that between managers controlled by majority shareholders on the one side and creditors and minority shareholders on the other. Moreover, the agency conflict with minority shareholders is more acute in our sample of listed firms than in the sample of private firms

analyzed by Chen *et al.* (2011). Hence our study focuses on an institutional environment different from that of Biddle *et al.* (2009) and Chen *et al.* (2011). We investigate whether FRQ improves investment efficiency in this context, so our first hypothesis is as follows:

***H1*:** Firms with higher FRQ will show higher investment efficiency

Since we analyze the role of FRQ in reducing overinvestment and underinvestment, we also test the following two sub-hypotheses:

***H1a*:** Firms with higher FRQ will mitigate overinvestment problem.

***H1b*:** Firms with higher FRQ will mitigate underinvestment problem.

1.2.3. Investment efficiency and debt maturity

The role of debt in reducing managers' discretion and disciplining their investment decisions has been discussed in the literature (Jensen, 1986; Myers, 1977), and there is some evidence that supports that debt reduces overinvestment (D'Mello and Miranda, 2010). However, the literature has also emphasized the role played by debt maturity under information asymmetry, showing that the use of short-term debt is a mechanism that can attenuate informational asymmetries and agency costs between shareholders, creditors and managers. From the borrower's perspective, Flannery (1986) predicts that under information asymmetry firms with good projects will prefer shorter maturity to transmit signals to the market and mitigate these information asymmetry problems. From the lender's perspective, when asymmetric information is present, the use of short-term debt is more suitable than long term debt to monitor firms (Diamond, 1991, 1993; Rajan, 1992). A shortening of debt maturity permits better control of managers, because shorter maturities induce more frequent renegotiations; lenders have closer contact with the borrower and can ascertain firms' performance during the first period and then they can decide whether to renew or change the contract terms (Ortiz-Molina and Penas, 2008). Therefore, greater use of short term debt is expected to reduce information asymmetry and adverse selection.

As regards investment efficiency, debt maturity can be used to mitigate overinvestment and underinvestment problems; when there are positive NPV projects, firms can finance them with short-term debt and diminish underinvestment problems, because the debt will be liquidated in a short time and the profitability will be entirely for

the company (Myers, 1977). In addition, due to the roll-over of short-term debt, debt holders may monitor borrowers better and thus reduce the agency conflict between creditors and borrowers that arises from investment opportunities (Barclay and Smith, 1995; Guedes and Opler, 1996; Lai, 2011; Parrino and Weisbach, 1999). As regards overinvestment, Childs *et al.* (2005) predict further that the higher flexibility of short-term debt to be rolled over and priced according to deviations from a firm-value maximizing strategy can mitigate agency conflicts between stockholders and creditors and thus reduce both underinvestment and overinvestment.

In Spain, as mentioned above, the lower enforcement and development of the capital market with respect US increases the role of shorter maturities to monitor managers (Barclay and Smith, 1995; Magri, 2010). According to La Porta *et al.* (1998) the index of creditor rights is not high (2 out of 4) even in comparison to the sample of emerging countries analyzed by Chen *et al.* (2011), which enhances the relevance of the monitoring of managers by creditors and the role played by debt maturity undertaking this. Thus, we expect the increased level of monitoring by the use of short term debt to be a key mechanism in Spain to reduce moral hazard problems and empire-building activities. Additionally, we expect that the higher financial flexibility for borrowers associated to lower maturities will also help control underinvestment.

Based on this, our second hypothesis and its sub-hypotheses are as follows:

***H2*:** Firms with higher use of short term debt (lower maturities) will show higher investment efficiency.

> ***H2a*:** Firms with higher use of short term debt (lower maturities) will mitigate overinvestment problem.
>
> ***H2b*:** Firms with higher use of short term debt (lower maturities) will mitigate underinvestment problem.

1.2.4. FRQ effect on investment efficiency conditioned to the level of debt maturity

As well as checking the isolated effect of financial reporting quality and debt maturity on investment efficiency, we examine their interaction effect, i.e., we investigate whether the effect of FRQ on investment efficiency is increasing or decreasing with the level of debt maturity. In this sense, the effect of FRQ on investment decisions could be mitigated by

the presence of short-term debt because through short-term debt creditors can exert their monitoring role on managers to reduce overinvestment and this short-term debt may also be beneficial for managers to carry out positive investments in underinvestment situations. According to this, the effect of FRQ on investment efficiency would be weaker in those firms with shorter maturities because the public information provided by FRQ and the closer and private relation with more frequent access to internal information provided by shorter maturities, are substitutive. In contrast, the effect of FRQ on investment efficiency could be greater for those firms with higher short-term debt if both beneficial effects of public and private information on investment efficiency are complementary.

Therefore, our third hypothesis is that the relation between FRQ and investment efficiency depends on the level of debt maturity. Since a priori we could expect either a stronger or a weaker effect of FRQ on investment efficiency according to the level of debt maturity, we pose two alternative hypotheses ($H3_1$ –shorter maturities and FRQ substitutive–and $H3_2$ –shorter maturities and FRQ complementary), as well as sub-hypotheses for the overinvestment (a) and underinvestment scenarios (b):

***H3₁*:** The relation between FRQ and investment efficiency is stronger for those firms with lower use of short term debt (higher maturities).

> ***H3₁a*:** In an overinvestment scenario, the relation between FRQ and investment efficiency is stronger for those firms with lower use of short term debt (higher maturities).
>
> ***H3₁b*:** In an underinvestment scenario, the relation between FRQ and investment efficiency is stronger for those firms with lower use of short term debt (higher maturities).

***H3₂*:** The relation between FRQ and investment efficiency is stronger for those firms with higher use of short term debt (lower maturities).

> ***H3₂a*:** In an overinvestment scenario, the relation between FRQ and investment efficiency scenario is stronger for those firms with higher use of short term debt (lower maturities).
>
> ***H3₂b*:** In an underinvestment scenario, the relation between FRQ and investment efficiency is stronger for those firms with higher use of short term debt (lower maturities).

1.3. RESEARCH DESIGN

1.3.1. Model specification

The model we propose to test the effect of FRQ and short-term debt on investment efficiency is the following:

$$\begin{aligned} InvEff_{i,t} = {} & \beta_0 + \beta_1 FRQ_{i,t} + \beta_2 STDebt_{i,t} + \beta_3 LnSales_{i,t} + \beta_4 LnAge_{i,t} + \beta_5 Tang_{i,t} + \\ & \beta_6 StdCFO_{i,t} + \beta_7 StdSales_{i,t} + \beta_8 QTobin_{i,t} + \beta_9 Z_{i,t} + \beta_{10} Loss_{i,t} + \\ & \beta_{11} CFO\_ATA_{i,t} + \beta_{12} Opercycle_{i,t} + \sum_j \beta_j Industry\ dummies + \varepsilon_{i,t} \end{aligned} \quad (1)$$

where *InvEff* represents investment efficiency. *FRQ* represents different proxies of FRQ; *STDebt* is an inverse proxy of debt maturity, the level of short-term debt over total debt (short- and long-term debt). Since our hypotheses predict that both *FRQ* and *STDebt* improve investment efficiency, we expect β_1 and β_2 to be positive and significant. The rest are control variables that may influence investment efficiency and innate determinants of *FRQ*: size, age, tangibility, standard deviation of cash flow and sales, Tobin's Q, Altman's Z-score, presence of losses, cash flow from operations, length of the operating cycle, and industry dummies. Following Petersen (2009), we estimate the model using t-statistics based on standard errors clustered at the firm and the year level, which are robust to both heteroskedasticity and within-firm serial correlation.

As shown in the literature review section, FRQ and the use of short-term debt can contribute to alleviating asymmetric information problems and thus improve investment efficiency. After testing the effects of FRQ and short-term debt on investment efficiency, we will extend the previous analysis to examine if the effect of FRQ on investment efficiency is increasing or decreasing with the level of debt maturity. To check this, we include an interaction effect between FRQ and a dummy variable for our inverse proxy of debt maturity ($DumSTDebt_{i,t}$) which takes the value 1 if the proportion of short-term debt over total debt is above the median and zero otherwise:

$$\begin{aligned} InvEff_{i,t} = {} & \beta_0 + \beta_1 FRQ_{i,t} + \beta_2 STDebt_{i,t} + \beta_3 FRQ_{i,t} * DumSTDebt_{i,t} + \\ & \beta_4 LnSales_{i,t} + \beta_5 LnAge_{i,t} + \beta_6 Tang_{i,t} + \beta_7 StdCFO_{i,t} + \\ & \beta_8 Std\,\mathrm{Re}venues_{i,t} + \beta_9 QTobin_{i,t} + \beta_{10} Z_{i,t} + \beta_{11} Loss_{i,t} + \\ & \beta_{12} CFO\_ATA_{i,t} + \beta_{13} Opercycle_{i,t} + \sum_j \beta_j Indutry\ dummies + \varepsilon_{i,t} \end{aligned} \quad (2)$$

where *FRQ*DumSTDebt* represents the interaction effect. In this model, β_1 indicates the effect of FRQ on investment efficiency for firms whose level of short-term debt is lower than the median and the sum of the coefficients on the main and interaction effect, $\beta_1+\beta_3$, represents the FRQ effect on investment efficiency for firms whose level of short-term debt is higher than the median. Therefore, if the effect of FRQ on investment efficiency is stronger for those firms with lower maturities (higher proportion of short-term debt), β_3 will be positive and significant, whereas if the effect of FRQ on investment efficiency is lower for those firms with shorter maturities, β_3 will be negative and significant.

1.3.2. Variable measures

1.3.2.1. Dependent variable: proxy for investment efficiency

Conceptually, investment efficiency means undertaking all those projects with positive net present value. Biddle *et al.* (2009), among others, use a model that predicts investment in terms of growth opportunities. Specifically, investment efficiency will exist when there is no deviation from the expected level of investment. However, companies that invest above their optimal (positive deviations from expected investment) overinvest, while those that do not carry out all profitable projects (negative deviations from expected investment) underinvest.

Following Biddle *et al.* (2009), to estimate the expected level of investment for firm *i* in year *t*, we specify a model that predicts the level of investment based on growth opportunities (measured by sales growth). Deviations from the model, as reflected in the error term of the investment model, represent the investment inefficiency.

$$Investment_{i,t} = \beta_0 + \beta_1 SalesGrowth_{i,t-1} + \varepsilon_{i,t} \quad (3)$$

where $Investment_{i,t}$ is the total investment of firm i in year t, defined as the net increase in tangible and intangible assets and scaled by lagged total assets. $SalesGrowth_{i,t}$ is the rate of change in sales of firm i from t-2 to t-1.

We estimate the investment model cross-sectionally for each year and industry. The residuals from the regression model reflect the deviation from the expected investment level, and we use these residuals as a firm-specific proxy for investment inefficiency. A positive residual means that the firm is making investments at a higher rate than expected according to the sales growth, so it will overinvest. In contrast, a negative residual assumes that real investment is less than that expected, representing an underinvestment scenario. Our dependent variable will be the absolute value of the residuals multiplied by -1, so a higher value means higher efficiency ($InvEff_{i,t}$).

1.3.2.2. Financial reporting quality (FRQ)

In order to estimate financial reporting quality we use three different proxies based on accounting precision with respect to fundamentals, according to previous research, as well as a summary statistic, by standardizing these three proxies and taking the average of the three measures ($Aggreg_{i,t}$).

The first measure is obtained following the model proposed by McNichols and Stubben (2008), who consider discretionary revenues as a proxy for earnings management.

$$\Delta AR_{i,t} = \beta_0 + \beta_1 \Delta Sales_{i,t} + \varepsilon_{i,t} \quad (4)$$

where $\Delta AR_{i,t}$ is the annual change in accounts receivable for firm *i* in the year *t*. $\Delta Sales_{i,t}$ represents the annual change in sales revenues for firm *i* in the year *t*. All terms are scaled by lagged total assets.

The model is estimated separately for each industry-year group. Discretionary revenues are the residuals from Eq. (4), which represents the change in accounts receivable that is not explained by sales growth. Our first proxy for FRQ will be the absolute value of

the residuals multiplied by -1. Thus, higher values indicate higher FRQ $(FRQ\_MNST_{i,t} = -\left|\hat{\varepsilon}_{i,t}\right|)$.

The second measure for FRQ is obtained from the model of discretionary accruals developed by Kasznik (1999), based on Jones (1991):

$$TA_{i,t} = \beta_0 + \beta_1 \Delta Sales_{i,t} + \beta_2 PPE_{i,t} + \beta_3 \Delta CFO_{i,t} + \varepsilon_{i,t} \quad (5)$$

where $TA_{i,t}$ is total accruals, calculated as the change in non-liquid current assets minus the change in current liabilities plus the change in the short-term bank debt, minus depreciation. $\Delta Sales_{i,t}$ is the change in revenues; $PPE_{i,t}$ is property, plant and equipment; $\Delta CFO_{i,t}$ is the change in cash flow from operations. All terms are deflated by lagged total assets.

The model is estimated in its cross-sectional version for each year and industry. The second proxy for financial reporting quality will be the absolute value of residuals from Eq. (5) multiplied by -1, so a higher level represents higher FRQ, ($FRQ\_KASZ_{i,t} = -\left|\hat{\varepsilon}_{i,t}\right|$).

Our third proxy is based on the accruals quality model developed by Dechow and Dichev (2002). In this model, current working capital accruals are regressed on cash flow from operations of the previous year, the current year and the subsequent year.

$$WCA_{i,t} = \beta_0 + \beta_1 CFO_{i,t-1} + \beta_2 CFO_{i,t} + \beta_3 CFO_{i,t+1} + \varepsilon_{i,t} \quad (6)$$

where $WCA_{i,t}$ is working capital accruals, calculated as the change in non-liquid current assets, minus the change in current liabilities plus the change in short-term bank debt. $CFO_{i,t-1}$, $CFO_{i,t}$ *and* $CFO_{i,t+1}$ are the cash flow from operations, which are expressed by the difference between net income before extraordinary items and total accruals. All variables are deflated by average total assets.

As in the previous models, the estimation is carried out by year and industry. The residuals from Eq. (6) reflect the variation in working capital accruals unexplained by cash flow of the current year and adjacent periods. Therefore, the third measure of FRQ will be the absolute value of the residuals multiplied by -1. Thus a higher value represents higher FRQ, ($FRQ\_DD_{i,t} = -\left|\hat{\varepsilon}_{i,t}\right|$).

Finally, the fourth measure of FRQ, $Aggreg_{i,t}$, is calculated as the average of the standardized values of the three proxies. A higher value means higher FRQ.

1.3.2.3. Debt maturity

To verify the role of debt maturity in investment efficiency, we include the variable STDebt, measured as the ratio of short-term debt (debt that matures before one year) over total debt.

1.3.2.4. Control variables

Following previous studies (Biddle *et al.*, 2009; Chen *et al.*, 2011), we introduce several control variables in our models. As a proxy for size we use the natural logarithm of sales (*LnSales*); Age is measured as the natural logarithm of the years since the inception of the firm (*LnAge*); Tangibility (*Tang*) is the ratio of property, plant and equipment to total assets; we include the standard deviation of cash flow from t-2 to t (*StdCFO*), as well as the volatility of sales in the same period (*StdSales*); to measure growth options we include Tobin's q (*QTobin*) as the ratio between the firm's market value of equity and debt over its total assets; to control for the financial solvency of the firm, we employ the firm's financial strength (*Z*), measured with Altman's z-score (1968), where Z is defined as:

$$Z = 0.012*X_1 + 0.014*X_2 + 0.033*X_3 + 0.006*X_4 + 0.999*X_5$$

where X_1 is the working capital/total assets; X_2 the retained earnings/total assets; X_3 the Earnings before interest and taxes/total assets; X_4 the market value equity/book value of total debt; X_5 the sales/total assets

We include a dummy variable that takes the value 1 if net income before extraordinary items is negative, and zero otherwise, to control whether the firm reports losses; moreover, we include the ratio of cash flow to average total assets (*CFO_ATA*), to capture the cash effect on investment efficiency; *Opercycle* represents the length of the operating cycle, and, finally, we add dummy variables to control for industry effects (*Industry dummies*).

1.3.3. Sample

We have used three sources to collect our data. We obtained balance sheets and profit and loss accounts from the SABI database, made by Bureau Van Dijk. Market values of the company shares were extracted from the Daily Bulletin of the MSE (Madrid Stock Exchange) and interest rates for the robustness analysis were obtained from the Statistic Bulletin of the Bank of Spain.

The estimates of investment efficiency and financial reporting quality variables have been made from a sample of 13,500 firm-year observations from 1997 to 2008, which represent big companies with consolidated information in SABI.

The sample used in our research includes firms listed on the Madrid Stock Exchange from 1998 to 2008. Initially, we had a total of 1,039 observations for this period, but the estimates of investment efficiency and financial reporting quality reduced the number of observations considerably. In order to mitigate the influence of outliers we drop observations for 1 and 99 percentiles for all variables, so our final sample consists of an unbalanced panel of 576 firm-year observations from 1998 to 2008. For the accruals quality measure proposed by Dechow and Dichev (2002), a year (t+1) is lost, so for analyses involving this variable our study is carried out with 500 firm-year observations.

1.4. RESULTS

1.4.1. Descriptive statistics

Panel A of Table 1 presents the descriptive statistics for the continuous variables, including the mean, median, standard deviation, 10^{th} percentile and 90^{th} percentile. Panel B provides the frequency for the dichotomous variable *Loss*.

Investment efficiency (*InvEff*) in the sample has a mean of -0.086 and a median of -0.048. Separately, the overinvestment scenario shows a mean of -0.123 whereas in the underinvestment scenario the mean is -0.053. These values are consistent with previous studies (Chen *et al.*, 2011). Likewise, all measures of FRQ have values according to earlier research (Biddle *et al.*, 2009; Chen *et al.*, 2011; McNichols and Stubben, 2008). As regards debt maturity, we observe that, on average, 61% of liabilities are short-term debt. This is consistent with the García-Teruel *et al.* (2010), which showed that Spanish firms hold around 60% of short-term debt, and contrasts with studies on US firms, such as Barclay and Smith (1995) and Datta *et al.* (2005), where the use of short-term debt is much lower, 28.2% and 21.46%, respectively.

Three out of four FRQ measures show significant positive correlations with investment efficiency, indicating that higher level of FRQ is associated with higher level of investment efficiency. They also show positive and significant correlations with each other, and higher ones with the aggregate measure of FRQ. Likewise, debt maturity (STDebt) presents significant positive correlation with investment efficiency, showing that a higher proportion of short-term debt (debt that matures before one year) over total debt is also associated with higher investment efficiency. With respect to FRQ measures, STDebt has a negative correlation with these variables, a result which is also consistent with previous studies (Bharath *et al.*, 2008; García-Teruel *et al.*, 2010). Correlations between independent variables are not high, therefore, collinearity is not likely to be a problem in our study.

Table 1. Descriptive statistics

Panel A. Continuous variables

	#obs.	*Mean*	*SD*	*10th perc*	*Median*	*90th perc*
InvEff	576	-0.086	0.135	-0.200	-0.048	-0.010
Overinvestment	275	-0.123	0.181	-0.322	-0.061	-0.008
Underinvestment	301	-0.053	0.053	-0.104	-0.041	-0.011
FRQ_MNST	576	-0.038	0.051	-0.082	-0.023	-0.003
FRQ_KASZ	576	-0.050	0.044	-0.112	-0.038	-0.007
FRQ_DD	500	-0.034	0.029	-0.069	-0.028	-0.005
Aggreg	500	0.088	0.599	-0.645	0.239	0.670
STDebt	576	0.615	0.194	0.344	0.621	0.875
LnSales	576	13.388	1.634	11.273	13.344	15.610
LnAge	576	3.593	0.678	2.694	3.675	4.384
Tang	576	0.349	0.201	0.080	0.337	0.617
StdCFO	576	0.082	0.059	0.022	0.067	0.167
StdSales	576	0.075	0.063	0.016	0.060	0.159
QTobin	576	1.428	0.566	0.867	1.222	2.136
Z	576	2.538	1.599	1.110	2.056	4.678
CFO_ATA	576	0.098	0.101	-0.023	0.096	0.219
Opercycle	576	291.136	288.910	110.557	213.909	424.332

Panel B. Dichotomous variable

	0		**1**	
Loss	526	91.33%	50	8.67%

InvEff is the absolute value of residuals of investment model multiplied by -1; *Overinvestment* is the positive residuals of investment model multiplied by -1; *Underinvestment* is the negative residuals of investment model; *FRQ_MNST* is the absolute value of residuals of the model proposed by McNichols and Stubben (2008), multiplied by -1; *FRQ_KASZ* is the absolute value of residuals of the Kasznik (1999) model, multiplied by -1; *FRQ_DD* is the absolute value of residuals of the model developed by Dechow and Dichev (2002), multiplied by -1; *Aggreg* is the summary measurement of FRQ computed as the standardized average of the three FRQ proxies; *STDebt* is the ratio of short-term debt to total debt; *LnSales* is the log of sales; *LnAge* is the log of age; *Tang* is the tangibility measure calculated as the ratio of tangible assets to total assets; *StdCFO* is the standard deviation of cash flows from t-2 to t; *StdSales* is the standard deviation of sales from t-2 to t; *QTobin* is the ratio of firm's market value plus liabilities to total assets; *Z* is the degree of solvency; *CFO_ATA* is the ratio of CFO to average total assets; *Opercycle* is calculated as: (average accounts receivables/sales)*360+(average inventory/cost of goods)*360; *Loss* is a dummy variable that takes the value 1 if the income before taxes and extraordinary items is negative, and 0 otherwise.

Table 2. Correlation matrix

	InvEff	*FRQ_MNST*	*FRQ_KASZ*	*FRQ_DD*	*Aggreg*	*STDebt*	*LnSales*	*LnAge*	*Tang*	*StdCFO*	*StdSales*	*Qtobin*	*Z*	*Loss*	*CFO_ATA*	*Opercycle*
InvEff	1															
FRQ_MNST	0.361***	1														
FRQ_KASZ	0.199***	0.287***	1													
FRQ_DD	-0.004	0.077*	0.446***	1												
Aggreg	0.261***	0.610***	0.801***	0.738***	1											
STDebt	0.228***	-0.120***	-0.172***	-0.332***	-0.283***	1										
LnSales	-0.120***	-0.012	0.013	0.019	0.015	-0.243***	1									
LnAge	-0.040	-0.087**	0.001	-0.0401	-0.042	-0.065	0.265***	1								
Tang	-0.085**	0.214***	0.229***	0.240***	0.317***	-0.468***	0.050	-0.153***	1							
StdCFO	-0.078*	-0.221***	-0.283***	-0.282***	-0.364***	0.185***	-0.102***	-0.032	-0.319**	1						
StdSales	-0.142***	-0.162***	-0.031	0.007	-0.063	0.053	0.017	-0.012	-0.169***	0.173***	1					
Qtobin	0.073*	0.011	-0.120***	-0.342***	-0.205***	0.192***	0.040	0.019	-0.287***	0.157***	-0.049	1				
Z	0.200***	0.099**	-0.103***	-0.357***	-0.159***	0.442***	-0.128***	0.153***	-0.177***	0.123***	-0.028	0.692***	1			
Loss	-0.010	0.016	-0.040	-0.086**	-0.066	-0.099**	-0.168***	-0.015	-0.044	0.050	0.116***	-0.041	-0.138***	1		
CFO_ATA	0.072	0.080*	-0.033	-0.219***	-0.073	0.169***	0.171***	0.074*	0.030	-0.013	0.017	0.300***	0.377***	-0.276***	1	
Opercycle	0.063	0.028	-0.030	0.060	0.021	0.044	-0.374***	0.074*	-0.185***	0.031	-0.150***	0.034	-0.024	0.021	-0.212***	1

See Table 1 for definitions of variables.
***, **, * denote significance at the 1%, 5% and 10% level, respectively.

1.4.2. Regression results

Table 3 reports the results of the estimation of Eq. (1) using different FRQ measures. In the first column, we use as FRQ measure the model proposed by McNichols and Stubben (2008); in the second, the model developed by Kasznik (1999); in the third, the model defined by Dechow and Dichev (2002), and finally, in the fourth column, the aggregate measure of FRQ.

Except for the Dechow and Dichev (2002) model, which is not significant at conventional levels, the conclusion is that FRQ enhances investment efficiency, since all coefficients of quality measures are positive and significant ($p<0.01$ for *FRQ_MNST* and *Aggreg,* and $p<0.05$ for *FRQ_Kasznik*). These results are in line with those reported by Biddle *et al.* (2009) and Chen *et al.* (2011), and confirm our *H1* that higher FRQ improves investment efficiency.

Additionally, in Eq. (1) we test the debt maturity effect on investment efficiency. In all four models, the *STDebt* variable presents a positive and significant coefficient, showing that shorter maturities increase investment efficiency, which is consistent with *H2*.

In terms of the control variables, in all our models tangibility (*Tang*) has a significant and negative coefficient, showing that a higher volume of tangible assets leads to lower investment efficiency. Moreover, higher financial strength, measured by Z, is associated with higher investment efficiency, whereas higher sales volatility and Tobin's Q have a negative impact on investment efficiency. These findings are consistent with previous studies.

We perform our analysis of investment efficiency distinguishing two alternative scenarios, overinvestment and underinvestment, represented by positive and negative residuals in the investment efficiency model. We consider as dependent variables: (a) in the overinvestment scenario, the positive deviations (positive residuals) with regard to expected investment multiplied by -1 (higher values, i.e., closer to zero, indicate lower overinvestment, that is, higher efficiency); and (b) in the underinvestment scenario, the negative deviations with regard to expected investment (higher values, i.e., closer to zero, indicate lower underinvestment, that is, higher efficiency). Thus, our overinvestment and

Table 3. Regression of investment efficiency on FRQ, debt maturity and control variables

	1	*2*	*3*	*4*
FRQ_MNST	0.979***			
	(4.13)			
FRQ_KASZ		0.762**		
		(2.40)		
FRQ_DD			0.416	
			(1.21)	
Aggreg				0.086***
				(3.04)
STDebt	0.144***	0.134**	0.138**	0.175***
	(2.61)	(2.18)	(2.12)	(2.63)
LnSales	-0.005	-0.003	-0.006*	-0.005
	(-1.08)	(-0.71)	(-1.66)	(-1.26)
LnAge	0.007	0.004	0.005	0.007
	(0.93)	(0.67)	(0.80)	(0.90)
Tang	-0.065***	-0.059**	-0.058***	-0.082***
	(-2.97)	(-2.07)	(-3.84)	(-5.81)
StdCFO	-0.113	-0.132	-0.271	-0.060
	(-0.72)	(-0.97)	(-1.47)	(-0.47)
StdSales	-0.220**	-0.313***	-0.293**	-0.299***
	(-2.33)	(-2.62)	(-2.45)	(-2.65)
QTobin	-0.014*	-0.021***	-0.018**	-0.012*
	(-1.91)	(-4.05)	(-2.33)	(-1.72)
Z	0.011*	0.019***	0.019***	0.016***
	(1.74)	(3.89)	(3.05)	(2.58)
Loss	0.016	0.035*	0.032	0.040*
	(0.72)	(1.65)	(1.26)	(1.72)
CFO_ATA	$-4.34 \cdot 10^{-4}$	0.041	0.021	0.026
	(-0.01)	(0.64)	(0.41)	(0.34)
Opercycle	$6.23 \cdot 10^{-6}$	$2.42 \cdot 10^{-5}$*	$3.59 \cdot 10^{-6}$	$1.13 \cdot 10^{-6}$
	(0.43)	(1.70)	(0.23)	(0.06)
Intercept	-0.073	-0.097	-0.063	-0.147
	(-0.83)	(-0.99)	(-0.75)	(-1.55)
Industry dummies	Yes	Yes	Yes	Yes
R^2	0.235	0.171	0.125	0.224
F	3.38	2.81	2.25	2.57
p>F	0.000	0.000	0.002	0.000
Obs.	576	576	500	500

See Table 1 for definitions of variables.
All the estimates have been carried out using pooled time-series cross-sectional regressions OLS coefficients.
t-statistics clustered at the firm and year level (Petersen, 2009) robust both to heteroskedasticity and within firm serial correlation in brackets.
***, **, * denote significance at the 1%, 5% and 10% level, respectively.

underinvestment variables are increasing in investment efficiency. Table 4 presents the results for investment efficiency in overinvestment and underinvestment scenarios. The first four models correspond to regressions using overinvestment as the dependent variable, while the remaining models (5-8) use underinvestment as the dependent variable.

In an overinvestment situation, FRQ contributes to decreasing investment excess. We note that all coefficients are positive and significant, indicating that higher FRQ reduces the overinvestment problem (we confirm *H1a*), that is, it is a mechanism that help firms to decrease their investment and so move towards their optimal level. These findings seem to support the view that higher FRQ helps control the overinvestment carried out by management in order to expropriate minority shareholders and creditors. However, in an underinvestment scenario, FRQ has no significant effect on enhancing efficiency, suggesting that in those firms with lower investment than expected FRQ is not effective in increasing the investment level. Regarding debt maturity, we obtain, in general, that lower debt maturity contributes to improving investment efficiency by decreasing both overinvestment (*H2a*) and underinvestment (*H2b*). This evidence is consistent with Childs *et al.* (2005).

1.4.3. Analysis extension

In this section we extend the previous analyses by testing whether higher use of short-term debt decreases or increases the FRQ effect on investment efficiency. We define *DumSTDebt*, as a dummy variable that takes the value 1 if short-term debt is higher than the median, and zero if it is lower than the median. In Table 5 we estimate Eq. (2) including the interaction effect between the aggregate measure of FRQ (*Aggreg*) and *DumSTDebt*.

As we have obtained in previous models, both *FRQ* and *STDebt* have positive and significant coefficients ($p<0.01$) in the general model of investment efficiency. For those firms that have lower STDebt, the coefficient of FRQ is 0.168 ($p<0.01$), whereas for those firms with higher short-term debt, the FRQ effect is lower ($\beta_3<0$), and its effect is given by $\beta_1+\beta_3 = 0.023$ ($p<0.01$). Therefore, for firms which have lower short-term finance, the FRQ effect (0.168) on investment efficiency is higher than for firms with a higher short-term debt level (0.023).

Table 4. Regression of overinvestment and underinvestment on FRQ, debt maturity and control variables

	Overinvestment (1-4); Underinvestment (5-8)							
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
FRQ_MNST	1.265***				0.039			
	(6.26)				(0.30)			
FRQ_KASZ		1.008**				-0.037		
		(2.43)				(-0.41)		
FRQ_DD			0.925*				-0.074	
			(1.82)				(-0.87)	
Aggreg				0.128***				-0.001
				(5.79)				(-0.19)
STDebt	0.236**	0.200*	0.197**	0.247**	0.048	0.046	0.065**	0.067**
	(2.08)	(1.75)	(2.05)	(2.23)	(1.50)	(1.43)	(2.03)	(1.96)
LnSales	-0.004	-0.003	-0.011	-0.007	-0.005**	-0.005*	-0.004	-0.004
	(-0.35)	(-0.30)	(-0.91)	(-0.60)	(-2.00)	(-1.89)	(-1.38)	(-1.39)
LnAge	0.013	0.010	0.012	0.010	0.005*	0.005	0.004	0.004
	(0.74)	(0.49)	(0.72)	(0.44)	(1.68)	(1.56)	(1.25)	(1.29)
Tang	-0.094	-0.070	-0.129*	-0.136	0.026	0.029	0.034	0.034
	(-1.10)	(-0.76)	(-1.75)	(-1.44)	(1.03)	(1.34)	(1.25)	(1.26)
StdCFO	-0.458	-0.384	-0.706*	-0.378	-0.032	-0.047	-0.029	-0.027
	(-1.37)	(-1.21)	(-1.71)	(-1.37)	(-0.92)	(-1.38)	(-0.91)	(-0.86)
StdSales	-0.321	-0.467**	-0.490*	-0.464*	-0.007	-0.002	-0.001	-0.002
	(-1.64)	(-1.99)	(-1.75)	(-1.87)	(-0.12)	(-0.03)	(-0.01)	(-0.03)
QTobin	-0.027	-0.033	-0.063***	-0.019	0.001	0.001	0.003	0.003
	(-1.24)	(-1.40)	(-2.95)	(-0.68)	(0.22)	(0.38)	(0.65)	(0.75)
Z	0.018	0.024**	0.040***	0.022	0.002	0.002	$6.84 \cdot 10^{-5}$	$1.92 \cdot 10^{-4}$
	(1.47)	(2.24)	(3.41)	(1.58)	(0.60)	(0.70)	(0.02)	(0.07)
Loss	0.009	0.039	0.048	0.055	-0.010	-0.010	-0.001	$-3.24 \cdot 10^{-4}$
	(0.20)	(0.77)	(0.73)	(0.87)	(-0.99)	(-0.97)	(-0.10)	(-0.03)
CFO_ATA	-0.044	0.111	0.126	0.097	0.056	0.055	0.037	0.037
	(-0.32)	(0.98)	(1.22)	(0.66)	(1.30)	(1.28)	(0.80)	(0.81)
Opercycle	$1.68 \cdot 10^{-5}$	$7.36 \cdot 10^{-5}$*	$3.98 \cdot 10^{-5}$	$4.88 \cdot 10^{-5}$	$2.32 \cdot 10^{-6}$	$3.33 \cdot 10^{-6}$	$5.15 \cdot 10^{-6}$	$4.68 \cdot 10^{-6}$
	(0.36)	(1.81)	(0.53)	(0.68)	(0.28)	(0.42)	(0.62)	(0.53)
Intercept	-0.123	-0.144	-0.004	-0.156	-0.049	-0.055	-0.082	-0.083
	(-0.62)	(-0.74)	(-0.02)	(-0.92)	(-0.88)	(-0.99)	(-1.46)	(-1.41)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.328	0.233	0.200	0.331	0.096	0.096	0.095	0.093
F	3.78	2.62	4.56	4.37	2.26	2.18	1.81	1.81
p>F	0.000	0.001	0.000	0.000	0.003	0.004	0.024	0.025
Obs.	275	275	230	230	301	301	270	270

See Table 1 for definitions of variables.
All the estimates have been carried out using pooled time-series cross-sectional regressions OLS coefficients.
t-statistics clustered at the firm and year level (Petersen, 2009) robust both to heteroskedasticity and within firm serial correlation in brackets.
***, **, * denote significance at the 1%, 5% and 10% level, respectively.

These findings prove that *FRQ* and *STDebt* are mechanisms with some degree of substitution in improving investment efficiency; a firm mitigates investment inefficiency by preparing information with higher quality or by using shorter maturities (we confirm $H3_1$).

If we divide our sample into overinvestment and underinvestment scenarios, the results show that STDebt improves investment efficiency in both contexts. As regards the association between FRQ and investment efficiency, in firms that overinvest and that have higher use of short-term debt, the FRQ effect on investment efficiency is given by $\beta_1+\beta_3 =$ 0.048 ($p<0.05$), with $\beta_3<0$. Instead, for firms that have a lower short-term debt level (higher maturities), the FRQ effect is positive and significant (0.186) and it is higher than for firms with higher STDebt (0.048). These conclusions in an overinvestment situation confirm the results obtained in the general model of investment efficiency and confirm our hypothesis $H3_1a$. With respect to the underinvestment scenario, we find that firms that have a higher use of short-term debt show a FRQ effect close to zero. For those firms with lower short-term debt level, FRQ is positive and close to be significant at conventional levels ($H3_1b$). This suggests that FRQ is more relevant for reducing overinvestment than underinvestment and that has a stronger effect when the short-term debt level is low, whereas debt maturity is effective reducing both overinvestment and underinvestment. There is some relation between our findings and those of Beatty, Liao and Weber (2010), who examine the role of public and private information in investment decisions and find that accounting quality has a larger influence on investment-cash flow sensitivity for firms with less access to private information, i.e., those with public debt, than for firms with private (bank) debt. Our findings add to theirs the relevance of the debt term and suggest that the closer and frequent relation that allows short term debt with respect to long term debt enhances this monitoring through private information, especially in an environment like Spain where most financial resources proceed from private debt.

Table 5. Regression of investment efficiency on FRQ, debt maturity, and interaction (I)

	InvEff	*Overinvestment*	*Underinvestment*
Aggreg	0.168***	0.186***	0.024
	(4.00)	(5.13)	(1.56)
STDebt	0.200***	0.238**	0.083**
	(3.36)	(2.49)	(2.26)
*FRQ*DumSTDebt*	-0.145***	-0.138***	-0.031**
	(-3.20)	(-2.63)	(-2.22)
LnSales	-0.007*	-0.009	-0.004*
	(-1.70)	(-0.71)	(-1.66)
LnAge	0.012	0.013	0.005**
	(0.96)	(0.50)	(2.07)
Tang	-0.102***	-0.160*	0.027
	(-4.36)	(-1.65)	(0.94)
StdCFO	-0.121	-0.415	-0.033
	(-0.85)	(-1.58)	(-0.85)
StdSales	-0.298***	-0.464*	-0.008
	(-2.66)	(-1.83)	(-0.13)
QTobin	-0.017***	-0.032	0.002
	(-2.76)	(-1.33)	(0.45)
Z	0.015**	0.024	$2.36 \cdot 10^{-4}$
	(2.38)	(1.56)	(0.08)
Loss	0.040*	0.063	0.001
	(1.73)	(0.96)	(0.05)
CFO_ATA	0.014	0.072	0.036
	(0.18)	(0.40)	(0.86)
Opercycle	$2.91 \cdot 10^{-6}$	$5.22 \cdot 10^{-5}$	$3.77 \cdot 10^{-6}$
	(0.15)	(0.77)	(0.40)
Intercept	-0.126	-0.119	-0.086
	(-1.30)	(-0.59)	(-1.39)
Industry dummies	Yes	Yes	Yes
Test $\beta_1+\beta_3$	5.93***	4.63**	2.14
R^2	0.307	0.378	0.109
F	3.17	4.51	2.41
p>F	0.000	0.000	0.001
Obs.	500	230	270

See Table 1 for definitions of variables.
FRQ is the aggregate measure of three proxies; *DumSTDebt* takes value 1 if short-term debt is higher than the median (0.62), and 0 otherwise. For the remaining variables see Table1.
All the estimates have been carried out using pooled time-series cross-sectional regressions OLS coefficients.
t-statistics clustered at the firm and year level (Petersen, 2009) robust both to heteroskedasticity and within firm serial correlation in brackets.
***, **, * denote significance at the 1%, 5% and 10% level, respectively.

1.4.4. Robustness checks

In this section we conduct additional robustness tests of the reported results.

1.4.4.1. Alternative investment efficiency model

We re-estimate the expected level of investment following the model developed by Chen *et al.* (2011). This model adds an independent dummy variable (*NEG*) because the authors consider that the relation between investment and sales growth could differ in the case of positive or negative growth.

$$Investment_{i,t} = \beta_0 + \beta_1 NEG_{i,t-1} + \beta_2 SalesGrowth_{i,t-1} + \beta_3 NEG_{i,t-1} * SalesGrowth_{i,t-1} + \varepsilon_{i,t} \quad (7)$$

where $NEG_{i,t-1}$ is a dummy variable that takes value 1 for negative sales growth, and 0 otherwise, and the rest of variables are defined as above.

The results of estimating Eq. (1) using this investment efficiency proxy are similar to those previously reported, as displayed in Table 6.

Higher FRQ enhances investment efficiency. For overinvestment firms, a higher FRQ reduces overinvestment, and for underinvestment firms, FRQ has no significant effect. STDebt increases investment efficiency in the two contexts: a greater use of short-term debt reduces overinvestment and underinvestment problems.

1.4.4.2. Investment efficiency model with 25 and 75 STDebt percentiles

In this section, we employ two alternative measures to interact FRQ and debt maturity: first, we divide our sample between those firms that have STDebt levels below percentile 25 (48%), in which case *DumSTDebt* takes value 1, and firms that have short-term debt levels above this percentile, in which case *DumSTDebt* takes value 0. Second, we separate the sample between those firms that present short-term debt levels above percentile 75 (77%), in which case the variable takes value 1, and firms below this level, in which case the variable takes value 0. In Table 7 we show the results for the estimation of equation (2) when adopting the percentile 25 as short-term debt dummy.

Table 6. Regression of investment efficiency (model of Chen *et al.*, 2011) on FRQ, debt maturity and control variables

	InvEff	*Overinvestment*	*Underinvestment*
Aggreg	0.085***	0.128***	$-6.74 \cdot 10^{-4}$
	(3.13)	(5.91)	(-0.10)
STDebt	0.177***	0.244**	0.076**
	(2.71)	(2.22)	(2.10)
LnSales	-0.005	-0.007	-0.004
	(-1.20)	(-0.56)	(-1.45)
LnAge	0.006	0.008	0.002
	(0.68)	(0.36)	(0.69)
Tang	-0.077***	-0.136	0.042
	(-15.01)	(-1.48)	(1.50)
StdCFO	-0.058	-0.362	-0.029
	(-0.47)	(-1.31)	(-0.91)
StdSales	-0.287***	-0.463*	0.011
	(-2.62)	(-1.88)	(0.17)
QTobin	-0.013*	-0.018	0.002
	(-1.91)	(-0.65)	(0.51)
Z	0.016***	0.022	0.001
	(2.64)	(1.58)	(0.36)
Loss	0.042*	0.056	0.004
	(1.86)	(0.91)	(0.43)
CFO_ATA	0.027	0.108	0.031
	(0.38)	(0.76)	(0.77)
Opercycle	$2.94 \cdot 10^{-6}$	$4.54 \cdot 10^{-5}$	$8.72 \cdot 10^{-6}$
	(0.15)	(0.66)	(1.07)
Intercept	-0.147	-0.152	-0.088
	(-1.53)	(-0.90)	(-1.54)
Industry dummies	Yes	Yes	Yes
R^2	0.226	0.330	0.113
F	2.64	2.50	2.06
p>F	0.000	0.001	0.008
Obs.	500	230	270

See Table 1 for definitions of variables.
All the estimates have been carried out using pooled time-series cross-sectional regressions OLS coefficients.
t-statistics clustered at the firm and year level (Petersen, 2009) robust both to heteroskedasticity and within firm serial correlation in brackets .
***, **, * denote significance at the 1%, 5% and 10% level, respectively.

Table 7. Regression of investment efficiency on FRQ, debt maturity, and interaction (II)

	InvEff	*Overinvestment*	*Underinvestment*
Aggreg	0.042***	0.064***	-0.004
	(2.80)	(3.71)	(-0.64)
STDebt	0.180***	0.210**	0.078**
	(3.35)	(2.37)	(2.15)
*FRQ*DumSTDebt*	0.165***	0.161***	0.029*
	(4.91)	(4.51)	(1.85)
LnSales	-0.008**	-0.009	-0.004
	(-2.01)	(-0.81)	(-1.60)
LnAge	0.006	0.008	0.004
	(0.56)	(0.35)	(1.60)
Tang	-0.116***	-0.189**	0.029
	(-7.03)	(-2.07)	(1.11)
StdCFO	-0.137	-0.429**	-0.037
	(-1.22)	(-1.96)	(-1.18)
StdSales	-0.278**	-0.461*	0.001
	(-2.11)	(-1.65)	(0.02)
QTobin	-0.017**	-0.039*	0.003
	(-2.44)	(-1.76)	(0.69)
Z	0.016**	0.028*	$3.41 \cdot 10^{-5}$
	(2.19)	(1.87)	(0.01)
Loss	0.040	0.056	$4.90 \cdot 10^{-4}$
	(1.45)	(0.73)	(0.05)
CFO_ATA	0.029	0.071	0.040
	(0.36)	(0.39)	(0.85)
Opercycle	$-3.45 \cdot 10^{-6}$	$3.30 \cdot 10^{-5}$	$4.09 \cdot 10^{-6}$
	(-0.19)	(0.49)	(0.45)
Intercept	-0.074	-0.048	-0.077
	(-0.84)	(-0.27)	(-1.31)
Industry dummies	Yes	Yes	Yes
Test $\beta_1+\beta_3$	36.35***	66.04***	1.98
R^2	0.315	0.393	0.102
F	3.04	3.38	2.05
p>F	0.000	0.000	0.007
Obs.	500	230	270

See Table 1 for definitions of variables.
FRQ is the aggregate measure of three proxies; *DumSTDebt* takes value 1 if short-term debt is lower than the 25 percentile (0.48), and 0 otherwise. For the remaining variables see Table1.
All the estimates have been carried out using pooled time-series cross-sectional regressions OLS coefficients.
t-statistics clustered at the firm and year level (Petersen, 2009) robust both to heteroskedasticity and within firm serial correlation in brackets
***, **, * denote significance at the 1%, 5% and 10% level, respectively.

The results obtained confirm the previous analysis: STDebt improves investment efficiency, reducing both overinvestment and underinvestment, whereas FRQ reduces overinvestment and has a stronger effect with higher maturities. In the general model, for those firms that have lower short-term debt, the effect of FRQ on investment efficiency is determined by $\beta_1+\beta_3$ = 0.207 ($p<0.01$), whereas for firms that have a higher degree of short-term debt the FRQ effect on efficiency is smaller (0.042). For companies that overinvest and present lower short-term debt, the FRQ repercussion is $\beta_1+\beta_3$ = 0.225 ($p<0.01$), which is greater than for companies with higher short-term debt (0.064). With regards those companies that underinvest and have lower short-term debt, FRQ repercussion on reducing underinvestment is provided by $\beta_1+\beta_3$ = 0.025, which is not significant, while for those companies with a greater degree of short-term debt the FRQ effect on underinvestment is close to zero.

In Table 8 we perform a similar analysis, but taking percentile 75 as a dummy variable of short-term debt.

We observe the same results as before: STDebt enhances investment efficiency and as firms increase the level of short-term debt, the effect of FRQ on investment efficiency decreases ($\beta3<0$ in the general and overinvestment models). Hence, if the use of short-term debt is reduced, FRQ takes a more active role in efficiency, whereas if short-term debt increases, the role of FRQ declines. In short, we conclude that both mechanisms play a substitutive role in enhancing investment efficiency.

Table 8. Regression of investment efficiency on FRQ, debt maturity, and interaction (III)

	InvEff	*Overinvestment*	*Underinvestment*
Aggreg	0.117***	0.155***	-0.004
	(3.12)	(4.99)	(-0.33)
STDebt	0.164***	0.220**	0.067*
	(3.02)	(2.39)	(1.90)
*FRQ*DumSTDebt*	-0.098**	-0.114**	0.005
	(-2.36)	(-2.49)	(0.43)
LnSales	-0.007	-0.010	-0.004
	(-1.44)	(-0.72)	(-1.36)
LnAge	0.012	0.015	0.004
	(0.99)	(0.58)	(1.23)
Tang	-0.087***	-0.143	0.035
	(-5.65)	(-1.49)	(1.29)
StdCFO	-0.071	-0.345	-0.026
	(-0.56)	(-1.30)	(-0.85)
StdSales	-0.283***	-0.437*	-0.002
	(-2.81)	(-1.84)	(-0.03)
QTobin	-0.018***	-0.024	0.004
	(-2.72)	(-0.92)	(0.85)
Z	0.017***	0.022	$2.66 \cdot 10^{-5}$
	(2.70)	(1.48)	(0.01)
Loss	0.047**	0.056	-0.001
	(2.12)	(0.87)	(-0.10)
CFO_ATA	0.040	0.108	0.036
	(0.58)	(0.69)	(0.79)
Opercycle	$9.21 \cdot 10^{-6}$	$6.14 \cdot 10^{-5}$	$4.38 \cdot 10^{-6}$
	(0.58)	(0.97)	(0.50)
Intercept	-0.131	-0.123	-0.082
	(-1.55)	(-0.63)	(-1.39)
Industry dummies	Yes	Yes	Yes
Test $\beta_1+\beta_3$	2.64*	4.54**	0.12
R^2	0.257	0.354	0.094
F	2.97	3.55	1.76
p>F	0.000	0.000	0.028
Obs.	500	230	270

See Table 1 for definitions of variables.
FRQ is the aggregate measure of three proxies; *DumSTDebt* takes value 1 if short-term debt is higher than the 75 percentile (0.77), and 0 otherwise. For the remaining variables see Table1.
All the estimates have been carried out using pooled time-series cross-sectional regressions OLS coefficients.
t-statistics clustered at the firm and year level (Petersen, 2009) robust both to heteroskedasticity and within firm serial correlation in brackets.
***, **, * denote significance at the 1%, 5% and 10% level, respectively.

1.4.4.3. Endogeneity issues

In this section we consider the potential endogeneity issue between short-term debt and FRQ. Recently, Bharath et al. (2008) and García-Teruel et al. (2010) suggest that firms with higher FRQ can obtain a longer maturity than those firms with lower FRQ. To address this possible concern of endogeneity between debt maturity and FRQ, we employ several robustness checks. First, we estimate our models using a two-stage regression. With this procedure, we estimate, in the first stage, the short-term debt level for each firm and use this estimate in the general model of investment efficiency. We adopt the following model in the first stage:

$$STDebt_{i,t} = \beta_0 + \beta_1 FRQ_{i,t} + \beta_2 Z_{i,t} + \beta_3 Z_{i,t}^2 + \beta_4 QTobin_{i,t} + \beta_5 AM_{i,t} + \beta_6 LnSize_{i,t} + \beta_7 LnAge_{i,t} + \beta_8 Tax_{i,t} + \beta_9 Lev_{i,t} + \beta_{10} IntDif_{i,t} + \beta_{11} StdSales_{i,t} + \varepsilon_{i,t} \quad (8)$$

where *STDebt* is the ratio of short-term debt over total debt. *FRQ* is the aggregate proxy of FRQ; Z is the financial strength; *QTobin* is growth options, expressed by Tobin's q; *AM* is asset maturity, calculated by Jun and Jen (2003)'s model; *LnSize* is firm size, measured by the log of market value; *LnAge* is the log of age; *Tax* is the corporate tax rate; *Lev* is the level of debt; *Int_Dif* is the interest rate differential between long (10 year) and short (1 year) debt; *StdSales* is the standard deviation of sales from t-2 to t. The results of the first stage confirm that higher FRQ is associated with a reduction of short-term debt. In the first column of Table 9 we present the results of our model, replacing the original short-term debt variable by its estimation in the Eq. (8).

After controlling for the possible endogeneity of short-term debt and FRQ, our findings are not affected. The results corroborate the hypotheses that higher FRQ and higher use of short-term debt help to improve investment efficiency, and that the effect of FRQ on investment efficiency is higher for those firms with lower short-term debt (β_3<0), thus confirming our previous results about the substitution role of FRQ and short-term debt.

Table 9. Two-stage regression (1), Reestimation of variables (2)

	2SLS(1)	*Reestimation of main variables (2)*
Aggreg	0.210***	0.144**
	(4.70)	(2.04)
STDebt	0.588**	0.099*
	(2.62)	(1.84)
*FRQ*DumSTDebt*	-0.164***	-0.135*
	(-4.45)	(-1.95)
LnSales	0.004	-0.009
	(0.49)	(-1.20)
LnAge	0.012	0.018
	(1.16)	(1.64)
Tang	0.045	-0.138***
	(0.51)	(-12.49)
StdCFO	-0.100	-0.325
	(-0.78)	(-1.27)
StdSales	-0.190**	-0.634***
	(-2.15)	(-3.51)
QTobin	0.012	-0.036*
	(0.84)	(-1.85)
Z	-0.009	0.028***
	(-0.53)	(3.66)
Loss	0.049**	0.050
	(2.19)	(1.49)
CFO_ATA	0.096*	0.108*
	(1.69)	(1.68)
Opercycle	$3.58 \cdot 10^{-5}$***	$-4.71 \cdot 10^{-6}$
	(2.74)	(-0.16)
Intercept	-0.597**	-0.035
	(-2.40)	(-0.58)
Industry dummies	Yes	Yes
Test $\beta_1+\beta_3$	9.20***	0.10
R^2	0.303	0.200
F	2.58	1.97
p>F	0.000	0.010
Obs.	500	290

***, **, * denote significance at the 1%, 5% and 10% level, respectively. See Table 1 for definitions of variables.
The dependent variable in all models is investment efficiency; *FRQ* variable is the aggregate measure of three proxies; *DumSTDebt* takes value 1 if estimated short-term debt is higher than the median (0.62), and 0 otherwise.
Model 1: STDebt is the estimated variable in the first stage.
Model 2: *FRQ* and *STDebt* variables are calculated as the mean from t-2 to t.
All the estimates have been carried out using pooled time-series cross-sectional regressions OLS coefficients.
t-statistics clustered at the firm and year level (Petersen, 2009) robust both to heteroskedasticity and within firm serial correlation in brackets.

1.4.4.4. Main variables reestimation

Since discretionary accruals are the central components of FRQ, and positive discretionary accruals that overstate earnings in one year are followed by negative discretionary accruals due to the reversion process of accruals, we reconsider our aggregate measure of FRQ and calculate, following Hutton, Marcus and Tehranian (2009), a new measure of FRQ as the average, from t-2 to t, of the aggregate FRQ measure. With this approach, we aim to solve the reversion process of accruals and assess the robustness of results with a variable that reflects the tendency of the firm to manipulate earnings across a three-year horizon. Likewise, for homogeneity, we also calculate the other main variable of our study, STDebt, as the average from t-2 to t.

Taking these alternative specifications into consideration, the tabulated results in column 2 of Table 9 are similar to those previously reported. STDebt improves investment efficiency (β_2>0) and FRQ improves investment efficiency for those firms with higher maturities (β_1>0). However, in firms with higher use of short-term debt, the FRQ effect is not significant ($\beta_1+\beta_3$ is not significantly different from zero).

1.4.4.5. Alternative estimation method

Finally, we repeat our analysis by using the generalized method of moments (GMM). We use the two-step system GMM, and since a minimum of 5 consecutive years is required, we lose some observations and estimate the general model of investment efficiency with a sample of 363 observations:

$$\begin{aligned} InvEff_{i,t} = {} & \beta_1 FRQ_{i,t} + \beta_2 STDebt_{i,t} + \beta_3 (FRQ_{i,t} * DumSTDebt_{i,t}) + \beta_4 LnSales_{i,t} \\ & + \beta_5 LnAge_{i,t} + \beta_6 Tang_{i,t} + \beta_7 StdCFO_{i,t} + \beta_8 StdRevenues_{i,t} + \\ & \beta_9 QTobin_{i,t} + \beta_{10} Z_{i,t} + \beta_{11} Loss_{i,t} + \beta_{12} CFO\_ATA_{i,t} \\ & + \beta_{13} Opercycle_{i,t} + \eta_i + \lambda_t + \upsilon_{i,t} \end{aligned} \quad (9)$$

where the variables are defined as in Eq. (1), and η_i (unobservable heterogeneity) is designed to measure unobservable firms' characteristics that have a significant impact on investment efficiency. These attributes are different across firms but are constant for each

firm. λ_t are temporary dummy variables that change over time, but are the same for all firms in each year considered. Finally, $v_{i,t}$ is the error term.

Our results, shown in Table 10, are similar to those previously reported, but with the addition that in these estimates FRQ may also reduce underinvestment: FRQ and STDebt are mechanisms that improve investment efficiency (β_1 and β_2>0) in all scenarios, and that present a substitutive effect (β_3<0), so the effect of FRQ is higher in those firms with lower STDebt. Nevertheless, since we use a reduced number of observations and the overinvestment and underinvestment regressions have been carried out without a minimum of 5 consecutive years in all firms, we prefer to be more cautious about the results for these scenarios.

Table 10. GMM regressions

	InvEff	*Overinvestment*	*Underinvestment*
Aggreg	0.154***	0.201***	0.078***
	(15.11)	(14.66)	(8.78)
STDebt	0.109**	0.172***	0.063**
	(2.30)	(3.22)	(2.29)
*FRQ*DumSTDebt*	-0.131***	-0.180***	-0.053***
	(-11.17)	(-9.22)	(-6.15)
LnSales	-0.002	-0.013**	$-2.64 \cdot 10^{-4}$
	(-0.29)	(-2.29)	(-0.12)
LnAge	-0.002	0.025	-0.001
	(-0.06)	(1.12)	(-0.25)
Tang	-0.308***	-0.106*	-0.164***
	(-5.19)	(-1.71)	(-5.06)
StdCFO	-0.164	-0.192	-0.055
	(-1.61)	(-0.95)	(-0.75)
StdSales	-0.349***	-0.763***	-0.318***
	(-3.83)	(-9.81)	(-6.80)
QTobin	-0.076***	-0.083***	-0.046***
	(-3.77)	(-3.58)	(-4.23)
Z	0.047***	0.043***	0.021**
	(4.24)	(5.81)	(2.20)
Loss	0.048***	0.049**	-0.005
	(3.04)	(2.00)	(-0.48)
CFO_ATA	-0.020	-0.081	-0.165***
	(-0.29)	(-1.39)	(-7.97)
Opercycle	$-7.23 \cdot 10^{-6}$	$-1.14 \cdot 10^{-4}$***	$8.21 \cdot 10^{-6}$
	(-0.26)	(-3.45)	(0.75)
Test $\beta_1+\beta_3$	7.60***	5.88**	15.12***
Hansen	40.49 (159)	32.32 (127)	36.51 (130)
m2	0.685	0.476	0.335
Obs.	363	174	189

The estimations have been carried out using the 2-stage system-GMM estimator.
Hansen is the test for over-identifying restrictions distributed asymptotically under null hypothesis of validity of instruments as a chi-squared. Degrees of freedom in brackets.
m_2 is the the pvalue of the Arellano-Bond test for second-order serial autocorrelation in residuals in first differences under the null hypothesis of no serial correlation.
For definition of variables see Table1 and 5.
z-statistics in brackets.

1.5. CONCLUSIONS

In this paper we analyze the effect of FRQ and debt maturity on investment efficiency, using a representative sample of Spanish listed firms for the period 1998-2008. The results indicate that higher FRQ and higher use of short-term debt (lower debt maturity) increase investment efficiency. However, if we distinguish between overinvestment and underinvestment, FRQ plays a role in reducing overinvestment. In contrast, lower debt maturity is a mechanism that contributes positively to improving investment efficiency in both scenarios.

In addition, we find evidence that FRQ and lower debt maturity have a substitute relationship in improving investment efficiency: in those firms with lower short-term debt, the FRQ effect on investment efficiency is higher than for those firms with a higher degree of short-term debt. This suggests that in firms with lower FRQ, debt maturity is the main mechanism that is used by creditors to control managers' behavior and to avoid expropriation. On the other hand, in those firms that present higher FRQ, accounting information may be used to monitor investment inefficiency problems.

These results contribute to the literature of investment efficiency showing that, in a context where FRQ plays a less significant role than in Anglo-Saxon countries in reducing information asymmetries, the shorter maturity of debt is a valid alternative for monitoring managers and affect investment efficiency. Our findings also contribute to the literature on the role of public and private information in investment decisions, and they extend this research by suggesting that, from private information perspective, short term debt is relevant to increase the monitoring of managers and mitigates the importance of FRQ as a mechanism to reduce information asymmetries. This is a significant finding for institutional contexts like Spain, where private debt constitutes the main source of financing and public debt is almost absent, since they show that the choice of the debt term do have important implications with relation to investment. The findings also have relevant implications for creditors, managers and researchers since they help understand the economic consequences of corporate financial and accounting policies in investment decisions.

Our study has some limitations. First, as in other studies on FRQ and investment efficiency, these proxies are subjected to measurement error, and neither can the proxy for debt maturity be as refined as in studies with US data. Second, the role of debt maturity and FRQ may differ according to institutional features, such as the level of creditor rights and enforcement, so these results may not be generalized to other contexts. Nevertheless, we think this also constitutes an opportunity to extend our research. In this sense, the economic implications on investment of accounting and financial policies could be examined in different frameworks of ownership (public and private firms), development of the market value, enforcement and investor protection, which would shed light on the role played by FRQ and the different corporate financial policy in firms' investment decisions. For instance, the role that debt maturity plays in a country with the characteristics of Spain may be different to that played in a country such as US, where debt maturity structure could be less important than its ownership (private/public) to the efficient monitoring of managers, and even the demand of higher FRQ may reduce, in comparison to our sample, the need for private debt to undertake this. Thus, different corporate financial and accounting policies might be used to obtain the same target. We consider these interesting issues for future research.

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CHAPTER 2

REAL EARNINGS MANAGEMENT AND INFORMATION ASYMMETRY IN THE EQUITY MARKET

2.1. INTRODUCTION

Earnings management occurs when managers use their discretion in the financial reporting process and in structuring transactions to misrepresent the true economic performance of the company (Dechow and Skinner, 2000; Healy and Wahlen, 1999). Firms can manage earnings through two types of activities: accrual-based activities and real activities manipulation. While accrual earnings management implies discretionary choices permitted within accounting standards and with no direct cash flow consequences, real earnings management (hereinafter REM) involves deviations from normal operational practices to manipulate earnings numbers, with direct consequences for current and future firm cash flows. In this paper, we are interested in investigating the association between REM and the level of information asymmetry in the stock market.

Although earnings management activities may be informative, most research adopts the opportunistic perspective, and assumes that managers try to mislead stakeholders. According to this view, earnings management reduces earnings quality and garbles the information provided by financial statements. Consequently, as Bhattacharya, Desai and Venkataraman (2013) hypothesize, based on the model of Kim and Verrecchia (1994), if investors differ in their ability to process earnings related information, then poor earnings quality can lead to differentially informed investors, so exacerbating the information asymmetry in financial markets. Consistent with this hypothesis, empirical evidence shows that accrual based earnings management is associated with higher information asymmetry and reductions in market liquidity, leading to a higher cost of capital (e.g. Bhattacharya *et al.*, 2013; Jayaraman, 2008; Rajgopal and Venkatachalam, 2011). Research has analyzed the association between earnings management (or earnings quality) and the firm's information environment, with the focus mainly on accrual-based earnings management. Nevertheless, there is little evidence for the effect of REM on the adverse selection problem in financial markets.

Since earnings management through real activities manipulation distorts earnings and cash flows, REM strategies may imply lower earnings quality, as manipulated earnings numbers hinder the evaluation and assessment of the true firm's current performance and the expected level of future cash flows by investors. Hence, a positive association of REM with information asymmetry could be expected. Moreover, since REM is less subject to

external monitoring and scrutiny by board, auditors and regulators than accruals earnings management (Cohen and Zarowin, 2010), and its implications for firm future performance are not clear (e.g. Graham, Harvey and Rajgopal, 2005; Gunny, 2010), it may be difficult to understand by capital markets (Kothari, Mizik and Roychowdhury, 2016) and thus, it may contribute to increase the informational asymmetry problem. As Gunny (2010) states, it is complicated to determine whether managers use REM opportunistically to the detriment of shareholders or, on the contrary, they use REM to signal future performance or to attain benefits that will allow the firm to perform better in the future. Hence, REM could increase the uncertainty of investors about the distribution of firm's future cash flows, and, in this case, traders who have better information-processing abilities could take advantage of their superior assessments of firm performance. In addition, since it is difficult to distinguish sub-optimal from optimal business decisions, the opacity of REM activities could lead some investors to engage in acquisition of private information with the aim of exploiting it and obtaining profits from trading on the market. For all these reasons, we expect REM strategies to exacerbate information asymmetry among investors in stock markets.

In order to examine the association between REM and information asymmetry we construct a sample of Spanish non-financial listed firms for the period 2001-2008 and use different measures of REM based on Roychowdhury (2006). However, since the proxies for REM represent abnormal levels of cash flows from operations, production costs and discretionary expenses, they may contain noise that is unrelated to managerial opportunism and that may be capturing situations other than intentional manipulation (e.g. unusual business circumstances). Therefore, the prediction of a positive relation between empirical proxies for REM and information asymmetry may not hold in general and the sign of this relation could depend on the particular underlying factors that determine the values of REM measures in the sample. Hence, we divide our total sample into two subsamples based on the incentives to manage earnings. Specifically, we examine the association of REM measures and information asymmetry in two settings: one where managers are likely to engage in REM activities to meet last year's net income (suspect sample) versus another, delimited by the rest of the sample, where deviations from normal activity may be unrelated to opportunistic earnings management (non-suspect sample).

To capture the extent of information asymmetry among investors we use an adverse selection index (denoted as *ASY* hereafter) based on market microstructure measures estimated from high frequency data: the bid-ask spread, the illiquidity measure developed in Amihud (2002), the price impact introduced by Huang and Stoll (1996), the probability of informed trading (*PIN*) of Easley, Nicholas, O'Hara and Paperman (1996), and the volume-synchronized probability of informed trading (*VPIN*) of Easley, López de Prado and O'Hara (2012). Bid-ask spread is a commonly used proxy for information asymmetry as it compensates liquidity providers for transacting with better-informed traders and increases with the degree of information asymmetry. The measures that capture the price impact of transactions – the illiquidity measure of Amihud (2002) and the price impact of Huang and Stoll (1996) – are important in describing the arrival of new information to market participants. The well-known *PIN* and the novel *VPIN* directly infer the presence of privately informed traders in the market from the computation of order imbalances between buys and sells. Using the index of information asymmetry, we extract the common variation in these information asymmetry proxies, so minimizing the possibility of their being driven by factors other than adverse selection (e.g. inventory costs, transactions costs, monopoly rents, etc.).

Our findings indicate that for firms which just meet last year's earnings, that is, firms with strong incentives to manage earnings, income increasing REM is associated with higher information asymmetry. This is consistent with our prediction that firms that incur in REM strategies distort earnings quality and thus, increase adverse selection among investors, because in this scenario informed investors can take advantage of their private information to assess the implication of REM activities for firm value. On the other hand, for firms which do not have incentives to meet last year's earnings, deviations from normal activity are associated with decreasing information asymmetry in the market. Thus, our findings show that deviations from normal operations affect the level of adverse selection in a contrary manner, depending on the particular underlying factors that determine them.

Our study contributes to the literature in several ways. First, it provides new evidence of the association between REM and information asymmetry on the stock market. The evidence on this topic is scarce, mixed and focuses exclusively on the US market. To the best of our knowledge, ours is the first paper that studies the effect of REM on information asymmetry outside the US. We examine this association for Spain, a country

with clearly different features from the US, not only in terms of the size and liquidity of the stock market, but also of weaker investor protection and lower accounting quality (e.g. La Porta, Lopez-de-Silanes, Shleifer and Vishny, 1998; Leuz, Nanda and Wysocki, 2003). Nevertheless, both countries show similar levels of REM according to the international comparison carried out by Enomoto, Kimura and Yamaguchi (2015). This study examines the differences in earnings management strategies across 38 countries, finding that Spain and US show similar levels of REM, ranked 17 and 21 out of 38, respectively. Therefore, we think it is interesting to provide new evidence on how REM is perceived by investors in a setting where they have more incentives to acquire private information than in US.

Second, this paper extends the recent literature on the market consequences of REM, which has shown that REM is positively associated with the cost of equity capital (Kim and Sohn, 2013) and the cost of new corporate bonds (Ge and Kim, 2014). Based on the well-documented positive association between information asymmetry and the cost of capital, both findings can be considered as indirect evidence of REM creating information asymmetry in financial markets. Unlike the authors above, we directly test the link between REM and information asymmetry. Third, our findings suggest that private informed investors produce information in those circumstances where firms have incentives to manipulate earnings through REM activities, that is, where earnings quality is lower. However, when such incentives are not clear, private informed investors do not engage in producing private information, since the benefit from producing private information in this context is lower.

Fourth, since REM affects the quality of earnings reported by firms, our paper also extends a large body of research on the economic consequences of earnings quality and disclosure quality (e.g. Bhattacharya *et al.*, 2013; Cormier, Houle and Ledoux, 2013; Francis, LaFond, Olsson and Schipper, 2005). Finally, to the best of our knowledge, this is one of the first papers to use a composite index of adverse selection to examine the effect of REM on the levels of information asymmetry in the market. Previous studies have mainly focused on individual proxies and sometimes on indirect measures of information asymmetry, such as the accuracy of financial analysts' forecasts (García Lara, García Osma and Penalva, 2013) or the cost of capital (Ge and Kim, 2014; Kim and Sohn, 2013). As Bharath, Pasquariello and Guojun (2009) argue, the use of an index of information asymmetry based on market microstructure measures is more desirable than using

individual proxies proposed by other areas of finance literature (e.g. analyst coverage, dispersion of analysts' forecasts, cost of capital, growth opportunities, tangibility of assets), because these measures are often inconsistent, static, persistent, or have multiple and *ad hoc* interpretations.

The rest of the paper proceeds as follows. Section 2 reviews the related literature and develops our testable hypothesis. Section 3 describes the research design, sample, and data. Section 4 presents the empirical results and the final section concludes.

2.2. RELATED LITERATURE AND HYPOTHESIS DEVELOPMENT

2.2.1. Real earnings management

Earnings management can be achieved through managerial discretion in the application of accounting standards and by changing the timing or structuring of real transactions. Traditionally, the extensive earnings management literature has mainly focused on accrual-based earnings manipulation (Xu, Taylor and Dugan, 2007). However, there has recently been a growing research interest in the relevance and understanding of how firms manage earnings through real activities manipulation and its consequences.

The survey study conducted by Graham *et al.* (2005) shows that financial officers of US public firms recognize that most earnings management actions are carried out via real actions, as opposed to accounting manipulations. They also report that approximately 80% of more than 400 US firms' executives surveyed admitted that they would decrease discretionary spending (including R&D, maintenance, and advertising expenses) and 55.3% said that they would delay a project in order to meet an earnings target, both of which are REM decisions. The increased importance of these managerial practices is also borne out by prior empirical research, which indicates that REM activities have increased steadily over the years, in particular substituting accrual-based earnings managements in contexts where managers are more subject to scrutiny and control of auditors and institutions. In this sense, Cohen, Dey and Lys (2008) find for the US that the level of accrual-based (real) earnings management decreases (increases) subsequent to the passing of the Sarbanes-Oxley Act (SOX) in 2002. This increase in REM practices could be to avoid auditors' and regulators' scrutiny. In contrast to accrual-based earnings management,

where a GAAP (General Accepted Accounting Principles) framework exists to assess deviations from normal practices, real operations belong to the expertise of managers, and it is more difficult for outsiders (auditors, regulators, external investors, among others) to distinguish sub-optimal decisions from optimal ones (Cohen *et al.*, 2008; Cohen and Zarowin, 2010; Kothari *et al.*, 2016).

Earnings management through REM can be defined as actions taken by managers that deviate from normal business practices to achieve certain earnings targets such as avoiding losses, maintaining or attaining positive growth in earnings, meeting analyst earnings forecasts, and smoothing earnings (Roychowdhury, 2006). Firms are found to manage earnings through manipulation of various operating and investing activities such as (Gunny, 2010; Roychowdhury, 2006): (a) reducing discretionary expenses, including R&D spending and SGA (selling, general, and administrative) expenses, which boosts earnings and lowers cash outflows in the current period, but could lead to lower future cash flows. (b) Sales manipulation, that is, increasing price discounts (cutting prices) or extending more lenient credit terms to boost sales, increasing reported earnings and lowering current operating cash flow for a given level of sales. (c) Overproduction or increased production in order to report a lower unit cost of goods sold, which leads to increased operating margins and hence increased reported earnings. (d) Timing the income recognition from the sales of fixed-assets.[1] These managerial decisions, which imply changes in the underlying business transactions, have different features of accrual-earnings management: they are undertaken during the fiscal period (Zang, 2012), are hard to detect, since they could be camouflaged as normal activities (Kothari *et al.*, 2016), and, fundamentally, they directly affect the firm's cash flow. Moreover, the deviation from normal business practices may impose a real cost on the firm, although there is a growing debate in the literature on the effects of REM on firm value (Ewert and Wagenhofer, 2005; Roychowdhury, 2006).

The literature is mixed regarding the effects and implications of REM on future performance and the value of the firm. On the one hand, as Roychowdhury (2006) and Gunny (2010) assert, REM may be opportunistic and reduce firm value because actions

[1]In their review of REM literature, Xu *et al.* (2007) consider a wider definition of REM strategies by including financing transactions. Financing activities include stock repurchases, use of stock options in compensation packages, use of financial instruments, and structuring financing transactions.

taken to boost current-period earnings can have a negative effect on cash flow in future periods. In this line, Bhojraj, Hribar, Picconi and McInnis (2009) provide evidence consistent with managers' undertaking myopic actions to beat benchmarks through earnings management. In particular, they find that firms that beat analysts' forecast by cutting discretionary expenditures underperform in the long-term with respect to firms that increase discretionary expenditures and miss forecasts. Studies have also found that REM around seasoned equity offerings is associated with a subsequent decline in firm operating performance (Cohen and Zarowin, 2010) and with negative returns (Kothari *et al.*, 2016). The perception of REM as opportunistic could lead credit agencies and bondholders to demand a higher risk premium, since the increase of earnings through REM is viewed as a factor that increases credit-risk. In this line, Ge and Kim (2014) find that sales manipulation and overproduction are associated with higher bond yield spreads, and Kim and Sohn (2013) also find a positive association between REM and the cost of capital, providing evidence that suggests that this association stems from managerial opportunism.

The opposite view is that earnings management via real activities is not opportunistic, but informative: managers engage in REM to attain current-period benefits that enable better performance in the future (Bartov, Givoly and Hayn, 2002; Gunny, 2010). Supporting this argument, Gunny (2010) finds that earnings management through REM is positively associated with firm future performance, and that those firms that engage in real activity manipulation have relatively better subsequent performances than firms that do not. In the same line, Zhao, Chen, Zhang and Davis (2012) find that abnormal real activities intended just to meet either zero earnings or the prior year's earnings are associated with better future performance.

2.2.2. REM and information asymmetry

According to the microstructure literature, information asymmetry (or adverse selection risk) in the stock market arises when there are traders with superior information who try to obtain profits by trading on the basis of their informational advantage (e.g. Bagehot, 1971; Copeland and Galai, 1983; Easley and O'Hara, 1987; Kyle, 1985). In all these models there are two types of traders in the market, informed and uninformed, trading an asset of uncertain value. Whereas uninformed traders negotiate in financial markets for liquidity reasons and have no special information, informed traders take a position in the market

based on information about the asset's true value. The informational advantages of informed market participants come from two sources. First, the informed investors may have access to private information about firm value that is not accessible to uninformed investors (insider trading). Second, traders who have a greater ability to process and interpret public information become informed traders because they can make superior assessments of the implications of this information for firm performance or value (Kim and Verrecchia, 1994). The information asymmetries among market participants create an adverse selection problem, which is typically manifested in increased trading costs and reduced levels of stock liquidity, because when liquidity providers perceive increases in the adverse selection risk, they protect themselves by widening the bid-ask spread, thereby reducing liquidity, and increasing the cost of capital (e.g. Copeland and Galai, 1983; Easley and O'Hara, 2004; Glosten and Milgrom, 1985; Kyle, 1985).

Based on the above, REM has attributes that can exacerbate the information asymmetry among investors in financial markets. First, financial executives asked in the anonymous survey by Dichev, Graham, Harvey and Rajgopal (2013) affirmed that REM is difficult to detect and understand for analysts and other market participants outside the firm. This REM opacity could offer sophisticated investors an opportunity to profit from this private information by detecting and analyzing the potential existence of these managerial practices, thereby creating information asymmetry. In this sense, some research shows evidence that specific sophisticated investors may be interested in and concerned about earnings management practices and their implications for the long-term value of the firm. Bushee (1998), for example, shows that certain sophisticated institutional investors can, by monitoring managers, gather, interpret, and value information about managerial investment decisions and R&D spending. [2]

Second, since REM involves management's attempts to alter reported earnings with the aim of misleading some stakeholders, the implications of which on firm value are not clear, these REM practices may reduce the information content of firm earnings. Therefore, earnings manipulation through real activities could impair the market's ability to infer the firm's future cash flows and could provide the opportunity to obtain benefits to

[2] Bushee (1998) hypothesizes that the monitor role of institutional investors could affect managerial incentives to manipulate R&D to meet earnings targets. In this study, we do not analyze this aspect, as we only seek to highlight that sophisticated or informed investors, unlike individual investors, are concerned about real activities manipulation and its firm's value implications.

traders with higher abilities to process earnings-related information. As a consequence, REM could contribute to information asymmetry in the stock markets.

Nevertheless, the prediction of a positive relation between empirical proxies for REM and adverse selection may not hold in general. As the theoretical model developed by Zhang (2001) predicts, the level of information asymmetry across firms can be positively or negatively related to the firm's disclosure quality, depending on the factors that cause differences between firms.[3] Since REM measures could be capturing earnings quality or specific business circumstances, the sign of the association between measures of REM and information asymmetry may not be the same for different firms. On the one hand, consistent with our hypothesis, the informed traders have high incentives to produce private information in those settings where managers use REM practices to meet an earnings target. Consequently, we expect to find a positive association between REM measures and the level of information asymmetry in the market. On the other hand, in those settings where the deviations from normal activities may be just a consequence of business circumstances and not of earnings management, the REM measures may affect information asymmetry in an opposite way. When empirical proxies for REM are less likely to be a proxy for poor earnings quality, the benefit of private information production may be lower and, consequently, we expect that informed investors will not engage in the production of private information. In addition, in this setting, the firm could have higher incentives to publicly disclose more information about the underlying business factors. Thus, the effect of private information production could be dominated by the effect of firm's public disclosure policy, leading to a reduction of the level of information asymmetry among investors.

Although prior literature suggests that earnings quality affects the information environment of the firm, most research to date has used accruals-based earnings management as a proxy for earnings quality, finding that poor earnings quality is significantly associated with higher information asymmetry (Bhattacharya *et al.*, 2013; Cormier *et al.*, 2013; Francis *et al.*, 2005). However, to our knowledge, only two papers

[3] Zhang (2001) theoretically examines incentives behind public disclosure by the firm and trading by informed investors, the interaction between both two forms of information dissemination, and their consequences on the extent of information asymmetry among traders. Assuming that the amount of private information production by informed traders (public disclosure by the firm) increases (reduces) information asymmetry, Zhang's model derives an equilibrium in which the amount of private information production, the level of disclosure, and information asymmetry are all linked to specific characteristics of the firm.

have analyzed the effect of REM on the firm information environment, and they provide unclear evidence. For a sample of NYSE (New York Stock Exchange) firms, Ascioglu, Hedge, Krishnan and McDermott (2012) find mixed results and weak evidence for the association between REM and liquidity. Their results depend on the proxies used: (a) in some regressions they find a significant association between abnormal discretionary expenses and liquidity, but with the opposite sign to that expected; (b) when they use abnormal cash flow, however, the association with liquidity proxies is, overall, not statistically significant.

Likewise, García Lara *et al.* (2013) provide mixed evidence for the information consequences of REM for a sample of US firms. Depending on the proxy used for the firm information environment, their findings lead to different conclusions. On the one hand, they find no evidence that REM impacts on analysts' forecast accuracy and dispersion. On the other, they report a positive association between REM and stock return volatility, which indicates that REM garbles the earnings signal and thus increases idiosyncratic volatility. Given these unclear findings regarding the association between REM and information asymmetry among market participants, we consider that it is still an open empirical question. Thus, we provide new evidence in a different context to the US market that may shed new light on whether REM is associated with the extent of adverse selection among investors in stock markets. Moreover, unlike our paper, the two previous papers do not consider the alternative interpretations of REM measures and they do not design tests to disentangle the effect of the different underlying factors which may influence the relation between empirical proxies for REM and information asymmetry. Therefore, our paper provides a more refined analysis of the influence of earnings management through real activities on the level of information asymmetry by considering the endogenous character of REM measures.

2.3. RESEARCH DESIGN AND DATA

2.3.1. Informational asymmetry metric

Market microstructure literature has proposed different measures and procedures to capture financial market perception about adverse selection risk, which arises when some traders possess private information not currently reflected in stock prices. In contrast to the

measures introduced by corporate finance, market microstructure exploits several sources of information contained in intraday market data to capture the presence of traders with better information (informed traders). Nevertheless, in the literature there has always been a debate about the appropriateness of each proxy in measuring information-based trading. Since information asymmetry is not directly observable, all measures available are imperfect proxies for the financial market's perception of the adverse selection between informed and uninformed traders. Thus, to obtain a more complete information asymmetry measure, prior studies (e.g. Bharath *et al.*, 2009) use principal component analysis to extract the first principal component from individual proxies of information asymmetry. In this paper, we create an *ASY* from five individual measures of information asymmetry developed by the market microstructure literature: the relative bid-ask spread, illiquidity measure developed in Amihud (2002), the price impact, introduced by Huang and Stoll (1996), the *PIN*, and the *VPIN*.

The first and effortless proxy for asymmetric information is the bid-ask spread, a widely used measure of trading costs (liquidity). Bid-ask spread incorporates a component related to the liquidity providers' protection from being adversely selected. Easley and O'Hara (1992) and Glosten and Milgrom (1985) theoretically show that the mere presence of traders with different levels of information is reason enough for the existence of the bid-ask spread. We compute the relative quoted spread, *RQS,* as the difference between the bid and ask quotes in time *t* scaled by the quote mid-point as follows:

$$RQS_t = \frac{(a_t - b_t)}{Q_t} \tag{1}$$

where a_t and b_t corresponds to the ask and the bid quotes in *t.* $Q_t = (a_t+b_t)/2$ is the quoted midpoint in *t*, commonly used as a proxy for the efficient price. First, we computed *RQS* on a daily basis by averaging (time-weighted) all the observations within the day. After that, we obtained an annual *RQS* by averaging (equally weighted) daily values.

Since adverse selection is an important determinant of stock liquidity, we estimate the index of illiquidity introduced by Amihud (2002), which is a volume-based liquidity indicator and is defined as:

$$AMH_t = \frac{1}{D_t}\sum_{d=1}^{D_t}\frac{|R_{dt}|}{V_{dt}} \tag{2}$$

where $R_{d,t}$ is the return on day d of year t, V_{dt} is the volume in euros on day d of year t, and D_t is the number of days for which data are available in year t. Like Amihud (2002), we multiply *AMH* by 10^6. Amihud's illiquidity measure gives the average of the daily price impact of the order flow or absolute percentage price change associated with a unit of trading volume. When a stock is liquid, large trading volumes provoke small price changes. Therefore, higher values of *AMH* indicate higher price moves in response to trading volume, and thus higher stock illiquidity. It is expected that the greater the information asymmetry, the worse the stock liquidity, and the higher the *AMH* value.

Both bid-ask spread and illiquidity ratio are noisy proxies for asymmetric information given that they commonly include other components that are not related to information (inventory costs, order processing cost, monopoly rents, etc.), but that they also influence stock liquidity. Moreover, the illiquidity index of Amihud (2002) provides a rough measure of the price impact. Trades initiated by noise traders lead to transitory changes in transaction prices, while information-based trades provoke permanent price changes. Thus, Huang and Stoll (1996) introduce the realized spread (or price reversal) and the price impact by considering the quote adjustment that takes place a period of time after a trade to extract the presence of new information. Price impact (*PI*) is the permanent price change (or information content) of a trade and is defined as:

$$PI_{t+\tau} = (Q_{t+\tau} - Q_t)X_t \tag{3}$$

where Q_t is the quote midpoint defined previously, X_t is a trade indicator variable taking the value -1 if the trade in t is initiated in the sell side and 1 if it is initiated in the buy side. Finally, τ is the period of time for prices to fully reflect the information content in trade t. Like Huang and Stoll (1996), we set τ equal to 30 minutes. A daily *PI* is computed in trade-time by averaging (volume-weighted) all the trades within the day. Then, we obtain an annual value by averaging (equally weighted) all the trading days in the year. A large and positive *PI* indicates a high frequency of information-based trades.

The fourth measure of information asymmetry considered to compute our index is the probability of information-based trading (*PIN*), a measure that can be included in the group of the asymmetric information measures based on the computation of order imbalances between buys and sells to extract the information content of the trading process. The *PIN* is a measure based on the theoretical work of Easley and O'Hara (1987, 1992), with the original *PIN* model introduced by Easley *et al.* (1996). The *PIN* is the unconditional probability that a randomly selected trade originates from an informed trader. The *PIN* is not directly observable but as a function of the theoretical parameters of a microstructure model that have to be estimated by numerical maximization of a likelihood function. Once the parameters of interest are estimated, the *PIN* is calculated as the ratio of orders from informed traders to the total number of orders. For reasons of space, the description of the model and the estimation process of this well-known methodology are presented in Appendix A.

As an update of the *PIN* model, Easley *et al.* (2012) have developed a new measure for adverse selection risk called volume-synchronized probability of informed trading or *VPIN*. The *VPIN* approach has some practical advantages over the *PIN* methodology that make it particularly attractive for both practitioners and researchers. The main advantage is that *VPIN* does not require the estimation of non-observable parameters using optimization or numerical methods, thereby avoiding all the associated computational problems and biases. In particular, *VPIN* measures order flow toxicity, which can be considered as a broader concept for adverse selection applied to the particular world of liquidity providers in a high frequency trading (HFT) environment. However, *VPIN* can be considered as a more flexible measure of asymmetric information that can be applied in a wide range of frameworks by choosing the appropriate values of the variables involved in the estimation process (Abad and Yagüe, 2012). There are three relevant variables in the *VPIN* approach: time bar, volume bucket, and sample length. At bar level, trade flow is split between buys and sells. At bucket level, order imbalances are computed. Finally, order imbalances are smoothed in the sample length by computing a moving average and the *VPIN* series is obtained. An annual *VPIN* is computed by averaging all the values of the result *VPIN* series into the year. A brief description of this procedure can be found in Appendix B.

2.3.2. REM measures

Roychowdhury (2006) develops three measures of real activities manipulation (abnormal cash flows, abnormal production costs, and abnormal discretionary expenses) to focus on three methods of manipulating real activities in order to manage earnings upwards: (1) sales manipulation through increased price discounts or more lenient credit terms, to temporarily boosts sales revenues, which will have the effect of unusually low cash flow levels from operations; (2) overproduction, to report a lower cost of goods sold; and (3) reduction of discretionary expenses. Following previous research on REM (Cohen *et al.*, 2008; Cohen and Zarowin, 2010; Ge and Kim, 2014; Kim and Sohn, 2013; Roychowdhury, 2006), we employ the three models proposed by Roychowdhury (2006) to construct REM measures. We use model (4) to estimate the normal level of cash flow from operations:

$$\frac{CFO_t}{Assets_{t-1}} = \alpha_0 + \alpha_1\left(\frac{1}{Assets_{t-1}}\right) + \beta_1\left(\frac{Sales_t}{Assets_{t-1}}\right) + \beta_2\left(\frac{\Delta Sales_t}{Assets_{t-1}}\right) + \varepsilon_t \qquad (4)$$

where *CFO* is cash flow from operations estimated as operating income less total accruals, *Sales* and Δ*Sales* represents sales and change in sales, respectively. All variables, including the intercept, are scaled by lagged total assets (*Assets*). We also include an unscaled intercept (Roychowdhury, 2006).

We use model (5) to estimate the normal level of production costs:

$$\frac{PROD_t}{Assets_{t-1}} = \alpha_0 + \alpha_1\left(\frac{1}{Assets_{t-1}}\right) + \beta_1\left(\frac{Sales_t}{Assets_{t-1}}\right) + \beta_2\left(\frac{\Delta Sales_t}{Assets_{t-1}}\right) + \beta_3\left(\frac{\Delta Sales_{t-1}}{Assets_{t-1}}\right) + \varepsilon_t \qquad (5)$$

where *PROD* is production costs defined as the sum of costs of goods sold, which we estimate from the profits and losses account, plus the change in inventory in the year. The other variables have been defined previously.

We estimate the normal level of discretionary expenses with model (6):

$$\frac{DISPEX_t}{Assets_{t-1}} = \alpha_0 + \alpha_1\left(\frac{1}{Assets_{t-1}}\right) + \beta_1\left(\frac{Sales_{t-1}}{Assets_{t-1}}\right) + \varepsilon_t \qquad (6)$$

where *DISPEX* is discretionary expenses and the other variables are calculated as defined previously. Since in Spain firms do not usually report advertising or general and administrative expenses specifically, we measure *DISPEX* with the item *other operating expenses* in the profits and losses statement, which includes R&D, advertising, and other general expenses.

We estimate models (4), (5) and (6) cross-sectionally for each year and industry group using all the data available on Spanish listed firms in the period. Based on the industry classification of the Madrid Stock Exchange, we classify firms into three big industries in order to have a minimum of 15 observations for each regression. For every firm-year, the residuals of the regressions represent, respectively, the abnormal cash flow from operations (*ACFO*), the abnormal productions costs (*APROD*), and the abnormal discretionary expenses (*ADISPEXP*). Firms that manage earnings upwards will show abnormally low cash flows from operations, and/or abnormally high productions costs, and/or abnormally low discretionary expenses (Cohen and Zarowin, 2010). Accordingly, for abnormal cash flows and abnormal discretionary expenses, we multiply the residuals of models (4) and (6) by (-1), so that higher values of these variables represent greater increases of earnings.[4] We separately analyze each measure and also define three combined measures of REM. Following Cohen and Zarowin (2010), we define *REM1* as *APROD*+*ADISEXP*; and *REM2* as *ACFO*+*ADISEX*P. Thus, higher values of *REM1* and *REM2* indicate higher probability of real decisions to increase earnings, in particular, that the firm is engaged in higher production costs and cutting discretionary expenses (*REM1*), and in sales manipulation and cutting discretionary expenses (*REM2*). Finally, we construct *REM3* as an overall measure of *REM* as *ACFO*+*APROD*+*ADISEXP* (Ge and Kim, 2014; Kim, Park and Wier, 2012).[5]

[4] Income increasing real earnings management does not always affect cash flows and earnings in the same direction (Roychowdhury, 2006) because, whereas price discount and overproduction have a negative effect on cash flows, cutting discretionary expenses has a positive effect. Although this has led some studies to disregard abnormal cash flows in REM measures, and thus focus only on abnormal production costs and abnormal discretionary expenses, other authors include abnormal cash flows in order to take into account the possibility of sales manipulation.

[5] Note that *ACFO* and *ADISPEXP* are the residuals of models (4) and (6) multiplied by (-1), so these are the values we add to *APROD* in *REM1*, *REM2* and *REM3*.

2.3.3. Incentives to engage in earnings management

REM measures, as defined in the previous section, are the residuals of the models developed by Roychowdhury (2006) to estimate normal levels of cash flow, production costs, and discretionary expenses. However, the abnormal levels of these measures, apart from earnings management activities, could be capturing abnormal situations caused by incompetent managers or unusual changes in the business conditions. Prior research addresses this concern by analyzing REM activities and their effects in settings in which earnings management is likely to occur, such as firms that use REM to meet earnings benchmarks (Gunny, 2010; Kim and Sohn, 2013; Roychowdhury, 2006; Zang, 2012). To avoid the association between proxies for information asymmetry and REM being explained by factors unrelated to managerial opportunism, we implement our analyses for two different settings: (a) firms with strong incentives to opportunistically manage earnings (suspect firms); and (b) the rest of the sample (non-suspect firms). In particular, we consider as a sample of suspect firm-year observations those that just meet last year's earnings. For each firm-year, we compute net income on total assets and suspect firm-years are those whose change in net income divided by total assets is between 0 and 0.01. Thus, in the first scenario we assume that deviations from normal operations represent REM decisions, whereas in the second setting these deviations are more likely to represent unusual business conditions.

2.3.4. Regression model

We test the association between REM and the level of information asymmetry between traders in the stock market with the following model:

$$\begin{aligned} ASY = {} & \beta_0 + \beta_1 REM + \beta_2 DiscAcc + \beta_3 Size + \beta_4 ROA + \beta_5 Turnover + \beta_6 Volat + \\ & \beta_7 Analysts + \beta_8 Own + \sum_t \beta_t Year + \sum_j \beta_j Ind + \varepsilon \end{aligned} \quad (7)$$

where *ASY* is our index of information asymmetry and *REM* corresponds to each of the different REM measures described in the previous section. We include variables in the regression to control for factors that, according to the previous literature, affect the information environment of a firm and that are likely to be associated with information asymmetry among investors in the capital markets. These control variables are:

discretionary accruals (*DiscAcc),* firm size *(Size)*, return on assets (*ROA*), trading volume (*Turnover)*, stock volatility (*Volat)*, financial analyst following (*Analyst*) and ownership concentration (*Own*).

As commented on above, previous studies document that accrual-based earnings management and REM can be used as substitutes to manipulate earnings (Cohen *et al.*, 2008; Cohen and Zarowin, 2010; Zang, 2012) and that earnings quality is associated with information asymmetry proxies. Empirical studies, such as Francis *et al.* (2005) and Bhattacharya *et al.* (2013), use discretionary accruals as a proxy for earnings quality and suggest that poor earnings quality enhance information asymmetry among investors. This supports the opportunistic view of accrual-based earnings management, which assumes that the objective of these accounting practices is to garble the market, resulting in an increase in the adverse selection risk. However, some studies support an informational view of discretionary accounting choices. According to these studies, if investors detect accrual-based earnings management, discretionary accruals might not be a noisy signal but could, in contrast, be informative about firm future cash flows. This would improve the informativeness of earnings (e.g. Subramanyam, 1996) and, as a consequence, more informative financial reporting could minimize the informational advantages of informed traders. Therefore, since we control for discretionary accruals, *DiscAcc, β_1* represents the incremental effect on information asymmetry of REM once accrual-based earnings management is taken into account. *DiscAcc* is calculated as the value of discretionary accruals estimated by the Jones (1991) model, modified by Dechow, Sloan and Sweeney (1995).

Market microstructure literature provides extensive empirical evidence of firms' characteristics that are related to the *PIN* and, consequently, stock liquidity. In particular, stocks of larger and more profitable firms and stocks with larger trading volumes and lower return volatility suffer lower adverse selection problems and are more liquid (e.g. Easley *et al.*, 1996; Goh, Lee, Ng and Yong, 2016; Stoll, 2000). This is consistent with the widely known argument that larger and more profitable firms, and firms whose stocks are more frequently traded, have richer information environment as a consequence of their higher levels of information production and publicly available information. Additionally, the positive relation between information asymmetry and stock volatility suggests a higher presence of informed traders due to the greater profit opportunities in stocks that have

higher information uncertainty (Bhattacharya *et al.*, 2013). Hence, we include *Size,* the company's size measured as the natural logarithm of total assets; *ROA*, defined as operating income divided by total assets; *Turnover,* the logarithm of the average daily trading volume in euro scaled by the market value of the firm's equity at the end of the year; and *Volat,* a proxy for stock return volatility calculated as the standard deviation of daily returns.

Disclosure literature also predicts that the information environment of a firm is affected by the activities of producing and disseminating information performed by financial analysts following the firm. However, neither theoretical nor empirical studies are totally conclusive about the sign of the relation between analyst following and information asymmetry. For example, Easley, O'Hara and Paperman (1998) state that the number of analysts following the firm can be either positively or negatively associated with the level of disclosure and with the *PIN* depending on whether financial analysts create new private information or disseminate public information among investors. Although it is possible to find some empirical studies that provide findings suggesting that the number of analyst following a stock is positively correlated with information asymmetry (e.g. Chung, McInish, Wood and Wyhowski, 1995), the great majority report that analyst coverage is negatively related to information asymmetry (e.g. Easley *et al.*, 1998; Roulstone, 2003). This inverse relation supports the argument that more analyst following increases publicly available information on the firm, which results in a reduction in the risk of information-based trading and an improvement in stock liquidity. Therefore, we include in our model the variable *Analyst*, which represents the natural log of the total number of analysts following a firm.

In addition, the distribution of private information among investors can be affected by the predominance of large shareholders in the firm ownership. For this reason, we include ownership concentration, *Own*, as a control variable measured by the percentage of common shares held by the largest five shareholders of the company. A more highly concentrated ownership is expected to be positively associated with information asymmetry because the larger shareholders are likely to control the firm and therefore to have access to, or generate, private information about the firm, so exacerbating adverse selection problems in the market (e.g. Heflin and Shaw, 2000).

Finally, we also include year and industry dummy variables to control for temporal and industry effects.

2.3.5. Sample and data

Our sample is made up of stocks traded on the electronic trading platform of the Spanish Stock Exchange, known as the SIBE (*Sistema de Interconexión Bursátil Español*). The SIBE is an order-driven market where liquidity is provided by an open limit order book. Trading is continuous from 9:00 am to 5:30 pm. There are two regular call auctions each day: the first determines the opening price (8:30-9:00 am), while the second sets the official closing price (5:30-5:35 pm). Three basic types of orders are allowed: limit orders, market orders, and market-to-limit orders. In the continuous session, a trade occurs whenever an incoming order matches one or more orders on the opposite side of the limit order book. Orders submitted that are not instantaneously executed are stored in the book, waiting for a counterparty, according to a strict price-time priority rule. Unexecuted orders can always be canceled and modified. Continuous trading can be temporally interrupted, since a system of stock-specific intraday price limits and short-lived call auctions is implemented to handle unusual volatility levels. In all auctions (open, close and volatility) orders can be submitted, modified, or canceled, but no trades occur.

Trade and quote data for this study come from SM data files provided by the *Sociedad de Bolsas, S.A.* SM files contain detailed time-stamped information about the first level of the limit order book for each stock listed on the SIBE. Any trade, order submission and cancelation affecting best prices in the book generates a new entry in the file. The distinction between buyer-initiated and seller-initiated trades is straightforward and no classification algorithm is needed. Firms' financial statement data were taken from the SABI database, made by Bureau Van Dijk, and from the annual reports at the Spanish Securities Market Commission (*Comisión Nacional del Mercado de Valores*, *CNMV*). Ownership concentration and analysts' data were collected from Thomson Reuters Eikon Datastream.

Our sample consists of non-financial firms listed on the main segment of the SIBE in the period 2001-2008, with full data available for all the period. After applying the usual filters to detect and eliminate errors in the preparation of the intraday trading data and

combining the different databases, we obtain 468 firm-year observations, for which we have been able to collect the information asymmetry measures, the complete financial-accounting information and data on analyst following and ownership concentration.

2.4. RESULTS

2.4.1. Descriptive statistics

Table 1 reports the estimations of normal levels of cash flow from operations, production costs and discretionary expenses –models (4), (5), and (6). We estimate these models using all the available information for Spanish listed firms during the period 2001-2008. The regressions are estimated for industry-year groups with at least 15 observations. The table reports the mean coefficients across all industry-years and *t*-statistics calculated using the standard error of the mean across industry-years, as well as the mean R^2 across industry-years. We can see that the models explain the real operations quite well, and our results are similar to those reported by Roychowdhury (2006) for US firms.

Table 2 presents descriptive statistics for the information asymmetry measures (Panel A), REM measures (Panel B), and control variables (Panel C). The mean, median, standard deviation, 10th percentile and 90th percentile are reported for each. With regard to proxies for information asymmetry, the mean (median) of *RQS* is 0.6% (0.4%). The mean value of *AMH* in our sample (0.3) is similar to that reported by Amihud (2002). The average (median) of price impact measure (*PI*) is 0.37% (0.30%). According to Abad and Yagüe (2012), the *PIN* and the *VPIN* show similar mean values of around 19% and 20%, respectively. *PIN* values are also consistent with those reported in prior studies that use this information asymmetry proxy (e.g. Brown and Hillegeist, 2007; Easley, Hvidkjaer and O'Hara, 2002). The statistical distributions of the above measures show that there are clear differences in the degree of asymmetric information among firms included in our sample.

Table 1. Estimation of the normal levels of cash flow, production costs and discretionary expenses

	CFO_t/A_{t-1}	$PROD_t/A_{t-1}$	$DISEXP_t/A_{t-1}$
$1/A_{t-1}$	-2.2742**	1.9773	1.1752
	(-2.01)	(1.12)	(1.44)
S_t/A_{t-1}	0.1078***	0.7743***	
	(8.04)	(48.44)	
S_{t-1}/A_{t-1}			0.1426***
			(15.77)
$\Delta S_t/A_{t-1}$	0.0941	0.2469***	
	(1.46)	(2.86)	
$\Delta S_{t-1}/A_{t-1}$		-0.0308	
		(-0.46)	
Intercept	0.0208	-0.0508***	0.0444***
	(1.58)	(-4.34)	(11.09)
Ad. R^2	0.132	0.911	0.366

Notes: This table reports OLS coefficients of the regressions (4), (5) and (6). The regressions are estimated for industry-year groups with at least 15 observations.

$$CFO_t / A_{t-1} = \alpha_0 + \alpha_1(1/A_{t-1}) + \beta_2(S_t / A_{t-1}) + \beta_3(\Delta S_t / A_{t-1}) + \varepsilon_t$$

$$PROD_t / A_{t-1} = \alpha_0 + \alpha_1(1/A_{t-1}) + \beta_2(S_t / A_{t-1}) + \beta_3(\Delta S_t / A_{t-1}) + \beta_4(\Delta S_{t-1} / A_{t-1}) + \varepsilon_t$$

$$DISEXP_t / A_{t-1} = \alpha_0 + \alpha_1(1/A_{t-1}) + \beta_2(S_{t-1} / A_{t-1}) + \varepsilon_t$$

CFO_t is cash flow from operations estimated as operating income less total accruals; $PROD_t$ is the production costs; $DISEXP_t$ is the discretionary expenses. S and ΔS represents sales and change in sales, respectively. All variables, including the intercept, are scaled by lagged total assets (A_{t-1}). ***, **, * denote significance at the 1%, 5%, and 10% (two-tailed) level, respectively.

As discussed in Section 3, in order to isolate the common adverse selection component underlying the former proxies, we constructed an index of information asymmetry (*ASY*) by employing principal components analysis (PCA) for each firm and year of our sample.

The mean of *ASY* is zero (by construction) and its median is -0.40. The first (and only) factor with an eigenvalue greater than one explains 64.3% of the variance and each component of *ASY* enters with a positive sign and loadings as follows:

$$ASY = 0.511RQS + 0.257AMH + 0.477PI + 0.459PIN + 0.484VPIN \quad (8)$$

Therefore, each proxy for information asymmetry plays its role in the index.[6] A higher value of the index means a higher level of adverse selection. As seen in Table 3,

[6] A potential concern about the use of *ASY* as proxy for information asymmetry for our sample is that the PCA is sensitive to sample size. To check the robustness of the index, we evaluate the performance of the

which provides the Pearson correlation matrix between the variables used in the study, all the information asymmetry proxies are positively correlated with each other, which indicates that these measures are likely to be driven by adverse selection, but each contains unique information. Moreover, the index is positive and significantly correlated with each information asymmetry variable, varying from a correlation of 92% between *ASY* and *RQS* to a correlation of 46% between *ASY* and *AMH.* Additionally, correlations between all five proxies for information asymmetry and the index are generally higher than between them, which suggests that the index is a parsimonious way of measuring information asymmetry.

Mean values of *ACFO*, *APROD*, *ADISPEXP*, and *DiscAcc* are very close to zero, as expected. Their deviation from zero is due to these variables having been estimated with all the available information for listed firms in the period, which is higher than the size of our sample. With regard to the control variables (*Size*, *ROA*, *Turnover*, *Volat*, *Analysts*, and *Own*), these show a significant level of dispersion in their values, reflecting the heterogeneity of our firm-year sample.

The correlations between REM variables are positive and significant, which means that firms simultaneously use different strategies of real activities manipulation to achieve their earnings objectives. Firms also simultaneously apply sales manipulation and discretionary accruals strategies to manipulate earnings, since *ACFO* and the REM variables that include *ACFO* are highly and positively correlated with *DiscAcc*. The positive correlations between *Size* and most of REM variables show that bigger firms are more likely to engage in REM activities to increase earnings, and the negative correlations between *ROA* and REM measures suggest that firms with better performance are less prone to managing earnings through real activities manipulation.

PCA by applying computer-based resampling (bootstrap) techniques. Thus, we draw a large number of samples (1000, 5000, and 10,000) of different sizes −smaller than (234 observations), equal to (468), and larger than (1000) our sample size. We perform PCA analysis to all the samples and compute confidence intervals (basic percentile) at the 1% level. We observe that our full-sample estimations for all relevant parameters (the eigenvalues and the component weights for the first factor) are always included in the bootstrap intervals.

Table 2. Descriptive statistics

Panel A. Information asymmetry measures						
	#obs.	*Mean*	*SD*	*10th perc.*	*Median*	*90th perc.*
RQS	468	0.006	0.006	0.001	0.004	0.014
AMH	468	0.302	2.068	0.000	0.009	0.352
PI	468	0.004	0.003	0.001	0.003	0.007
PIN	468	0.189	0.060	0.122	0.179	0.265
VPIN	468	0.205	0.124	0.073	0.174	0.365
ASY	468	0.000	1.793	-1.904	-0.396	2.434
Panel B. REM measures						
ACFO	468	0.002	0.110	-0.119	0.000	0.132
APROD	468	-0.003	0.101	-0.126	0.004	0.098
ADISEXP	468	-0.001	0.073	-0.089	0.006	0.067
REM1	468	-0.005	0.162	-0.204	0.019	0.149
REM2	468	0.001	0.137	-0.164	-0.003	0.147
REM3	468	-0.002	0.220	-0.265	0.006	0.217
Panel C. Control variables						
DiscAcc	468	-0.008	0.099	-0.123	-0.004	0.103
Size	468	14.228	1.735	12.090	14.144	16.628
ROA	468	0.070	0.063	0.016	0.066	0.132
Turnover	468	-6.266	1.047	-7.548	-6.279	-5.123
Volat	468	1.830	0.764	1.086	1.651	2.771
Analysts	468	1.957	0.957	0.000	2.197	3.091
Own	468	0.490	0.235	0.155	0.490	0.788

Notes: This table reports descriptive statistics of the variables employed in the present study. *RQS* is the relative quote bid-ask spread; *AMH* is the illiquidity measure of (2002). *PI* is the price impact measure proposed by Huang and Stoll (1996). *PIN* is based on the Easley *et al.* (1996) model. *VPIN* is developed in Easley *et al.* (2012). *ASY* is the composite index of information asymmetry based on the before market microstructure measures: *RQS*, *AMH*, *PI*, *PIN*, and *VPIN*. *ACFO* is the abnormal level of cash flows according to model (4) multiplied by (-1); *APROD* is abnormal production costs according to model (5); *ADISEXP* is abnormal discretionary expenses according to model (6) multiplied by (-1); *REM1*, *REM2,* and *REM3* are aggregate measures of REM defined as *APROD+ADISEXP, ACFO+ADISEXP*, and *ACFO+APROD+ADISEXP*, respectively. *DiscAcc* is the value of discretionary accruals estimated by the Jones (1991) model modified by Dechow *et al.* (1995). *Size* is the natural logarithm of total assets. *ROA* is operating income divided by total assets. *Turnover* is the natural logarithm of the average daily trading volume in euro scaled by market value of the firm's equity at the end of the year. *Volat* is the standard deviation of daily returns. *Analysts* is the natural logarithm of the total number of analysts following a firm. *Own* is the proportion of common shares held by the largest five shareholders.

Table 3. Correlation matrices

Panel A. Measures of information asymmetry

	RQS	*AMH*	*PI*	*PIN*	*VPIN*	*ASY*
RQS	1					
AMH	0.306***	1				
PI	0.920***	0.218***	1			
PIN	0.599***	0.347***	0.526***	1		
VPIN	0.700***	0.310***	0.594***	0.766***	1	
ASY	0.916***	0.461***	0.855***	0.824***	0.868***	1

Panel B. Explanatory variables

	ACFO	*APROD*	*ADISEXP*	*REM1*	*REM2*	*REM3*	*DiscAcc*	*Size*	*ROA*	*Turnover*	*Volat*	*Analysts*	*Own*
ACFO	1												
APROD	0.391***	1											
ADISEXP	0.100**	0.728***	1										
REM1	0.289***	0.952***	0.903***	1									
REM2	0.851***	0.696***	0.608***	0.707***	1								
REM3	0.711***	0.894***	0.714***	0.879***	0.944***	1							
DiscAcc	0.708***	0.008	-0.025	-0.006	0.552***	0.348***	1						
Size	0.021	0.168***	0.146***	0.170***	0.094**	0.136***	0.005	1					
ROA	-0.347***	-0.515***	-0.113***	-0.373***	-0.336***	-0.447***	0.119***	-0.009	1				
Turnover	0.132***	0.032	-0.047	-0.001	0.081*	0.065	0.067	0.178***	-0.119***	1			
Volat	0.047	-0.011	-0.108**	-0.055	-0.019	-0.017	-0.091**	-0.145***	-0.234***	0.416***	1		
Analysts	-0.069	-0.059	0.032	-0.023	-0.038	-0.051	0.003	0.635***	0.265***	0.275***	-0.147***	1	
Own	-0.054	-0.035	-0.020	-0.031	-0.054	-0.050	-0.078	0.125***	0.134***	-0.407***	0.008	0.060	1

Notes: This table reports the pairwise correlation coefficients between the measures used in the study. *RQS* is the relative quote bid-ask spread; *AMH* is the illiquidity measure of Amihud (2002). *PI* is the price impact measure proposed by Huang and Stoll (1996). *PIN* is based on the Easley *et al.* (1996) model. *VPIN* is developed in Easley *et al.* (2012). *ASY* is the composite index of information asymmetry based on the before measures: *RQS*, *AMH*, *PI*, *PIN*, and *VPIN*. *ACFO* is the abnormal level of cash flows according to model (5) multiplied by (-1); *APROD* is abnormal production costs according to model (6); *ADISEXP* is abnormal discretionary expenses according to model (7) multiplied by (-1); *REM1*, *REM2*, and *REM3* are aggregate measures of REM defined as *APROD+ADISEXP, ACFO+ADISEXP*, and *ACFO+APROD+ADISEXP*, respectively. *DiscAcc* is the value of discretionary accruals estimated by the Jones (1991) model modified by Dechow *et al.* (1995). *Size* is the natural logarithm of total assets. *ROA* is operating income divided by total assets. *Turnover* is the natural logarithm of the average daily trading volume in euro scaled by market value of the firm's equity at the end of the year. *Volat* is the standard deviation of daily returns. *Analysts* is the natural logarithm of the total number of analysts following a firm. *Own* is the proportion of common shares held by the largest five shareholders. ***, **, * denote significance at the 1%, 5%, and 10% (two-tailed) level, respectively.

2.4.2. Analysis for the whole sample

Table 4 reports the results of model (7) for the different measures of REM in the whole sample. Columns (1)-(3) present the results for individual proxies while columns (4)-(6) do so for the aggregate measures. Since Table 3 shows high correlations between *DiscAcc* and *ACFO* and *DiscAcc* and *REM2*, models in columns (1) and (5) are estimated using orthogonalized variables with respect to *DiscAcc*, that is, they incorporate the residuals of the regression of *ACFO* on *DiscAcc* and the residuals of the regression of *REM2* on *DiscAcc*, respectively. We report OLS coefficients and *t*-statistics (in brackets) based on robust standard errors, which are clustered by firm.

The results do not show significant associations between REM proxies and information asymmetry. These insignificant effects could be explained by the heterogeneity of the sample, composed by firms with different incentives to engage in REM activities. Thus, the findings for the overall sample could be showing an offset between a positive and a negative effect in different scenarios, depending on whether or not there are incentives to engage in REM. Neither is accrual-based earnings management significantly associated with information asymmetry in the Spanish market. [7] This finding, which is not consistent with most of the empirical evidence in the literature, along with the findings reported below for the analysis of two subsamples, suggests that, like the REM effect on information asymmetry, the effect of accrual-based earnings management may depend on the incentives to produce private information in relation to accrual-based manipulation of earnings.

Regarding the other control variables, the signs of their coefficients are as expected according to the literature. We find that the stocks of larger and more profitable firms, with higher trading volume, and those being followed by more analysts show less information asymmetry, whereas firms with more volatile stock returns are associated with higher information asymmetry. All these variables are significant at the 1% level in all models estimated. The coefficient on *Own,* as expected, always presents a positive sign, but it is not significant.

[7]The results do not change (the coefficient on discretionary accruals is not significant) if we include the absolute value of discretionary accruals, as in Kim *et al*. (2012).

Table 4. Information asymmetry and REM in the whole sample

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
ACFO	0.046					
	(0.14)					
APROD		-0.076				
		(-0.29)				
ADISEXP			-0.389			
			(-0.94)			
REM1				-0.115		
				(-0.63)		
REM2					-0.172	
					(-0.76)	
REM3						-0.074
						(-0.57)
DisAcc	0.063	0.069	0.057	0.068	0.078	0.132
	(0.66)	(0.73)	(0.62)	(0.72)	(0.82)	(0.86)
Size	-0.202***	-0.202***	-0.202***	-0.201***	-0.203***	-0.202***
	(-10.63)	(-10.68)	(-10.87)	(-10.69)	(-11.10)	(-10.90)
ROA	-1.404***	-1.511***	-1.510***	-1.567***	-1.614***	-1.584***
	(-3.39)	(-3.43)	(-4.21)	(-3.80)	(-3.88)	(-3.60)
Turnover	-0.223***	-0.223***	-0.225***	-0.224***	-0.223***	-0.223***
	(-9.09)	(-8.93)	(-9.25)	(-9.07)	(-8.95)	(-8.94)
Volat	0.121***	0.120***	0.115***	0.118***	0.118***	0.118***
	(4.17)	(4.04)	(3.94)	(3.95)	(3.97)	(3.98)
Analysts	-0.102***	-0.101***	-0.102***	-0.102***	-0.101***	-0.101***
	(-3.00)	(-3.07)	(-3.02)	(-3.05)	(-3.06)	(-3.07)
Own	0.109	0.111	0.111	0.112	0.118	0.114
	(0.98)	(1.04)	(1.05)	(1.05)	(1.10)	(1.07)
Intercept	2.435***	2.444***	2.448***	2.446***	2.472***	2.457***
	(7.29)	(7.19)	(7.43)	(7.28)	(7.39)	(7.28)
Year	Yes	Yes	Yes	Yes	Yes	Yes
Ind	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.861	0.861	0.863	0.862	0.862	0.862
#obs.	468	468	468	468	468	468

Notes: This table reports OLS coefficients of our information asymmetry index on real activities manipulation and control variables following the regression model:

$$ASY = \beta_0 + \beta_1 REM + \beta_2 DiscAcc + \beta_3 Size + \beta_4 ROA + \beta_5 Turnover + \beta_6 Volat + \beta_7 Analysts + \beta_8 Own + \sum_t \beta_t Year + \sum_j \beta_j Ind + \varepsilon$$

ASY is the log of 3 plus the composite index of information asymmetry based on the following market microstructure measures: *RQS*, *AMH*, *PI*, *PIN*, and *VPIN*. *REM* refers to each of our six proxies of REM: *ACFO* is the abnormal level of cash flows according to model (4) multiplied by (-1); *APROD* is abnormal production costs according to model (5); *ADISEXP* is abnormal discretionary expenses according to model (6) multiplied by (-1); *REM1*, *REM2,* and *REM3* are aggregate measures of REM defined as *APROD+ADISEXP, ACFO+ADISEXP*, and *ACFO+APROD+ADISEXP*, respectively. *DiscAcc* is the value of discretionary accruals estimated by the Jones (1991) model modified by Dechow *et al.* (1995). *Size* is the natural logarithm of total assets. *ROA* is operating income divided by total assets. *Turnover* is the natural logarithm of the average daily trading volume in euro scaled by market value of the firm's equity at the end of the year. *Volat* is the standard deviation of daily returns. *Analysts* is the natural logarithm of the total number of analysts following a firm. *Own* is the proportion of common shares held by the largest five shareholders. *Year* and *Ind* represent year and industry dummies, respectively. *ACFO* and *REM2* are orthogonalized respect to *DiscAcc* in models (1) and (5). Robust *t*-statistics clustered at the firm level in parentheses. ***, **, * denote significance at the 1%, 5%, and 10% (two-tailed) level, respectively.

2.4.3. Analysis for the suspect and non-suspect samples

In the previous analysis, we have examined the association between REM measures and information asymmetry in the whole sample. However, since empirical proxies for REM represent abnormal levels of real transactions, they could be capturing the consequences of opportunistic managerial practices, but also specific business circumstances unrelated to earnings management, such as changes in business or unique business models. Consequently, the sign of the association between measures of REM and the level of information asymmetry may depend on these sources of variation among firms in a particular sample.

Hence, in order to extend the understanding of the association between REM practices and information asymmetry, we analyze this association in two subsamples: (a) *suspect sample*, that is, firm-years observations with strong incentives to manage earnings in order to just meet zero earnings growth (last year's earnings), and (b) *non-suspect sample*, that is, firm-years observations without incentives to meet this target. In settings where managers have strong incentives to manage earnings and the reason for earnings management is well-understood, such as the aim to meet an earnings target (Graham *et al.*, 2005), we would expect investors to enhance the private information production to increase their trading profits. This would have the effect of raising the level of information asymmetry in the market. However, in settings without incentives to engage in earnings management, deviations from normal operations can be attributed to other circumstances, rather than the firm's disclosure quality. Since in this case there are fewer incentives to produce private information, we could expect that these deviations from normal operations do not create information asymmetry in the market.

As a preliminary analysis, we compare REM in the suspect sample versus the non-suspect sample. Following Roychowdhury (2006), we run the following regression:

$$REM = \beta_0 + \beta_1 Size + \beta_2 BTM + \beta_3 ROA + \beta_4 Suspect + \sum_t \beta_t Year + \sum_j \beta_j Ind + \varepsilon \quad (9)$$

where *REM* corresponds to each of the different REM measures as described previously, *BTM* is the book to market ratio, *ROA* is operating income divided by total assets, and *Suspect* is a dummy variable that takes the value of 1 if the change in net income divided

by total assets is between 0 and 0.01, and 0 otherwise. Table 5 displays the estimate of the model for the six REM measures. The results in columns (2)-(4) and (6), show that the coefficients on *Suspect* are positive and significant (at the 10% level, in the *REM3* model; at the 5% level in the abnormal production costs model; and at the 1% level in the abnormal discretionary expenses and *REM1* models). This suggests that suspect firm-years have higher abnormal production costs and lower discretionary expenses than the rest of firms, which is consistent with their engagement in REM activities to meet last year's earnings. The non-significant coefficients for the abnormal cash flow model and for *REM2* could be explained by the opposite effect on cash flows of cutting discretionary expenses in relation to sales manipulation and increasing production costs.

Table 5. Comparison of suspect firm-years with the rest of the sample in relation to REM activities

	ACFO	*APROD*	*ADISEXP*	*REM1*	*REM2*	*REM3*
Size	-0.001	0.005	0.001	0.005	-0.001	0.004
	(-0.29)	(1.11)	(0.13)	(0.64)	(-0.13)	(0.39)
BTM	0.001	-0.017	-0.015	-0.032	-0.014	-0.031
	(0.04)	(-1.21)	(-1.48)	(-1.40)	(-0.85)	(-1.05)
ROA	-0.618***	-0.859***	-0.133	-0.992***	-0.751***	-1.610***
	(-8.24)	(-7.52)	(-1.33)	(-5.11)	(-5.52)	(-6.99)
Suspect	-0.004	0.037**	0.038***	0.075***	0.034	0.070*
	(-0.32)	(2.36)	(2.85)	(2.64)	(1.57)	(1.97)
Intercept	0.067	0.022	0.038	0.060	0.105	0.127
	(0.89)	(0.31)	(0.57)	(0.46)	(1.02)	(0.77)
Year	Yes	Yes	Yes	Yes	Yes	Yes
Ind	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.135	0.402	0.214	0.314	0.190	0.314
#obs.	468	468	468	468	468	468

Notes: This table reports OLS coefficients of our REM measures and control variables following the regression model:

$$REM = \beta_0 + \beta_1 Size + \beta_2 BTM + \beta_3 ROA + \beta_4 Suspect + \sum_t \beta_t Year + \sum_j \beta_j Ind + \varepsilon$$

REM refers to each of our six proxies of REM: *ACFO* is the abnormal level of cash flows according to model (4) multiplied by (-1); *APROD* is abnormal production costs according to model (5); *ADISEXP* is abnormal discretionary expenses according to model (6) multiplied by (-1); *REM1*, *REM2,* and *REM3* are aggregate measures of REM defined as *APROD+ADISEXP, ACFO+ADISEXP*, and *ACFO+APROD+ADISEXP*, respectively. *Size* is the natural logarithm of total assets. *BTM* is the book to market ratio. *ROA* is operating income divided by total assets. *Suspect* is a dummy variable that takes the value of 1 if the change in net income divided by total assets is between 0 and 0.01, and 0 otherwise. *Year* and *Ind* represent year and industry dummies, respectively. Robust *t*-statistics clustered at the firm level in parentheses. ***, **, * denote significance at the 1%, 5%, and 10% (two-tailed) level, respectively.

Table 6 reports the results of model (7) for the two subsamples. Panel A corresponds to the suspect sample and Panel B to the non-suspect sample. We report OLS coefficients and *t*-statistics (in brackets) based on robust standard errors that are clustered by firm.

In the sample with strong incentives to manage earnings (suspect sample), we find that, with the exception of the cash flow model, all coefficients on REM measures are positive and significant (at the 5% level, in the abnormal discretionary expenses and *REM2* models, and at the 1% level in abnormal production costs, *REM1* and *REM3* models). These findings are consistent with the hypothesis that managerial opportunism to increase earnings through REM creates information asymmetry in the market in those contexts where managers have incentives to engage in REM activities, and consequently, informed investors also have incentives to produce private information. However, as in the whole sample, the coefficient on *DiscAcc* is not statistically significant. Therefore, the strong and clear effect of REM and the non-significant effect of accrual-based earnings management on information asymmetry could be explained by the different implications of both types of earnings management. The larger opacity and real effects of REM for firm value in comparison to accrual-based management may imply a higher marginal benefit for the production of private information. As a consequence, informed traders may have more incentives to produce information about REM than in relation to accrual-based management. The signs and significance of the other control variables are quite similar to those of the analysis with the whole sample, but in the subsample of suspect firms we also find that *ROA* is not significant, which can be explained by its low variability or because earnings numbers are nosier or less credible due to the high likelihood of REM in this setting. In contrast, we find a significant positive association between ownership concentration and information asymmetry, which is consistent with lower disclosure levels in firms with a predominance of large shareholders.

Table 6. Information asymmetry and REM in suspect and non-suspect samples

Panel A. Suspect sample

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
ACFO	0.135					
	(0.48)					
APROD		0.611***				
		(3.41)				
ADISEXP			0.531**			
			(2.23)			
REM1				0.322***		
				(2.94)		
REM2					0.239**	
					(2.22)	
REM3						0.213***
						(2.86)
DisAcc	-0.147	-0.081	-0.082	-0.073	-0.123	-0.267
	(-0.80)	(-0.45)	(-0.43)	(-0.40)	(-0.64)	(-1.35)
Size	-0.226***	-0.235***	-0.229***	-0.233***	-0.228***	-0.231***
	(-9.11)	(-9.67)	(-9.38)	(-9.57)	(-9.25)	(-9.49)
ROA	-1.049	-0.516	-0.992	-0.720	-0.897	-0.703
	(-0.99)	(-0.51)	(-0.96)	(-0.70)	(-0.85)	(-0.68)
Turnover	-0.182***	-0.175***	-0.178***	-0.176***	-0.181***	-0.179***
	(-5.12)	(-5.08)	(-5.00)	(-5.03)	(-5.11)	(-5.10)
Volat	0.106***	0.110***	0.120***	0.116***	0.111***	0.112***
	(3.10)	(3.58)	(3.53)	(3.67)	(3.40)	(3.57)
Analysts	-0.093**	-0.094***	-0.091**	-0.092**	-0.092**	-0.093**
	(-2.32)	(-2.57)	(-2.44)	(-2.53)	(-2.36)	(-2.44)
Own	0.300**	0.268*	0.291**	0.276*	0.284*	0.272*
	(2.01)	(1.88)	(2.00)	(1.92)	(1.95)	(1.89)
Intercept	2.926***	3.070***	2.942***	3.013***	2.946***	2.995***
	(7.29)	(8.01)	(7.49)	(7.79)	(7.51)	(7.79)
Year	Yes	Yes	Yes	Yes	Yes	Yes
Ind	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.911	0.917	0.914	0.916	0.912	0.914
#obs.	148	148	148	148	148	148

Table 6. Continued

Panel B. Non-suspect sample

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
ACFO	-0.038					
	(-0.09)					
APROD		-0.550*				
		(-1.69)				
ADISEXP			-0.982**			
			(-2.20)			
REM1				-0.428**		
				(-1.99)		
REM2					-0.552**	
					(-2.12)	
REM3						-0.322**
						(-2.00)
DisAcc	0.133	0.191	0.165	0.193	0.215	0.464**
	(0.95)	(1.39)	(1.34)	(1.47)	(1.58)	(2.16)
Size	-0.198***	-0.197***	-0.199***	-0.198***	-0.204***	-0.201***
	(-9.23)	(-9.78)	(-10.55)	(-10.12)	(-10.48)	(-10.21)
ROA	-1.468***	-1.899***	-1.526***	-1.835***	-1.946***	-2.005***
	(-3.05)	(-3.91)	(-4.14)	(-4.24)	(-4.22)	(-4.10)
Turnover	-0.230***	-0.227***	-0.229***	-0.227***	-0.225***	-0.225***
	(-8.42)	(-8.13)	(-8.49)	(-8.32)	(-8.39)	(-8.26)
Volat	0.126***	0.115***	0.114***	0.112***	0.114***	0.113***
	(3.17)	(2.89)	(2.97)	(2.86)	(2.82)	(2.80)
Analysts	-0.106***	-0.109***	-0.109***	-0.109***	-0.104***	-0.106***
	(-2.74)	(-2.88)	(-2.87)	(-2.87)	(-2.77)	(-2.84)
Own	0.049	0.047	0.043	0.045	0.061	0.055
	(0.38)	(0.38)	(0.35)	(0.37)	(0.50)	(0.45)
Intercept	2.373***	2.469***	2.473***	2.493***	2.579***	2.553***
	(6.11)	(6.29)	(6.78)	(6.59)	(6.90)	(6.63)
Year	Yes	Yes	Yes	Yes	Yes	Yes
Ind	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.845	0.849	0.855	0.852	0.850	0.851
#obs.	320	320	320	320	320	320

Notes: This table reports OLS coefficients of our information asymmetry index on real activities manipulation and control variables following the regression model for the suspect sample (Panel A) and non-suspect sample (Panel B):

$$ASY = \beta_0 + \beta_1 REM + \beta_2 DiscAcc + \beta_3 Size + \beta_4 ROA + \beta_5 Turnover + \beta_6 Volat + \beta_7 Analysts + \beta_8 Own + \sum_t \beta_t Year + \sum_j \beta_j Ind + \varepsilon$$

ASY is the log of 3 plus the composite index of information asymmetry based on the following market microstructure measures: *RQS*, *AMH*, *PI*, *PIN*, and *VPIN*. *REM* refers to each of our six proxies of REM: *ACFO* is the abnormal level of cash flows according to model (4) multiplied by (-1); *APROD* is abnormal production costs according to model (5); *ADISEXP* is abnormal discretionary expenses according to model (6) multiplied by (-1); *REM1*, *REM2*, and *REM3* are aggregate measures of REM defined as *APROD+ADISEXP*, *ACFO+ADISEXP*, and *ACFO+APROD+ADISEXP*, respectively. *DiscAcc* is the value of discretionary accruals estimated by the Jones (1991) model modified by Dechow *et al.* (1995). *Size* is the natural logarithm of total assets. *ROA* is operating income divided by total assets. *Turnover* is the natural logarithm of the average daily trading volume in euro scaled by market value of the firm's equity at the end of the year. *Volat* is the standard deviation of daily returns. *Analysts* is the natural logarithm of the total number of analysts following a firm. *Own* is the proportion of common shares held by the largest five shareholders. *Year* and *Ind* represent year and industry dummies, respectively. *ACFO* and *REM2* are orthogonalized respect to *DiscAcc* in models (1) and (5). Robust *t*-statistics clustered at the firm level in parentheses. ***, **, * denote significance at the 1%, 5%, and 10% (two-tailed) level, respectively.

In the rest of the sample (non-suspect sample), we find that, with the exception of the cash flow model, all coefficients on REM measures are significantly negative (at the 10% level in the abnormal production costs and at the 1% level in abnormal discretionary expenses, *REM1*, *REM2* and *REM3* models). Thus, in this setting there is a negative association between information asymmetry and REM measures after taking into account the effect of accrual-based earnings management. This finding suggests that when REM measures are not reflecting low earnings quality but change in business, the informed traders have fewer incentives to produce private information. Regarding the control variables, the coefficient on discretionary accruals (*DisAcc*) is positive and significant at the 1% level in the *REM3* model or quite close to being significant at conventional levels in the rest of models (with the exception of the cash flow model) at two-tail tests. Even if we consider one-tail tests the coefficients on *DisAcc* are significant in all estimations with the exception of the cash flow model. This is consistent with previous research, which has found that accruals earnings management may create information asymmetry in the market. Finally, the coefficients of the rest of control variables show similar signs and significance levels to those presented for the whole sample.

2.5. CONCLUSIONS

This study examines the consequences of real activities manipulation on information asymmetry in Spain. Previous studies have examined this association basically for US markets, providing inconclusive evidence. We consider that the analysis of the Spanish market may shed new light because it exhibits a weaker investor protection, lower accounting quality and stock market liquidity, and higher incentives for investors to search for private information than US. We use 468 firm-year observations from 2001 to 2008 and an information asymmetry index built on microstructure measures such as the bid-ask spread, illiquidity measure developed in Amihud (2002), price impact introduced by Huang and Stoll (1996), *PIN*, and *VPIN*.

In line with previous literature, we find that firms with high strong incentives to engage in earnings management to just meet last year's earnings, show higher levels of income increasing REM. Overall, our evidence on the association between REM and information asymmetry is consistent with the prediction that firms' strategies of REM garble the market and create information asymmetry among traders. Thus, in a setting

where REM measures are highly likely to indicate low earnings quality (suspect sample) we find a significant and positive association between proxies for earnings management through real activities manipulation and information asymmetry among investors. In contrast, in a setting where the empirical proxies for REM could be capturing situations rather related with business circumstances than with earnings manipulation, we find that deviations from normal activity are significantly and negatively associated with the level of information asymmetry. Thus, we show that the private information production and its influence on the level of information asymmetry in the market depend on firm's circumstances.

Our results have implications for managers, regulators, and researchers. Our evidence confirms that managers will possibly manipulate earnings with real activities to meet earnings benchmarks. We add to the literature that these practices may distort the market by creating information asymmetry between traders in those contexts where managers have incentives to engage in REM, since it raises the production of private information by sophisticated investors. We extend previous research on the economic consequences of earnings management in general, and REM in particular, to the study of the adverse selection problem in financial markets, where prior literature is scarce and focused exclusively on the US market. By examining a direct link between REM and information asymmetry, we show that previous findings that associate the engagement in REM activities with a higher cost of capital can be explained by the increase in information asymmetry produced by REM. Finally, from a methodological point of view, this is one of the first papers to use a composite index of adverse selection to examine this issue.

APPENDIX 1. PIN MODEL AND ESTIMATION

The *PIN* model views trading as a game between liquidity providers and traders (position takers) that is repeated over trading days. Trades can come from informed or uninformed traders. For any given trading day the arrival of buy and sell orders from uninformed traders, who are not aware of the new information, is modeled as two independent Poisson processes with daily arrival rates ε_b and ε_S, respectively. The model assumes that information events occur between trading days with probability α. Informed traders only trade on days with information events, buying if they have seen good news (with probability 1-δ) and selling if they have seen bad news (with probability δ). The orders from the informed traders follow a Poisson process with a daily arrival rate μ.

Under this model, the likelihood of observing *B* buys and *S* sells on a single trading day is

$$L((B,S)\mid\theta)=(1-\alpha)e^{-\varepsilon_b}\frac{(\varepsilon_b)^B}{B!}e^{-\varepsilon_s}\frac{(\varepsilon_s)^S}{S!}+ \\ +\alpha\delta e^{-\varepsilon_b}\frac{(\varepsilon_b)^B}{B!}e^{-(\varepsilon_s+\mu)}\frac{(\varepsilon_s+\mu)^S}{S!}+\alpha(1-\delta)e^{-(\varepsilon_b+\mu)}\frac{(\varepsilon_b+\mu)^B}{B!}e^{-\varepsilon_s}\frac{(\varepsilon_s)^S}{S!} \tag{A.1}$$

where *B* and *S* represent total buy trades and sell trades for the day respectively, and $\theta=(\alpha, \delta, \mu, \varepsilon_b, \varepsilon_s)$ is the parameter vector. This likelihood function is a mixture of three Poisson probabilities, weighted by the probability of having a 'good news day' $\alpha(1-\delta)$, a 'bad news day' $\alpha\delta$, and 'no-news day' (1-α). Assuming cross-trading-day independence, the likelihood function across *J* days is just the product of the daily likelihood functions:

$$L(M\mid\theta)=\prod_{j=1}^{J}L(\theta\mid B_j,S_j) \tag{A.2}$$

where B_j, and S_j are the numbers of buy and sell trades for day $j=1,\ldots, J$, and $M = [(B_1, S_1),\ldots, (B_J, S_J)]$ is the data set. Maximization of (2) over θ given the data *M* yields maximum likelihood estimates for the underlying structural parameters of the model ($\alpha, \delta, \mu, \varepsilon_b, \varepsilon_s$). Once the parameters of interest have been estimated, the *PIN*, is calculated as

$$PIN=\frac{\alpha\mu}{\alpha\mu+\varepsilon_b+\varepsilon_s} \tag{A.3}$$

where $\alpha\mu + \varepsilon_b + \varepsilon_s$ is the arrival rate of all orders, $\alpha\mu$ is the arrival rate of informed orders. The *PIN* is thus the ratio of orders from informed traders to the total number of orders.

An attractive feature of the *PIN* methodology is its apparently modest data requirement. All that is necessary to estimate the model is the number of buy- and sell-initiated trades for each stock and each trading day. However, one shortcoming of the methodology is that, although the estimation procedure is straightforward, it often encounters numerical problems when performing the estimation in practice, especially with stocks with a huge number of trades when the optimization program may clash with computational overflow or underflow (floating-point exception) and, as a consequence, it may not be able to obtain an optimal solution. These difficulties in estimating *PIN* have been exacerbated in recent years due to the steady increase in the number of trades which are a consequence, among other reasons, of the growth in automated trading and structural changes in the market, which have greatly reduced market depth (Aslan, Easley, Hvidkjaer and O'Hara, 2011). We estimate first the *PIN* model via maximum likelihood for each stock and month in each year. The use of one-month transaction data should be a wide enough period to produce reliable estimates and allows us to maximize the number of estimations (Easley, Kiefer and O'Hara, 1997) indicate that a 30 trading-day window allows sufficient trade observations for the *PIN* estimation procedure, and Akay, Cyree, Griffiths and Winters (2012) use 20 trading days to estimate *PIN* finding numerical solutions for all their estimations). Finally, we calculate an annual *PIN* by averaging monthly values. We use the optimization algorithm of the Matlab software. We run the maximum likelihood function 100 times for each stock in our sample, except for several large stocks, for which we increase the iterations to 1000 to ensure that a maximum is reached. We follow Yan and Zhang's (2012) proposal to set initial values for the five parameters in the likelihood function.

APPENDIX 2. VPIN ESTIMATION PROCEDURE

In this appendix we briefly review the three levels in which *VPIN* calculation takes place (for a more accurate description of the procedure, see the original paper of Easley *et al.*, 2012).

(1) Time bars

The original procedure begins with trade aggregation in *timebars*. *Bar size* is the first key variable of the *VPIN* computation process. Easley *et al.* (2012) initially use one-minute time bars. In each time bar, trades are aggregated by adding the volume of all the trades in the bar (if any) and by computing the price change for this period of time. Afterwards, and in order to take into account trade size, the sample is 'expanded' by repeating each bar price change a number of times equal to the number of shares traded in the bar. Thus, the original raw sample became a sample of one-unit trades, each of them associated with the price change of the corresponding bar.

(2) Volume buckets, bulk classification and order imbalance

Volume bucket is the second essential variable in *VPIN* metric. Volume buckets represent pieces of homogeneous information content that are used to compute order imbalances. In Easley *et al.* (2012) volume bucket size (VBS) is calculated by dividing the average daily volume (in shares) by 50, which is the number of buckets they initially consider. Therefore, if we depart from the average daily volume, it is the number of buckets which fully determines VBS. Consequently, we consider the number of buckets as our second key variable.

Buckets are filled by adding the volume in consecutive time bars until completing the VBS. If the volume of the last time bar needed to complete a bucket is for a size greater than required, the excess size is given to the next bucket. In general, a volume bucket needs a certain number of time bars to be completed, although it is also possible that the volume in one time bar could be enough to fill one (or more) volume buckets.

At the same time of bucket completion, time bar volume is classified as buyer- or seller-initiated in probabilistic terms by employing the Normal distribution. Thus, we label as 'buy' the volume that results from multiplying the volume bar by the value of the normal distribution evaluated in the standardized price change $Z\ (\Delta P/\sigma_{\Delta P})$. To standardize, we divide the corresponding price change by the standard deviation of all price changes for the whole sample. Analogously, we categorize as 'sell' the volume that results from multiplying the volume bar by the complementary of the normal distribution for the buy side, $1\text{-}Z\ (\Delta P/\sigma_{\Delta P})$.

Order imbalance (*OI*) is then computed for each bucket by simply obtaining the absolute value of the difference between buy volume and sell volume in the assigned time bars.

(3)VPIN and sample length

Finally, in the last step we obtain *VPIN* values. Here, it is necessary to define a new variable: *sample length* (*n*). This variable establishes the number of the buckets with which *VPIN* is computed. Following the link established in Easley *et al.* (2012),

$$VPIN = \frac{\alpha\mu}{\alpha\mu + \varepsilon_b + \varepsilon_s} \approx \frac{E[V_\tau^{Sell} - V_\tau^{Buy}]}{E[V_\tau^{Sell} + V_\tau^{Buy}]} = \frac{\sum_{\tau=1}^{n} OI_\tau}{n * VBS} \qquad \text{(A.4)}$$

where *VPIN* is simply the average of order imbalances in the sample length, that is, the result of dividing the sum of order imbalances for all the buckets in the sample length (proxy of the expected trade imbalance) by the product of volume bucket size (*VBS*) multiplied by the sample length (*n*) (proxy for the expected total number of trades). *VPIN* metric is updated after each volume bucket in a rolling-window process. For example, if the sample length is 50, when bucket #51 is filled, we drop bucket #1 and we calculate the new *VPIN* based on buckets #2 to #51. Easley *et al.* (2012) first consider sample length equal to the number of buckets (50), but throughout the paper the authors change this variable to 350 or 250, depending on what they want to analyze. A sample length of 50 buckets when the number of buckets is also 50 is equivalent to obtaining a daily *VPIN*. A sample length of 250 (350) when the number of buckets is 50 is equivalent to obtaining a 5-day (7-day) *VPIN*.

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PART II

CHAPTER 3

DOES IFRS MANDATORY ADOPTION AFFECT INFORMATION ASYMMETRY IN THE STOCK MARKET?

3.1. INTRODUCTION

In this paper we investigate the relation between the mandatory adoption of International Financial Reporting Standards (IFRS) and information asymmetry in the equity market, using direct measures of information asymmetry derived from the microstructure literature. The adoption of IFRS around the world has been one of the most important regulatory changes in financial reporting in many years. In particular, European Union (EU) Regulation No. 1606/2002 required listed companies to prepare their consolidated financial statements according to IFRS as of January 1st, 2005. The purpose of this regulatory change was to improve the comparability and transparency of accounting information (European Communities, 2002). This should have led to financial statements of higher informational quality for market participants and potential beneficial economic consequences on the market. As a result, the switch to IFRS has generated extensive empirical literature about its economic consequences on financial reporting quality and capital markets in general.[8] Most of the previous empirical literature examining the market consequences of IFRS adoption has found positive market effects in terms of liquidity and the cost of capital (Christensen, Hail and Leuz, 2013; Daske, Hail, Leuz and Verdi, 2008 and 2013; Li, 2010), and also, by examining its effects on analyst forecast accuracy and consensus on the information environment (Byard, Li and Yu, 2011; Horton, Serafeim and Serafeim, 2013; Tan, Wang and Welker, 2011). This empirical evidence is consistent with the idea that higher accounting information quality and increased disclosure derived from IFRS adoption (Barth, Landsman and Lang, 2008) should achieve one of the main objectives of standard setters, which is to increase investor confidence through the reduction of information asymmetry.

Theoretical and empirical research shows that increased financial reporting transparency and disclosure reduce information asymmetry between investors by decreasing private information search incentives and by lowering the amount of private information compared to publicly available information (Diamond, 1985; Diamond and Verrecchia, 1991; Easley and O'Hara, 2004). Lower levels of information asymmetry benefit investors because they lead to more-informed valuation, so reducing adverse selection risk and, hence, increasing market liquidity (e.g. Glosten and Milgrom, 1985).

[8] See Brüggemann, Hitz and Sellhorn (2013) for a review.

Consequently, information asymmetry proxies should reflect, among other things, firms' accounting quality (Leuz, 2003). Therefore, if IFRS adoption really implies an increase in the financial reporting quality or disclosure, and/or enhances financial information comparability, so, according to the economic theory, the market benefits after IFRS adoption can be attributed to the change in the accounting standards. However, in the recent accounting literature there is an ongoing debate about whether the post-IFRS market benefits have been driven by the change in the accounting standards *per se* or by other related factors that include: a) institutional factors such as the level of the enforcement of the country and the extent of enforcement changes made to support the implementation of IFRS; b) firms' reporting incentives; and c) the degree of similarity between IFRS and preceding local Generally Accepted Accounting Principles (GAAP).

Most previous studies argue that, at the national level, post-IFRS liquidity benefits appear in countries with high enforcement or with concurrent changes in reporting enforcement, or, at the firm level, they depend on firm's reporting incentives. In particular, Daske *et al.* (2008) and Li (2010) find that capital market benefits occur in countries with strong legal enforcement mechanisms and where firms have more incentives to be transparent. Descending to firm level heterogeneity to examine the economic consequences around International Accounting Standards (IAS) and IFRS adoptions, Daske *et al.* (2013) conclude that reductions in the cost of capital and increases in liquidity are found in those firms with higher changes in their reporting incentives, i.e., in those that increase their commitment to transparency after IAS/IFRS adoptions. Christensen *et al.* (2013) try to disentangle the effects due to switching to IFRS from those motivated by concurrent changes in enforcement, and find that the liquidity increase is concentrated in those EU countries that improved their reporting enforcement. Thus, they conclude that the liquidity benefits observed around IFRS adoption are driven basically by the changes in enforcement more than by the accounting standards changes themselves. Barth and Israeli (2013), in contrast, believe that the Christensen *et al.* (2013) findings suggest that it is the combination of changes in accounting standards to IFRS and advances in enforcement which conveys liquidity benefits.

Regarding the influence of the degree of similarity between IFRS and preceding local GAAP, the evidence is not conclusive. Several studies have found that the extent of the differences between prior domestic standards and IFRS is positively associated with the

increase in analyst following (Tan *et al.*, 2011) and analyst forecast accuracy (Byard *et al.*, 2011). In contrast, Brochet, Jagolinzer and Rield (2013) report that the adoption of IFRS leads to informational benefits, even in a country whose domestic standards present few differences with IFRS, as is the United Kingdom (UK).

To shed further light on the debate surrounding the main determinants of the market benefits following IFRS adoption, we examine the IFRS effects on the level of information asymmetry in the Spanish Stock Exchange.[9] Our study provides new evidence, which could be valuable for at least two reasons: 1) we analyse IFRS adoption using market microstructure measures estimated from high frequency data: the bid-ask spread, the illiquidity measure developed in Amihud (2002), the price impact introduced by Huang and Stoll (1996), the probability of informed trading (*PIN*) of Easley, Nicholas, O'Hara and Paperman (1996), the volume-synchronized probability of informed trading (*VPIN*) of Easley, López de Prado, O'Hara (2012), and an index of information asymmetry as the first principal component of the five former measures. Bid-ask spread is a commonly used proxy for information asymmetry because it compensates liquidity providers for transacting with better-informed traders and it increases with the degree of information asymmetry. The measures that capture price impact of transactions –the illiquidity measure of Amihud (2002) and the price impact of Huang and Stoll (1996) – appear to be important in describing the arrival of new information to market participants. The well-known measure of *PIN* and the novel *VPIN* directly infer the presence of privately informed traders in the market from the computation of order imbalances between buys and sells. As well as testing these measures individually, we construct an index of adverse selection from this set of market microstructure measures, which allows us to extract the common variation in all these information asymmetry measures and, in this way, we minimize the possibility that these proxies are driven by others factors different to adverse selection – i.e. inventory costs, transactions costs, etc. 2) We focus on the Spanish market, which can be considered a suitable setting for understanding the capital market effects of IFRS adoption. As in all the other EU countries, the Spanish firms listed on secondary stock markets have been mandatorily required to prepare their consolidated financial statements in accordance with IFRS since 2005. Spain is a country characterized by low enforcement

[9] In terms of market capitalization and trading volume, the Spanish Stock Exchange was one of the largest stock markets for which IFRS were mandatorily required in 2005 (see the 2006 World Federation of Exchanges annual report: http://www.world-exchanges.org/insight/reports/2006-wfe-annual-report).

(Kaufmann, Kraay and Mastruzzi, 2009; La Porta, Lopez-de-Silanes, Shleifer and Vishny, 1998) and high disparity between Spanish Accounting Standards (SAS) and IFRS in terms of standards and disclosure requirements (Bae, Tan and Welker, 2008; Nobes, 2011). Therefore, the chosen setting is appropriate for the analysis of the consequences of the accounting change, since we avoid selection bias of voluntary adopters (Ashbaugh, 2001) and we deal with a context without concurrent changes in the legal environment and enforcement (Choi, Peasnell and Toniato, 2013). Effectively, in Spain, the accounting changes and, in particular, the increases in disclosure requirements implied by IFRS are implemented without relevant concurrent enforcement changes. Hence, if we find a reduction in the level of information asymmetry after IFRS adoption, this result would support the arguments that IFRS confer information asymmetry benefits when the distance between local GAAP and IFRS is high, even though the enforcement level is low and the reporting enforcement changes around the adoption of IFRS are not important. This reduction of information asymmetry could be driven by the relevant accounting change *per se*, which enhances financial reporting transparency and disclosure. On the contrary, a non-significant result would be consistent with the view that IFRS adoption by itself does not provide capital market benefits, at least with regards to information asymmetry.

To conduct our analyses, we constructed a balanced panel of Spanish non-financial firms for the period 2001-2008. By controlling for market determinants of information asymmetry and firms' characteristics, we find a significant reduction in the level of information asymmetry among investors in the Spanish Stock Exchange after IFRS adoption. Overall, we find significant and consistent decreases in five out of our six proxies for information asymmetry, which means that IFRS has had an effect not only on liquidity, but also in the level of information asymmetry among market participants. After implementing several sensitive analyses we confirm that this post-IFRS improvement in information asymmetry is not simply due to time effects, and we also find that the reduction in information asymmetry is stronger in those firms with higher concentrated ownership, which are usually characterized as less proactive to disclose information. Overall, these findings suggest that the higher disclosure and transparency requirements implied by IFRS adoption have benefited the information environment of Spanish firms.

Our study contributes to the literature by providing new empirical evidence to the debate on the market effects of IFRS by using measures of adverse selection developed by

market microstructure literature. To the best of our knowledge, this is the first study that uses measures such as *PIN, VPIN,* and a composite index of adverse selection to examine the effects of IFRS adoption on the levels of information asymmetry in the market. Prior studies researching into the effects of IFRS on the information environment have mainly focused on proxies that can be considered as indirect measures of information asymmetry, such as the accuracy of financial analysts' forecasts (e.g. Byard *et al.*, 2011, Tan *et al.*, 2011), liquidity measures and the cost of capital (e.g. Christensen *et al.*, 2013; Daske *et al.*, 2008 and 2013; Li, 2010). As Bharath, Pasquariello and Guojun (2009) argue, the use of an index of information asymmetry based on market microstructure measures has more desirable properties than using individual proxies proposed by corporate finance literature (e.g. analyst coverage, dispersion of analysts' forecasts, tangibility of assets), because these measures are often inconsistent, static, persistent, and have multiple and *ad hoc* interpretations. In addition, using the proxies individually allows us to examine the channel through which IFRS affects information asymmetry. Moreover, since IFRS adoption may be associated with higher disclosure and financial reporting quality, our results also extend previous literature on the market effects of disclosure and accounting quality (Diamond and Verrecchia, 1991; Easley and O'Hara, 2004; Lambert, Leuz and Verrecchia, 2007 and 2012).

The rest of the paper proceeds as follows. Section 2 describes the measures of information asymmetry used. Section 3 describes the research design, sample selection, and data. Section 4 presents the descriptive statistics and empirical results. Section 5 concludes.

3.2. MEASURES OF INFORMATION ASYMMETRY

Information asymmetry is a key concept in capital markets because it affects stock liquidity (Kyle, 1985), which in turn has an effect on asset pricing and on the cost of capital (e.g. Amihud and Mendelson, 1986; Easley and O'Hara, 2004). Empirically capturing the level of information asymmetry in a firm's market valuation is a difficult task since information asymmetry is not directly observable. Market microstructure literature has proposed different measures and procedures to capture financial market perception concerning adverse selection risk, which arises when some traders possess private information not currently reflected in stock prices. In contrast to the measures introduced

by corporate finance, market microstructure exploits several sources of information contained in intraday data to capture the presence of traders with better information (informed traders). Nevertheless, in the literature there has always been a debate about the appropriateness of each proxy in measuring information-based trading. All measures of information asymmetry are imperfect proxies for the financial market's perception of the adverse selection between informed and uninformed traders. For this reason, to obtain a more accurate information asymmetry measure, prior studies (e.g. Bharath *et al.*, 2009) use principal component analysis to extract the first principal component from individual proxies for information asymmetry. In this paper, as well as testing the IFRS effect on five individual proxies of information asymmetry developed by market microstructure literature: bid-ask spread, illiquidity measure, price impact, *PIN*, and *VPIN*, we create an adverse selection index (denoted as *ASY* hereafter) applying principal component analysis to these measures.

3.2.1. Bid-ask spread (QSPD)

The first and effortless proxy for asymmetric information is the bid-ask spread, a widely used measure of trading costs (liquidity). Bid-ask spread incorporates a component related to the liquidity providers' protection from being adversely selected. Easley and O'Hara (1992) and Glosten and Milgrom (1985) theoretically show that the sole presence of traders with different levels of information is reason enough for the existence of the bid-ask spread. We estimate the relative quoted spread, *QSPD*, which is defined as:

$$QSPD_t = \frac{a_t - b_t}{Q_t}, \tag{1}$$

where a_t and b_t correspond to the ask and the bid quotes in t. $Q_t = (a_t+b_t)/2$ is the quoted midpoint in t, commonly used as a proxy for the efficient price. For each asset, we calculate a yearly equally-weighted mean from daily relative quoted spreads, which we compute as the time-weighted average of relative quote spreads registered over a day.

3.2.2. Illiquidity measure (AMH)

Since adverse selection is an important determinant of stock liquidity, we estimate the index of illiquidity introduced by Amihud (2002), which is a volume-based liquidity indicator defined as:

$$AMH_t = \frac{1}{D_t} \sum_{d=1}^{D_t} \frac{|R_{dt}|}{V_{dt}} \tag{2}$$

where $R_{d,t}$ is the return on day d on year t, V_{dt} is the volume in euros on day d on year t, and D_t is the number of days for which data are available in year t. This illiquidity measure gives the average of the daily price impact of the order flow or the absolute percentage price change associated with a unit of trading volume. When a stock is liquid, large trading volumes provoke small price changes. Therefore, higher values of *AMH* indicate higher price moves in response to trading volume, and thus higher stock illiquidity. It is expected that the greater the extent of information asymmetry, the worse stock liquidity will be, and the greater *AMH* will be.[10] We use the yearly mean of the daily *AMH* values, and following Amihud (2002), we multiply *AMH* by 10^6.

3.2.3. Price impact (PI)

The illiquidity index of Amihud (2002) provides a rough measure of price impact. Trades initiated by noise traders lead to transitory changes in transaction prices, while information-based trades provoke permanent price changes. Huang and Stoll (1996) introduce the realized spread (or price reversal) and the price impact by considering the quote adjustment that takes place a period of time after a trade to extract the presence of new information. Price impact (*PI*) is the permanent price change (or information content) of a trade and is defined as:

$$PI_{t+\tau} = (Q_{t+\tau} - Q_t) X_t \tag{3}$$

[10] Both bid-ask spread and illiquidity ratio are noisy proxies for asymmetric information given that they commonly include other components that are not related with information (inventory costs, order processing cost, monopoly rents, etc.), but that also influence the stock liquidity.

where Q_t is the quote midpoint defined previously, X_t is a trade indicator variable taking the value -1 if the trade in *t* is initiated in the sell side and 1 if it is initiated in the buy side. Finally, τ is the period of time for prices to fully reflect the information content in trade *t*. We use 1-, 5- and 30-minute periods to estimate *PI*.[11] *PI* is also computed in trade-time by averaging (volume-weighted) all the trades within the day and, after that, by averaging (equally-weighted) all the trading days within the year. A large and positive *PI* indicates a high frequency of information-based trades.

3.2.4. Probability of informed trading (PIN)

The *PIN* is the unconditional probability that a randomly selected trade originates from an informed trader. The *PIN* is a measure based on the theoretical work of Easley and O'Hara (1987 and 1992), although the original *PIN* model was introduced by Easley *et al.* (1996). The *PIN* is not directly observable but as a function of the theoretical parameters of a microstructure model that have to be estimated by numerical maximization of a likelihood function. The *PIN* model considers trading as a game between liquidity providers and traders (position takers) that is repeated over trading days. Trades can come from informed or uninformed traders. For any given trading day the arrival of buy and sell orders from uninformed traders, who are not aware of the new information, is modeled as two independent Poisson processes with daily arrival rates ε_b and ε_S, respectively. The model assumes that information events occur between trading days with probability α. Informed traders only trade on days with information events, buying if they have seen good news (with probability 1-δ) and selling if they have seen bad news (with probability δ). The orders from the informed traders follow a Poisson process with a daily arrival rate μ.

Under this model, the likelihood of observing *B* buys and *S* sells on a single trading day is:

$$L\left((B,S)\mid\theta\right)=(1-\alpha)e^{-\varepsilon_b}\frac{(\varepsilon_b)^B}{B!}e^{-\varepsilon_s}\frac{(\varepsilon_s)^S}{S!}+ \\ +\alpha\delta e^{-\varepsilon_b}\frac{(\varepsilon_b)^B}{B!}e^{-(\varepsilon_s+\mu)}\frac{(\varepsilon_s+\mu)^S}{S!}+\alpha(1-\delta)e^{-(\varepsilon_b+\mu)}\frac{(\varepsilon_b+\mu)^B}{B!}e^{-\varepsilon_s}\frac{(\varepsilon_s)^S}{S!} \quad (4)$$

[11] We only report the results using 30-minute price impact. The results using 1- and 5-minute price impact are quite similar to those presented and they are available upon request from the authors.

where B and S represent total buy trades and sell trades for the day respectively, and $\theta = (\alpha, \delta, \mu, \varepsilon_b, \varepsilon_s)$ is the parameter vector. This likelihood function is a mixture of three Poisson probabilities, weighted by the probability of having a 'good news day' $\alpha(1-\delta)$, a 'bad news day' $\alpha\delta$, and 'no-news day' $(1-\alpha)$. Assuming cross-trading day independence, the likelihood function across J days is simply the product of the daily likelihood functions:

$$L(M \mid \theta) = \prod_{j=1}^{J} L(\theta \mid B_j, S_j) \tag{5}$$

where B_j, and S_j are the numbers of buy and sell trades for day $j=1,\ldots, J$, and $M = [(B_1, S_1),\ldots, (B_J, S_J)]$ is the data set. Maximization of (5) over θ given the data M yields maximum likelihood estimates for the underlying structural parameters of the model ($\alpha, \delta, \mu, \varepsilon_b, \varepsilon_s$). Once the parameters of interest are estimated, the *PIN* is calculated as:

$$PIN = \frac{\alpha\mu}{\alpha\mu + \varepsilon_b + \varepsilon_s} \tag{6}$$

where $\alpha\mu + \varepsilon_b + \varepsilon_s$ is the arrival rate of all orders, $\alpha\mu$ is the arrival rate of informed orders. The *PIN* is therefore the ratio of orders from informed traders to the total number of orders.

An attractive feature of the *PIN* methodology is its apparently modest data requirement. All that is necessary to estimate the model is the number of buy- and sell-initiated trades for each stock and each trading day. However, one shortcoming of the methodology is that, although the estimation procedure is straightforward, it often encounters numerical problems when performing the estimation in practice. Especially in stocks with a huge number of trades, the optimization program may clash with computational overflow or underflow (floating-point exception) and, as a consequence, it may not be able to obtain an optimal solution. These difficulties in estimating *PIN* have been exacerbated in recent years due to the steady increase in the number of trades which are a consequence, among other reasons, of the growth in automated trading and structural changes in the market, which have greatly reduced market depth (Aslan, Hvidkjaer and O'Hara, 2011). To estimate *PIN* we use the computational-friendly likelihood function proposed by Lin and Ke (2011) using Matlab software. To set initial values we follow the process described in Gan, Wei and Johnstone (2015) that assists the maximum likelihood

estimation process both in terms of speed and accuracy[12]. We finally use the yearly mean of the monthly PIN estimates.[13]

3.2.5. Volume- synchronized probability of informed trading (VPIN)

As an update of the *PIN* model, Easley *et al.* (2012) have developed a new measure for adverse selection risk called volume-synchronized probability of informed trading or *VPIN*. The *VPIN* approach has some practical advantages over the *PIN* methodology that make it particularly attractive for both practitioners and researchers. The main advantage is that *VPIN* does not require the estimation of non-observable parameters using optimization or numerical methods, thereby avoiding all the associated computational problems and biases. In particular, *VPIN* measures order flow toxicity which can be considered as a broader concept for adverse selection applied to the particular world of liquidity providers in a high frequency trading (HFT) environment. Abad and Yagüe (2012) show that *VPIN* can be considered as a more flexible measure of asymmetric information that can be applied in a wide range of frameworks by choosing the appropriate values of the variables involved in the estimation process. There are three relevant variables in the *VPIN* approach: time bar, volume bucket and sample length. Below, we briefly review the three levels in which the *VPIN* calculation takes place (for a more accurate description of the procedure, see the original paper of Easley *et al.*, 2012; for a numeric example of this procedure, see Abad and Yagüe, 2012).

(1) Time bars

The original procedure begins with trade aggregation in *time bars*. *Bar size* is the first key variable of the *VPIN* computation process. Easley *et al.* (2012) initially use 1-minute time bars. In each time bar, trades are aggregated by adding the volume of all the trades in the bar (if any) and by computing the price change for this period of time. Afterwards, and in

[12] We thank one reviewer for the suggestion of adopting the method of Gan *et al.* (2005) to set initial values. In the previous version, we used Yan and Zhang (2012)'s procedure. Results present neither quantitative nor qualitative variations, but we have decided to use this method because it allows us to obtain more available estimations.

[13] Easley *et al.* (1997) indicate that a 30 trading-day window allows sufficient trade observations for the *PIN* estimation procedure. Akay *et al.* (2012) use 20 trading days to estimate *PIN*, finding numerical solutions for all their estimations. Hence, the use of one-month transaction data should be wide enough to produce reliable estimates and also to allow us to obtain more *PIN* estimations as a result of being confronted with fewer computational problems.

order to take into account trade size, the sample is 'expanded' by repeating each bar price change a number of times equal to the number of shares traded in the bar. Thus, the original raw sample becomes a sample of one-unit trades, each associated with the price change of the corresponding bar.

(2) Volume buckets, bulk classification and order imbalance.

Volume bucket is the second essential variable in *VPIN* metrics. Volume buckets represent pieces of homogeneous information content that are used to compute order imbalances. In Easley *et al.* (2012) volume bucket size (*VBS*) is calculated by dividing the average daily volume (in shares) by 50, which is the number of buckets they initially consider. Therefore, if we depart from the average daily volume, it is the number of buckets which fully determines *VBS*. Consequently, we consider the number of buckets as our second key variable.

Buckets are filled by adding the volume in consecutive time bars until completing the *VBS*. If the volume of the last time bar needed to complete a bucket is for a size greater than that required, the excess size is given to the next bucket. In general, a volume bucket needs a certain number of time bars to be completed although it is also possible that the volume in a time bar could be enough to fill one (or more) volume buckets.

At the same time as bucket completion, time bar volume is classified as buyer- or seller-initiated in probabilistic terms. Normal distribution is employed labeling as 'buy' the volume that results from multiplying the volume bar by the value of the normal distribution evaluated in the standardized price change $Z(\Delta P/\sigma_{\Delta P})$. To standardize, we divide the corresponding price change by the standard deviation of all price changes for the whole sample. Analogously, we categorize as 'sell' the volume that results from multiplying the volume bar by the complementary of the normal distribution for the buy side, $1\text{-}Z(\Delta P/\sigma_{\Delta P})$.

Order imbalance (*OI*) is then computed for each bucket simply by obtaining the absolute value of the difference between buy volume and sell volume in the assigned time bars.

(3) VPIN and sample length

Finally, in the last step we obtain *VPIN* values. To do this, it is necessary to define a new variable: sample length (*n*). This variable establishes the number of the buckets with which *VPIN* is computed. Following the link between *PIN* and *VPIN* established in Easley *et al.* (2012),

$$VPIN = \frac{\alpha\mu}{\alpha\mu + \varepsilon_b + \varepsilon_s} \approx \frac{E\left[V_\tau^{Sell} - V_\tau^{Buy}\right]}{E\left[V_\tau^{Sell} + V_\tau^{Buy}\right]} = \frac{\sum_{\tau=1}^{n} OI_\tau}{n * VBS} \quad (7)$$

where *VPIN* is simply the average of order imbalances in the sample length, that is, the result of dividing the sum of order imbalances for all the buckets in the sample length (proxy of the expected trade imbalance) by the product of volume bucket size (*VBS*) multiplied by the sample length (*n*) (proxy for the expected total number of trades). *VPIN* metric is updated after each volume bucket in a rolling-window process. For example, if the sample length is 50, when bucket #51 is filled, we drop bucket #1 and we calculate the new *VPIN* based on buckets #2 to #51. Easley *et al.* (2012) first consider sample length equal to the number of buckets (50), but throughout the paper the authors change this variable to 350 or 250 depending on what they want to analyze. A sample length of 50 buckets when the number of buckets is also 50 is equivalent to obtaining a daily *VPIN*. A sample length of 250 (350) when the number of buckets is 50 is equivalent to obtaining a five-day (seven-day) *VPIN*. An annual *VPIN* is computed by averaging the values of the result *VPIN* series for each year. In this study, *VPIN* series are obtained using time bars of 1-minute. The volume bucket size (*VBS*) corresponds to the daily average trading volume (in shares) for each year. The sample length to obtain each *VPIN* observation is one volume bucket.

3.2.6. Information asymmetry index (ASY)

Finally, to isolate the common adverse selection component underlying our market microstructure proxies, we constructed an index of information asymmetry (*ASY*) by employing principal components analysis. After computing the five measures of information asymmetry for each firm-year, the first (and only) factor with an eigenvalue

greater than one explains 62.93% of the variance and each component of the asymmetry factor enters with positive sign, leading to the following index:

$$ASY = 0.510QSPD + 0.277AMH + 0.468PI + 0.467PIN + 0.474VPIN \quad (8)$$

Therefore, each proxy for information asymmetry plays its role in the index. A higher value of the index means a higher level of adverse selection[14].

3.3. RESEARCH DESIGN, SAMPLE AND DATA

3.3.1. Model specification

We examine the effects of mandatory IFRS adoption on the level of information asymmetry among market participants. Specifically, we estimate the following regression model:

$$\begin{aligned} ASYInf_{i,t} = \beta_0 + \beta_1 IFRS + \beta_2 Size_{i,t} + \beta_3 Turnover_{i,t} + \beta_4 Volat_{i,t} + \beta_5 Lev_{i,t} + \beta_6 Prof_{i,t} + \\ \beta_7 BTM_{i,t} + \beta_8 Own_{i,t} + \beta_9 Analys_{i,t} + \beta_{10} Ibex_{i,t} + \sum_j \beta_j Ind + \varepsilon \end{aligned} \quad (9)$$

where $ASYInf_{i,t}$ is one of our six proxies for information asymmetry (*QSPD*, *AMH*, *PI*, *PIN*, *VPIN* and *ASY*) for firm *i* in year *t*. *IFRS* is a dummy variable that takes the value 1 for the post adoption period (from 2005 to 2008) and 0 otherwise (from 2001 to 2004). We expect $\beta_1<0$ if after IFRS adoption information asymmetry is reduced. We include control variables according to previous market microstructure and accounting literature. Thus, based on the extensive disclosure literature, it is expected that more transparent firms will present lower levels of information asymmetry. Following prior studies (e.g. Easley *et al.*, 1996), we include firm size, share turnover and return variability, because the microstructure literature shows that larger, more frequently traded and less volatile firms

[14] In addition to estimating this index by employing the principal components analysis, we also estimate an equally weighted index from our information asymmetry measures. To do so, we standardize the individual proxies and calculate the mean of the five proxies. The results obtained with both indexes are very similar. We do not report the results obtained by using the equally weighted index, but they are available upon request from the authors.

are more liquid and suffer lower information asymmetry problems. *Size* is the natural logarithm of total sales. *Turnover* is the natural logarithm of trading volume (measured as the average daily volume in Euros) scaled by the market value of a firm's equity to facilitate cross-sectional comparison. *Volat* is a proxy for stock return volatility calculated as the standard deviation of daily returns. In addition, we control for firm characteristics, such as financial leverage, return on assets and growth options, because it is expected that firms with more financing needs, more profitable, and with more growth opportunities will have more incentives to be transparent and to disclose more information (e.g. Daske *et al.*, 2013). *Lev* is the ratio of total debt to total assets, *Prof* is the return on assets, and *BTM* is the book-to-market ratio. We also include variables that prior literature has demonstrated to be associated with the quantity and quality of information disseminated by/about the firm and with its information environment, such as ownership concentration, financial analyst coverage, and the inclusion in a stock market index (e.g. Leuz, 2003). A higher concentrated ownership is expected to be positively associated with information asymmetry because shareholders with large blocks are likely to have access to more private information about the firm. We use *Own* as a proxy for ownership concentration, which is the percentage of common shares held by the largest five shareholders of the company. Prior research also suggests that analyst coverage reduces the level of information asymmetry among market participants because the more analysts that follow a firm, the more the information gathered by intermediaries and investors and, therefore, the better the information environment of the firm. We include in our model the variable *Analys*, which represents the total number of analysts following a firm. Moreover, those firms whose shares are constituents of a stock market index are monitored with greater intensity by investors and market agents, thereby positively affecting the information environment of the firm. We include *Ibex*, which is a dummy variable which takes the value of 1 if the company's share is a constituent of the IBEX-35[15], and zero otherwise. Finally, we control for industry effects by including industry dummy variables, and for temporary effects using robust standard errors clustered by time and firm (Petersen, 2009).

[15] The IBEX-35 is the official index of the Spanish Stock Exchange, which is composed of the 35 most liquid and active stocks listed on the Spanish Stock Exchange.

3.3.2. Sample and data

The sample is made up of stocks traded on the electronic trading platform of the Spanish Stock Exchange, known as the SIBE (*Sistema de Interconexión Bursátil Español*). The SIBE is an order-driven market where liquidity is provided by a limit order book. Trading is continuous from 9:00 am to 5:30 pm There are two regular call auctions each day: the first determines the opening price (8:30-9:00 am), while the second sets the official closing price (5:30-5:35 pm). Traders can submit three basic types of orders: limit orders, market orders, and market-to-limit orders. When the market is open in continuous session, a trade occurs whenever an incoming order hits the quotes on the other side of the order book. Non-executed orders remain in the order book using a price-time priority rule. Unexecuted orders can be altered or cancelled at any time. Continuous trading can be temporally interrupted since a system of stock-specific intraday price limits and short-lived call auctions is implemented to handle unusual volatility levels. In all auctions (open, close and volatility) orders can be submitted, modified or cancelled, but no trades occur.

Trade and quote data for this study come from SM data files provided by the Sociedad de Bolsas, S.A. SM files comprise detailed time-stamped information about the first level of the limit order book for each stock listed on the SIBE. Any trade, order submission and cancellation affecting best prices in the book generates a new record. The distinction between buyer-initiated and seller-initiated trades is straightforward, without the need to use a classification algorithm. Firms' financial statements data were obtained from the SABI database, compiled by Bureau Van Dijk, and ownership concentration and analysts' data were collected from Thomson Datastream files.

Our initial sample consists of all the non-financial firms listed continuously on the main segment of the SIBE during the period January 2001-December 2008. We choose this sample period to get a balanced set of four years before (from 2001 to 2004) versus after (from 2005 to 2008) mandatory IFRS adoption. Within our sample period, 64 non-financial firms are traded during all the years, but we have not been able to collect market microstructure data for one of them. Hence, the final sample consists of a balanced panel of 63 firms and 504 firm-year observations, 252 observations for the period 2001-2004 and 252 for the period 2005-2008. On average, stocks included in our sample represent around

72% of the market capitalization and 82% of the trading volume of the Spanish non-financial firms listed on the SIBE within our sample period.

3.4. RESULTS

3.4.1. Descriptive statistics

Table 1 presents the descriptive statistics for the study variables for the full period (2001-2008): mean, median, standard deviation, 10th percentile and 90th percentile for the continuous variables (Panel A and Panel B) and frequency for dichotomous variables (Panel C). The mean (median) of *QSPD* is 0.72% (0.46%). With regard to *AMH*, its mean in our sample (0.35) is similar to that reported by Amihud (2002). The average (median) of price impact measure (*PI*) is 0.41% (0.33%). Consistent with Abad and Yagüe (2012), the *PIN* and the *VPIN* show similar mean values, around 20% and 21%, respectively. *PIN* values are also consistent with those reported in other studies using this information asymmetry proxy (e.g. Brown and Hillegeist, 2007; Easley, Hvidkjaer and O'Hara, 2002). The mean of *ASY* is zero (by construction) and its median is -0.36. The statistical distributions of the above variables show that there are clear differences in the degree of asymmetric information among the firms in our sample. The control variables also show a significant level of dispersion in their values, reflecting the heterogeneity of our firm-year sample.

Table 2 provides the Pearson correlation matrix between the variables used in the study. All the information asymmetry proxies are positively correlated with each other, which indicates that these measures are likely to be driven by adverse selection, but each contains unique information. Moreover, the index is positively and significantly correlated with each information asymmetry variable, ranging from a correlation of 91% between *ASY* and *QSPD* to a correlation of 49% between *ASY* and *AMH*. Moreover, correlations between the index and the five proxies for information asymmetry are generally higher than correlations between the five proxies. This suggests that the index is a parsimonious way of measuring information asymmetry. The correlations between information asymmetry proxies and control variables are quite significant.

Table 1. Descriptive statistics

Panel A. Information asymmetry measures						
	#obs.	*Mean*	*SD*	*10^{th} perc.*	*Median*	*90^{th} perc.*
QSPD	504	0.007	0.007	0.001	0.005	0.017
AMH	504	0.354	2.068	0.001	0.012	0.441
PI	504	0.004	0.003	0.001	0.003	0.009
PIN	504	0.196	0.065	0.124	0.190	0.274
VPIN	504	0.211	0.127	0.072	0.183	0.377
ASY	504	0.000	1.774	-1.912	-0.359	2.246
Panel B. Control variables						
Size	504	13.476	1.958	11.350	13.489	16.136
Turnover	504	-6.271	1.170	-7.731	-6.306	-4.999
Volat	504	1.949	0.932	1.063	1.711	3.205
Lev	504	0.629	0.234	0.352	0.064	0.824
Prof	504	0.032	0.088	-0.007	0.038	0.094
BTM	504	0.641	0.758	0.219	0.580	1.290
Own	504	0.472	0.233	0.151	0.466	0.760
Analys	504	8.829	7.541	1	7	19
Panel C. Dichotomous variables						
	#obs.	*0*	*%*	*1*	*%*	
IFRS	504	252	50	252	50	
Ibex	504	351	69.64	153	30.36	

Notes: This table reports descriptive statistics on the variables of the present analysis. Panel A corresponds to information asymmetry metrics. *QSPD* is the relative quote bid-ask spread. *AMH* is the illiquidity measure of Amihud (2002). *PI* is the price impact measure proposed by Huang and Stoll (1996). *PIN* is the probability of informed trading based on the Easley *et al.* (1996) model. *VPIN* is the volume-synchronized probability of informed trading developed in Easley *et al.* (2012). *ASY* is the composite index of information asymmetry based on the before market microstructure measures: *QSPD*, *AMH*, *PI*, *PIN*, and *VPIN*. Panel B contains control variables: *Size* is the natural logarithm of sales. *Turnover* is the natural logarithm of the average daily trading volume in € scaled by market value of the firm's equity at the end of the year. *Volat* is the standard deviation of daily returns. *Lev* is the ratio of total debt to total assets. *Prof* is the return on assets. *BTM* is the book-to- market ratio. *Own* is the proportion of common shares held by the largest five shareholders. *Analys* is the total number of analysts following a firm. Panel C reports the frequency dummy variables. *IFRS* takes the value 1 for the post-adoption period and 0 for the pre-adoption period. *Ibex* is a dummy that takes the value 1 if the firm's stocks are constituents of the IBEX-35 and 0 otherwise.

Table 2. Correlation matrix

	QSPD	*AMH*	*PI*	*PIN*	*VPIN*	*ASY*	*IFRS*	*Size*	*Turnover*	*Volat*	*Lev*	*Prof*	*BTM*	*Own*	*Analys*
QSPD	1														
AMH	0.325***	1													
PI	0.919***	0.216***	1												
PIN	0.585***	0.362***	0.502***	1											
VPIN	0.635***	0.335***	0.509***	0.778***	1										
ASY	0.905***	0.492***	0.831***	0.828***	0.842***	1									
IFRS	-0.154***	-0.105**	-0.039	-0.212***	-0.320***	-0.212***	1								
Size	-0.578***	-0.175***	-0.577***	-0.545***	-0.554***	-0.637***	0.133***	1							
Turnover	-0.208***	-0.292***	-0.020	-0.450***	-0.576***	-0.384***	0.227***	0.028	1						
Volat	0.342***	-0.012	0.525***	-0.015	-0.158***	0.189***	0.122***	-0.236***	0.527***	1					
Lev	-0.058	-0.028	0.004	-0.213***	-0.226***	-0.136***	0.093**	0.223***	0.230***	0.212***	1				
Prof	-0.282***	-0.019	-0.386***	-0.036	-0.003	-0.196***	0.015	0.170***	-0.306***	-0.461***	-0.212***	1			
BTM	0.165***	0.024	0.147***	0.118***	0.122***	0.154***	-0.105**	-0.037	-0.073*	0.020	-0.592***	0.024	1		
Own	-0.047	0.106**	-0.080*	0.143***	0.090**	0.044	0.143***	0.230***	-0.413***	-0.102**	0.057	0.135***	0.055	1	
Analys	-0.489***	-0.154***	-0.502***	-0.576**	-0.569***	-0.601***	0.192***	0.669***	0.233***	-0.101**	0.123***	0.105**	-0.066	0.023	1
Ibex	-0.498***	-0.113***	-0.552***	-0.535***	-0.598***	-0.608***	-0.013	0.604***	0.254***	-0.124***	0.151***	0.108**	-0.084*	-0.006	0.628***

Notes: This table reports the pairwise correlation coefficients between the measures used in the study. *QSPD* is the relative quote bid-ask spread. *AMH* is the illiquidity measure of Amihud (2002). *PI* is the price impact measure proposed by Huang and Stoll (1996). *PIN* is the probability of informed trading based on the Easley *et al.* (1996) model. *VPIN* is the volume-synchronized probability of informed trading developed in Easley *et al.* (2012). *ASY* is the composite index of information asymmetry based on the before market microstructure measures: *QSPD*, *AMH*, *PI*, *PIN*, and *VPIN*. *Size* is the natural logarithm of sales. *Turnover* is the natural logarithm of the average daily trading volume in € scaled by market value of the firm's equity at the end of the year. *Volat* is the standard deviation of daily returns. *Lev* is the ratio of total debt to total assets. *Prof* is the return on assets. *BTM* is the book-to-market ratio. *Own* is the proportion of common shares held by the largest five shareholders. *Analys* is the total number of analysts following a firm. *Ibex* is a dummy that takes the value 1 if the firm's stocks are constituents of the IBEX-35 and 0 otherwise.

*, **, and *** represent significance levels at two-tail tests of 0.10, 0.05, and 0.01, respectively.

3.4.2. Univariate analysis

We begin our analysis with univariate comparisons of the measures of information asymmetry before and after IFRS adoption. In Table 3 we report summary statistics of our variables for both periods, the difference of means, and the paired *t*-test and Wilcoxon test (*z*-statistic) values to check the null hypothesis of no significant differences between both two periods.

Table 3. Comparison between pre and post adoption period

	Pre-adoption			*Post-adoption*			*Difference*		
	#obs.	*Mean*	*SD*	*#obs.*	*Mean*	*SD*	*Mean*	*t-stat*	*z-Wil*
QSPD	63	0.008	0.006	63	0.006	0.007	-0.002	-6.14***	-5.50***
AMH	63	0.572	2.218	63	0.137	0.492	-0.435	-1.72*	-4.98***
PI	63	0.004	0.003	63	0.004	0.003	-0.000	-1.49	-2.26**
PIN	63	0.210	0.067	63	0.183	0.051	-0.027	-5.45***	-4.93***
VPIN	63	0.252	0.127	63	0.170	0.093	-0.081	-10.15***	-6.83***
ASY	63	0.376	1.781	63	-0.376	1.441	-0.753	-7.99***	-6.21***
Size	63	13.216	2.032	63	13.735	1.814	0.520	5.14***	6.44***
Turnover	63	-6.537	0.996	63	-6.005	1.097	0.531	7.19***	5.70***
Volat	63	1.836	0.743	63	2.063	0.671	0.227	3.33***	3.34***
Lev	63	0.607	0.174	63	0.651	0.194	0.044	2.01**	2.13**
Prof	63	0.031	0.060	63	0.034	0.070	0.003	0.37	0.17
BTM	63	0.721	0.415	63	0.562	0.517	-0.159	-2.24**	-2.69***
Own	63	0.438	0.224	63	0.505	0.213	0.067	3.62***	3.95***
Analys	63	7.381	5.345	63	10.278	8.127	2.897	4.95***	4.06***

Notes: This table presents summary statistics of variables before and after IFRS adoption. The value of the difference before and after the adoption is also reported. *QSPD* is the relative quote bid-ask spread; *AMH* is the illiquidity measure of Amihud (2002). *PI* is the price impact measure proposed by Huang and Stoll (1996). *PIN* is the probability of informed trading based on the Easley *et al.* (1996) model. *VPIN* is the volume-synchronized probability of informed trading developed in Easley *et al.* (2012). *ASY* is the composite index of information asymmetry based on the before market microstructure measures: *QSPD*, *AMH*, *PI*, *PIN*, and *VPIN*. *Size* is the natural logarithm of sales. *Turnover* is the natural logarithm of the average daily trading volume in € scaled by market value of the firm's equity at the end of the year. *Volat* is the standard deviation of daily returns. *Lev* is the ratio of total debt to total assets. *Prof* is the return on assets. *BTM* is the book-to-market ratio. *Own* is the proportion of common shares held by the largest five shareholders. *Analys* is the total number of analysts following a firm. *Ibex* is a dummy that takes the value 1 if the firm's stocks are constituents of the IBEX-35 and 0 otherwise. The *t-test* and Wilcoxon *z* statistic (*z-Wil*) are used to test the null hypothesis of no significant differences in each measure between two periods.
*, **, and *** represent significance levels at two-tail tests of 0.10, 0.05, and 0.01, respectively

Focusing on information asymmetry, we observe a reduction after IFRS adoption for all proxies estimated, which is significant at conventional levels using both parametric and non-parametric tests (with the only exception of *PI* in the case of the *t*-test). This finding is consistent with the hypothesis that the higher disclosure and information comparability enhanced by the IFRS implementation is associated with a reduction in information asymmetry, even in a country where the level of enforcement is not high. Regarding the changes in our control variables, we find increases almost in all of them, according to the parametrical *t*-test and non-parametrical test of Wilcoxon at the 1% significance level (except in leverage, significant at the 5% level). In *BTM*, inverse of growth opportunities, we show a reduction after IFRS, consistent with an increase in growth options, at the 5% (1%) significance level for *t*-test (z-test). Only for *Prof* do we not find evidence of a significant change.

3.4.3. Multivariate regression

Table 4 presents the results of the multivariate regression analyses for Eq. (9) for the different information asymmetry proxies (*QSPD*, *AMH*, *PI*, *PIN*, *VPIN* and *ASY*) used as dependent variables. We report the coefficients and *t*-statistics based on standard errors double-clustered by firm and year (Petersen, 2009), which are robust to both heteroskedasticity and within firm serial correlation.

Overall, in a country with significant differences between the previous local GAAP and IFRS and a low enforcement level, our findings show that, after controlling for market determinants of adverse selection and the information environment of the firms, IFRS adoption is associated with a reduction in the level of information asymmetry in the stock market. Thus, our findings support Barth and Israeli's (2013) point of view that IFRS adoption itself can confer capital-market benefits.

Table 4. Information asymmetry effects of IFRS adoption
Pre-adoption period: 2001-2004; Post-adoption period: 2005-2008

	DEPENDENT VARIABLES					
	QSPD	*AMH*	*PI*	*PIN*	*VPIN*	*ASY*
IFRS	-0.209***	-0.566***	-0.041	-0.059*	-0.238***	-0.123***
	(-3.74)	(-3.80)	(-0.93)	(-1.75)	(-3.47)	(-3.67)
Size	-0.163***	-0.648***	-0.103***	-0.052***	-0.094***	-0.106***
	(-3.59)	(-6.10)	(-2.60)	(-3.39)	(-4.25)	(-3.81)
Turnover	-0.287***	-1.050***	-0.155***	-0.071***	-0.162***	-0.171***
	(-8.10)	(-10.88)	(-6.20)	(-4.01)	(-8.82)	(-7.99)
Volat	0.336***	0.573***	0.357***	0.018	-0.065***	0.123***
	(6.61)	(7.55)	(9.66)	(0.76)	(-2.88)	(5.58)
Lev	0.483**	1.547***	0.308*	-0.026	0.154	0.215
	(2.17)	(3.56)	(1.83)	(-0.28)	(1.32)	(1.54)
Prof	-0.634	-0.374	-0.359	-0.182	-0.458	-0.570
	(-0.88)	(-0.28)	(-0.65)	(-0.75)	(-1.36)	(-1.22)
BTM	0.193***	0.531***	0.130***	0.012	0.046	0.086**
	(3.12)	(3.61)	(2.67)	(0.47)	(1.29)	(2.23)
Own	-0.039	0.723*	0.004	0.228***	0.170	0.146
	(-0.20)	(1.91)	(0.02)	(2.68)	(1.40)	(1.21)
Analys	-0.016**	-0.028*	-0.014***	-0.010***	-0.013**	-0.016***
	(-2.33)	(-1.93)	(-2.57)	(-3.54)	(-2.45)	(-3.02)
Ibex	-0.582***	-1.223***	-0.545***	-0.106***	-0.428***	-0.354***
	(-6.25)	(-4.93)	(-7.92)	(-2.69)	(-7.22)	(-7.19)
Intercept	-5.733***	-4.501***	-6.234***	-1.438***	-1.337***	1.020***
	(-9.81)	(-3.00)	(-12.02)	(-5.87)	(-4.01)	(2.58)
Indus. dum.	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.815	0.879	0.825	0.641	0.838	0.830
#obs.	504	504	504	504	504	504

Notes: This table reports OLS coefficients of the regression model (9) for the full period (from 2001 to 2008). *QSPD* is the relative quote bid-ask spread; *AMH* is the illiquidity measure of Amihud (2002). *PI* is the price impact measure proposed by Huang and Stoll (1996). *PIN* is the probability of informed trading based on the Easley *et al.* (1996) model. *VPIN* is the volume-synchronized probability of informed trading developed in Easley *et al.* (2012). *ASY* is the composite index of information asymmetry based on the before market microstructure measures: *QSPD*, *AMH*, *PI*, *PIN*, and *VPIN*. All microstructure measures are included in natural logarithms. *IFRS* is a dummy that takes the value of 1 for the post-adoption period (2005-2008) and 0 for the pre-adoption period (2001-2004). *Size* is the natural logarithm of sales. *Turnover* is the natural logarithm of the average daily trading volume in € scaled by market value of the firm's equity at the end of the year. *Volat* is the standard deviation of daily returns. *Lev* is the ratio of total debt to total assets. *Prof* is the return on assets. *BTM* is the book-to-market ratio. *Own* is the proportion of common shares held by the largest five shareholders. *Analys* is the total number of analysts following a firm. *Ibex* is a dummy that takes the value 1 if the firm's stocks are constituents of the IBEX-35 and 0 otherwise. Robust *t* statistics clustered at the firm-year level in brackets.
*, **, and *** represent significance levels at two-tail tests of 0.10, 0.05, and 0.01, respectively.

3.4.4. Sensitivity analyses

3.4.4.1. Alternative year- periods of analysis

To assess the robustness of our results, we examine alternative periods to mitigate concerns that the findings may differ depending on the pre-post IFRS periods selected. First, like other listed firms within the European Union, Spanish firms were mandatorily required to prepare their financial statements from January 1, 2005. However, the IFRS adoption was preceded by a long introduction process and any firm could exceptionally pre-empt the introduction of IFRS. For this reason, we drop 2004 from our original sample period and repeat all analyses. The results, reported in Table 5, are robust to excluding this year. We again find for five out of our six proxies of information asymmetry a negative and significant effect of IFRS.

Furthermore, to avoid any potential impact that the first year of IFRS adoption may have on our results, for example, firms could disclose greater levels of information or be subject to higher control by investors and regulators, as suggested by Brochet *et al*. (2013, p. 1394), we exclude 2005 from the original analysis period. Table 6 reports the results once effects that may be attributable to the transition year are eliminated, and we find the results are similar to those reported above.

We obtain the same results after dropping simultaneously the last year before and the first year of the mandatory IFRS adoption (2004-2005) to avoid effects of this transaction period to IFRS (see Table 7). We also repeat the analyses removing those years farthest from the year of IFRS adoption to minimize the potential effects of the financial crisis, i.e. 2002-2004 vs. 2005-2007; 2002-2004 vs. 2006-2007; 2002-2003 vs. 2006-2007. All the results (not tabulated) are robust. Finally, although in our regression estimations we control for temporal effects, to check once more that the improvements in information asymmetry observed after IFRS adoption are not a function of time we analyze changes in our information asymmetry measures in the years of the pre-IFRS period (e.g. 2003 vs. 2004). The (untabulated) results show that there are no improvements in information asymmetry prior to IFRS adoption. Therefore, all our findings suggest that the IFRS adoption is significantly associated with lower levels of information asymmetry and that it is not due to an improvement through time.

Table 5. Information asymmetry effects of IFRS adoption
Pre-adoption period: 2001-2003; Post-adoption period: 2005-2008

	DEPENDENT VARIABLES					
	QSPD	*AMH*	*PI*	*PIN*	*VPIN*	*ASY*
IFRS	-0.235***	-0.667***	-0.065	-0.079**	-0.259***	-0.144***
	(-3.49)	(-4.77)	(-1.32)	(-2.43)	(-3.74)	(-4.06)
Size	-0.167***	-0.644***	-0.105***	-0.050***	-0.098***	-0.109***
	(-3.69)	(-6.05)	(-2.58)	(-3.47)	(-4.30)	(-3.93)
Turnover	-0.285***	-1.025***	-0.152***	-0.066***	-0.159***	-0.164***
	(-7.65)	(-11.54)	(-5.63)	(-3.84)	(-7.86)	(-8.12)
Volat	0.306***	0.522***	0.335***	0.007	-0.078***	0.104***
	(5.82)	(7.71)	(9.47)	(0.34)	(-4.27)	(6.88)
Lev	0.528**	1.521***	0.340*	-0.033	0.147	0.230
	(2.20)	(3.33)	(1.87)	(-0.35)	(1.11)	(1.53)
Prof	-0.611	-0.438	-0.372	-0.206	-0.479	-0.575
	(-0.86)	(-0.34)	(-0.68)	(-0.89)	(-1.43)	(-1.25)
BTM	0.196***	0.504***	0.131***	0.007	0.039	0.085**
	(3.33)	(3.72)	(2.85)	(0.28)	(1.08)	(2.31)
Own	0.003	0.762	0.015	0.226***	0.165	0.153
	(0.02)	(1.91)	(0.09)	(2.60)	(1.21)	(1.17)
Analys	-0.016**	-0.026*	-0.014**	-0.010***	-0.013**	-0.016***
	(-2.28)	(-1.78)	(-2.48)	(-3.47)	(-2.38)	(-2.92)
Ibex	-0.583***	-1.265***	-0.554***	-0.109***	-0.419***	-0.356***
	(-6.21)	(-4.95)	(-8.00)	(-2.83)	(-6.48)	(-7.76)
Intercept	-5.636***	-4.198***	-6.134***	-1.386***	-1.209***	1.135***
	(-9.83)	(-2.84)	(-11.70)	(-6.14)	(-3.71)	(3.08)
Indus. dum.	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.814	0.878	0.819	0.648	0.839	0.833
#obs.	441	441	441	441	441	441

Notes: This table reports OLS coefficients of the regression model (9) for the full period, excluding 2004. *QSPD* is the relative quote bid-ask spread; *AMH* is the illiquidity measure of Amihud (2002). *PI* is the price impact measure proposed by Huang and Stoll (1996). *PIN* is the probability of informed trading based on the Easley *et al.* (1996) model. *VPIN* is the volume-synchronized probability of informed trading developed in Easley *et al.* (2012). *ASY* is the composite index of information asymmetry based on the before market microstructure measures: *QSPD*, *AMH*, *PI*, *PIN*, and *VPIN.* All microstructure measures are included in natural logarithms. *IFRS* is a dummy that takes the value of 1 for the post-adoption period (2005-2008) and 0 for the pre-adoption period (2001-2003). *Size* is the natural logarithm of sales. *Turnover* is the natural logarithm of the average daily trading volume in € scaled by market value of the firm's equity at the end of the year. *Volat* is the standard deviation of daily returns. *Lev* is the ratio of total debt to total assets. *Prof* is the return on assets. *BTM* is the book-to-market ratio. *Own* is the proportion of common shares held by the largest five shareholders. *Analys* is the total number of analysts following a firm. *Ibex* is a dummy that takes the value 1 if the firm's stocks are constituents of the IBEX-35 and 0 otherwise. Robust *t* statistics clustered at the firm-year level in brackets.
*, **, and *** represent significance levels at two-tail tests of 0.10, 0.05, and 0.01, respectively.

Table 6. Information asymmetry effects of IFRS adoption
Pre-adoption period: 2001-2004; Post-adoption period: 2006-2008

	DEPENDENT VARIABLES					
	QSPD	*AMH*	*PI*	*PIN*	*VPIN*	*ASY*
IFRS	-0.180***	-0.604***	-0.022	-0.074*	-0.304***	-0.137***
	(-2.61)	(-3.35)	(-0.041)	(-1.95)	(-4.81)	(-3.23)
Size	-0.165***	-0.639***	-0.102**	-0.052***	-0.093***	-0.107***
	(-3.53)	(-5.85)	(-2.53)	(-3.34)	(-3.91)	(-3.71)
Turnover	-0.289***	-1.034***	-0.156***	-0.078***	-0.156***	-0.173***
	(-9.23)	(-10.91)	(-7.05)	(-4.95)	(-10.69)	(-8.67)
Volat	0.317***	0.579***	0.351***	0.015	-0.057**	0.119***
	(6.48)	(6.67)	(9.07)	(0.65)	(-2.21)	(4.82)
Lev	0.520**	1.541***	0.308*	-0.017	0.189*	0.240*
	(2.33)	(3.72)	(1.74)	(-0.19)	(1.68)	(1.74)
Prof	-0.664	-0.357	-0.320	-0.236	-0.454	-0.597
	(-0.91)	(-0.28)	(-0.56)	(-0.98)	(-1.40)	(-1.23)
BTM	0.194***	0.511***	0.125**	0.013	0.050	0.088**
	(3.18)	(3.63)	(2.55)	(0.54)	(1.53)	(2.36)
Own	-0.054	0.765*	-0.012	0.248***	0.219*	0.159
	(-0.26)	(1.95)	(-0.08)	(3.13)	(1.92)	(1.31)
Analys	-0.162**	-0.026*	-0.014**	-0.009***	-0.009**	-0.015***
	(-2.24)	(-1.80)	(-2.45)	(-3.13)	(-2.16)	(-2.71)
Ibex	-0.567***	-1.288***	-0.554***	-0.095**	-0.453***	-0.357***
	(-6.12)	(-5.23)	(-8.40)	(-2.32)	(-7.53)	(-7.18)
Intercept	-5.713***	-4.533***	-6.233***	-1.493***	-1.391***	0.996**
	(-9.80)	(-2.88)	(-12.02)	(-6.21)	(-3.90)	(2.41)
Indus. dum.	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.808	0.876	0.820	0.638	0.846	0.824
#obs.	441	441	441	441	441	441

Notes: This table reports OLS coefficients of the regression model (9) for the full period, excluding 2005. *QSPD* is the relative quote bid-ask spread; *AMH* is the illiquidity measure of Amihud (2002). *PI* is the price impact measure proposed by Huang and Stoll (1996). *PIN* is the probability of informed trading based on the Easley *et al.* (1996) model. *VPIN* is the volume-synchronized probability of informed trading developed in Easley *et al.* (2012). *ASY* is the composite index of information asymmetry based on the before market microstructure measures: *QSPD*, *AMH*, *PI*, *PIN*, and *VPIN*. All microstructure measures are included in natural logarithms. *IFRS* is a dummy that takes the value of 1 for the post-adoption period (2006-2008) and 0 for the pre-adoption period (2001-2004). *Size* is the natural logarithm of sales. *Turnover* is the natural logarithm of the average daily trading volume in € scaled by market value of the firm's equity at the end of the year. *Volat* is the standard deviation of daily returns. *Lev* is the ratio of total debt to total assets. *Prof* is the return on assets. *BTM* is the book-to-market ratio. *Own* is the proportion of common shares held by the largest five shareholders. *Analys* is the total number of analysts following a firm. *Ibex* is a dummy that takes the value 1 if the firm's stocks are constituents of the IBEX-35 and 0 otherwise. Robust *t* statistics clustered at the firm-year level in brackets.
*, **, and *** represent significance levels at two-tail tests of 0.10, 0.05, and 0.01, respectively.

Table 7. Information asymmetry effects of IFRS adoption
Pre-adoption period: 2001-2003; Post-adoption period: 2006-2008

	DEPENDENT VARIABLES					
	QSPD	*AMH*	*PI*	*PIN*	*VPIN*	*ASY*
IFRS	-0.200**	-0.702***	-0.041	-0.091**	-0.321***	-0.155***
	(-2.36)	(-3.84)	(-0.69)	(-2.54)	(-4.85)	(-3.19)
Size	-0.169***	-0.633***	-0.104**	-0.050***	-0.097***	-0.110***
	(-3.62)	(-5.77)	(-2.48)	(-3.41)	(-3.89)	(-3.79)
Turnover	-0.290***	-1.004***	-0.153***	-0.074***	-0.152***	-0.168***
	(-9.23)	(-11.70)	(-6.58)	(-5.02)	(-9.16)	(-9.02)
Volat	0.280***	0.519***	0.323***	0.002	-0.073***	0.096***
	(6.34)	(7.03)	(9.68)	(0.10)	(-3.44)	(7.38)
Lev	0.574**	1.507***	0.342*	-0.025	0.183	0.258*
	(2.35)	(3.45)	(1.76)	(-0.28)	(1.40)	(1.72)
Prof	-0.676	-0.463	-0.350	-0.279	-0.483	-0.619
	(-0.96)	(-0.38)	(-0.63)	(-1.28)	(-1.51)	(-1.32)
BTM	0.199***	0.482***	0.125***	0.008	0.044	0.088**
	(3.39)	(3.78)	(2.67)	(0.33)	(1.29)	(2.44)
Own	-0.012	0.811*	-0.004	0.247***	0.218	0.166
	(-0.06)	(1.92)	(-0.02)	(3.05)	(1.62)	(1.23)
Analys	-0.016**	-0.024*	-0.014**	-0.009***	-0.010**	-0.014***
	(-2.18)	(-1.65)	(-2.37)	(-2.95)	(-2.06)	(-2.59)
Ibex	-0.559***	-1.336***	-0.563***	-0.094**	-0.433***	-0.356***
	(-6.03)	(-5.18)	(-8.28)	(-2.41)	(-6.59)	(-7.85)
Intercept	-5.625***	-4.216***	-6.130***	-1.448***	-1.257***	1.113***
	(-9.96)	(-2.72)	(-11.73)	(-6.63)	(-3.51)	(2.86)
Indus. dum.	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.807	0.875	0.813	0.647	0.846	0.826
#obs.	378	378	378	378	378	378

Notes: This table reports OLS coefficients of the regression model (9) for the full period, excluding 2004 and 2005. *QSPD* is the relative quote bid-ask spread; *AMH* is the illiquidity measure of Amihud (2002). *PI* is the price impact measure proposed by Huang and Stoll (1996). *PIN* is the probability of informed trading based on the Easley *et al.* (1996) model. *VPIN* is the volume-synchronized probability of informed trading developed in Easley *et al.* (2012). *ASY* is the composite index of information asymmetry based on the before market microstructure measures: *QSPD*, *AMH*, *PI*, *PIN*, and *VPIN*. All microstructure measures are included in natural logarithms. *IFRS* is a dummy that takes the value of 1 for the post-adoption period (2006-2008) and 0 for the pre-adoption period (2001-2003). *Size* is the natural logarithm of sales. *Turnover* is the natural logarithm of the average daily trading volume in € scaled by market value of the firm's equity at the end of the year. *Volat* is the standard deviation of daily returns. *Lev* is the ratio of total debt to total assets. *Prof* is the return on assets. *BTM* is the book-to-market ratio. *Own* is the proportion of common shares held by the largest five shareholders. *Analys* is the total number of analysts following a firm. *Ibex* is a dummy that takes the value 1 if the firm's stocks are constituents of the IBEX-35 and 0 otherwise. Robust *t* statistics clustered at the firm-year level in brackets.

*, **, and *** represent significance levels at two-tail tests of 0.10, 0.05, and 0.01, respectively.

3.4.4.2. Firm-month analyses around the mandatory IFRS adoption

In addition to the prior firm-year analyses, we collect monthly data for our information asymmetry proxies and repeat the same analyses around the time of IFRS adoption taking into account the early release of IFRS information through interim reports. Thus, we explicitly assess the sensitivity of our findings using another data frequency. We analyze a window of -15 and +15 months around the first interim report prepared under IFRS (March 2005), so it includes monthly data from January 2004 to June 2006 (Table 8). Focusing on this shorter time period around mandatory IFRS adoption, as Daske *et al.* (2008) point out, we could be capturing the effects of the relevant accounting change *per se* with less likelihood of capturing the effects of other institutional changes (e.g, in the governance or enforcement regimes). As shown in Table 8, in four out of our six proxies of information asymmetry, there is a negative and significant effect of *IFRS*, suggesting that IFRS adoption is significantly associated with lower levels of information asymmetry. Our results (not tabulated) are also robust if we exclude the year 2005 in the analysis and thus analyze the period from October 2003 (-15) to March 2007 (+15).

Table 8. Firm-month analysis of information asymmetry effects around IFRS adoption

	DEPENDENT VARIABLES					
	QSPD	*AMH*	*PI*	*PIN*	*VPIN*	*ASY*
IFRS	-0.102**	-0.220***	0.032	0.015	-0.136***	-0.046**
	(-2.26)	(-2.76)	(0.99)	(0.54)	(-3.30)	(-2.15)
Size	-0.110***	-0.430***	-0.074***	-0.031	-0.036	-0.046**
	(-2.72)	(-3.31)	(-2.56)	(-1.55)	(-1.28)	(-2.22)
Turnover	-0.249***	-0.950***	-0.099***	-0.055***	-0.077***	-0.104***
	(-7.78)	(-11.28)	(-3.34)	(-2.68)	(-3.63)	(-4.89)
Volat	0.225***	0.428***	0.308***	0.093***	0.047*	0.128***
	(5.24)	(4.57)	(5.75)	(6.36)	(1.79)	(5.94)
Lev	0.047	0.534	-0.009	-0.107	-0.296**	-0.066
	(0.18)	(0.86)	(-0.04)	(-0.65)	(-2.21)	(-0.51)
Prof	-1.956**	-1.008	-1.307***	-0.063	0.088	-0.747**
	(-2.56)	(-0.56)	(-2.74)	(-0.21)	(0.31)	(-2.20)
BTM	0.209**	0.588**	0.176**	0.059	0.063	0.101*
	(2.02)	(2.17)	(2.05)	(1.12)	(1.00)	(1.86)
Own	-0.139	0.572	0.089	0.244**	0.438***	0.094
	(-0.64)	(1.34)	(0.58)	(2.15)	(3.99)	(1.01)
Analys	-0.026**	-0.063**	-0.020**	-0.010*	-0.011**	-0.013**
	(-2.42)	(-2.33)	(-2.52)	(-1.91)	(-2.02)	(-2.47)
Ibex	-0.620***	-1.001***	-0.483***	-0.147***	-0.423***	-0.288***
	(-5.21)	(-3.64)	(-5.35)	(-2.75)	(-6.33)	(-5.19)
Intercept	-5.792***	-6.344***	-6.117***	-1.820***	-1.886***	0.772***
	(-11.22)	(-4.36)	(-16.35)	(-6.69)	(-5.00)	(2.76)
Indus. dum.	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.800	0.876	0.742	0.305	0.603	0.745
#obs.	1884	1882	1882	1857	1882	1856

Notes: This table reports OLS coefficients of the regression model (9) for fifteen months before and after IFRS adoption. *QSPD* is the relative quote bid-ask spread; *AMH* is the illiquidity measure of Amihud (2002). *PI* is the price impact measure proposed by Huang and Stoll (1996). *PIN* is the probability of informed trading based on the Easley *et al.* (1996) model. *VPIN* is the volume-synchronized probability of informed trading developed in Easley *et al.* (2012). *ASY* is the composite index of information asymmetry based on the before market microstructure measures: *QSPD*, *PI*, *PIN*, and *VPIN*. All microstructure measures are included in natural logarithms. *IFRS* is a dummy that takes the value of 1 for the post-adoption period and 0 for the pre-adoption period. *Size* is the natural logarithm of sales. *Turnover* is the natural logarithm of the average daily trading volume in € scaled by market value of the firm's equity at the end of the month. *Volat* is the monthly standard deviation of daily returns. *Lev* is the ratio of total debt to total assets. *Prof* is the return on assets. *BTM* is the book-to-market ratio. *Own* is the proportion of common shares held by the largest five shareholders. *Analys* is the total number of analysts following a firm. *Ibex* is a dummy that takes the value 1 the firm's stocks are constituents of the IBEX-35 and 0 otherwise. Robust *t* statistics clustered at the firm and month-year levels in brackets.
*, **, and *** represent significance levels at two-tail tests of 0.10, 0.05, and 0.01, respectively.

3.4.4.3. Analyses of the effects of IFRS adoption for heterogeneous firms

We provide additional evidence of the IFRS effects for firms characterized by different information environments. Since extensive research suggests that both firm size and ownership concentration proxies for the quantity and quality of information available about a firm, we divide our sample firms into big versus small firms and into those with high versus low ownership concentration according to the median values. Thus, we further investigate whether the effects of IFRS adoption on information asymmetry are different depending on the firm's information environment. Table 9 reports the results for the two firm partitions, by size (Panel A) and by ownership concentration (Panel B), obtained using the composite index of asymmetric information (*ASY*) and the firm-year panel data of our sample period. As seen in Panel A, the coefficient on *IFRS* is significantly negative for both small and large firms presenting very similar values in both cases (coefficients equal to -0.115 and -0.124, respectively). Focusing on the effects of IFRS depending on the firm's corporate governance environment, which we proxy for ownership concentration, as Panel B shows, the coefficient on *IFRS* is also negative and significantly negative different from zero for both those firms with low concentrated (coefficient=-0.082, *t*-statistic=-2.03) and high concentrated ownership (coefficient=-0.154, *t*-statistic=-2.45), however, it seems that the effect is stronger for more concentrated firms (the difference between coefficients on IFRS of both two firms' groups is statically significant at the 5% level). This finding could suggest that IFRS adoption has implied a reduction of information asymmetries in those firms which are less proactive in disclosing information, thus advocating the benefits of IFRS and the argument that the benefits produced could be due to the higher disclosure requirements of IFRS.

Table 9. Information asymmetry effects of IFRS adoption by firm size and ownership concentration

	Panel A. Partition by firm size			Panel B. Partition by ownership concentration		
	Small	*Large*	*Diff.*	*Low concentred*	*High concentred*	*Diff.*
IFRS	-0.115***	-0.124**	0.009	-0.082**	-0.154**	0.072**
	(-5.27)	(-2.06)		(-2.03)	(-2.45)	
Size	-0.078***	-0.161***		-0.088***	-0.145***	
	(-2.46)	(-14.10)		(-3.57)	(-4.60)	
Turnover	-0.177***	-0.184***		-0.196***	-0.183***	
	(-7.52)	(-5.09)		(-6.12)	(-6.88)	
Volat	0.139***	0.115***		0.143***	0.119***	
	(4.92)	(2.93)		(7.14)	(3.51)	
Lev	0.297*	-0.141		0.370**	-0.173	
	(1.86)	(-0.97)		(2.09)	(-0.94)	
Prof	-0.253	-1.830***		-0.321	-1.116	
	(-0.65)	(-3.33)		(-0.63)	(1.60)	
BTM	0.092**	0.097		0.109**	0.139***	
	(2.39)	(1.27)		(2.21)	(2.91)	
Own	0.178	0.128		0.665***	0.221	
	(0.97)	(1.05)		(2.57)	(1.59)	
Analys	-0.014	-0.011**		-0.017***	-0.008**	
	(-1.19)	(-2.33)		(-2.93)	(-2.19)	
Ibex	-0.567***	-0.269***		-0.496***	-0.265***	
	(-6.75)	(-4.18)		(-7.13)	(-3.64)	
Intercept	0.687*	1.980***		0.415	1.604***	
	(1.84)	(5.36)		(1.18)	(3.26)	
Indus. dum.	Yes	Yes		Yes	Yes	
R^2	0.546	0.884		0.855	0.857	
#obs.	252	252		252	252	

Notes: This table reports OLS coefficients of the regression model (9) for the full period by using as dependent variable *ASY,* which is the composite index of information asymmetry based on the market microstructure measures: *QSPD*, *AMH*, *PI*, *PIN*, and *VPIN. IFRS* is a dummy that takes the value of 1 for the post-adoption period (2005-2008) and 0 for the pre-adoption period (2001-2004). *Size* is the natural logarithm of sales. *Turnover* is the natural logarithm of the average daily trading volume in € scaled by market value of the firm's equity at the end of the year. *Volat* is the standard deviation of daily returns. *Lev* is the ratio of total debt to total assets. *Prof* is the return on assets. *BTM* is the book-to-market ratio. *Own* is the proportion of common shares held by the largest five shareholders. *Analys* is the total number of analysts following a firm. *Ibex* is a dummy that takes the value 1 if the firm's stocks are constituents of the IBEX-35 and 0 otherwise. Robust *t* statistics clustered at the firm-year level in brackets.
*, **, and *** represent significance levels at two-tail tests of 0.10, 0.05, and 0.01, respectively.

3.5. CONCLUSIONS

This study examines the consequences of IFRS regarding information asymmetry in Spain, a country with significant differences between local GAAP and IFRS and low levels of enforcement. We use individual proxies for information asymmetry developed by market microstructure literature (i.e. relative quoted spread, illiquidity measure, price impact, *PIN*, and *VPIN*) and an adverse selection index combining all of them, which allows us to assess in a precise way the effect of IFRS on the level of adverse selection among market participants. Using annual and monthly data, we find a significant reduction of information asymmetry associated with mandatory IFRS adoption, which in a sensitivity analysis we find is higher for those firms with higher ownership concentration. Due to the Spanish features mentioned above and since the enforcement level has not substantially changed in this country after IFRS adoption, our results support the view that IFRS *per se* convey benefits to the market. Our findings are consistent with the argument that IFRS adoption implies an increase in financial reporting quality or disclosure and enhances financial information comparability.

Our study contributes to the literature on the consequences of IFRS adoption in the capital market and to the debate regarding which sources bring about market benefits after this adoption. Previous studies with international samples have found market benefits associated with IFRS adoption in terms of liquidity and cost of capital, particularly in countries with strong legal enforcement and in firms that have more reporting incentives (Daske *et al.*, 2008 and 2013; Li, 2010). By focusing on a single country we avoid the heterogeneity of low enforcement countries, showing that even in this type of country IFRS adoption can be associated with positive economic consequences in the market. Nevertheless, we are cautious with regard to this argument, because, although we have controlled for market and firm characteristics and carried out several robustness tests, the reduction in the level of information asymmetry observed could be driven, besides the implementation of the new standards, by other economic factors that may have affected the firms' information environment.

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CHAPTER 4

THE EFFECTS OF IFRS ON NET INCOME AND EARNINGS COMPONENTS: VALUE RELEVANCE, PERSISTENCE AND PREDICTIVE VALUE

4.1. INTRODUCTION

The adoption of International Financial Reporting Standards (IFRS) represents one of the most significant regulatory changes in financial reporting. The International Accounting Standards Board (IASB) has succeeded in establishing IFRS as the accepted set of financial reporting standards in more than 100 countries, with the primary objective of developing a single set of high quality, understandable, enforceable, and globally accepted financial reporting standards (IASCF Constitution, part 2). These standards should help investors and other market participants to make informed resource allocation and other economic decisions (IFRS Foundation, 2012). In compliance with the European Commission Regulation 1606/2002, since 2005 all listed firms in the European Union must prepare their consolidated financial statements according to IFRS, in order to contribute to the convergence of accounting standards around the world, and thus improve information quality for investors and enable a better functioning of the financial markets.

The switch from domestic accounting standards to IFRS has generated extensive empirical literature regarding its economic consequences on capital markets and financial reporting quality.[16] However, the empirical evidence on accounting quality (in terms of the value relevance of accounting numbers, financial reporting comparability, and earnings management) for IFRS adopters is mixed. For instance, studies such as Barth, Landsman and Lang (2008) and Yip and Young (2012) find an improvement in comparability of accounting information after IFRS, which is attributed to accounting convergence and higher accounting quality (i.e. less earnings management and more value relevance of accounting information under IFRS). This evidence is consistent with the arguments presented by Barth *et al.* (2008) explaining why IFRS adoption may improve accounting quality: (i) the reduction of managerial discretion, as a consequence of the limitation of accounting alternatives, may reduce earnings management; (ii) the implementation of capital-market-oriented accounting standards may improve the value relevance of accounting numbers. However, as Barth *et al.* (2008) also point out, similar reasons can justify a worsening of accounting quality post-IFRS: (a) the elimination of accounting choices may lead firms to using less appropriate alternatives to reflect their underlying economic situation and performance and, therefore, to disclose less relevant accounting

[16]See Brüggemann, Hitz and Sellhorn (2013), Pope and McLeay (2011), and Soderstrom and Sun (2007) for comprehensive reviews on this topic.

amounts; (b) the adoption of principles-based accounting standards may lead to a lack of implementation guidance, more discretion and, consequently, more earnings management. Supporting these last arguments, Ahmed, Neel and Wang (2013) find a reduction in accounting quality − i.e., higher income smoothing and recognition of accruals, lower timeliness of loss recognition − after mandatory IFRS adoption in countries with strong enforcement, which they attribute to the greater flexibility of IFRS.

One issue that, to the best of our knowledge, has not been considered by the literature regarding post-IFRS financial reporting quality is whether the change in the income statement presentation has affected the usefulness for investors of the different line items in the income statement. Effectively, some nonrecurring items, considered as extraordinary items according to previous domestic standards, are reclassified under IFRS into continuing operations as operating and financial income, whereas there is a new section for discontinued operations (IAS 1 *Presentation of Financial Statements,* IFRS 5 *Non-current assets Held for Sale and Discontinued Operations*).

The literature has shown that special and extraordinary items are less recurrent and have lower value relevance and predictive value regarding future earnings than operating income (Elliot and Hanna, 1996; Fairfield, Sweeney and Yohn, 1996; Lipe, 1986). Furthermore, these items can be used by managers to smooth or overstate core earnings (Athanasakou, Strong and Walker, 2007; Barnea, Ronen and Sadan, 1976; McVay, 2006; Ronen and Sadan, 1975) and of achieving earnings targets (Parte Esteban, 2008). In addition, previous studies have found that income from discontinued operations is not informative regarding future earnings (Fairfield *et al.*, 1996). Therefore, the inclusion of extraordinary and special items at the operating and financial income levels, and the fact that the new discontinued operations section under IFRS comprises only part of the previous extraordinary items, may have consequences for the attributes of these line items in the income statement.

In this paper, using a similar framework to that suggested by Jones and Smith (2011), we examine how useful the net income and its components − i.e. operating income, financial income, extraordinary income-net profit/loss from discontinued operations, and other consolidated items and corporation tax− are to investors before and after mandatory adoption of IFRS. We address two main analyses. First, we examine the attributes of the

bottom line of earnings pre- and post-IFRS in order to assess the impact of the whole package of IFRS on financial information. Second, with the goal of understanding whether the change in the income statement structure has affected the earnings quality of the different income measures, we compare the pre-IFRS attributes of operating, financial, extraordinary income, and other consolidated items and taxes, with the post-IFRS attributes of operating, financial, net profit/loss from discontinued operations, and other consolidated items and taxes, respectively. Thus, we investigate the impact of IFRS adoption on the earnings response coefficients (ERC), persistence and predictive value of the different income measures. A priori, it is difficult to foresee whether IFRS adoption would improve or lessen these attributes for each income measure. In fact, apart from the diverse implications of the differences in reporting flexibility between domestic standards and IFRS, under IFRS operating and financial incomes have more non-recurrent components and managers could use these special and extraordinary items to achieve earnings goals (such as smoothing and avoiding negative earnings), so obscuring the information contained in reported earnings. However, if these non-recurrent components are value relevant for investors or the implementation of capital-market-oriented accounting standards has increased the usefulness of accounting numbers, we could expect more information content for investors of accounting earnings. Consequently, we consider that the effect of IFRS adoption on the accounting attributes of the different income measures is an open empirical question.

To implement our analyses, we construct a balanced panel of Spanish non-financial listed firms in the period 2001-2008. As in all the other EU countries, Spanish firms listed on secondary stock markets have been mandatorily required to prepare their consolidated financial statements in accordance with IFRS since 2005. Spain, in particular, is a good context for our empirical investigation for several reasons. Spain is one of the countries in which IFRS adoption implies a significant change regarding the location of nonrecurring items within the income statement. Specifically, prior to IFRS adoption, according to the SAS (Spanish Accounting Standards), the profit and loss statement included nonrecurring items in a separate section such as gains (losses) from disposals of fixed assets and long-term financial investments with controlling purposes, changes in impairment of fixed assets and long-term financial investments with controlling purposes, and other nonrecurring income and expenses. However, following the adoption of IFRS, the notion

of extraordinary items has become more restrictive in Spain. Most of the former extraordinary items have been classified as continuing operations according to their origin either in operating income or in financial income, and a separate section has been added after income from continuing operations for the post-tax net profit/loss from discontinued operations (IAS 1 *Presentation of Financial Statements,* IFRS 5 *Non-current assets Held for Sale and Discontinued Operations*). Hence, while SAS adopted a wide notion of extraordinary items, which were presented in an independent section, the equivalent section under IFRS only includes post-tax gains and losses derived from discontinued operations and post-tax gains and losses recognized on the measurement to fair value less costs to sell or on the disposal of the assets constituting the discontinued operations (IFRS 5). In addition, Spain is a country characterized by lower financial reporting quality than Anglo-Saxon countries where prior research has documented that extraordinary items are widely used for earning management practices (Parte Esteban, 2008). Although Spain is in the middle of a comparability ranking of 14 European countries regarding its differences between IFRS and local Generally Accepted Accounting Principles (GAAP) (Aharony, Barniv and Falk, 2010), significant variations have been found in operating income due to the treatment of revenues and expenses (R&D expenses, amortization goodwill, etc) (Callao, Jarne and Laínez, 2007). Therefore, these accounting features make Spain a good setting in which to examine the research questions proposed in this study regarding the effects of IFRS adoption.

Our results indicate an increase in the value relevance of net income and non-significant changes in its persistence. Regarding the different earnings components, we find a significant increase in the value relevance of operating income and, although the operating income is persistent before and after IFRS adoption, there is a significant decrease in its persistence. However, if we exclude the year 2008, to mitigate the potential consequences from the incipient economic crisis, the levels of persistence of the pre- and post-IFRS operating income are not significant different. Similarly, we observe that the operating income presents a significant predictive ability before and after IFRS adoption, but we do not find significant changes between both periods. We also find that the former extraordinary section under SAS was significantly value relevant and persistent, whereas the current, and more restrictive, IFRS income measure of net profit/loss from discontinued operations is neither value relevant nor persistent. Overall, our findings could suggest that

IFRS adoption has improved the value relevance of operating income due to the inclusion in this income measure of the extraordinary and special items. Regarding the other income measures, we do not find significant changes in the earnings attributes of the financial income and we find an increase in the value relevance of other consolidated items and corporation tax after IFRS adoption. The higher information content of other consolidated items and corporation tax could be a consequence of the increase in the value relevance of other income measures, such as the operating income, and of a better alignment of this income measure with future firm performance.

Our study contributes to the literature in several ways. First, we provide evidence on how earnings attributes of net income have changed after IFRS, when examining the whole impact of IFRS (e.g. fair value orientation, restrictions to recognize R&D expenditures as an asset, recognitions of provisions and impairments, identification of start-up costs, elimination of the amortization of goodwill, etc.). Secondly, we provide evidence on how IFRS, and in particular the change in the structure and classification of items in the income statement, may affect the interpretation and information content of earnings. Previous literature has mainly focused on the effects of IFRS adoption on the attributes of the bottom line of the income statement or certain specific accounting items. However, we examine how IFRS affect attributes of the different income measures associated with forward-looking decisions, so enriching the debate on the usefulness to investors of the different income measures. Finally, our results contribute to the debate surrounding the international harmonization of accounting standards.

The rest of the paper proceeds as follows. Section 2 summarises the main differences between SAS and IFRS. Section 3 reviews related literature and develops our testable hypotheses. Section 4 describes the research design and sample. Section 5 presents the empirical results and Section 6 concludes.

4.2. DIFFERENCES BETWEEN IFRS AND SPANISH ACCOUNTING STANDARDS

The goal of IFRS adoption worldwide is convergence of the accounting normative for preparing financial statements and, consequently, to provide comparable and quality information to help investors in their resource allocation decisions. IFRS adoption has

involved a substantial change in financial reporting for most firms listed on the stock exchanges of European Union member states and those of a great number of countries around the world, such as Australia or China. In many countries IFRS adoption has implied the switch from rules-based standards to principles-based standards, which, on average, are looser than the former (Ahmed *et al*., 2013).

In 2002, the European Union required all European listed companies to implement the IFRS from 1 January 2005. Some European countries permitted voluntary adoption of IFRS prior to 2005, but the majority of firms adopted the international standards when it became mandatory in 2005 (Barth, Landsman, Young and Zhuang, 2014). This is the case of Spain, where until 2004 practically all Spanish listed firms prepared their financial statements in compliance with the local standards issued in 1990. Summarising, the main changes derived from the shift from SAS to IFRS are those that refer to the use of a principle-based approach and the classification of information in the income statements.

The fair value orientation is placing more emphasis under IFRS than under SAS. Whereas IFRS permits two alternative valuation methods –fair value and the acquisition cost– under Spanish standards the mandatory criterion was the acquisition cost. In addition to the application of fair value, other major differences in the balance sheet and the profit and loss statement between both set of standards refer to the capitalisation of expenses and the accounting for intangible assets (Callao *et al.*, 2007). In this sense, the capitalisation of research and development (R&D) expenditures and other expenses, such as start-up costs or advertising costs, is more limited under IFRS. Another important change introduced by the adoption of IFRS is the amortization of intangible assets over their useful life, unless they have an indefinite life, in which case they cannot be amortised (e.g. goodwill) (See Callao *et al.*, 2007, pp. 167-172).

Besides the adoption of two new statements –the statement of cash flows and the statement of changes in owners' equity– there are significant differences in the structure of the profit and loss statement related to the treatment of extraordinary items. The previous Spanish legislation distinguished between ordinary and extraordinary results, with the latter included in a broad and independent section that included several concepts: (i) gains (losses) from disposals of fixed assets and long-term financial investments with controlling purposes; (ii) changes in impairment of fixed assets and financial investments with

controlling purposes; (iii) gains and losses derived from transactions with the firm's own shares and debentures; (iv) gains (losses) from previous accounting periods; and (v) and other income and expenses, such as non-recurrent ones and grants related to assets recognized in income. Nevertheless, under IFRS the notion of extraordinary items disappears and is substituted by the notion of discontinued operations, which are more restrictive than the previous extraordinary section under SAS. IAS 1 establishes that the income statement should include line items with information about several amounts, such as revenues, gains and losses from the recognition of financial assets, finance costs, impairment losses, share of the profit or loss of the associate, tax expense, or a single amount for the income derived from total discontinued operations, which are regulated in IFRS 5. According to this, the income statement of Spanish companies under IFRS does not disclose in a separate section the amounts considered under the previous SAS as extraordinary income and expense. Some of these extraordinary items are now treated as ordinary ones and are classified as operating or financial income depending on their nature, whereas others, those that could fit into the definition of discontinued operations, are presented separately in the income statement (IFRS 5)[17].

4.3. RELATED LITERATURE AND HYPOTHESES DEVELOPMENT

An extensive literature has analysed the IFRS effects on financial reporting quality by examining different market-based and accounting-based attributes of accounting numbers (e.g. value relevance, persistence, predictability, earnings management, timeliness of loss recognition, earnings smoothing).[18] Among these, we focus on value relevance, persistence and predictive value in our study. The three previous earnings attributes are obviously influential for users of financial information due to the fact that earnings plays a crucial role in the resource allocation in capital markets and, therefore, these attributes provide investors with signals about the usefulness of reporting earnings, which could vary across different sets of rules. The extant research that investigates the impact of IFRS adoption on

[17]A discontinued operation is defined (IFRS 5) as 'a component of an entity that either has been disposed of, or is classified as held for sale and: a) represents a separate line of business or geographical area of operations, b) is a part of a single co-ordinate plant to dispose of a separate major line of business or geographical area of operations or c) is a subsidiary acquired exclusively with the aim to resale'. IFRS establishes that firms should disclose: 'i) the post-tax profit or loss of discontinued operations and ii) the post-tax gain or loss recognised on the measurement to fair value less costs to sell or on the disposal of the assets or disposal group(s) constituting the discontinued operation'.

[18] Francis *et al.* (2004) classify earnings attributes in these two categories, accounting-based and market-based.

these three different attributes of accounting earnings has fundamentally focused on the final income or specific items from the income statement –such as goodwill impairment, research and development expenses, asset revaluation, share-based payments, and deferred taxes (Aharony *et al.*, 2010; Horton and Serafeim, 2010). However, to the best of our knowledge, previous studies have not analysed the effect of IFRS on the different income measures. We think that it is an interesting topic that deserves to be examined because of the changes in its composition after the switch from local accounting standards to IFRS in many countries, especially in those whose local standards greatly differed from IFRS.

4.3.1. Value relevance

An accounting number is value relevant if it incorporates significant and reliable information for investors and, accordingly, is reflected in stock prices. For this reason, firms with higher associations between stock price reactions (returns) and earnings are considered of higher accounting quality since they better reflect the firm's underlying economics (Barth, Beaver and Landsman, 2001). In order to improve relevance of accounting items, the Financial Accounting Standards Board (FASB) and the IASB support market-based measures, differing from domestic standards in many countries that rely on acquisition cost, and highlight the capacity of market prices to incorporate efficient and objective expectations about future cash flows (Hitz, 2007). According to prior studies, such as Gjerde, Knivsflå and Sættem (2008) and Herrmann, Saudagaran and Thomas (2006), fair value criterion represents notable implications for the value of long-term assets under IFRS standards, since assets valued using fair value criterion usually report higher amounts than those using the acquisition cost valuation method.

Prior research regarding the impact of IFRS on the value relevance of earnings provides mixed empirical evidence. A large number of studies show findings that are consistent with an increase in the value relevance of earnings after IFRS adoption. For instance, by measuring value relevance as the regression coefficient of returns on earnings, Barth *et al.* (2008) and Bartov, Goldberg and Kim (2005) show the greater value relevance of net income for different samples of firms under voluntarily adopted International Accounting Standards. Similarly, Chalmers, Clinch and Godfrey (2011) suggest an increase in the ERC of net income under IFRS for Australian listed firms, and Barth *et al.* (2014) find that adjustments to net income as a consequence of mandatory adoption are

value relevant in a sample of European firms. Among studies that focus on specific accounting items, Aharony *et al.* (2010) find an increase in the value relevance of goodwill, research and development expenses, and asset revaluation. In contrast, another stream of studies does not find any improvement in the value relevance of earnings after the switch to IAS/IFRS. For instance, Hung and Subramanyam (2007) and Paananen and Lin (2009) find that net income is less value relevant under IAS/IFRS than under German GAAP for samples of both voluntary and mandatory adopters. Similarly, Jarva and Latto (2012) find that returns are more highly associated with income based on Finnish accounting standards than with IFRS income. Finally, a clear example of the mixed evidence regarding the IFRS effects on the value relevance of earnings is Devalle, Onali and Magarini (2010). They examine companies listed on five European stock exchanges (Frankfurt, Madrid, Paris, Milan, and London), which mandatorily adopted IFRS, and find that the explanatory power of the returns-earnings model regressions increases for Spain, Italy, and the United Kingdom, but not for France and Germany.

Other studies have found that investors value the items of the income statement differently depending upon their permanent or transitory nature (Gu and Chen, 2004; Kinney and Trezevant, 1997; Lipe, 1986; Mechelli and Cimini, 2014). Consistent with this idea, studies have shown that core earnings (i.e. from recurring activities) are more value relevant than net income, which incorporates non-operating items (Bradshaw and Sloan, 2002; Brown and Sivakumar, 2003; Cheng, Cheung and Gopalakrishnan, 1993). However, although nonrecurring items, such as extraordinary, special items and discontinued operations, are less value relevant than recurring items by their transitory nature, there is empirical evidence that shows that nonrecurring earnings components are value relevant and have information content for stock markets (Black, Carnes and Richardson, 2000; Chen and Wang, 2004; Jones and Smith, 2011). Based on this, since after IFRS most of the former extraordinary items are incorporated within operating and financial income in the income statement, the recurrence of these incomes and their value relevance could have been negatively affected. But on the other hand, we could also expect that the inclusion of nonrecurring items may increase the value relevance of income measures if these items are also value relevant for investors or if the implementation of the principles-based IFRS leads to accounting measurements that better reflect a firm's economic situation and performance. Thus, we test the following hypothesis and sub-hypotheses in their null form:

H_1: The ERC of net income has not been affected by the adoption of IFRS.

H_{1a}: The ERC of operating income has not been affected by the adoption of IFRS.

H_{1b}: The ERC of financial income has not been affected by the adoption of IFRS.

H_{1c}: The ERC of extraordinary income under SAS is not different to the ERC of net profit/loss from discontinued operations under IFRS.

H_{1d}: The ERC of other consolidated income and corporation tax has not been affected by the adoption of IFRS.

4.3.2. Persistence

Persistence is another important attribute of earnings quality for investors' decisions which captures earnings sustainability or recurrence (Francis, LaFond, Olsson and Schipper, 2004). It is generally assumed that more (less) persistent earnings are more sustainable (transitory) and are of high (low) quality (Francis *et al.*, 2004; Penman and Zhang, 2002). It is also known from the literature that special items are mainly transitory, which means they have zero persistence (Bradshaw and Sloan, 2002; Burgstahler, Jiambalvo and Shevlin, 2002; Fairfield *et al.*, 1996; Jones and Smith, 2011), although some of them may not be completely transitory and follow a particular trend. For instance, Burgstahler *et al.* (2002) find that positive special items are usually followed by small amounts of positive earnings. In contrast, negative special items, e.g., restructuring charges that reduce current income, can be followed by positive earnings. In addition, these items can be used by managers to influence the trend in reported earnings and to affect investors and analysts' perceptions (Kinney and Trezevant, 1997). Elliott and Hanna (1996), Francis, Hanna and Vincent (1996), and Cready, Lopez and Sisneros (2010), among others, find that some special items are recurrent over time.

The evidence on the consequences of IFRS adoption on the persistence of earnings is also mixed. For instance, Atwood, Drake, Myers and Myers (2011) compare earnings reported under IFRS versus local GAAP in an international sample and find no differences in persistence, whereas Chalmers *et al.* (2011) find evidence that earnings become more persistent around IFRS adoption for an Australian sample. In contrast, Doukakis (2010) finds a decrease in the persistence of return on equity (ROE) under IFRS, which he

attributes to the recognition and measurement practices imposed under IFRS, such as the use of a fair-value orientation.

Since the net income, both before and after IFRS adoption, incorporates the same recurring and nonrecurring items, it could be expected that there are no significant changes in persistence between the pre- and post-IFRS adoption periods, unless the switch to the IFRS measurement criteria affects the volatility of earnings. Regarding other income measures, apart from the differences in valuation between domestic accounting standards and IFRS, the inclusion of nonrecurring items under IFRS may have decreased the persistence of operating and financial income. However, due to the inclusion of nonrecurring items in other income measures after IFRS adoption, such as operating income, if managers play with the timing of real transactions to achieve a higher stability of earnings, we will observe under IFRS a higher persistence in this income measure. Thus, we test the following hypothesis and sub-hypotheses in their null form:

H_2: The persistence of net income has not been affected by the adoption of IFRS.

> ***H_{2a}:*** The persistence of operating income has not been affected by the adoption of IFRS.
>
> ***H_{2b}:*** The persistence of financial income has not been affected by the adoption of IFRS.
>
> ***H_{2c}:*** The persistence of extraordinary income under SAS is not different to the persistence of net profit/loss from discontinued operations under IFRS.
>
> ***H_{2d}:*** The persistence of other consolidated income and corporation tax has not been affected by the adoption of IFRS.

4.3.3. Predictive value

Just as value relevance and persistence are key concepts considered by analysts and investors in asset valuation, so the predictive value of earnings (Francis *et al.*, 2004) is closely connected with persistence. Predictability is defined as the ability of the current and past values of earnings or earnings components to predict future performance (Jones and Smith, 2011; Lipe, 1990). It is assumed that earnings reported are of high quality when they are a good indicator of future performance of the firm and, as a consequence, are a useful input in making investment decisions. In our framework, similar to that of Jones and

Smith (2011), the main difference with persistence is that in the predictive value analysis we focus on the ability of the different income measures to predict bottom line earnings, i.e., net income. Research has shown that different components of earnings have different predictive values (Chen, Firth and Gao, 2011; Fairfield *et al.*, 1996; Sloan, 1996). Although there are studies that document a positive relation between special items and future income (Cready *et al.*, 2010; Fairfield *et al*., 1996; Jones and Smith, 2011), in general, studies find that permanent items have more predictive value for future earnings than transitory ones (Brown and Sivakumar, 2003; Burgstahler *et al.,* 2002; Dechow and Ge, 2006).

Recent research based on IFRS adoption has analysed whether the introduction of IFRS has affected the predictability of net income. Some studies show that IFRS increases the accuracy and decreases the dispersion of analyst forecasts (Byard, Li and Yu, 2011; Horton, Serafeim and Serafeim, 2013), which may be attributed to information and comparability effects (Horton *et al.*, 2013). In contrast, Atwood *et al.* (2011) find that earnings reported under IFRS do not differ in their ability to predict future cash flows compared with earnings reported under local GAAP, and Van der Meulen, Gaeremynck and Willekens (2007) find that the US GAAP earnings show a significantly higher predictive ability for future cash flows than IFRS earnings. Furthermore, Doukakis (2010) examines the predictive value of current earnings (operating income, non-operating income, extraordinary charge and extraordinary credit) on future net income for non-financial firms listed on the Athens Stock Exchange, and finds that IFRS does not improve the predictability of net income. Similarly to persistence, there are arguments, on the one hand, that the differences in measurement between the two set of standards as well as the inclusion of nonrecurring items into the operating and financial income could lead to higher volatility of earnings; but, on the other hand, the possibility of playing with real transactions to obtain more stable earnings, and the fact that the nonrecurring items have changed their location under IFRS, may also have positively affected the predictive ability of income measures, such as the operating and financial ones. We test the following hypotheses in their null form:

H_{3a}: The predictive value of operating income for net income has not been affected by the adoption of IFRS.

H_{3b}: The predictive value of financial income for net income has not been affected by the adoption of IFRS.

H_{3c}: The predictive value for net income of extraordinary income under SAS is not different to the predictive value of net profit/loss from discontinued operations under IFRS.

H_{3d}: The predictive value of other consolidated income and corporation tax has not been affected by the adoption of IFRS.

4.4. RESEARCH DESIGN, SAMPLE, AND DATA

4.4.1. Classification of earnings components

In this study, we decompose net income (NI) into four different measures: operating income (OI), financial income (FI), extraordinary income or net profit/loss from discontinued operations (EI/DO), and other consolidated income and corporation tax (hereafter other income, OT). This division is inspired by the structure of the mandatory format of the income statement under SAS, and is similar to the one used by Giner and Reverte (1999) in their study about the value relevance of the different earnings components reported by Spanish firms.

The definition of each one of the earnings components under both accounting standards is presented below. According to SAS (pre-IFRS period), the line items in the income statement include the following amounts:

OI = operating revenues and operating expenses, such as cost of goods sold, personnel expenses, amortization and depreciation.

FI = financial income and expenses, exchange gains or losses, and impairment and gains or losses on disposal of financial instruments.

EI/DO = gains (losses) from disposals of fixed assets and long-term financial investments with controlling purposes; changes in impairment of these same assets; gains and losses derived from transactions with the firm's own shares and debentures; grants related to assets recognized in income; gains (losses) from prior periods; and other

exceptional gains and losses (e.g. fines, changes of accounting policies and errors from previous financial years).

OT = other consolidated income and tax expenses.

NI = profit or loss for the period.

For the post-IFRS period, these income measures are restructured as follows:

OI = operating expenses, such as cost of goods sold, personnel expenses, amortization and depreciation, and revenues, but also impairment and gains or losses on disposal of fixed assets.

FI = financial gains and expenses, exchange gains or losses and impairment and gains or losses on disposal of financial instruments, but also change in fair value of financial instruments.

EI/DO = net profit or loss from discontinued operations.

OT = other consolidated income and tax expenses.

NI = profit or loss for the period.

4.4.2. Value relevance

To test the value relevance of earnings before and after IFRS adoption, we regress stock returns on income surprises. Thus, we measure value relevance with the responses of stock returns to shocks in each one of the income measures defined. First, we regress stock returns on changes of the bottom line earnings to assess the effect of IFRS as a whole on the aggregate income reported by the company. We refer to this as the *net income model*. In a second model, we partition net income shocks into operating income, financial income, extraordinary income-net profit/loss from discontinued operations, and other income, and we examine their associations with company stock returns in order to evaluate whether the change in the income statement composition has altered the effect of earnings surprises on stock returns. We refer to this second model as the *sub-earnings model*. Based on Kormendi and Lipe (1987) and Jones and Smith (2011), the models estimated are:

$$Ret_{i,t} = \beta_0 + \beta_1 \Delta NI_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$Ret_{i,t} = \beta_0 + \beta_1 \Delta OI_{i,t} + \beta_2 \Delta FI_{i,t} + \beta_3 \Delta EI/DO_{i,t} + \beta_4 \Delta OT_{i,t} + \varepsilon_{i,t} \quad (2)$$

where $Ret_{i,t}$ is the buy and hold stock returns over the period ending three months after the company's year-end; $\Delta NI_{i,t}$ is the change in net income from *t*-1 to *t*;$\Delta OI_{i,t}$ is the change of operating income from *t*-1 to *t;* $\Delta FI_{i,t}$ is the change of financial income from *t*-1 to *t*; $\Delta EI/DO_{i,t}$ is the change in extraordinary income from *t*-1 to *t* for the pre-adoption period (2001-2004) and the change in net profit/loss from discontinued operations from *t*-1 to *t* for the post-adoption period (2005-2008); and $\Delta OT_{i,t}$ is the change in other income from *t*-1 to *t*. All independent variables are deflated by average total assets. We estimate the models using robust standard errors corrected for clustering at the firm level (Petersen, 2009; Gow, Ormazabal and Taylor, 2010).

In Model (1), β_1 is the ERC for net income and represents the effect of earnings surprises on stock returns, whereas in Model (2), β_1, β_2, β_3, β_4 are the ERC for operating income, financial income, extraordinary income and net profit/loss from discontinued operations, and other income, respectively, and they identify the stock market response for the surprises in the different earnings components. We run both models for the pre- and post-IFRS periods in order to examine the informativeness of the different income measures on contemporaneous stock returns before and after IFRS implementation. If the value relevance of income measures improves after IFRS adoption, we should observe increases in both ERC and goodness of fit statistics (R^2) in the post-adoption period.

4.4.3. Persistence

To test the persistence of income measures, we use an autoregressive model to regress net income, operating income, financial income, extraordinary income-net profit/loss from discontinued operations, and other income in year *t* on their respective values in year t-1. Based on Collins and Kothari (1989) and Jones and Smith (2011), we use the following models:

$$NI_{i,t} = \beta_0 + \beta_1 NI_{i,t-1} + \varepsilon_{i,t} \quad (3)$$

$$OI_{i,t} = \beta_0 + \beta_1 OI_{i,t-1} + \varepsilon_{i,t} \quad (4)$$

$$FI_{i,t} = \beta_0 + \beta_1 FI_{i,t-1} + \varepsilon_{i,t} \quad (5)$$

$$EI/DO_{i,t} = \beta_0 + \beta_1 EI / DO_{i,t-1} + \varepsilon_{i,t} \quad (6)$$

$$OT_{i,t} = \beta_0 + \beta_1 OT_{i,t-1} + \varepsilon_{i,t} \quad (7)$$

where $NI_{i,t}$ is net income;$NI_{i,t\text{-}1}$ is lagged net income; $OI_{i,t}$ is operating income; $OI_{i,t\text{-}1}$ is lagged operating income; $FI_{i,t}$ is financial income; and $FI_{i,t\text{-}1}$ is lagged financial income; $EI/DO_{i,t}$ is extraordinary income (from 2001 to 2004) and net profit/loss from discontinued operations (from 2005 to 2008); $EI/DO_{i,t\text{-}1}$ is lagged extraordinary income or net profit/loss from discontinued operations; $OT_{i,t}$ is other income; and $OT_{i,t\text{-}1}$ is lagged other income. All variables are deflated by average total assets. We estimate the models using robust standard errors corrected for clustering at the firm level (Petersen, 2009; Gow *et al.*, 2010).

In Models (3) to (7), β_1 represents earnings persistence of the different income measures. Thus, earnings persistence is measured by the slope coefficient from the regression of current earnings on lagged ones. We assume that an income measure shows positive persistence if β_1 is positive and significant. If β_1 is close to one, it implies highly persistent earnings, while values of β_1 not significantly different from zero mean transitory earnings. Therefore, we are interested in examining whether the coefficients (β_1) are closer to one in the post-adoption period, and whether the difference between the periods is significant.

4.4.4. Predictive value

To test the predictive value for net income of operating income, financial income, extraordinary income and net profit/loss from discontinued operations, and other income, we regress net income in year *t* on the previous year's disaggregated income measures. Following Fairfield *et al.* (1996) and Jones and Smith (2011), the regression model estimated is:

$$NI_{i,t} = \beta_0 + \beta_1 OI_{i,t-1} + \beta_2 FI_{i,t-1} + \beta_3 EI / DO_{i,t-1} + \beta_4 OT_{i,t-1} + \varepsilon_{i,t} \quad (8)$$

where $NI_{i,t}$ is net income; $OI_{i,t\text{-}1}$ is lagged operating income; $FI_{i,t\text{-}1}$ is lagged financial income; $EI/DO_{i,t\text{-}1}$ is lagged extraordinary income (from 2001 to 2004) and net profit/loss

from discontinued operations (from 2005 to 2008); and $OT_{i,t-1}$ is lagged other income. All variables are deflated by average total assets. We estimate the model using robust standard errors corrected for clustering at the firm level (Petersen, 2009; Gow *et al.*, 2010).

In Model (8), β_1, β_2, β_3, and β_4 represent, respectively, the ability of each income measure (operating income, financial income, extraordinary income net profit/loss from discontinued operations, and other income) to predict future net income. If β_1, β_2, β_3, and β_4 are significant and positive, the earnings components associated to each coefficient contribute to future earnings being more predictable, so we conclude that these income measures have predictive value. We assess differences in the predictive value of income measures by examining whether there are significant changes in the coefficients (β_1, β_2, β_3, and β_4) between the periods.

4.4.5. Sample selection and data

Our initial sample consists of all non-financial firms listed continuously on the main segment of the Sistema de Interconexión Bursátil Español (SIBE) during the period January 2001-December 2008.We choose this sample period to get a balanced set of the 4 years before (2000-2004) versus the 4 years after (2005-2008) mandatory IFRS adoption. We exclude financial firms because they are subject to different financial regulation and accounting rules and in order to reduce the likelihood of other factors confounding our results. Within our sample period, 64 non-financial firms are listed during January 2001-December 2008, but we have not been able to collect full data for one of them. Hence, the final sample consists of a balanced panel of 63 firms and 504 firm-year observations, 252 observations for the period 2001-2004 and 252 for the period 2005-2008. On average, stocks included in our sample represent around 72% of the market capitalisation and 82% of the trading volume of the Spanish non-financial firms listed on the SIBE within our sample period. Balance sheets and income statements are obtained from the Sistema de Análisis de Balances Ibéricos (SABI) database, drawn up by Bureau Van Dijk, and from the annual reports at the Spanish Securities Market Commission (Comisión Nacional del Mercado de Valores, CNMV), while daily stock prices are provided by Bolsas y Mercados Españoles (BME) Market Data.

Table 1 presents descriptive statistics (i.e. mean, median, standard deviation, 10th percentile and 90th percentile) for the main variables for the full sample period (2001-2008). The mean (median) of stock returns is 6.7% (7.8%). On average (median), both net income and operating income are positive, 0.036 (0.041), and 0.077 (0.064), respectively. As expected, financial income and other income are negative, with a mean (median) of -0.014 (-0.014), and -0.013 (-0.010), respectively, and the mean (median) extraordinary income and net profit/loss from discontinued operations is 0.000 (0.000).

Table 1. Descriptive statistics

	#obs.	*Mean*	*SD*	*10^{th} perc.*	*Median*	*90^{th} perc.*
Ret	504	0.067	0.473	-0.546	0.078	0.559
NI	504	0.036	0.079	-0.007	0.041	0.096
OI	504	0.077	0.135	-0.008	0.064	0.135
FI	504	-0.014	0.014	-0.029	-0.014	0.000
EI/DO	504	0.000	0.043	-0.015	0.000	0.018
OT	504	-0.013	0.036	-0.036	-0.010	0.011

This table reports the sample descriptive statistics on main variables for the full sample period. *Ret* is the buy and hold stock returns over the period ending 3 months after the company's year end; *NI* is the net income deflated by average total assets; *OI* is the operating income deflated by average total assets; *FI* is the financial income deflated by average total assets; *EI/DO* is the extraordinary income or net profit/loss from discontinued operations, for pre- and post-adoption period, respectively, deflated by average total assets; *OT* is the other consolidated income and taxes deflated by average total assets.

Table 2 reports descriptive statistics for both pre- and post-adoption periods, as well as the difference of means, the paired *t*-test and Wilcoxon test (z-statistic) values for a comparison of the variables between the pre- and the post-adoption period. We observe a significant reduction of returns after IFRS adoption, but do not find differences in the deflated income measures between both periods.[19] However, this univariate analysis cannot detect if earnings attributes, such as value relevance, persistence or predictive value, have changed after IFRS implementation.

[19] We highlight that the values of all income measures reported are deflated by total assets and are the average of multi-year periods. Prior evidence shows that earnings figures prepared under SAS are substantially different from earnings figures prepared under IFRS for the 2004 accounting period. For example, Callao *et al*. (2007) show that several balance sheet items (i.e. debtors, cash, equity, long-term liabilities, and total liabilities) and operating income of the income statement prepared under SAS are significantly different from those prepared under IFRS.

Table 2.Comparison between pre- and post-adoption period

	Pre-adoption			*Post-adoption*			*Difference*		
	#obs.	*Mean*	*SD*	*#obs.*	*Mean*	*SD*	*Mean*	*t-stat*	*z-Wil*
Ret	63	0.129	0.144	63	0.058	0.178	-0.123	-4.52***	-4.27***
NI	63	0.035	0.055	63	0.038	0.069	0.002	0.38	0.36
OI	63	0.079	0.135	63	0.076	0.117	-0.003	-0.40	-0.27
FI	63	-0.014	0.001	63	-0.015	0.010	-0.001	-0.82	-0.67
EI/DO	63	-0.001	0.026	63	0.001	0.009	0.002	0.41	0.44
OT	63	-0.014	0.025	63	-0.013	0.024	0.001	0.33	0.08

This table reports summary statistics of variables before and after IFRS adoption and the value of the difference before and after the adoption. *Ret* is the buy and hold stock returns over the period ending 3 months after the company's year end; *NI* is the net income deflated by average total assets; *OI* is the operating income deflated by average total assets; *FI* is the financial income deflated by average total assets; *EI/DO* is the extraordinary income or net profit/loss from discontinued operations, for pre- and post-adoption period, respectively, deflated by average total assets; *OT* is the other consolidated income and taxes deflated by average total assets. The *t*-test and Wilcoxon z statistic (z-Wil) are used to test the null hypothesis of no significant differences in each measure between two periods. *** denotes significance levels at two-tail tests of 1%.

4.5. EMPIRICAL RESULTS

4.5.1. Value relevance

The regression results of Models (1) and (2) pre- and post-IFRS are shown in Table 3. We report ordinary least-squares (OLS) coefficients with firm cluster-adjusted *t*-statistics and two-tailed *p*-values.

In order to evaluate the value relevance of earnings on stock returns, we focus on the ERC. The results for net income, Model (1), show that the coefficients of earnings surprise in net income (β_1) are significantly positive in both periods (β_1 = 1.012 for pre-adoption and β_1 = 3.394 for post-adoption, with p<0.01 in both cases) and significantly higher under IFRS (difference = 2.382, p<0.01), so we reject the null hypothesis H_1 of no change in the ERC of net income between both periods and confirm a higher value relevance of net income under IFRS.

Table 3.Value relevance of income measures

	Pre-adoption		Post-adoption		Test of coefficient equality	
	Model (1)	Model (2)	Model (1)	Model (2)	Difference	*t*
Δ*NI*	1.012***		3.394***		2.382***	4.09
	(4.09)		(6.49)			
Δ*OI*		1.082*		3.161***	2.079***	3.89
		(1.86)		(6.17)		
Δ*FI*		7.920***		8.985***	1.065	0.46
		(3.85)		(5.08)		
Δ*EI/DO*		0.856**		0.241	-0.615	-0.48
		(2.44)		(0.21)		
Δ*OT*		0.817		3.048***	2.231***	4.25
		(1.37)		(6.20)		
Intercept	0.124***	0.122***	0.007	0.023		
	(6.55)	(6.14)	(0.36)	(1.04)		
R^2	0.063	0.117	0.148	0.219		
F	16.75	7.59	42.11	13.52		
p<F	0.00	0.00	0.00	0.00		
#obs.	252	252	252	252		

This table reports OLS coefficients of value relevance of income measures on stock returns for pre- and post-IFRS adoption following regression Models (1) and (2):

$$Ret_{i,t} = \beta_0 + \beta_1 \Delta NI_{i,t} + \varepsilon_{i,t}$$

$$Ret_{i,t} = \beta_0 + \beta_1 \Delta OI_{i,t} + \beta_2 \Delta FI_{i,t} + \beta_3 \Delta EI/DO + \beta_4 OT + \varepsilon_{i,t}$$

Ret is the buy and hold stock returns over the period ending 3 months after the company's year end; Δ*NI* is the change of net income from *t*-1 to *t;* Δ*OI* is the change of operating income from *t*-1 to *t*; Δ*FI* is the change of financial from *t*-1 to *t*; Δ*EI/DO* is the change of extraordinary from *t*-1 to *t* for the pre-adoption period and is the change of net profit/loss from discontinued operations from *t*-1 to *t* for the post-adoption period; Δ*OT* is the change of other consolidated income from *t*-1 to *t*. All income variables are deflated by average total assets.

***,**,* denote significance levels at two-tail tests of 1%, 5%, and 10% level, respectively.

Focusing on the different earnings components, in Model (2), we observe that the earnings surprise in operating income is also positively associated with returns in both periods (β_1 = 1.082 for pre-adoption, with p<0.10, and β_1 = 3.161 for post-adoption, with p<0.01) and significantly higher under IFRS (difference = 2.079, p<0.01). The coefficient on extraordinary items is significantly positive in the pre-adoption period, while net profit/loss from discontinued operations is not value relevant after IFRS, which could be due to the fact that under IFRS discontinued operations do not include items that may be value relevant but are now included in operating income. Therefore, this change in the classification of these relevant extraordinary items in the income statement could be one of the sources of the significant increase in the value relevance of operating income observed after IFRS adoption. In addition, surprises in financial income are significantly and

positively associated with stock returns in both periods, although the coefficient does not differ between both periods. Finally, surprise in other income (ΔOT) seems to have an important effect on stock returns in the post-adoption period ($\beta_4 = 3.048$) and the difference between coefficients is significantly higher under IFRS (difference = 2.231, $p<0.01$). This increase in the value relevance of consolidated income and corporate tax suggests a higher alignment of these items with the underlying performance of the firm under IFRS, so improving its usefulness for investors (Lev and Nissim, 2004). Hence, we can reject the null hypotheses H_{1a} and H_{1d}, but H_{1b} and H_{1c} cannot be rejected. Besides, the improvement in the goodness of fit statistics (R^2), in Model (1) from 6.3% to 14.8%, and in Model (2) from 11.7% to 21.9%, support, overall, the increase in value relevance under IFRS.

These findings are consistent with the literature (Barth *et al.*, 2008; Choi, Peasnell and Toniato, 2013) which, although focused on net income, shows higher value relevance of earnings numbers under IFRS. Our results for Spain suggest that the improvement in the value relevance of net income is mainly due to operating income and other income.

4.5.2. Persistence

Table 4 presents the results of Models (3)-(7) for earnings persistence. We report OLS coefficients with firm cluster-adjusted *t*-statistics and two-tailed *p*-values.

With regard to net income, the coefficient is 0.442 ($p<0.05$) in the pre-adoption period and 0.788 ($p<0.01$) in the post-adoption period. Although the coefficient on lagged net income is higher after IFRS adoption, it is not significantly different from that of the pre-adoption period. Hence, we cannot reject the null hypothesis H_2 of no difference in net income persistence between both periods.

For the operating income model, the coefficient exhibits a positive and significant persistence in both periods (β_1 = 0.951 and 0.766 for pre- and post-adoption periods, respectively, with $p<0.01$) and the difference between both coefficients is significantly negative (-0.185, $p<0.05$). Thus, we find a significant decrease in persistence in operating income under IFRS. This leads us to raise the question as to whether the findings for operating income may be affected by the economic downturn. In order to discard this possibility, we repeat this analysis, excluding 2008. We do not find significant differences in the persistence of operating income before and after IFRS adoption and, therefore,

Table 4. Persistence of income measures

	Pre-adoption					Post-adoption					Test of coefficient equality	
	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)	Difference	*t*
NI	0.442**					0.788***					0.346	1.56
	(2.31)					(492)						
OI		0.951***					0.766***				-0.185**	-2.54
		(20.85)					(15.36)					
FI			0.647***					0.546***			-0.101	-0.49
			(12.21)					(3.04)				
EI/DO				0.167***					-0.021		-0.188***	-5.28
				(4.96)					(-0.67)			
OT					0.029					0.023	-0.006	-0.31
					(0.93)					(0.58)		
Intercept	0.187**	0.003	-0.004***	-0.000	-0.013***	0.002	0.012**	-0.008***	0.001	-0.012***		
	(2.31)	(1.33)	(-3.03)	(-0.08)	(-4.27)	(0.22)	(2.05)	(-3.29)	(0.88)	(-4.28)		
R^2	0.178	0.717	0.431	0.020	0.007	0.471	0.663	0.248	0.002	0.008		
F	5.35	434.89	149.00	24.56	0.86	24.21	235.82	9.22	0.45	0.33		
p<F	0.024	0.000	0.000	0.000	0.357	0.000	0.000	0.004	0.507	0.565		
#obs.	252	252	252	252	252	252	252	252	252	252		

This table reports OLS coefficients of persistence of income measures for pre- and post-IFRS adoption following regression Models (3), (4), (5), (6), and (7):

$$NI_{i,t} = \beta_0 + \beta_1 NI_{i,t-1} + \varepsilon_{i,t}$$

$$OI_{i,t} = \beta_0 + \beta_1 OI_{i,t-1} + \varepsilon_{i,t}$$

$$FI_{i,t} = \beta_0 + \beta_1 FI_{i,t-1} + \varepsilon_{i,t}$$

$$EI/DO_{i,t} = \beta_0 + \beta_1 EI/DO_{i,t-1} + \varepsilon_{i,t}$$

$$OT_{i,t} = \beta_0 + \beta_1 OT_{i,t-1} + \varepsilon_{i,t}$$

NI is net income*; OI* is the operating income; *FI* is the financial income; *EI/DO* is the extraordinary income or net profit/loss from discontinued operations for pre- and post-adoption period, respectively; *OT* is the other consolidated income. All income variables are deflated by average total assets.
***,**,* denote significance levels at two-tail tests of 1%, 5%, and 10% level, respectively.

the decrease in persistence reported above could be attributed to the incipient downward shift in the economic cycle.

With regard to the persistence of financial income; although the coefficient on *FI* is significantly positive (with values of 0.647 and 0.564 for pre- and post-adoption period, respectively, and with $p<0.01$ in both cases) in both periods, the difference between the two periods is not significant. Focusing on Model (6), we find that extraordinary income was persistent before IFRS adoption ($\beta_1 = 0.167$, with $p<0.01$), whereas net profit/loss from discontinued operations does not show persistence in the post-IFRS period, so the difference between the persistence of *EI* and *DO* is strongly significant and negative (-0.188, $p<0.01$). Finally, other income does not show persistence either before or after IFRS. Hence, we can reject the null hypotheses H_{2a} and H_{2c}, but H_{2b} and H_{2d} cannot be rejected. Therefore, based on our findings, we conclude that the adoption of IFRS has not significantly affected the persistence of operating, financial, and net income.

4.5.3. Predictive value

Table 5 presents the results of Model (8) for the predictive value of each one of the income measures (operating, financial, extraordinary income and net profit/loss from discontinued operations, and other income) in relation to net income. Thus, we regress current net income on past earning components. We report OLS coefficients with firm cluster-adjusted *t*-statistics and two-tailed *p*-values.

Almost all earnings components are positive and significantly associated with future net income in both periods. For the pre-adoption model, operating, financial, and other income have a positive and significant effect on net income ($\beta_1 = 0.756$, $\beta_2 = 1.638$, $\beta_4 = 0.727$, with $p<0.01$), whereas the coefficient on extraordinary income is not significant. In the post-adoption model, the coefficients of all income measures are significant ($\beta_1 = 0.754$, $\beta_2 = 1.464$, and $\beta_4 = 0.697$, with $p<0.01$ and $\beta_3 = 1.049$, with $p<0.05$). This confirms that, all income measures in the income statement have a significant ability to predict future net income after IFRS adoption. However, when we examine the differences in predictive value between pre- and post-adoption periods, only the difference between the coefficients on net profit/loss from discontinued operations and extraordinary income are significant at conventional levels (1.073, $p<0.01$), with a higher predictive value for net profit/loss from discontinued operations. Therefore, we cannot

reject H_{3a}, H_{3b} and H_{3d} of no effects on the predictive value of operating, financial, and other income and we only reject H_{3c} of no difference between the predictive value of extraordinary items and net profit/loss from discontinued operations. In short, although the R^2 of the model has increased due to net profit/loss from discontinued operations, we cannot affirm that the remaining earnings components under IFRS exhibit differences in predictive value for net income compared with those under SAS.

Table 5. Predictive value of income measures

	Pre-adoption	*Post-adoption*	*Test of coefficientequality*	
	Model (8)	*Model (8)*	*Difference*	*t*
OI	0.756***	0.754***	-0.002	-0.01
	(8.90)	(5.44)		
FI	1.638***	1.464***	-0.174	-0.28
	(3.50)	(4.43)		
EI/DO	-0.024	1.049**	1.073***	2.97
	(-0.14)	(2.45)		
OT	0.727***	0.697***	-0.030	-0.17
	(7.65)	(4.39)		
Intercept	0.018*	0.009		
	(1.88)	(0.93)		
R^2	0.358	0.512		
F	38.27	19.07		
p<F	0.00	0.00		
#obs.	252	252		

This table reports OLS coefficients of the predictive value of income measures for net income pre- and post-IFRS adoption following Model (8):

$$NI_{i,t} = \beta_0 + \beta_1 OI_{i,t-1} + \beta_2 FI_{i,t-1} + \beta_3 EI/DO_{i,t-1} + \beta_4 OT_{i,t-1} + \varepsilon_{i,t}$$

NI is net income*; OI* is operating income; *FI* is the financial income; *EI/DO* is the extraordinary income or net profit/loss from discontinued operations for pre- and post-adoption period, respectively; *OT* is the other consolidated income. All variables are deflated by average total assets.

***,**,* denote significance levels at two-tail tests of 1%, 5%, and 10% level, respectively.

4.5.4. Robustness analysis

As a robustness test, we repeat all of the previous analyses for value relevance and predictive value, excluding the transitory year 2005 and thus considering 2006-2008 as the post-adoption period, in order to avoid any potential impact that the transition period could have on our results. The untabulated results are quite robust to the omission of the observations corresponding to 2005. Most are similar to those reported above. All reported earnings, with the exception of financial income, which does not show a change in value relevance between pre- and post-IFRS, are more value relevant under IFRS. In the case of

the predictive value of earnings components, the difference with respect to the results shown in Table 5 is that we do not find significant differences between the coefficients on extraordinary income and net profit/loss from discontinued operations, so we are cautious about the results reported in Table 5. Hence, we do not find differences in the predictive value of any of the earnings components.

4.6. CONCLUSIONS

This study analyses whether IFRS adoption has affected the attributes of the different income measures in relation to future-oriented decisions. In particular, we analyze whether the value relevance, persistence, and predictability of net income as well as its earnings components (i.e. operating income, financial income, extraordinary income-net profit/loss from discontinued operations, and other income) have been altered by the implementation of IFRS, thus extending the literature on the usefulness of IFRS reporting. For our analyses, we employ a balanced panel of 63 Spanish listed firms for the period 2001-2008 (i.e. 504 firm-year observations).

Overall, our results show that the value relevance of net income has improved in Spain after the adoption of IFRS, since we find an increase of ERC and of R^2 in the value relevance model. However, the persistence of net income has not changed significantly after IFRS. By examining the changes in the attributes of the different earnings components, we find a significant increase in the value relevance of operating income and a significant decrease in its persistence. However, the decrease in the persistence of operating income, which we have found in the analysis for the whole period, could be attributed to the economic downturn, because the change in persistence is not significant if we exclude 2008. Thus, our findings suggest that the classification changes in the income statement have positively affected the value relevance of operating income, but have not affected its persistence. With regard to other income measures, our findings show a significant improvement in the value relevance of other consolidated income and corporation tax, and a significant decrease in the persistence of net profit/loss from discontinued operations in relation to extraordinary items. Finally, except for this last income measure, we do not find statistically relevant changes in the predictive ability of the different income measures after the switch to IFRS.

Our findings suggest that the mandatory adoption of IFRS has led to net income measures of higher quality, since post-IFRS bottom-line earnings are more value relevant without altering the level of persistence. Although previous studies have found a higher value relevance of net income under IFRS (Barth *et al.*, 2008 and 2014; Chalmers *et al.*, 2011; Choi *et al.*, 2013), our results contribute to the literature by showing that, at least in the Spanish case, operating income also improves its value relevance. Since the non-recurring items were value relevant in the pre-adoption period, the increase in the value relevance of operating income is consistent with the inclusion of some of these items in this income measure after IFRS adoption. Therefore, we could conclude that the adoption of IFRS has had significant and positive implications on the value relevance of the key income measures, such as operating and net incomes.

This study has two main limitations. First, although the sample includes almost all representative non-financial firms on the Spanish stock market over the given period, it is small and focused on only one country. Second, as shown in the persistence analysis, there are other economic factors that could affect the results. Nevertheless, our findings could be useful to investors, financial analysts or other financial statement users for their respective decision makings since they highlight the value relevance increase of operating income following IFRS adoption.

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CONCLUSIONS

The main objective of this doctoral thesis is to contribute to the FRQ literature. Thus, its first part, Chapters 1 and 2, analyses the effect of FRQ on investment efficiency and information asymmetry. The second part of the thesis, which comprises Chapters 3 and 4, extends the debate on the economic consequences of IFRS adoption by investigating whether the switch to IFRS affects information asymmetry in the stock market and earnings attributes (i.e. value relevance, predictive ability, and persistence) of the main line items of the income statement.

Firstly, Chapter 1 examines the effect of FRQ and debt maturity on investment efficiency in order to analyse whether these mechanisms can minimize overinvestment and underinvestment problems. The findings contribute to the literature, showing that in a code law country, where FRQ is lower than in Anglo-Saxon countries and where debt maturity structure presents a short-term orientation, FRQ and short-term debt are mechanisms to enhance investment efficiency. Specifically, the reported findings suggest that FRQ helps to reduce overinvestment, while the higher use of short term debt mitigates overinvestment and underinvestment problems. In addition, the results show that FRQ and debt maturity are tools with a certain degree of substitution with regard to improving investment efficiency. Those firms with lower (higher) short-term debt exhibit higher (lower) FRQ effect on investment efficiency. Thus, in firms with lower FRQ, debt maturity can be a relevant resource with which to monitor managerial activities.

Chapter 2 extends the scarce and mixed empirical literature about the effect of REM on the adverse selection problem in financial markets. Among the studies that directly test the link between REM and information asymmetry, this is the first one that takes into account the alternative interpretations or endogenous character of REM measures and the first in examining the effect of REM on information asymmetry outside the US. The main contribution is that REM enhances the production of private information and thus increases information asymmetry in firms with incentives to engage in earnings manipulation. By contrast, in those firms without incentives to meet last year's earnings, deviations from normal operations that increase earnings are associated with lower information asymmetry. This evidence suggests that the private information production depends on a firm's circumstances. Thus, private informed investors produce information in those circumstances where firms have incentives to manipulate earnings through REM

activities, that is, where earnings quality is lower. However, when the empirical proxies for REM could be capturing situations rather related with business circumstances than with earnings manipulation, private informed investors do not engage in producing private information, due to the lower profitability of producing private information in this context.

In the second part, motivated by IFRS adoption, Chapter 3 analyses whether the switch from Spanish Accounting Standards to IFRS has affected the level of information asymmetry between market participants in a context where there are significant differences between local GAAP and IFRS and where the enforcement is weak. To analyse the effect of mandatory IFRS adoption on the information environment, prior studies have mainly used indirect proxies for information asymmetry, such as liquidity, cost of capital or analyst forecasts. To the best to our knowledge, this is the first study which uses measures of adverse selection developed by market microstructure literature, which allows a better understanding of the link through which IFRS affects the information environment. The findings show a significant reduction in the information asymmetry risk in the Spanish stock market after IFRS adoption, which is higher in firms with more ownership concentration, that is, those firms characterized by less proactive information disclosure. This evidence suggests that the higher disclosure and transparency requirements imposed by IFRS have mitigated the informational differences between investors and, consequently, improved the information environment.

Finally, Chapter 4 examines whether the change in the location of non-recurring and extraordinary items in the profit and loss account that IFRS adoption has implied for some countries, has affected the usefulness for investors of the different line items in the income statement. Specifically, this chapter examines whether the earnings attributes for future decisions of net income and its earnings components (operating income, financial income, extraordinary income-net profit/loss from discontinued operations, and other consolidated income and corporation tax) have changed with the adoption of IFRS. The results show an increase in the value relevance of net income and non-significant changes in its persistence. Regarding the different earnings components, a significant increase in the value relevance of operating income and a significant reduction in its persistence are found. Moreover, the former extraordinary income was value relevant and persistent under SAS, while the current net profit/loss from discontinued operations, a much more restrictive section, is neither value relevant nor persistent. Overall, these findings show that

mandatory IFRS adoption has led to positive implications on the value relevance of the main income measures, net and operating income, providing novel empirical evidence to the debate surrounding the effect of IFRS adoption on the earnings quality

The findings obtained in this doctoral thesis have relevant implications for managers, stakeholders, investors, regulators and academics, and other financial statement users. They exhibit the importance of FRQ as a mechanism to reduce information asymmetries even in a context of a code law country, where accounting quality is lower and the enforcement is weaker than the US market, where most previous research is focused. Future research could delve further into the economic implications of IFRS on investment. For instance, as earnings measures influence the resource allocation, it would be interesting to analyze whether the change in earnings attributes brought about by IFRS has affected resource allocation decisions. In addition, it is necessary to advance the understanding of the economic consequences of REM strategies. Due to their high opacity, their less well-known effects, and their possible substitution relation with accrual-based strategies, their economic implications for the long-term value of the firm should be investigated in depth in different contexts.