



# Cash holdings and earnings quality: evidence from the Main and Alternative UK markets<sup>☆</sup>

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## ABSTRACT

In this paper we investigate the importance of earnings quality as a determinant of cash holdings by companies, exploring among other factors the nature of earnings (positive or negative) and the level of financial disclosure, proxied by the market where firms are listed (Main or AIM-Alternative Investment Markets in the United Kingdom). Based on a sample covering the period of 1998–2015, we provide evidence that as earnings quality decreases, firms tend to hold more cash except when firms are facing losses in both Main and AIM markets. In addition, we document that information conveyed by earnings quality is a more important determinant of cash reserve levels for Main Market than for AIM firms (where the level of financial disclosure and oversight is lower). Overall, our evidence suggests that cash balances are positively influenced by the presence of greater information asymmetries arising from poor earnings quality but also from the existence of lower levels of regulatory oversight and the occurrence of losses, both of which reduce the importance of earnings quality as a determinant of cash levels. Our results also imply that companies with higher levels of earnings opacity seem to benefit from having higher cash holdings so as to avoid dependence from costly external funding.

## 1. Introduction and motivation

Prior research has shown that companies may set their levels of cash holdings by trading off the costs and benefits of larger liquidity reserves (Miller & Orr, 1966). Costs that have been analysed typically include low returns and possible tax disadvantages of cash reserves (Bigelli & Sánchez-Vidal, 2012) while usual benefits that have been identified are the reduction in transaction costs that would exist in the case of new capital raising or the liquidation of assets, the reduced likelihood of default, the avoidance of possibly expensive funding or even the shortage of financing alternatives (Kim, Mauer, & Sherman, 1998; Opler, Pinkowitz, Stulz, & Williamson, 1999).

Reasons for a costly external financing relate in general to the presence of information asymmetries between firms and investors (Myers & Majluf, 1984) or to the existence of agency problems associated with underinvestment and asset substitution (Jensen & Meckling, 1976). Additionally, managers may pursue their own interests by maintaining large amounts of cash on companies' balance sheets so as to keep sub-optimal levels of net debt, risk and/or dividends in comparison to those desired by shareholders (Easterbrook, 1984).

With the exception of García-Teruel, Martínez-Solano, and Sánchez-Ballesta (2009) who focused on Spanish firms prior to the adoption of IFRS by listed business groups, there has been, however, little research on the relation between cash reserves and earnings quality in an European setting. In the US context, Sun, Yung, and Rahman (2012) show a negative impact of earnings quality on corporate cash holdings. Chung, Kim, Kim, and Zhang (2015) document that companies in industries with greater levels of information asymmetry hold lower amounts of cash balances, consistent with a shareholders monitoring hypothesis where managers are restrained from holding large cash reserves that could be misused when their environment is more opaque. The UK is a particularly interesting setting to test the relationship between earnings quality and cash-holdings. This is not just due to earnings quality being usually perceived to be higher in Anglo-Saxon (common-law) accounting systems than in continental Europe (code-law) ones but also because, as Ball, Kothari, and Robin (2000) observe, “*within the common-law group, there is less asymmetric conservatism in accounting income in the United Kingdom, a country we characterize in terms of lower political involvement in accounting, lower litigation costs and less issuance of public debt*” (p. 4). Finally, we are able also to test whether different

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levels of financial disclosure for UK companies according to the particular requirements of their listing market (the AIM-Alternative Investment Market or the Main Market) have an impact on the corporate need for cash balances. As [Nielsson \(2013\)](#) and [Jenkinson and Ramadorai \(2013\)](#), among others, observe, companies in the AIM market face fewer reporting obligations in comparison with their Main Market counterparts.

We posit that as firms' earnings quality decrease, managers may need to counter a possible negative perception from investors by holding larger amounts of cash reserves. This may be caused by the fact that in the presence of lower quality earnings, information asymmetries are perceived to be stronger (as suggested by [Sun et al., 2012](#)) and external financing can become more costly or even unavailable. This in turn will lead managers to rely more on internal funds and create a cash buffer to prevent any eventual shortage of funding needed for future investments.

Given the less stringent supervision, as well as the less demanding listing and financial disclosure requirements prevailing for firms listed in the AIM market, access to external funding may be more difficult to obtain for these companies and so we explore the relation between cash holdings and earnings quality separately for firms listed in the AIM and Main Markets. Finally, we also look at companies experiencing losses, as well as those engaging in substantial R&D activities or undergoing periods of robust growth to analyse whether in these cases a negative relation between earnings quality and cash earnings can also occur along the same or different terms as for other companies.

Our results reveal that earnings quality indeed has a negative impact on the level of cash holdings, consistent with an expected substitution effect, either for firms in the UK's AIM or Main Markets. However, when we split our sample between profitable and loss-making firms, we observed that for the latter earnings quality does not influence the amount of cash reserves held by a company, except when such firms are listed in the AIM market. We interpret this finding as meaning that for loss-making companies in the Main Market managers refrain from having prohibitively high opportunity costs associated with large cash holdings as a means to compensate for a low quality earnings perception. This could be because new capital will be generally available for companies in this market even though at a substantially increased cost. However, if loss-making firms are in the AIM market, the high level of information asymmetry and/or lack of official supervision will make it almost compulsory for managers to hold larger cash reserves when their firms present negative earnings on top of a perceived low quality of its published results. A possible reason for this is that fears could be greater among investors that loss-making, low quality earnings firms coupled with the low level of financial disclosure and supervision in this market will be more prone to default or bankruptcy risk and therefore companies will not want to become dependent on external funding which may become unavailable.

We also find that the negative impact of earnings quality on cash holdings is more strongly felt in low-growth companies and, in the case of AIM firms, is restricted to these kinds of companies. Finally, we document that earnings quality is an important factor in the determination of cash holdings only for companies that do not engage in substantial, informational-relevant, R&D activities.

Overall, our evidence suggests that R&D intensive and AIM-listed firms have specificities in the way earnings quality impacts on cash holdings. In particular, our results are consistent with the importance of specific information asymmetries prevailing in companies listed in the AIM that are relevant determining factors for cash holdings. These asymmetries arise either as the result of both the nature of their activities and the level of financial disclosure which depends on the particular requirements of the market where these firms are listed.

Our contribution to the literature on the determinants of cash holdings is threefold. First, we extend previous research by [García-Teruel et al. \(2009\)](#) in several directions. We use data from UK-listed firms including firms from both the Main and AIM markets that have

different regulatory environments and distinct listing and financial disclosure requirements. Because there is more regulatory oversight and financial disclosure requirements, firm listed in the Main Market the information available to external parties is typically more detailed and access to external funding is more accessible than for AIM firms. Accordingly, we posit and test whether the expected relationship between earnings quality and cash holdings could be different for these two sets of firms. In addition, the [García-Teruel et al. \(2009\)](#) paper covers a period (1995–2001) prior to the issuance of EU's Regulation 1606/2002, which required the mandatory adoption of International Financial Reporting Standards by Spanish-listed firms. Before this, the Spanish accounting system was considered as being in an “opposite group” ([Gastón, García, Jarne, & Gadea, 2010](#)) as that of the UK, i.e. the former belonging to the European continental accounting model and the latter to the Anglo-Saxon one. As the IFRS is usually seen as being closer to the Anglo Saxon model ([Gastón et al., 2010](#)), analyzing the issue of the relation between earnings quality and cash holdings in the UK would provide relevant additional evidence to test whether [García-Teruel et al. \(2009\)](#) conclusions would still hold in an accounting environment where, in general, earnings quality is seen as having a higher standard and accordingly being more informative. For instance, [Zeghal, Chtourou, and Fourati \(2012\)](#) document that following the adoption of IFRS standards earnings quality improves in a sample of firms from 15 EU countries. Similarly, [Van Tendeloo and Vanstraelen \(2005\)](#) show that earnings management levels are lower after the adoption of IFRS in Germany. However, even when countries adopt the same IFRS standards, [Nobes \(2006\)](#) observes that significant differences in international financial reporting quality remain.

Second, we explore the impact of earnings losses on cash holdings. For firms with negative profits, earnings quality may be a less important determinant of cash holdings. As pointed out by [Darrough and Ye \(2007\)](#), when firms incur losses, “*the link between current and future abnormal earnings is weakened*” (p. 62). In addition, cash reserves for these firms may also have a particularly high opportunity cost due to the perceived risk of financial distress and related funding shortage. In such a setting, low earnings quality may not imply that the firm will seek to maintain high levels of expensive cash holdings. We also test for the joint effect of losses and type of listing (AIM or Main) to see whether the impact of losses is the same for firms listed in each of these markets.

Finally, our paper also addresses the relevance of R&D and growth for the relation between earnings quality and cash holdings. As documented by [Franzen and Radhakrishnan \(2009\)](#), R&D expenses can have an especially important informational role from the standpoint of firm valuation by the market for both firms with losses and with positive profits. Using UK data, [Green, Stark, and Thomas \(1996\)](#) also reach similar conclusions. As also observed by [Franzen and Radhakrishnan \(2009\)](#), growth can additionally have a similar value-relevant informational role as R&D. In line with this literature, it is therefore possible that for firms where R&D is important or that are experiencing high growth, a different relation may also exist between earnings quality and cash holdings. We test for this and also provide an analysis that combines these factors with the existence of a listing in the AIM market.

Our paper proceeds as follows. In the next section we provide a literature review and present our major research hypotheses. We then proceed in [Section 3](#) to describe the sample and the methodology used. In [Section 4](#) we analyse the empirical results while the final part of the paper provides the main conclusions.

## 2. Literature review and research questions

### (i) General determinants of cash holdings

Several papers have analysed the determinants of cash holdings by companies. [Opler et al. \(1999\)](#) show evidence consistent with firms choosing an optimal level of cash holdings according to a static trade-

off model initially suggested by Miller and Orr (1966). Their results show that a firm's level of cash is positively related to growth opportunities, risk and negatively related to size. The authors observe that companies that have an easier access to capital markets (like larger ones or those with better credit ratings) tend to hold less cash. This evidence suggests that a higher cost, or unavailability, of external financing can lead managers to hold larger amounts of cash in their companies' balance sheets, particularly when facing future investment needs related to an expected high growth rate in their activities. Similar results have been achieved, among others, by Kim et al. (1998), Pinkowitz and Williamson (2001) and D'Mello, Krishnaswami, and Larkin (2008) while Bigelli and Sánchez-Vidal (2012) show that these empirical findings tend to hold not just for public but also for private firms.

As Myers and Majluf (1984) suggest, information asymmetries between the firm and external investors can raise the cost of external financing and this can lead to an incentive for managers to hold larger amounts of cash as a way of reducing their dependence on external funding. Along similar lines, the possibility, raised among others by Myers (1977) and Jensen and Meckling (1976), of underinvestment or asset substitution can also motivate firms to keep larger liquidity reserves so as to avoid expensive external financing. Agency costs between managers and shareholders can also lead managers to refrain from paying dividends and to reduce net debt and related financial risks to levels below those desired by shareholders (Easterbrook, 1984). Consistent with this assertion, Opler et al. (1999) shows evidence of persistence in excess cash that could be caused by agency problems between shareholders and managers. Evidence on conflicts of interest between managers and shareholders causing higher levels of cash holding in companies is however, mixed. On one hand, Ferreira and Vilela (2004) report that firms in countries with better investor protection and concentrated ownership hold less cash. Along similar agency theory-related lines, García-Teruel and Martínez-Solano (2008) find that managerial ownership can also have an impact on the level of cash reserves held by a company. On the other hand, results by Ozkan and Ozkan (2004) observe a non-monotonical relation between cash holdings and managerial ownership. According to their results, cash levels increase after a critical ownership level, in contrast to the usual expected shareholder alignment effect caused by larger holdings by managers.

Other factors that have been shown to exert a potential influence on cash holdings are: size, growth opportunities, risk, profitability, debt levels, debt maturity structure and R&D intensity. Kim et al. (1998) propose a model where the costs of external funding, volatility of cash-flows and growth opportunities are positive influences on the determination of cash holdings by companies and find supporting evidence using US data. Décamps, Mariotti, Rochet, and Villeneuve (2011) predict a similar relation between cash holdings, cash-flow volatility and the costs of external funding. Consistent with the predictions and results of these authors, Ozkan and Ozkan (2004) present evidence that debt levels, cash-flows and investment opportunities have an impact on cash holdings. Opler et al. (1999) also show that smaller firms, those with more investment opportunities or having riskier activities tend to hold a larger fraction of their assets in the form of cash. Similar factors are also shown to influence cash holdings for small and medium size enterprises according to an analysis by García-Teruel and Martínez-Solano (2008) focusing on Spanish firms. A common characteristic for most of the above explanatory factors is their consistency with explanations based on the role of informational asymmetries, its relation with the cost of external funding and the associated marginal costs and benefits of cash reserves.

## (ii) Earnings quality and cash holdings

Accounting quality has been analysed as a measure of information asymmetry in different settings (see for example Biddle & Hilary, 2006 for an analysis of investment efficiency and Bhattacharya, Daouk, &

Welker, 2003 for a study on the cost of capital determinants). Dechow, Ge, and Schrand (2010) provide a thorough review of the earnings quality literature. Defining, similarly to SFAC 1,<sup>1</sup> earnings quality as those earnings where more information is provided about “the features of a firm's financial performance that are relevant to a specific decision made by a specific decision-maker” (p. 344), they note that relevant measures of earnings quality are contingent on the decision context.<sup>2</sup>

One of our main research hypotheses is that earnings quality is a potentially relevant influence on the level of companies' cash holdings. We expect this to occur for a number of reasons related to information asymmetries and to the cost of external financing. First, a number of papers (e.g. Dittmar, Mahrt-Smith, & Servaes, 2003; Ozkan & Ozkan, 2004) have shown that cash holdings are positively related to the level of information asymmetries. In turn, information asymmetries have been recognized as an important determinant of the cost of capital which can be reduced by higher earnings quality (see for instance Bhattacharya et al., 2003 and Francis, LaFond, Olsson, & Schipper, 2005). In accordance with this, Easley and O'Hara (2004) derive a model where the quality of accounting earnings is a non-diversifiable risk factor which accordingly affects the firm's cost of capital. Given that earnings are simultaneously composed of accrual and cash components then, as Dechow et al. (2010) observe, when earnings are predominantly composed of accruals they will be less persistent and thus less informative (i.e., of “lower quality”) than when they are composed predominantly of cash-flows. Therefore, to counterbalance a low level of earnings quality, it could make sense for companies to accumulate substantial cash reserves so as to avoid dependence from capital markets to raise funds and/or to convey an image of greater stability and lower risk than that transmitted by low quality earnings.

In brief, if earnings quality is poor, the degree of information asymmetries can be very high and the firm may find it too costly to engage in external capital raising. Thus, it may prefer to hold larger amounts of cash reserves that act as a buffer against cash shortages in the future that could occur as the result of capital expenditures or future losses. Another possibility is that in the face of a perception of low quality earnings by investors, the firm may want to counter this by presenting a comfortable financial position where larger amounts of cash reserves are shown to investors so as to increase their confidence on the firm in an attempt to reduce the cost of capital. In any case, this will lead to a negative relation between earnings quality and cash reserves. This expected outcome is consistent with the predictions of Myers and Majluf (1984) whose pecking order theory states that due to information asymmetries, companies will prefer to use internally generated funds rather resource to the market for fundraising.

Using a sample of Spanish SMEs and a Dechow and Dichev (2002) model, García-Teruel et al. (2009) find evidence consistent with higher accounting quality reducing the levels of liquid assets. Sun et al. (2012) provide an analysis on the relation between earnings quality and cash holdings for US firms for the period 1980–2005 and find evidence of a negative association consistent with the arguments above described.

In addition, Chung et al. (2015) find evidence in favour of a monitoring cost hypothesis for the relation between cash holdings and information asymmetry. According to such hypothesis, active monitoring

<sup>1</sup> Statement of Financial Accounting Concepts are a set of guidelines issued by the FASB-Financial Accounting Standards Board.

<sup>2</sup> As an example, for a financial analyst the ability of earnings to be used for forecasting future performance may be a crucial dimension. For a lender, the ability of earnings to convey the true economic reality and riskiness of a firm with little influence from arbitrary accounting options made by managers may be another key feature of earnings quality. For an investor, the ability of prices and stock returns to react to changes in earnings may be another relevant key dimension for earnings quality, as well as the way earnings can track changes in value that can form the basis for awarding bonuses to managers without the interference of earnings management practices. Accordingly, Dechow et al. (2010) classify earnings quality models alongside three categories: (i) properties of earnings, and (ii) investors' responsiveness to earnings and external indicators of earnings misstatements.

by shareholders will restrict the access of managers to free cash-flow to avoid value-destroying activities (Jensen, 1986) and this will be more likely in the face of environments with a high level of information asymmetry. As a result, there should be a negative relation between cash holdings and the level of information asymmetry, which the authors document in their analysis. Nonetheless, Chung et al. (2015) acknowledge the possibility of a competing hypothesis where information asymmetry and cash holdings would be positively related under the lines discussed by Myers and Majluf (1984), termed the “investment opportunities hypothesis of cash holdings”.<sup>3</sup>

Also, it would be conceivable that, in the absence of adequate monitoring mechanisms, earnings quality could be low as the result of agency problems between managers and shareholders, and in that case managers would also engage in the build-up of cash reserves in order to insulate themselves from external monitoring by capital markets (Easterbrook, 1984) or for other private benefits. In that case, one would expect a negative relation between cash holdings and earnings quality. Koo, Ramalingegowda, and Yu (2017) show that higher quality reporting is associated with higher dividend payments, thus suggesting as well the possibility that earnings quality could have a negative impact on cash holdings.

Finally, Greiner (2017) shows that aggressive income increasing real activities management is associated with larger cash holdings, again suggesting the existence of a relationship between earnings quality and cash holdings. The authors also consider that such an association can be related to Jensen's (1986) free cash-flow hypothesis as the observed relation is stronger for weakly-governed firms.

In our analysis, we extend this field of research by looking at the UK environment that is particularly interesting for a number of reasons. First, Harris and Muller (1999) present evidence that US GAAP have superior information quality compared to the IAS/IFRS system used in the UK. In addition, Barth, Landsman, Lang, and Williams (2012) examine the application of IFRS by non-US firms and conclude that “US-GAAP earnings reconciliation amounts are value relevant after controlling for IAS amounts for market value and return models” (p. 309, lines 11–12). They also observe that although the adoption of IFRS “has enhanced reporting comparability with US firms, significant differences remain”.

Second, the UK enables us to test the differential relevance of cash holdings in the Main and AIM markets that are characterised, as will be detailed later, by different levels of information asymmetry.

Finally, we extend Garcia-Teruel et al.'s (2009) research that is restricted to a period (1995–2001) for which it was not mandatory for Spanish business groups to prepare consolidated statements in accordance with IFRS (which became compulsory only after 2005). In addition, as Sun et al. (2012) point out, Spain is a continental European country with a low level of investor protection, a less developed capital market and considerably concentrated ownership of listed firms. Therefore, relative to Garcia-Teruel et al.'s (2009) research, the analysis of UK data allows the study of the relation between earnings quality and cash holdings in an European country characterised by a high level of investor protection, fairly dispersed ownership and within an Anglo-Saxon accounting system that is usually seen as being characterised by generally higher financial reporting quality (Leuz & Verrecchia, 2000). As García-Teruel et al. (2009) themselves acknowledge, the Spanish firms in their sample “are most likely to present lower accounting quality” (p. 97, line 1).

Our first research hypothesis is then stated as follows:

**H1.** Earnings quality has a negative impact on the level of cash holdings, all else being constant.

<sup>3</sup> According to Myers and Majluf (1984), the unavailability of enough cash holdings relative to investment opportunities (i.e. the existence of an “inadequate slack”) would lead firms to pass on valuable investments in order to avoid issuing securities in financial markets due to the negative impact on stock prices caused by information asymmetries.

(iii) AIM versus Main Market firms

The Alternative Investment Market (AIM) was created in 1995 by the London Stock Exchange with the purpose of providing a special market for smaller companies to raise capital without imposing the same costly listing requirements that are imposed on firms in the Main Market, and has since then attracted a substantial number of companies, currently exceeding 3000<sup>4</sup> listings. As observed by Piotroski (2013), this market offers such companies an important degree of flexibility that “includes listing, regulatory and disclosure requirements that are limited relative to other major markets and selectively chosen by the listing firm (p. 217)”. In particular, companies in this market have an oversight which is ensured not by a regulatory agency, like the UK's Financial Services Authority, but rather by nominated advisors that are selected and hired by the listing firms themselves, thus embodying what one could call a “private sector oversight” (Piotroski, 2013). Furthermore, they are not required to have a trading record, minimum public float or market capitalization (Espenlaub, Khurshed, & Mohamed, 2012, Table 1) thus reducing the market information requirements on the firms' performance.

Despite its increasing popularity, research on the differences between the Main Market and AIM firms is still very incipient. Gerakos, Lang, and Maffett (2013) suggest that the particular regulatory setting of the Alternative Investment Market can generate greater information asymmetry which could explain why firms in this market typically underperform those in more traditional markets on a number of important dimensions like failure rates and post-listing returns. They also observe few instances of such companies upgrading for more demanding exchanges or becoming “high-flyers”. Espenlaub et al. (2012) provide evidence that the reputation of the IPO nominated advisors has an impact on the rate of survival of firms listed on AIM and Vismara, Paleari, and Ritter (2012) and report that these firms are characterised by higher bid-ask spreads, and lower share turnover when compared with Main Market firms. Mallin and Ow-Yong (2011) find that AIM firms have lower levels of corporate governance disclosure when compared with their Main Market counterparts, with this phenomenon more evident for firms with high levels of debt.

In this context, it is reasonable to expect that for AIM firms the existence of stronger information asymmetries in comparison with the Main Market and the possible perception by investors of the risks associated with less effective oversight will affect the relationship between earnings quality and cash holdings. In accordance with this, on the one hand we could anticipate that, for the same level of earnings quality, and in comparison to Main Market firms, a firm listed in the AIM will present higher levels of cash holdings. This would be a natural outcome of the fact that AIM companies face higher costs of external funding due to information asymmetries, lower liquidity levels, weaker levels of financial disclosure, and generally lower confidence on the part of investors regarding the robustness of their financial performance and situation. Therefore, these companies could hold, all else constant, larger amounts of cash than their counterparts to maintain a buffer to protect them from the need to raise costly external capital or simply in an attempt to signal better quality.

On the other hand, the same reasons mentioned above could actually have an opposite impact. If external financing is indeed more costly and difficult to obtain for AIM firms, their managers may view cash holdings as having a much higher opportunity cost than in the case of Main Market companies. This being the case, top executives could seek to minimize the destination of cash for less productive ends, like the accumulation of idle funds in a bank account. As a consequence, the impact of earnings quality on the level of cash held by a company could actually be weaker than in the case of firms listed in the more traditional exchange market. Therefore, it is essentially an empirical matter

<sup>4</sup> Source: London Stock Exchange, January 2014.



**Table 1**  
Number of firm observations by market and industry.

Panel A: Number of firm year observations in the Main and AIM						
Year	Main Market		AIM		Total	
	Initial	Final	Initial	Final	Initial	Final
1998	957	446	379	95	1336	541
1999	841	393	385	95	1226	488
2000	772	387	499	94	1271	481
2001	725	377	579	88	1304	465
2002	681	408	590	124	1271	532
2003	633	419	591	170	1224	589
2004	606	389	671	177	1277	566
2005	591	349	827	183	1418	532
2006	541	319	941	231	1482	550
2007	518	295	938	246	1456	541
2008	508	284	859	244	1367	528
2009	490	264	766	238	1256	502
2010	470	263	710	252	1180	515
2011	431	262	693	295	1124	557
2012	413	252	674	318	1087	570
2013	403	261	679	331	1082	592
2014	414	249	701	326	1115	575
2015	417	237	684	312	1101	549
Total	10,411	5854	12,166	3819	22,577	9673

Panel B: Number of firm year observations by Industry1998 to 2015		
Industry	Number	Percentage
Aerospace & defense	149	1.54
Alternative energy	16	0.17
Chemicals	108	1.12
Construction & materials	426	4.4
Electronic & electrical equipment	542	5.6
Food & drug retailers	59	0.61
Food producers	264	2.73
Gas, water & multi-utilities	70	0.72
General industrials	110	1.14
General retailers	610	6.31
Health care equipment & services	219	2.26
Household goods & home construction	553	5.72
Industrial engineering	632	6.53
Industrial transportation	112	1.16
Media	807	8.34
Mining	332	3.43
Oil & gas producers	307	3.17
Personal goods	148	1.53
Pharmaceuticals & biotechnology	394	4.07
Software & computer services	1045	10.8
Support services	1729	17.87
Technology hardware & equipment	240	2.48
Travel & leisure	801	8.28
Total	9673	100

Panel C: Number of firm year observations with profit vs. losses in the Main and AIM											
Year	Profit firms					Loss firms					Total
	Main	Main %	Aim	AIM %	Total	Main	Main %	AIM	AIM %	Total	
1998	404	90.58	76	80.00	480	42	9.42	19	20.00	61	541
1999	355	90.33	77	81.05	432	38	9.67	18	18.95	56	488
2000	335	86.56	68	72.34	403	52	13.44	26	27.66	78	481
2001	316	83.82	57	64.77	373	61	16.18	31	35.23	92	465
2002	331	81.13	74	59.68	405	77	18.87	50	40.32	127	532
2003	349	83.29	103	60.59	452	70	16.71	67	39.41	137	589
2004	343	88.17	120	67.80	463	46	11.83	57	32.20	103	566
2005	310	88.83	116	63.39	426	39	11.17	67	36.61	106	532
2006	286	89.66	140	60.61	426	33	10.34	91	39.39	124	550
2007	275	93.22	159	64.63	434	20	6.78	87	35.37	107	541
2008	260	91.55	161	65.98	421	24	8.45	83	34.02	107	528
2009	231	87.50	142	59.66	373	33	12.50	96	40.34	129	502

(continued on next page)

Table 1 (continued)

Panel C: Number of firm year observations with profit vs. losses in the Main and AIM											
Year	Profit firms					Loss firms					Total
	Main	Main %	Aim	AIM %	Total	Main	Main %	AIM	AIM %	Total	
2010	240	91.25	167	66.27	407	23	8.75	85	33.73	108	515
2011	242	92.37	180	61.02	422	20	7.63	115	38.98	135	557
2012	235	93.25	196	61.64	431	17	6.75	122	38.36	139	570
2013	238	91.19	191	57.70	429	23	8.81	140	42.30	163	592
2014	225	90.36	185	56.75	410	24	9.64	141	43.25	165	575
2015	218	91.98	167	53.53	385	19	8.02	145	46.47	164	549
Total	5193	88.71	2379	62.29	7572	661	11.29	1440	37.71	2101	9673

whether AIM firms do in fact set cash levels differently from their Main Market counterparts in the presence of lower quality earnings.

We accordingly state our second hypothesis as follows:

**H2.** Earnings quality impacts the level of cash holdings in companies listed in the AIM Market in a different (stronger or weaker) way than in companies listed in the Main Market, due to the lower levels of information requirements and regulatory oversight for companies listed in the former market.

(iv) Profit versus loss-making firms

Losses have been the subject of a wide array of studies that have looked, among other aspects, at the importance of non-earnings information for loss-making firms or the analysis of several accounting properties associated with negative income. Hayn (1995) observes that since shareholders have a liquidation option, negative earnings are not expected to persist across several years and thus become less informative. Similarly, Darrough and Ye (2007) argue that, for companies experiencing losses, intangible assets become especially relevant in the determination of their market value by investors. Joos and Plesko (2005) show evidence that investors determining the likelihood that negative earnings persisting for several periods by looking at both cash-flow and accrual components of reported earnings. For the US, recent evidence shows an increase in the frequency of firms reporting losses (Collins, Maydew, & Weiss, 1997). In the UK, similar evidence is provided by Jiang and Stark (2013) who document a relative higher importance of book-value in valuing loss firms. Nevertheless, for the UK, Jiang, Soares, and Stark (2016) report that the market seems unable to correctly price the reversal of losses into profits. Based on the US and for the period of 1980–2006, Bates et al. (2009, Table 2) provide evidence that the average cash-to-total assets ratio for profit firms has increased from 0.101 to 0.176 but loss firms have reported an increase from 0.122 to 0.351 for the sample period.

From this literature, one can infer that for loss-making firms earnings quality may have less importance in comparison to firms with positive profits and this could translate into a possibly weaker relation to cash holdings. Moreover, in recent years profit and loss firms seem to exhibit a different pattern in terms of their cash holdings that warrant further analysis.

Also, one could argue that the existence of losses may increase the cost of external funding and even its unavailability in some cases. In that context, cash reserves can become the sole source of funding and therefore idle cash balances may suffer a substantial increase in their opportunity cost. This could mean that in those cases earnings quality may have a much weaker impact on cash holdings in comparison with what one would expect for companies with positive profits.

Depending on the level of information asymmetry between investors and firms on the Main or AIM markets, the relation between earnings quality and cash holdings will be contingent on a trade-off between the relative costs and benefits of idle cash, which will be potentially different for companies in these two markets. One could anticipate that

the relation between cash holdings and earnings quality could be stronger if loss firms are in the AIM market as the lack of financial funding alternatives arising from the combination of losses, low earnings quality, less regulatory oversight and lower levels of financial disclosure may imply the need to hold a larger buffer of cash in spite of the associated opportunity costs or to send a more credible signal to investors.

From the discussion above, we state our next hypothesis in the following manner:

**H3.** For companies experiencing losses, earnings quality has a weaker impact on cash holdings due to the increased cost, or low availability, of external financing.

(v) R&D expenses, growth and cash holdings

R&D expenses have been shown to provide value-relevant information for investors both for firms with losses (Darrough & Ye, 2007) and for those with positive profits (Franzen & Radhakrishnan, 2009). According to Darrough and Ye (2007), if firms face losses, their earnings could be seen as non-informative regarding the value of their business and in those circumstances, R&D expenses could be much more relevant in providing information about their future prospects. In accordance with this, Opler et al. (1999) argue that cash shortages forces firms to reduce capital expenditure when information asymmetries cause external financing to become exceedingly expensive. These authors consider that such costs would be greater for firms with substantial research and development expenses.

In addition, Myers and Majluf (1984) recognise that the levels of information asymmetry are higher for firms whose value is very much determined by their growth opportunities. Under a similar perspective, Myers (1977) argues that firms experiencing high growth face more agency costs of debt making external financing more expensive and thus implying, as observed and documented by Ozkan and Ozkan (2004), higher levels of cash holdings.

Since these could be factors that affect the reaction of investors to the informational content of earnings quality, one can thus infer that for firms experiencing high growth or that have substantial R&D expenses, earnings quality may not play such an important role, as a determinant of cash holdings.

Our fourth hypothesis is therefore formulated as:

**H4.** Companies that experience high levels of R&D or high growth have a weaker relation between earnings quality and cash holdings than firms with low levels for these variables, due to the information relevance of R&D and growth.

### 3. Sample, methodology and summary statistics

#### 3.1. Data and sample selection

Our analysis starts by retrieving the necessary accounting

information for all the listed firms on the London Stock Exchange from the Worldscope database, between the years 1990 to 2015, which have industry information on Datastream. Given the different nature of cash holdings for financial firms, these are excluded from our initial sample. Next, we merge all the firms with the information available on the London Share Price Database in order to determine to which market – Main or Alternative Investment Market – a firm belongs to at the end of the respective financial year. We then exclude all observations that do not meet the necessary data requirements for calculating the variables used in this paper, in particular the earnings quality variable.<sup>5</sup> Finally, since the Alternative Investment Market was launched on June 19, 1995 and in order to allow for the informational environment to stabilize, we restrict our sample to the years of 1998 onwards. After this selection process, the final sample is comprised of 9673 firm-years for the financial years of 1998 to 2015. All continuous variables are winsorised at the top and bottom 1%.

Table 1, Panel A reports the number of firm observations in the initial sample of non-financial firms and those for which there was data, and the final number of firm observations. These firm observations are discriminated for both the Main and Alternative Investment Markets. Firms are allowed “to leave and enter” the dataset over time, in order to minimize any survivorship bias. Overall, 43.7 and 68.8% of the initial firm-year observations were lost in the Main and AIM markets samples, respectively. This was mainly due to the earnings quality variable construction requirements for which a minimum of ten firm-year observations for each industry and market is needed. Our final sample comprises 5854 firm-year observations for the Main Market and 3819 firm-year observations for the AIM. On average, the number of firm observations per year is 325 and 212 for the Main and AIM markets, respectively. It should be noted that the proportion of firm-year observations for the AIM increased in recent years from 17.6% in 1998 to 56.8% for the last year of the sample, highlighting the growing importance of this market since it was launched.

We also divide the number of firm-year observations in our sample according to industry. Table 1, Panel B shows the number of firm-year observations for 23 different industries (three digit classification). Support Services is the most representative industry accounting for 17.87% of the full sample. The top five industries in our sample represent slightly more than one half of the overall sample (51.84%) whereas the bottom five just a little less than 4% (3.75%). There is clear evidence of high industry concentration in our sample.<sup>6</sup>

We also report on Table 1, Panel C the number and percentage of profit versus loss-making firms. It is important at this stage to understand the proportion of both types of firms in the Main Market and AIM, since earnings quality for loss-making firms may have less importance in comparison to firms with positive profits. This could translate into a possible weaker relation to cash holdings. There is a different pattern in the two markets. Indeed, on average, close to 89% of the Main Market firms report positive profits in an average year whereas for AIM firms this value drops to 62%. Therefore, roughly one out of every three AIM companies report losses in an average year, in contrast with the Main Market, where that figure is about one for every ten firms. This reflects the unique characteristics of the AIM market and their firms (smaller, higher costs of external funding, lower liquidity levels, etc.).

### 3.2. Model

As discussed previously, our study aims to investigate how earnings quality affect cash reserves for both Main and AIM firms.

According to previous literature, cash holdings of firm *i* at time *t* is

<sup>5</sup> Calculation of the earnings quality measure requires firms to have at least 8 years of financial information available, which excludes the first years of the sample from being used in the main analysis.

<sup>6</sup> Later, our empirical results are controlled by industry.

given by:

$$Cash_{i,t} = \beta_0 + \sum_{k=1}^n \beta_{1,k} Y_{i,k,t} + \varepsilon_{i,t} \tag{1}$$

where,  $Cash_{i,t}$  is the stacked vector of the dependent (endogenous) variable (the *i*th firm Cash ratio on the *t*th period),  $Y_{i,k,t}$  is the matrix of *n* firm independent (explanatory) variables which includes the earnings quality proxy,  $\beta_0$  is the intercept,  $\beta_{1,k}$  is the matrices of coefficients, and  $\varepsilon_{i,t}$  is a vector of error terms.

### 3.3. Variables specification

#### 3.3.1. Dependent variable: cash holdings

The dependent variable in our study are cash holdings which, following Ozkan and Ozkan (2004), is measured as cash and cash equivalents to total assets.

#### 3.3.2. Independent variables

Firm determinant factors for the cash holdings are chosen from those often suggested in the literature. Based on past literature, the set of firm specific variables used as determinants of cash holdings consist of the following:

##### i) Earnings Quality

The Earnings Quality measure is of capital importance in our study. In its construction we use the yearly industry and cross-sectional approach initially presented by Dechow and Dichev (2002) extended by McNichols (2002) and Francis et al. (2005). Underlying the proposed model is the assumption that accruals help match past, current and future cash flows. The standard deviation of the estimated residual is a measure of the firms' earnings quality and higher values indicates lower earnings quality. We follow the implementation proposed by Chan, Lee, and Lin (2009) for the UK and Raman, Shivakumar, and Tamayo (2013) for the US, with the following regression being estimated for each year-industry combination:

$$ACC_{it} = \alpha + \beta_1 CF_{i,t-1} + \beta_2 CF_{i,t} + \beta_3 CF_{i,t+1} + \beta_4 \Delta REV_{i,t} + \beta_5 GPPE_{i,t} + \varepsilon_{i,t} \tag{2}$$

where  $ACC_{it}$  is total accruals for firm *i* in year *t* and it is defined as the change in two consecutive years in current assets minus cash and cash equivalents minus current liabilities minus depreciation and amortization expenses (Botsari & Meeks, 2008);  $CF_{i,t}$  is the cash flow from operations calculated as net income before extraordinary items minus total accruals for firm *i* in year *t*;  $\Delta REV_{i,t}$  is the change in total revenue for firm *i* in year *t* and  $GPPE_{i,t}$  is defined as gross property, plant and equipment firm *i* in year *t*. We follow the standard practice of deflecting all variables by their total assets average and winsorise all variables at the bottom and top 1%. The total accruals variable is estimated independently for the Main Market and AIM firms. We run Eq. (2) for every year and industry using a three digit Industry Classification benchmark. We require at least ten observations to calculate the error term,  $\varepsilon_{i,t}$ , for each industry and year. The error term will provide information on the portion of total accruals that are left unexplained by the independent variables. We follow Dechow and Dichev (2002) and calculate the standard deviation of the error term for the specific firm *i* for the prior years (requiring at least 5 observations) and use it as a proxy for earnings quality variable for firm *i* in year *t*,  $EQ_{i,t}$ . This Earnings Quality variable should be read as meaning that the higher the standard deviation, the higher the uncertainty of the information conveyed by earnings and, consequently, the lower the earnings quality for the respective firm. Accordingly, we expect from the previous discussion a positive relationship between this proxy for earnings quality and cash reserves.

## ii) Cash Flow

Cash Flow is often understood as one of the best measures of a company's financial health. Firms with a large cash flow are likely to accumulate more cash to prevent against earnings volatility or shortness of liquidity. Additionally, according to the Pecking order theory (Myers & Majluf, 1984) when the cost of financing increases with asymmetric information firms do prefer to use internal resources before resorting externally. However, cash flow has also been found as a substitute for cash, in that firms with higher cash flows are not so reliant on cash holdings to finance liquidity demands (Ferreira & Vilela, 2004; Kim et al., 1998). Consequently, there is no clear expected relation between cash flow (defined as operating income plus depreciation plus amortization over total assets) and cash reserves.

## iii) Size

The literature supports the view that larger firms generally face lower borrowing costs and are less likely to go bankrupt, are more diversified and have easier access to external financing. For all of these reasons and following Opler et al. (1999), a negative relationship between firm size (measured as natural logarithm of total sales) and cash balances is expected.

## iv) Market to Book

Growth opportunities are associated with higher agency costs of debt arising from the conflicts of interest between shareholders and debtholders (Kim & Sorensen, 1986) which in turn makes external financing more expensive. Therefore, we expect that firms with greater growth options will have larger cash reserves to overcome increased cost in external financing. In accordance with this, Kim et al. (1998) and Ozkan and Ozkan (2004) show that larger cash levels are associated with higher growth opportunities. We proxy growth opportunities by the market-to-book ratio calculated as ratio of book value of total assets minus the book value of equity plus the market value of equity to book value of assets.

## v) Liquidity

Liquid assets can also affect cash holdings since they can substitute each other (John, 1993). We expect a negative relationship between liquidity and cash reserves. We measure liquidity as receivables plus inventory minus accounts payable over total assets.

## vi) Short-term debt

Previous research indicates that leverage and cash holdings relationship is not linear (e.g. Guney, Ozkan, & Ozkan, 2007; Hall, Mateus, & Mateus, 2014). This supports the view that until a certain amount of leverage, firms tend to reduce cash holdings but when this amount increases substantially, firms will begin to accumulate cash reserves to avoid possible financial distress. We define this variable as short-term debt plus current portion of long-term debt paid in the year divided by total assets, and it is included in a quadratic format in our analysis. This measure should better capture the non-linear relationship with cash reserves, especially because long-term debt is most of the time supplied with collateral (Bartholdy, Mateus, & Olson, 2012).

## vii) Long term debt

Based on trade-off considerations that the optimal maturity of debt is determined by the trade-off between the costs of rolling over short-term debt vis-à-vis the usually higher interest rate bore by long-term debt, we expect on the one hand that firms with a larger ratio of long-term debt will reduce their cash reserves due to the increased cost of

funds to invest in liquidity (Hall et al., 2014). On the other hand, higher long-term debt levels can increase the probability of financial distress and in this case we expect firms to increase their cash holdings. This variable is calculated as the ratio of long-term debt over total assets.

## viii) Probability of default

If there is an increase in the probability of default, firms may tend to protect themselves by holding more cash reserves. Therefore, we might expect a negative relationship between an increase in the probability of default and cash balances. In this paper we use the Agarwal and Taffler (2007) adaptation of the Altman (1968) Z-score to the UK. Specifically, the Z-score is calculated as:

$$\begin{aligned} Zscore = & 3.2 + 12.18 \frac{\text{Profits before taxes}}{\text{Current Liabilities}} + 2.50 \frac{\text{Current Assets}}{\text{Total Liabilities}} \\ & - 10.68 \frac{\text{Current Liabilities}}{\text{Total Assets}} \\ & + 0.029 \frac{\text{Quick Assets} - \text{Current Liabilities}}{\text{Sales} - \text{Profit before taxes minus depreciation, depletion and Amortization}} \times 365 \end{aligned}$$

An increase in the Z-score is associated with lower probability of default and less cash reserves for precautionary motives.

## ix) Research and development

Evidence supports that firms with large cash holdings have higher investment expenditure particularly R&D expenditures (Mikkelsen & Partch, 2003, Opler et al., 1999, among others). The intangibility of R&D expenses implies greater information asymmetry and an increase in the cost of external financing. He and Wintoki (2016) show that the increase in the cash-to-assets ratio of US firms in recent decades is substantially explained by R&D investment. We define our variable as research and development expenses divided by total assets and we expect that firms with greater R&D expenditure will have higher cash holdings.

## x) Dividends

We include in our analysis a dummy variable to test the effect of differences in cash holdings arising from the firm's dividend policy. This variable takes the value of one if a firm pays dividends and zero otherwise. The expected relation of dividends in cash holdings is ambiguous. On the one hand, a firm that pays dividends can raise funds by dividend cuts and in this case dividend payers would hold less cash. On the other hand, a firm that systematically pays dividends might not want to cut dividends due to the negative market reaction and in this case might hold more cash to avoid this situation.

## xi) Industry and year dummies

Finally, industry and year dummies are also included in Eq. (1) estimation in order to control for time and industry effects.

Table 2 below summarizes the variables used in this study and their expected relationship with cash reserves.

## 3.4. Descriptive statistics

Table 3, Panel A, reports summary statistics for all the variables used in the analysis and were defined previously. For the entire sample, cash holdings accounts for 13.7% of total assets, firms have higher average values for long-term than short-term debt and the market value is 1.72 times the average firm's book value. R&D expenses are 2.4% of total assets and liquidity accounts for more than 20% of total assets.

In Panel B, we report summary statistics for both markets. Aligned with our expectations, AIM firms have, on average, larger cash reserves



**Table 2**  
Variables definition and expected relationship with cash holdings.

Variables	Description	Expected sign
Dependent		
Cash	Cash & short term investments divided by total assets	
Independent		
EARNINGS QUALITY	Earnings quality measure following Chan et al. (2009) and Raman et al. (2013)	Positive
CASH FLOW	Operating income plus depreciation plus amortization divided by total assets	Ambiguous
SIZE	Natural logarithm of total sales	Negative
MARKET to BOOK	Total assets minus total shareholders' equity plus market capitalization at the end of the year divided by total assets	Positive
LIQUIDITY	Receivables plus inventory minus accounts payable divided by total assets	Negative
ST DEBT	Short term debt plus current portion of long term debt divided by total assets	U-shaped
LT DEBT	Long-term debt divided by total assets	Ambiguous
R&D	Research and development expenses divided by total assets	Positive
Z-SCORE	Z-score calculated according to Agarwal and Taffler (2007)	Negative
DIVIDENDS	Dummy variable which takes the value of 1 if a firm pays a dividend in year t, and zero otherwise	Ambiguous

than their Main counterparts, 17.2 and 11.4%, respectively. The earnings quality is higher in Main Market firms (remembering that lower values for our proxy imply higher quality), these firms are larger and have substantially higher cash flow levels. Finally, Main Market firms rely less on short-term debt but have higher levels of long-term debt, are more often dividend payers and have relatively similar levels of

liquidity as AIM firms. Overall, the differences highlighted between Main and AIM firms are statistically significant as reported by both the difference in means *t*-test and the Wilcoxon rank-sum (Mann-Whitney) test.

In Panel C, we divide the earnings quality measure in quartiles and show the corresponding cash levels for profitable and loss-making firm.

**Table 3**  
Summary statistics.

Panel A: Full sample					
Variables	Mean	Std. Dev.	25th percentile	Median	75th percentile
CASH	0.137	0.157	0.031	0.082	0.178
EARNINGS QUALITY	0.046	0.040	0.020	0.033	0.056
CASH FLOW	0.080	0.177	0.056	0.109	0.163
SIZE	11.450	2354	9951	11.493	13.109
MARKET to BOOK	1718	1372	1000	1315	1885
LIQUIDITY	0.204	0.177	0.074	0.179	0.307
ST DEBT	0.060	0.089	0.002	0.026	0.079
LT DEBT	0.120	0.146	0.000	0.067	0.194
R&D	0.024	0.070	0.000	0.000	0.010
Z-SCORE	0.011	0.146	-0.021	0.016	0.058
DIVIDENDS	0.682	0.466	0	1	1

  

Panel B: Main vs. AIM								
Variables	Mean		Std. Dev.		Median		Equality of Means	
	Main	AIM	Main	AIM	Main	AIM	Wilcoxon Z-score	t-Test
CASH	0.114	0.172	0.126	0.191	0.072	0.107	-11.352***	-18.038***
EARNINGS QUALITY	0.030	0.070	0.021	0.049	0.025	0.054	-49.000***	-53.867***
CASH FLOW	0.123	0.015	0.111	0.230	0.124	0.076	29.429***	30.929***
SIZE	12.637	9.631	1.864	1.799	12.658	9.864	64.731***	78.615***
MARKET to BOOK	1.702	1.744	1.163	1.640	1.369	1.218	11.094***	-1.486
LIQUIDITY	0.209	0.196	0.176	0.178	0.183	0.170	2.535**	3.398***
ST DEBT	0.054	0.068	0.076	0.106	0.027	0.022	4.569***	-7.425***
LT DEBT	0.149	0.076	0.152	0.124	0.113	0.013	28.627***	24.658***
R&D	0.018	0.034	0.053	0.089	0.000	0.000	-1.895*	-11.220***
Z-SCORE	0.029	-0.016	0.105	0.189	0.021	0.005	14.555***	14.974***
DIVIDENDS	0.838	0.444	0.369	0.497	1	0	40.620***	44.599***

  

Panel C: Cash levels distribution by earnings quality quartiles in profit and loss firms					
	All firms	Profit vs. loss firms		Wilcoxon Z test	t-Test
		Profit firms	Loss firms		
High quality	0.097	0.094	0.130	0.201	4.777***
2	0.121	0.111	0.174	2.913**	8.008***
3	0.146	0.126	0.208	3.744***	10.469***
Low quality	0.185	0.166	0.217	3.085**	6.340***

Notes: see Table 2 for variables definition. Superscripts indicate statistical significance at 0.01 (\*\*\*), 0.05 (\*\*), and 0.10 (\*).

**Table 4**  
Pearson and Spearman correlation matrix.

Panel A: Main Market										
	EARNINGS QUALITY	CASH FLOW	SIZE	MARKET to BOOK	WORKING CAPITAL	ST DEBT	LT DEBT	R&D	Z-SCORE	DIVIDENDS
EARNINGS QUALITY	1	−0.093	−0.329	<b>0.084</b>	<b>0.101</b>	0.018	−0.203	<b>0.084</b>	−0.166	−0.207
CASH FLOW	−0.187	1	<b>0.163</b>	<b>0.510</b>	<b>0.066</b>	−0.053	<b>0.047</b>	<b>0.035</b>	<b>0.447</b>	<b>0.313</b>
SIZE	−0.345	<b>0.307</b>	1	<b>0.101</b>	−0.092	<b>0.081</b>	<b>0.362</b>	−0.077	−0.049	<b>0.275</b>
MARKET to BOOK	<b>0.199</b>	<b>0.114</b>	−0.087	1	−0.015	−0.090	−0.044	<b>0.218</b>	<b>0.234</b>	0.018
LIQUIDITY	<i>0.036</i>	<b>0.043</b>	−0.063	−0.040	1	<b>0.062</b>	−0.260	<b>0.145</b>	−0.118	<b>0.091</b>
ST DEBT	<b>0.096</b>	−0.096	−0.058	−0.008	<b>0.056</b>	1	<b>0.133</b>	−0.051	−0.363	<b>0.047</b>
LT DEBT	−0.132	<b>0.070</b>	<b>0.265</b>	−0.029	−0.253	−0.051	1	−0.100	−0.051	<b>0.088</b>
R&D	<b>0.202</b>	−0.344	−0.246	<b>0.315</b>	−0.007	−0.093	−0.159	1	<b>0.085</b>	−0.091
Z-SCORE	−0.147	<b>0.432</b>	0.012	<b>0.075</b>	−0.056	−0.266	−0.079	−0.103	1	<b>0.174</b>
DIVIDENDS	−0.267	<b>0.359</b>	<b>0.314</b>	−0.071	<b>0.074</b>	−0.051	0.028	−0.265	<b>0.140</b>	1

  

Panel B: AIM										
	EARNINGS QUALITY	CASH FLOW	SIZE	MARKET to BOOK	WORKING CAPITAL	ST DEBT	LT DEBT	R&D	Z-SCORE	DIVIDENDS
EARNINGS QUALITY	1	−0.293	−0.392	<b>0.273</b>	−0.191	−0.036	−0.100	<b>0.086</b>	−0.274	−0.453
CASH FLOW	−0.356	1	<b>0.503</b>	<i>0.034</i>	<b>0.283</b>	<i>0.036</i>	<b>0.112</b>	−0.110	<b>0.589</b>	<b>0.490</b>
SIZE	−0.373	<b>0.591</b>	1	−0.231	<b>0.292</b>	<b>0.169</b>	<b>0.242</b>	−0.186	<b>0.244</b>	<b>0.495</b>
MARKET to BOOK	<b>0.312</b>	−0.494	−0.390	1	−0.103	−0.127	−0.131	<b>0.242</b>	−0.037	−0.114
LIQUIDITY	−0.156	<b>0.237</b>	<b>0.282</b>	−0.139	1	<b>0.144</b>	−0.011	<b>0.079</b>	<b>0.137</b>	<b>0.306</b>
ST DEBT	<b>0.075</b>	−0.078	−0.007	<b>0.061</b>	<b>0.091</b>	1	<b>0.425</b>	−0.154	−0.244	−0.028
LT DEBT	0.031	−0.016	<b>0.055</b>	<b>0.069</b>	−0.094	<b>0.128</b>	1	−0.132	−0.098	<b>0.046</b>
R&D	<b>0.183</b>	−0.489	−0.314	<b>0.454</b>	−0.059	−0.041	−0.054	1	−0.028	−0.084
Z-SCORE	−0.212	<b>0.620</b>	<b>0.378</b>	−0.287	<b>0.114</b>	−0.137	−0.102	−0.301	1	<b>0.396</b>
DIVIDENDS	−0.425	<b>0.415</b>	<b>0.475</b>	−0.201	<b>0.276</b>	−0.124	−0.059	−0.200	<b>0.292</b>	1

Notes: see Table 2 for variables definition. Pearson (Spearman) correlations in the bottom (top) diagonal. Bold numbers indicate statistical significance at 0.01, and italic at 0.05.

For the whole sample, and as expected, the lower quartile average (firms with lower earnings quality) the cash-levels are almost double of the average of the top quartile. In addition, profitable firms have lower cash-levels than loss-making ones for all quartiles of earnings quality, suggesting that the latter ones may need to accumulate cash as external financing is more difficult to obtain. The results are in accordance with both the hypotheses that earnings quality is negatively related to cash reserves levels and that, similar to AIM firms, loss-making firms are associated with larger cash-reserves as the result of their difficulty in accessing external funding. The differences presented between profit and loss firms for each quartile are again statistically significant as reported by the Wilcoxon rank-sum (Mann-Whitney) test.

In Table 4 (Panels A and B) the Pearson and Spearman correlation matrices are presented, for the Main and AIM firm-year observations. Due to the low levels of pairwise correlations multicollinearity seems not to be a relevant sample problem.<sup>7</sup> The following pairwise correlations nonetheless emerge between the independent variables: i) larger firms have better earnings quality, larger cash flow, lower levels of short-term debt and larger long-term debt and less R&D expenses; ii) higher liquidity is negatively correlated with long-term debt, growth opportunities and R&D expenses; iii) lower probability of bankruptcy (Z-score) is positively related with larger cash flows, lower liquidity and dividend paying firms. When comparing Main and AIM firms we find that liquidity and long-term debt are correlated differently with the quality of earnings. It is observed that for AIM firms i) the larger the liquidity, the higher the long-term debt levels and the lower the probability of bankruptcy the better is the quality of earnings, and ii) for firms with larger R&D expenses the worst is the quality of earnings.

<sup>7</sup> We tested for the existence of possible multicollinearity problems by calculating the variance inflation factors (VIF) for each regression used. We found no evidence of problematic multicollinearity in the models used.

## 4. Empirical results

### 4.1. Determinants of cash balances

We start the empirical analysis by addressing the question whether the firm and market specific characteristics discussed in Sections 2 and 3 affect cash holdings with the predicted signs. OLS with firm and year clustering standard errors are used to estimate Eq. (1).<sup>8</sup> Results are presented in Table 5 for the full sample of 9673 firm-year observations and for each market independently (5854 and 3819 firm-year observations to Main and AIM firms, respectively).

The variable *EARNINGS QUALITY* confirms the expected positive relationship with cash balances for the 1% significance level, in accordance with our Hypothesis 1. An increase of 1% in the *EARNINGS QUALITY* variable (an increase in the uncertainty of the information conveyed by earnings) will increase the cash reserves by 0.285%. The variable *STDEBT* is U-shaped as indicated by the different coefficients for the term and its square. This result confirms the findings from Hall et al. (2014) and Guney et al. (2007). *LIQUIDITY* is negatively related with cash balances at the 1% significance level, showing that a greater difference between current assets (receivables plus inventories) and accounts payables reduces the need for holding larger cash reserves given that, as discussed earlier, these can be seen to a certain extent as substitutes. As expected, *SIZE* has a negative relationship with cash reserves. This confirms the argument that larger firms are less likely to go bankrupt and, therefore, are comfortable with holding less cash reserves. Also, the variables *MARKET-to-BOOK* and *R&D* have the expected positive sign and are statistically significant. Regarding the *R&D*, *DIVIDENDS*, *CASH FLOW* and *ZETA SCORE* variables, our analysis shows several findings. First, in accordance with predictions, companies with

<sup>8</sup> According to Petersen (2009), Gow, Ormazabal, and Taylor (2010), and Thompson (2011) the use of two-way clustering when in the presence of variables that are cross-sectionally and serially correlated would correct for the correlation of residuals across observations.

**Table 5**  
Multivariate regression results for cash holdings (Main and AIM markets).

CASH Holdings	Full sample	Main Market	AIM
EARNINGS QUALITY	0.285*** (3.320)	0.605*** (4.059)	0.256** (2.449)
CASH FLOW	-0.069*** (-2.716)	-0.081* (-1.928)	-0.036 (-1.117)
SIZE	-0.007*** (-4.098)	-0.005** (-2.157)	-0.013*** (-3.398)
MARKET to BOOK	0.020*** (7.726)	0.018*** (5.528)	0.021*** (5.359)
LIQUIDITY	-0.156*** (-9.415)	-0.116*** (-5.821)	-0.195*** (-6.833)
ST DEBT	-0.665*** (-9.872)	-0.441*** (-4.977)	-0.893*** (-7.812)
ST DEBT (SQR)	1.081*** (4.906)	0.839*** (3.486)	1.445*** (4.381)
LT DEBT	-0.213*** (-10.976)	-0.161*** (-7.343)	-0.298*** (-9.592)
R&D	0.524*** (7.116)	0.503*** (5.246)	0.544*** (5.734)
Z-SCORE	0.157*** (6.813)	0.172*** (4.273)	0.158*** (4.533)
DIVIDENDS	-0.015** (-2.294)	-0.029*** (-2.839)	-0.007 (-0.837)
Constant	0.258*** (11.196)	0.214*** (6.617)	0.336*** (7.686)
Observations	9.673	5.854	3.819
Adjusted-R <sup>2</sup>	0.374	0.309	0.409

Notes: see Table 2 for variables definition. Firm and year clustered *t*-statistics reported in parenthesis. Superscripts indicate statistical significance at 0.01 (\*\*\*), 0.05 (\*\*) and 0.10 (\*). Industry and year dummies included in the estimation not reported.

larger R&D expenses tend to hold greater cash reserves. In turn, when firms pay dividends this reduces the level of cash holdings, consistent with the argument that firms that pay dividends can raise funds by dividend cuts and thus can afford to hold less cash. In the case of the CASH FLOW variable, the results show a negative sign for the coefficient of this variable that is statistically significant however only for the Main Market firms. This suggests that the existence of a stronger ability to generate cash may render less crucial the accumulation of cash for precautionary reasons in the case of Main Market firms but not for AIM firms. The ZETA SCORE variable shows a positive sign against expectations across both subsamples, consistent with a lower default risk leading to an increase in cash reserves. Overall, the full sample model has an Adjusted R-squared of 0.374 which can be considered a good fit for a panel data analysis.

#### 4.2. Determinants of cash balances for Main and AIM firms

In Table 5, we re-run the previous full sample model but addressing independently Main and AIM firms so as to test our Hypothesis 2 that earnings quality has a different (weaker or stronger) impact on cash holdings in the two markets. Overall, the results are not qualitatively different for the two markets broadly in accordance with the evidence from the full sample reported in Section 4.1.

The variables' coefficient signs and their statistical significance do not differ substantially when the regressions are performed independently for Main and AIM firms. However, some quantitative differences are identified in the variables' coefficients: i) consistent with our Hypothesis 2, the impact on cash reserves of the information uncertainty conveyed by lower quality earnings is considerably different between Main firms and their AIM counterparts, the effect being significantly stronger in the case of Main firms (difference of coefficients  $\chi^2 = 8.84$  and  $p$ -value = 0.003); ii) SIZE becomes statistically insignificant at a 5% level for both AIM and Main Market firms; iii) an increase in liquidity has a larger negative marginal effect on cash reserves for AIM firms, iv) R&D expenses have a larger impact on AIM firms and;

v) the signs for Short Term Debt and its square suggest that Main Market firms start to accumulate cash for higher levels of short-term debt than AIM firms. This supports the view that, as expected, the presence of short-term debt reduces cash levels but only until a critical level that is smaller for AIM firms forcing these to start accumulating cash reserves earlier to avoid possible financial distress. The adjusted R-squared suggests that the fitness of the models is slightly better for AIM than Main firms' regression.

#### 4.3. Determinants of cash balances for profit- and loss-making firms

The next question to discuss relates to our Hypothesis 3 of whether the impact of earnings quality on cash reserves is stronger for firms with positive earnings versus loss-making firms. In Table 6 we report regressions for the full, Main and AIM firm's sub-samples. We first start by analyzing the impact of firm-specific variables for profit versus loss-making firms, independently of the market (full sample).

The results support strong evidence (statistically significant at the 1% level) of the impact of EARNINGS QUALITY on cash reserves for profit but not for loss-making firms, vindicating our Hypothesis 3 and confirming that for loss-making firms earnings quality is less informative and thus has little importance for investors which translates into a weaker relation to cash holdings (difference of coefficients  $\chi^2 = 44.98$  and  $p$ -value = 0.000). The effect of SIZE on cash reserves is stronger for loss-making firms (significant at 1% level). On average a 1% increase in size (measured by natural logarithm of total sales) is associated with a 0.009% reduction in cash reserves. The negative effect of LIQUIDITY on cash reserves is substantially stronger than that observed for loss-making firms. Non profitable firms start to accumulate cash reserves for lower levels of short-term debt and results support a strong negative effect of long-term debt levels on cash holdings for both profitable and loss-making firms.

Next, we compare firms with positive earnings in both markets. The coefficients signs and statistical significance for the firm-specific variables do not differ substantially (difference of coefficients  $\chi^2 = 0.17$  and  $p$ -value = 0.677). Indeed, a decrease of 1% on firm's EARNINGS QUALITY has a positive impact on cash reserves on average by 0.657 and 0.603 for Main and AIM firms, respectively. Besides LIQUIDITY, SHORT-TERM DEBT and DIVIDENDS, no quantitative differences and statistical significance in the coefficients between the two markets were found. However, one can highlight that for profitable firms: i) the negative effect of LIQUIDITY on cash reserves for AIM firms is double that observed for Main Market firms; ii) AIM firms start to accumulate cash reserves for lower levels of short-term debt and iii) dividends payments negatively affect cash holdings only for positive profits firms in Main Market but not for those in belonging to the AIM market.

The final step in this section is to perform the same analysis between markets but for loss firms. The major difference identified and very relevant to our study is the effect of Earnings Quality in cash reserves. It is clear that, in contrast to profitable firms, an increase on the information uncertainty contained in earnings now does not affect cash reserves for neither AIM nor Main Market loss making firms. This is line with our Hypothesis 3 where we posit a weaker relation between earnings quality and cash holdings for firms enduring losses.

The results in Table 6 in general show a high significance of the variables analysed in the multiple regressions undertaken, with an adjusted R-squared between 0.260 and 0.439.

Overall, we can highlight and summarize the following results from Table 6: i) Earnings Quality is important as a determinant of cash holdings for positive profit firms but not for loss-making ones, ii) higher levels of long-term debt reduce cash reserves for both profitable and loss-making firms and, iii) loss-making firms and AIM firms start to accumulate cash reserves for lower levels of short-term debt.

**Table 6**  
Multivariate regression results for cash holdings: profit vs. loss firms.

CASH Holdings	Full sample		Main Market		AIM market	
	Profit	Loss	Profit	Loss	Profit	Loss
EARNINGS QUALITY	0.608*** (5.830)	-0.121 (-1.097)	0.657*** (4.657)	0.268 (0.764)	0.603*** (3.852)	-0.097 (-0.766)
CASH FLOW	-0.015 (-0.339)	-0.145*** (-3.940)	-0.059 (-1.096)	-0.170* (-1.889)	0.083 (1.230)	-0.126*** (-3.378)
SIZE	-0.004** (-2.132)	-0.009*** (-2.882)	-0.004* (-1.729)	-0.010* (-1.781)	-0.008 (-1.518)	-0.014*** (-3.069)
MARKET to BOOK	0.021*** (6.260)	0.011** (2.289)	0.019*** (4.931)	0.007 (1.019)	0.026*** (5.193)	0.012** (2.198)
LIQUIDITY	-0.136*** (-8.316)	-0.217*** (-5.814)	-0.092*** (-4.963)	-0.316*** (-4.764)	-0.221*** (-6.930)	-0.183*** (-4.230)
ST DEBT	-0.528*** (-7.387)	-1.093*** (-8.830)	-0.368*** (-4.273)	-0.923*** (-5.699)	-0.701*** (-6.134)	-1.117*** (-7.026)
ST DEBT (SQR)	1.092*** (4.906)	1.769*** (5.419)	0.739*** (3.393)	1.721*** (4.016)	1.487*** (4.220)	1.731*** (4.265)
LT DEBT	-0.198*** (-9.549)	-0.204*** (-6.770)	-0.160*** (-6.966)	-0.167*** (-3.532)	-0.338*** (-8.630)	-0.232*** (-5.983)
R&D	0.520*** (6.496)	0.458*** (5.821)	0.545*** (4.378)	0.356*** (4.049)	0.525*** (5.027)	0.493*** (5.016)
Z-SCORE	0.226*** (5.555)	0.152*** (5.302)	0.168*** (2.973)	0.241*** (2.841)	0.262*** (4.579)	0.139*** (3.772)
DIVIDENDS	-0.011 (-1.489)	-0.004 (-0.407)	-0.025** (-2.271)	-0.023 (-1.541)	-0.001 (-0.141)	-0.004 (-0.306)
Constant	0.176*** (8.170)	0.365*** (8.012)	0.182*** (6.111)	0.370*** (4.285)	0.224*** (3.802)	0.412*** (7.975)
Observations	7.572	2.101	5.193	661	2.379	1.440
Adjusted-R <sup>2</sup>	0.317	0.434	0.260	0.438	0.392	0.439

Notes: see Table 2 for variables definition. Firm and year clustered *t*-statistics reported in parenthesis. Superscripts indicate statistical significance at 0.01 (\*\*\*), 0.05 (\*\*) and 0.10 (\*). Industry and year dummies included in the estimation not reported.

4.4. Determinants of cash balances according to firms' growth and R&D expenses

An additional step in our analysis is to test Hypothesis 4 discussed in Section 2, of whether the value-relevant information embedded on R&D expenses and firm's growth (Darrrough & Ye, 2007; Franzen & Radhakrishnan, 2009) affects firm's cash holdings determinants, namely weakening the positive impact of our earnings quality proxy when firms experience high growth or large R&D expenses. Table 7 presents different regression specifications by firms with low versus high sales growth<sup>9</sup> and R&D expenses (firms with and without R&D expenses). Additionally, from previous model specifications, we include two interacting variables to control for the effect of market (AIM or Main Market) and firm's profit status (positive earnings or loss-making) interacting with Earnings Quality on cash reserves.

Overall, the results for the sub-sample strong versus weak sales growth show that while earnings quality (i.e., higher levels for our EARNINGS QUALITY variable) seems to have a lower impact on cash reserves for high-growth firms, the differences are not statistically significant when a  $\chi^2$  test is conducted. We thus find no strong evidence in favour of our Hypothesis 4 in what concerns the influence of growth. On average, a 1% increase on Earnings Quality (higher in the uncertainty of the information conveyed by earnings) will increase the cash reserves by about 0.4% for growth firms (statistically significant at the 1% level) in the two specifications used and, depending on the model in question, about 0.6 or 0.5% for low growth firms. In addition, there is a statistically significant negative impact of the interaction variable loss-making firm and EARNINGS QUALITY on Cash reserves for both high growth and low growth firms. The presence of losses thus again weakens the impact of earnings quality across the two subsamples of high and low growth firms. Also to be noted is the fact that CASH-FLOW

<sup>9</sup> Each year, firms are assigned to quartiles according to the average firm sales growth in the past 5 years. Firms in the lowest quartile are classified as low growth and firms in the highest quartile are classified as high growth.

now has a negative impact on cash levels only for the low growth sub-sample. In other words, the ability to generate cash flow is a substitute for cash only when firms are not growing.

For the sub-samples of firms with no-R&D versus with-R&D expenses, results show a strong statistically significant effect (at the 1% level) of earnings uninformativeness on cash reserves for both no-R&D firms and firms with-R&D expenses. Again, while the impact of earnings quality on cash levels seems to be lower for positive R&D firms, a  $\chi^2$  test fails to find statistically-significant differences between the coefficients of the EARNINGS QUALITY variable for the two sub-samples, thus leading us to reject Hypothesis 4 regarding the influence of R&D. However, we observe that the impact of earnings quality on cash holdings is reduced for loss-making firms only for firms with no R&D and differences were also found between AIM and Main Market firms (only for no-R&D firms). We can, therefore, conclude that we find no convincing evidence that earnings quality has the weaker impact on cash reserves for R&D-intensive firms predicted in our Hypothesis 4. However, we also show that the existence of R&D is nonetheless relevant, given that we document that losses reduce the impact of earnings quality on cash levels only for companies that do not engage in R&D activities and that differences in the impact of Earnings Quality between AIM and Main Market firms are only relevant for firms without R&D expenses.

4.5. Robustness tests

a) Earnings management as basis for an alternative proxy for earnings quality

As a robustness test, and in order to test if the results were driven by the earnings quality measure used, the previous analysis was ran using the absolute value of the residuals from the implementation of the Collins, Pungaliya, and Vjih (2017) model for estimating expected accruals as a proxy for earnings quality. The results obtained are consistent with the methodology used in the paper, and hence the



**Table 7**  
Multivariate regression results for cash holdings: low vs. high growth firms and no R&D vs. positive R&D expenses.

CASH Holdings	Sales				R&D			
	Low growth		High growth		No R&D		With R&D	
EARNINGS QUALITY	0.616** (2.503)	0.466*** (3.169)	0.437** (1.963)	0.363*** (3.224)	0.632*** (4.264)	0.495*** (5.330)	0.569** (2.131)	0.269* (1.696)
AIM × EARNINGS QUALITY	−0.298 (−1.284)		−0.176 (−0.811)		−0.290** (−1.985)		−0.381 (−1.613)	
LOSS × EARNINGS QUALITY		−0.209* (−1.936)		−0.258*** (−2.851)		−0.242*** (−2.825)		−0.141 (−0.966)
CASH FLOW	−0.084*** (−2.641)	−0.100*** (−3.015)	−0.004 (−0.093)	−0.029 (−0.651)	−0.031 (−1.148)	−0.052* (−1.938)	−0.094* (−1.935)	−0.102* (−1.938)
SIZE	−0.007** (−2.420)	−0.006** (−2.200)	−0.012*** (−3.414)	−0.011*** (−3.366)	−0.004* (−1.819)	−0.003 (−1.399)	−0.017*** (−5.997)	−0.016*** (−5.666)
MARKET to BOOK	0.007 (1.271)	0.008 (1.414)	0.022*** (5.450)	0.023*** (5.562)	0.022*** (8.768)	0.023*** (9.184)	0.015*** (3.652)	0.015*** (3.795)
LIQUIDITY	−0.207*** (−6.140)	−0.208*** (−6.178)	−0.181*** (−6.189)	−0.183*** (−6.198)	−0.103*** (−5.868)	−0.103*** (−5.880)	−0.337*** (−8.496)	−0.337*** (−8.465)
ST DEBT	−0.926*** (−8.082)	−0.929*** (−8.034)	−0.533*** (−6.732)	−0.537*** (−6.716)	−0.575*** (−8.734)	−0.578*** (−8.766)	−0.715*** (−4.957)	−0.729*** (−5.020)
ST DEBT (SQR)	1.716*** (4.956)	1.714*** (4.950)	0.881*** (3.822)	0.898*** (3.926)	1.016*** (5.608)	1.023*** (5.688)	0.986* (1.805)	1.007* (1.833)
LT DEBT	−0.205*** (−7.347)	−0.207*** (−7.318)	−0.190*** (−5.438)	−0.185*** (−5.306)	−0.195*** (−8.848)	−0.193*** (−8.661)	−0.213*** (−6.247)	−0.214*** (−6.132)
R&D	0.535*** (5.220)	0.534*** (5.301)	0.502*** (3.298)	0.501*** (3.411)			0.388*** (4.416)	0.395*** (4.554)
Z-SCORE	0.183*** (4.253)	0.177*** (4.146)	0.158** (2.446)	0.149** (2.321)	0.153*** (5.223)	0.147*** (4.940)	0.184*** (3.619)	0.180*** (3.464)
DIVIDENDS	−0.008 (−0.730)	−0.009 (−0.875)	0.001 (0.067)	0.000 (0.014)	−0.015* (−1.842)	−0.015* (−1.896)	−0.018 (−1.621)	−0.020* (−1.744)
Constant	0.317*** (7.695)	0.314*** (7.687)	0.279*** (6.513)	0.277*** (6.633)	0.166*** (7.382)	0.162*** (7.226)	0.475*** (11.297)	0.469*** (11.144)
Observations	2.426	2.426	2.413	2.413	5.893	5.893	3.780	3.780
Adj. R-squared	0.343	0.343	0.377	0.378	0.237	0.237	0.471	0.469

Notes: see Table 2 for variables definition. *t*-Statistics reported in parenthesis. Firm and year clustered *t*-statistics reported in parenthesis. Superscripts indicate statistical significance at 0.01 (\*\*\*), 0.05 (\*\*) and 0.10 (\*). Industry and year dummies included in the estimation not reported.

conclusions remain unchanged.

#### b) Endogeneity issues

Additionally, and given that the inclusion of cash flows simultaneously as a control variable and to estimate the earnings quality measure might induce potential endogeneity issues, several robustness tests were implemented. First, cash flows were excluded as an explanatory variable in the cash model. Second, instead of using the earnings quality proxy information for the year, the one period lag was used. Finally, the full cash model was estimated using fixed-effects instead of the firm and a year-clustered approach used. In all instances, the conclusions remained unchanged.

#### c) IFRS adoption

Finally, the mandatory adoption of IFRS in 2005 by UK listed firms (following the issuance of EU Regulation 1606/2002) allows us to conduct an additional robustness test by analyzing the impact of a structural change in the quality of financial reporting. Following extant literature (e.g., Van Tendeloo & Vanstraelen, 2005; Zeghal et al., 2012) we expect that this should translate into accounting earnings being more informative and consequently to a negative impact on the need for cash reserves. However, to the extent that the introduction of IFRS fair value accounting may have increased managerial discretion in the valuation of some assets, this might actually contribute to less informativeness. Aligned with this second line of reasoning, Ahmed, Neel and Wang (2013), show that firms adopting IFRS show increases in income smoothing and aggressive reporting of accruals, and a significant decrease in timeliness of loss recognition. In contrast, Horton and Serafeim (2010) show evidence in support of the argument that the adoption of IFRS reduces information asymmetries as they observe that earnings

reconciliation adjustments, following a move to IFRS by UK firms, are associated with changes in market value. If, as documented also by Zeghal et al. (2012) and by Van Tendeloo and Vanstraelen (2005), the move to IFRS implies a reduction in information asymmetries between investors and managers, one would expect this would negatively affect the relation between our measure earnings quality and cash reserves.

To analyse this hypothesis, we introduced a dummy taking the value of 1 for observations that reported having their financial statements prepared under IFRS and interacted this variable with our earnings quality measure. Unreported results (available upon request) show that, as expected, the adoption of IFRS standards by listed UK firms has a negative impact on the need for companies to hold cash reserves given the anticipated increase in the informativeness of reported earnings. This is shown by a negative and statistically significant sign for the interactive term in the case of the Main firms but not for AIM companies. This means that IFRS adoption seems to have reduced information asymmetries only for the companies that already had presumably higher earnings quality and for which access to external funding was easier in comparison to AIM firms.

In a further analysis, we re-ran our regressions with the addition of an interactive term of Earnings quality and IFRS adoption. Our unreported tests (available upon request) show that the adoption of IFRS seems to increase the informativeness of earnings in the case only of Main Market firms, an effect which is confined however to loss-making companies and translates into lower needs for cash reserves for a given measure of our earnings quality proxy. We observe that apparently IFRS does not bring any observable benefits for profit firms in the Main Market of for any AIM firms, either profit or loss-making.

Notwithstanding the results described, the inclusion of an IFRS adoption dummy and interactive terms in the analysis does not change in a material way our remaining conclusions as described in the previous sections.

## 5. Conclusions

The study of how earnings quality and firm-level characteristics affect cash balances for both AIM and Main UK markets has been ignored in the literature. The understanding of earnings quality for both markets is important due to the different regulatory environments and distinct listing requirements. Using panel data analysis, we examine a sample of 9673 non-financial firm-year observations in the UK for the period 1998 to 2015.

This paper set out to address four main research questions: does earnings quality matter when firms determine their levels of cash holdings? Second, are the cash holdings determinants different for firms in markets with different levels of financial disclosure and information asymmetries (AIM and Main Market)? Third, is the impact of earnings quality different for profit versus loss-making firms – does profit status matter? Finally, do firm's growth and R&D expenses matter for cash reserves and in particular for the impact of earnings quality on cash levels? Our results support the following findings. First, in line with expectations, we conclude that earnings quality is an important determinant of cash holdings, a result consistent with the argument that companies with lower levels of earnings informativeness have greater difficulty in obtaining external finance and thus accumulate larger cash reserves as a buffer for future financing needs.

Second, and also in accordance with our hypotheses, our analysis reveals that AIM firms tend to hold more cash than Main Market firms, a result that can be attributed to the less stringent listing requirements, looser regulatory oversight and lower levels of financial disclosure that jointly reduce the ability of those firms to obtain external financing from investors. Related to this, the information conveyed by earnings quality is a more important determinant for cash reserve levels for Main Market than for AIM firms.

Third, there is evidence that earnings quality significantly and negatively affects cash reserves for profitable but not for loss-making firms. Fourth, we fail to find evidence that earnings quality has a weaker negative impact on cash reserves for growth firms where information asymmetries are likely to be stronger or for firms with significant R&D expenses. However, R&D still matters given that we observe that the impact of earnings quality on cash levels is reduced by the presence of losses or the presence on the AIM market only for firms not engaging in R&D. Finally, the same determinants of cash balances are generally relevant for both Main Market and AIM firms even though their quantitative impact may differ in ways that are generally consistent with the existence of higher levels of information asymmetries for the AIM market and corresponding greater difficulties of firms in that market to access external financing.

Overall, our results offer several insights for both academic research and managers. They imply that companies with higher levels of earnings opacity seem to benefit from having higher cash holdings so as to avoid dependence from costly external funding. This is the case, albeit with significant differing degrees, for firms either in Main or AIM markets with distinct levels of required financial information disclosure. The importance of earnings quality to cash holdings varies however not just with the characteristics of the market (Main or AIM) but also according to the nature of companies' profits (negative or positive) and, to a lower extent, due to the existence of relevant R&D expenses.

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