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Digital corporate reporting

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Digital corporate reporting: research developments and implications

Abstract

Innovations surrounding digital corporate reporting and underlying technology such as XBRL have been slowly introduced to corporate reporting infrastructure since the early part of the century. These innovations have been promised to enhance the accessibility, accuracy and comparability of reported information, and more effectively meet the needs of information users. Whilst research in the last two decades has attempted to evidence the impact of digital corporate reporting, the research remains largely fragmented and sparse. We take an eclectic perspective to review and synthesise existing research on digital corporate reporting and assess the broader research implications for key stakeholders, including preparers and users of corporate reports, regulators and standard-setters. In doing so, we offer an appraisal for those contemplating the growing influence of digital corporate reporting, and identify opportunities and avenues for future research.

Key words*: XBRL, digital corporate reporting*

1. Introduction

Over the last two decades, digital corporate reporting activity has been driven by advances in information technology that offer innovations in how corporate information is communicated to users. Digitising corporate reporting is the process by which accounting data are atomised and structured in ways that facilitate automated reporting, extraction and analysis (Locke et al., 2018). This process of digitisation[1] enables users to access accounting information at a granular level thereby enabling potentially significant changes to the accessibility, transparency, accuracy and comparability of reported information. Amongst regulators, these changes are viewed as having the potential to improve capital allocation decisions and investment flows, and enhance corporate accountability to stakeholders (CPAAustralia, 2014; FEE, 2015).

Major regulators around the world have instigated activity and made significant investment to advance digital corporate reporting in their jurisdictions. For example, regulators in the US, Japan and China have introduced regulation and developed infrastructure that enable listed firms to file digital corporate reports (FSA, 2008; XBRLInc, 2020). A similar mandate has

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[1] Knudsen (2020) distinguishes between digitisation and digitalisation, where digitisation is depicted as the process of converting data from a traditional, analogue format to a digital format whilst digitalisation encompasses broader organisational and social processes associated with that transition. Contrastingly, Østerlie and Monteiro (2020) depict digitalisation as the manipulation digital representations. In both conceptions, digitisation appears to enable, and be a subset of digitalisation.

come into effect in the European Union where the European Securities and Markets Authority (ESMA) is requiring EU-listed firms to file digital corporate reports in the European Single Electronic Format (ESEF) from 2020 (ESMA, 2020). More recently, a joint parliamentary inquiry in Australia recommended that the Government make digital corporate reporting a standard practice in Australia (ParliamentOfAustralia, 2020). Although it is argued that a compelling case for the adoption of digital corporate reporting exists in Australia, market demand has not led Australian companies to voluntarily respond by providing information in digital formats (ParliamentOfAustralia, 2020; Tarca, 2020).

Digitising corporate reporting calls for significant transformation of corporate information infrastructure. The transformation is disruptive as it challenges long established procedures, models and technologies used for collecting, processing and communicating corporate data. Such challenges are exacerbated by the costs of implementation, resistance to change and the respective roles in leading change amongst key stakeholders, such as preparers of corporate financial reports, users of the financial information, regulators and standard-setters (Guilloux et al., 2013; Locke et al., 2018). Perceptions surrounding the effectiveness of digital corporate reporting will be further influenced by adoption rates. Given that the 'positive network externality' of a co-ordination standard grows with the number of adopters, a critical mass of entities must use digital corporate reporting before benefits are perceived to materialise across the corporate reporting supply chain.

To a significant extent, expected benefits have formed the basis of investment and activity on digital corporate reporting around the world. Whilst research in the last two decades has attempted to evidence if and how expected digital corporate reporting benefits have materialised in practice, *ex-post,* this research remains fragmented and noncumulative. Importantly, there is no attempt to systematise and synthesise existing research on digital corporate reporting impacts for preparers, users, auditors, regulators and standard-setters across the corporate reporting supply chain.

We address this shortcoming, and offer a foundation for researchers and policy-makers to understand what is at stake in major jurisdictions that have yet to adopt digital corporate

reporting, such as Australia,[2] plus those jurisdictions that are developing their digital corporate reporting practices, such as the US and the EU. Existing research analysing adoption of digital reporting has documented evidence that preparers of corporate reports generally perceive digital reporting to be a compliance burden where the benefits mostly accrue to regulators (Troshani et al., 2018; Troshani et al., 2019; Troshani and Lymer, 2010; Troshani et al., 2015; Henderson et al., 2012). Lowe et al. (2012) and Guilloux et al. (2013) argue that these perceptions arise because regulators have strong incentives to develop and mandate broader adoption of digital corporate reporting because it facilities their monitoring and surveillance roles, while the incentives to other stakeholders are less clear. Whilst stakeholder perceptions present a significant barrier to both adoption and use of digital corporate reporting (Cordery et al., 2011; Dunne et al., 2009, 2013; Troshani and Rao, 2007), digital reports now represent the most heavily downloaded dataset on the US SEC website (ESMA, 2019).

To contribute to our understanding of the implications of digital corporate reporting, we conduct a review of existing empirical research analysing the consequences of digital corporate reporting. We conceptually structure our analysis around different stages of the digital corporate reporting process, including digital corporate reporting regulation and standard-setting, impact on firm behaviour, usage of digital reporting information, capital market consequences of digital corporate reporting, impact on audit and assurance, and business-to-government digital reporting.

To identify studies that form the basis for our analysis, we use Google Scholar and keyword searches to identify research published in this area between 1999-2020.[3] Using a range of key terms, this first stage returned several thousand documents. A second stage of our review narrowed down this longlist by focusing on research offering empirical studies of digital corporate reporting. During the third stage of our review, the publications were analysed and allocated to stages of the corporate reporting supply chain consistent with our conceptual

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[2] Whilst some Australian regulators, such as the Australian Taxation Office and Australian Prudential Regulatory Authority require firms within their remit to file digital reports for regulatory compliance (Troshani et al., 2018; Troshani and Lymer, 2010), the requirement been not yet been extended to the corporate reports of Australian listed firms (ParliamentOfAustralia, 2020).

[3] This timescale incorporates the date from which XBRL was commercially developed and includes the period in which significant development and adoption activity occurred across major global jurisdictions. Specifically, we looked for research for inquiring into how digital corporate reporting was developing within the identified timescale.

structure. Our readings and selection of cited papers was also guided by the relevance, rigour and quality of the publication outlets (according to the ABDC Journal Ranking).

We use our review to appraise digital corporate reporting research, develop our understanding of the consequences of digital corporate reporting and to assess if and how these consequences are materialising in practice, *ex-post*, across the corporate reporting supply chain. Given the manifold nature of the research analysing the impacts of digital corporate reporting, we examine the evidence from across different methodologies and theories using an eclectic perspective. The contribution of our paper lies in providing a platform highlighting findings and gaps to inform ongoing and future research and offering a common foundation of evidence to facilitate assessment and appraisal concerning what corporate reporting supply chain participants stand to gain (or lose) from the changes brought forth by digital corporate reporting.

This paper is structured as follows. After we introduce digital corporate financial reporting and its underlying technology, XBRL, we discuss (i) digital corporate reporting regulation and standard-setting; (ii) the impact of digital corporate reporting on the reporting behaviour of firms; (iii) experimental research analysing the use of digital reporting information; (iv) the capital market consequences of digital corporate reporting; (v) the impact of digital corporate reporting on audit and assurance, and (vi) business-to-government digital reporting. We conclude the paper by discussing the broader implications of our appraisal and the avenues for future research.

2. Digital corporate reporting and XBRL

In this section, we discuss the nature of digital corporate reporting, and the underlying technology. Where feasible, we highlight differences with traditional, electronic corporate reporting, in order to understand the novel aspects of digital corporate reporting and highlight its potential for changing the practices of corporate reporting supply chain participants.

Digital corporate reporting describes the process by which paper-based corporate reports are converted and represented in a machine-readable digital format. Digital corporate reporting can be distinguished from 'electronic reporting' that presents traditional, paper-based corporate reports in electronic formats (e.g. PDF, HTML). Although the information in electronic formats is digitised (i.e., coded and transmitted as 0 and 1s), these reports essentially retain their paper-

based arrangement and presentation. Most importantly, machines/computers cannot understand the contextual 'meaning' of those 0 and 1s. For example, no distinction is made between Apple (the company) and apple (the fruit), nor whether 2021 might represent a year or a net profit. These 'electronic reports' can be easily read by humans, but entail extensive, inefficient and potentially error-prone manual processing before users can extract information, transfer it between computers and use it to compare different companies (Guilloux et al., 2013; Locke et al., 2018). With digital corporate reporting, information is assigned or 'tagged' with contextual meaning to enable computers to have some 'understanding' of what is being reported. This enables users to easily extract whatever reporting information they want in any arrangement they wish across a range of companies.

The technology used to assign contextual meaning is XBRL (eXtensible Business Reporting Language). XBRL is based on XML technology that is used to convey contextual meaning between computers when, for example, one's input of a 4-digit number onto a webpage (e.g., 5000) is recognised as an Australian post code. XBRL uses "tags" to assign contextual information to specific accounting numbers and text within corporate financial reports.

A corporate report is converted into a digital corporate report when it is structured with XBRL tags that convey the contextual meaning of reported information. The contextual tags are listed, classified and standardised within accepted data models called taxonomies. A taxonomy defines standard tags based on the accounting standards and disclosure requirements of a particular jurisdiction. For example, the IFRS Taxonomy and the US GAAP Taxonomy are based on IFRS Standards and US GAAP, respectively. To illustrate, Figure 1 (a) provides an excerpt of the IFRS Taxonomy specifically showing the `Current Assets` element and the corresponding tag in the taxonomy, whilst Figure 1 (b) highlights the IFRS Standards upon which the `Current Assets` element is based.

<INSERT FIGURE 1 HERE>

Where reporting information does not match a specific contextual tag, the taxonomy can be extended. This enables preparers to create their own non-standard tags, 'extensions', for firm-

specific disclosures that reflect information about their particular circumstances (Locke et al., 2018). A taxonomy is thus an essential part of the corporate information infrastructure that enables preparers to produce digital corporate reports based on accounting standards, and users to interpret reported accounting numbers in the manner intended by preparers (IFRSF, 2015; Locke et al., 2018).

Digital corporate reports can be visually presented into human readable formats that depict traditional, paper-based corporate reports. This capability can be achieved by using iXBRL (Inline XBRL) which structures digital corporate reports internally by using XBRL tags, but also facilitates presentation of the digital reports in ways that seek to replicate paper-based reporting formats (e.g., in HTML) (Troshani et al., 2015). Figure 2 shows excerpts of the digital 2016 IFRS Foundation Annual Report illustrating the `Current Assets` disclosure in XBRL (e.g., see (a)) and in HTML format using iXBRL (e.g., see (b)) (IFRSF, 2016).

<INSERT FIGURE 2 HERE>

In summary, the potential of digital corporate reporting centres on its ability to enable the automated extraction and reconciliation of reporting information across large samples to enable comparative analyses in a manner and arrangement chosen by the user (Doolin and Troshani, 2004; Turner, 2005).[4]

3. Digital corporate reporting in accounting regulation and standard-setting

A body of research has examined how digital corporate reporting mandates have been incorporated into corporate regulation, and how digital reporting has affected standard-setting processes. Early work by Locke and Lowe (2007) focused on the governance structure of the international consortium that sought to develop and promote XBRL technology (XBRL International). Whilst finding that this private-sector body represented the interests of regulators,

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[4] This ability of the technology can also be leveraged further by integrating corporate reporting data in XBRL format with data external to corporate reports that are not in XBRL format (e.g., economic data, government data, financial news, financial discussion forums, and social media) to increase opportunities for holistic investment analyses (O'Riain et al., 2012).

Big 4 accounting firms, and large data aggregators, other stakeholders, such as large and small preparers, and non-professional investors were largely excluded.

The findings of Locke and Lowe (2007) can be related to later work focusing on the motivations used to justify the world's first large-scale digital corporate reporting mandate by the US SEC, the 'Interactive Data' project. Whilst the overarching aim of this project was to create efficient markets and lower the cost of capital, a specific focus was placed on 'protecting retail investors' by using digital reporting to 'level the information playing field' (USSEC, 2009). In their assessment of the development of the US project, Lowe et al. (2012) find that the retail investors' needs for accountability and transparency, however, were largely constructed by the US SEC and proponents of XBRL technology. Given that 'retail investors' were not consulted or engaged, Lowe et al. (2012) conclude that they were "silent" in the development of the US digital reporting mandate echoing findings from the wider standard-setting literature (for example, see Young, 2006).

Other literature has examined how digital reporting has affected standard-setting processes. An important consequence of digital reporting has been the construction of a reporting taxonomy which defines the contextual information associated with each accounting disclosure. In the context of international accounting standards, Locke et al. (2018) focus on the processes of translation as IFRS-based corporate reports are digitised. They examine the manner in which translation activity impacts on the syntax and semantics of communication between the standard-setters, preparers and users of corporate reports. Troshani et al. (2019) examine the construction of the IFRS Taxonomy and focus on the mechanisms used to gain legitimacy, achieve support and align interests so that the IFRS Taxonomy is viewed as an authentic representation of 'IFRS Standards'.

This stream of research demonstrates how digitisation activity has challenged the primacy of accounting standards and established standard-setting processes. Specifically, regulators and standard-setters have argued that digital corporate reporting is just a "form of presentation" (Hoogervorst, 2012), and a new transportation medium for financial information, which would have no impact on accounting standards, nor the meaning and message of corporate reports (Hoogervorst, 2012). However, research finds that the IFRS Taxonomy is more than just

a medium of transportation: it is actively influencing both standards and standard-setting (Rowbottom et al., 2021; Troshani et al., 2019; Locke et al., 2018).

Whilst taxonomy construction work occurred initially as an "after thought" (i.e., after standards were set), Locke et al. (2018) and Troshani et al. (2019) note how it is now "integral" to standard-setting activity at the IASB (i.e., standard-setting and standard digitisation in the taxonomy are carried out simultaneously and inform each other). Accounting standard-setting has been amended to be "sensitive" to the XBRL technology requirements and formally incorporated in the IASB standard-setting lifecycle and underlying processes (Troshani et al., 2019). Specifically, the IASB acknowledge that the IFRS Taxonomy is influenced by both IFRS Standards and XBRL technology, but in conflicting ways. To be perceived as a legitimate, authentic form representing the IFRS Standards, the taxonomy must remain faithful to the principles-based nature of the standards. However, the taxonomy is implemented using XBRL which requires that disclosures must adhere to prescriptive technology requirements for it to work and be useful to preparers and users of corporate reports (Rowbottom et al., 2021). Early evidence on the processes undertaken by the IASB to incorporate taxonomy considerations into standardisation processes hints that the changes are influencing the drafting of accounting standards (Rowbottom et al., 2021; Troshani et al., 2019; Locke et al., 2018). Further research could build on these initial findings by focusing on how standard-setting processes are affected by the implementation of digital reporting in other jurisdictions and contexts, and to examine how accounting standard construction incorporates digital reporting implications.

4. Reporting behaviour of preparers of digital corporate reports

Another body of research has looked at the impact of XBRL-based digital reporting on the behaviour of those firms preparing digital corporate reports. Using samples from the US environment, this body of research assesses the speed at which corporate reports are published, the content, quality and the construction of digital corporate reports, and the consequences on manager's reporting behaviour.

A stream of research has compared the timeliness of filing of corporate reporting before and after the digital reporting mandate came into effect for both those larger and smaller firms required to adopt digital reporting at different times. For example, both Du and Wu (2018) and

Zhou (2019) measure the reporting lag between the financial year end and actual filing date for key corporate reports. Both studies find that the reporting lag is shortened for those larger firms subject to the first wave of the US mandate which they interpret as evidence that XBRL-based digital reporting triggers improvements to internal reporting processes that enable firms to file their corporate reports in a timelier fashion.

However, the studies provide mixed findings in terms of timeliness of those reports filed by smaller firms who were subject to the XBRL mandate 1-2 years after its introduction. Du and Wu (2018) explain that reporting lag remains the same for smaller firms as they are less likely to have access to the corporate reporting infrastructure needed to streamline (digital) reporting. In contrast, Zhou (2019) find an increase in the reporting lag for smaller preparers which they attribute to outsourcing the XBRL conversion of corporate reports to third party providers, which introduces delays in the filing process.

Early evidence concerning the quality of initial XBRL-based reports in the US mandate shows that earlier filings had errors in them. For example, Debreceny et al. (2010) looked at the first round of the digital quarterly reports after the XBRL mandate and find that over a quarter of the XBRL filings had computation errors. Similarly, Du et al. (2013) find 4,260 errors in 4,532 filings from the first six quarters after the XBRL mandate. Whilst the number of errors in digital financial statements declined over time, Du et al. (2013) also find that errors rose again after footnote tagging requirements became effective, one year after a firm's initial digital filing, which they attribute to corporate infrastructure limitations.

Du et al. (2013) also find that the number of errors was positively associated with filer's use of their own extensions. Furthermore, Debreceny et al. (2011) find that 40% of the extensions used by 67 large US filers between April 2009-June 2010 were unnecessary since equivalent tags were available in the US GAAP taxonomy. Errors in digital corporate reports are problematic as filers lose credibility, whilst users lose confidence in digital corporate reporting data (Bartley et al., 2011). Similarly, unnecessary extensions increase the burden on filers to maintain consistency in the filings over time whilst creating ongoing data usability challenges for the users (Debreceny et al., 2011). Recall that extensions can be used by preparers for making disclosures that are unique to them, for which they believe there are no tags available in the standard taxonomy. US preparers are allowed to use extensions, although their use remains

controversial. For example, Kim et al. (2019) find a positive association between the firms that use more non-standard extensions and absolute discretionary accruals. Supporters view extensions as a means to allow preparers to provide disclosures that they would otherwise be unable to make, thereby reducing possibility for information loss, whilst increasing transparency. Meanwhile critics raise concerns about loss of comparability which exacerbates users' efforts to analyse financial information. Dhole et al. (2015) find that financial statement comparability declined after the US digital reporting mandate was introduced, particularly in relation to operating expense line items. Meanwhile, Blankespoor (2019) focuses on the extent of reporting disclosure, and finds that firms adopting XBRL-based digital corporate reporting increase the amount of quantitative disclosures in their footnotes to the accounts. She infers that the preparers change their reporting behaviour in anticipation of greater attention to the footnote disclosures by users whose information processing costs have decreased due to XBRL technology.

An emerging stream of research has begun to focus on managers' reporting behaviour. For example, Hsieh et al. (2019) and Kim et al. (2019) focus on the association between the introduction of digital corporate reporting and the level of accruals-based reporting choices. Both find that accruals-based earning management is reduced after the XBRL mandate in the US. Although not directly observed, Kim et al. (2019) argue that digital reporting constrains accruals-based earnings management because users can more easily monitor abnormal accrual choices. This, in turn, affects the behaviour of reporting firms. Hsieh et al. (2019) also present evidence that digital reporting is associated with real earnings management. They infer that managers are more likely to engage in real earnings management by, for example, altering the timing of a sales transaction, as a trade-off for the reduced scope of accruals-based earnings management given the constraints arising from enhanced 'digital monitoring'.

Overall, the nascent research in this area suggests the introduction of digital reporting mandate is associated with changes in firms' reporting behaviour relating to the timeliness of reporting, digital report quality, and reporting choices. In interpreting the impact of digital corporate reporting on reporting behaviour, it is important to recognise variation in implementations across preparers. The effect on reporting behaviour is likely to be different for firms preparing 'traditional' reports in the usual manner and then converting them to digital reports, in comparison to those firms integrating digital reporting more comprehensively in their

reporting infrastructure. Specifically, there are three general implementation approaches that are available to preparers: (i) outsourcing the XBRL tagging process of corporate reports to third party providers; (ii) using 'bolt-on' software applications to convert traditional corporate reports into a digital XBRL format prior to filing with regulators; and (iii) integrating XBRL into existing accounting packages or ERP systems, thereby enabling XBRL tagging to occur at the lower data capture and representation levels (Garbellotto, 2006; Janvrin and No, 2012). However, these different approaches have different implications pertaining to control over digital tagging processes and the quality of the disclosures (Garbellotto, 2006; Janvrin and No, 2012). Future research could further analyse the implementation approaches used by preparers in practice, and examine how those approaches interact with observed changes in reporting behaviour.

5. Usage of XBRL-based digital reporting information: experimental research evidence

A body of research has sought to understand how XBRL-based digital corporate reporting might be used and how it might affect decision-making. This stream is based on experimental research focusing on analysing the behavioural differences between users provided with XBRL-based digital accounting information, and traditional, paper-based accounting information.

An early study by Hodge et al. (2004) found that experimental subjects using 'XBRL-based' hyperlinked financial statements are better at acquiring and integrating accounting information for investment decision-making than those using paper-based financial statements. Ghani et al. (2011) analysed whether experimental subjects' functional ability to search for reporting information in specific, expected locations in the corporate report differed across reporting formats. Comparing between PDF, HTML, and XBRL-based formats, they find no evidence that the XBRL-based format reduces the retail investors' functional fixations when acquiring and processing financial information.

Arnold et al. (2012) analyse how users interact with a MD&A tagged and hyperlinked using XBRL versus one disclosed in a PDF-based format. They find that investors using the XBRL-based format spent less time viewing information in the tagged structure suggesting that it improves the efficiency of their decision processes. However, those non-professional investors in the study found the XBRL-tagged presentation more difficult to navigate. Locke et al. (2015)

report on how experimental subjects used financial statements presented in a PDF format with those presented in an XBRL-tagged, hyperlinked, spreadsheet format. They find that data format made no difference in the participants' ability to access and integrate information from footnotes in financial statements to improve decision making. However, anecdotal evidence provided by the participants suggests that they found XBRL-based financial statements easier to use than PDF statements, specifically highlighting the automated ratio calculation functionality offered by the XBRL-based format (Locke et al., 2015). Within the Australian setting, Birt et al. (2017) find those subjects using 'XBRL reports', that hyperlink line items and associated notes in Excel, perceived them to be more relevant, understandable and comparable than abridged PDF reports during a profit-forecasting exercise.

This body of research generally finds that 'XBRL-based statements' help users in locating information. However, there is difficulty in unpacking what an XBRL-based statement or report is. Due to the constraints of controlling experimental design and the early stage of the technology, initial studies (e.g., Hodge et al., 2004) were testing the use of hyperlinked versus non-hyperlinked statements. Later studies sought to introduce more functionality into their experimental designs by designing XBRL-based statements in spreadsheets that offered more scope for reformulation, user-controlled calculations and navigation (e.g., Birt et al., 2017; Locke et al., 2015). However, no studies to date have examined the experimental use of digital reporting that offers its full functionality and its main purported strengths: being able to download data across large samples into user-defined arrangements and reformulations. Whilst experimental set-ups are difficult to design, this observation offers scope for future research that more comprehensively tests the functionality of XBRL-based digital reporting technology against the common electronic data formats in contemporary use by professional users.

The usage of test subjects also offers another opportunity for research. Due to the difficulties in recruiting experimental subjects, only one of the reviewed studies (e.g., Arnold et al., 2012) uses professional investors in their designs. The remainder of studies tend to use accountants (e.g., Ghani et al., 2009, 2011) and students (e.g., Birt et al., 2017; Hodge et al., 2004; Locke et al., 2015) as surrogates for professional or non-professional investors. Whilst challenging, future research could seek to engage experimental subjects who are more likely to use XBRL-based digital data in their vocational decision-making. Taken together, this research

offers significant potential in helping to clarify and understand many of the changes in capital market indicators observed in the body of research reviewed in the next section.

6. Capital market consequences of digital corporate reporting

An important body of research has looked at the impact of digital corporate reporting on capital markets. This research is based on archival evidence sourced from markets where XBRL technology is used by preparers to prepare digital corporate reports before filing to the regulators, either voluntarily or in response to a regulatory mandate. Set within the neo-classical economic paradigm, and based upon information economics and rational choice theory, the research generally seeks to examine associations between the introduction of digital corporate reporting and a range of capital market indicators.

This research can be broadly categorised based on the stages in which digital corporate reporting has been adopted: (i) voluntary adoption; (ii) early mandatory adoption; and (iii) ongoing mandatory adoption. Voluntary adoption research has looked at filers that participated in the US SEC's Voluntary Filing Program (VFP).[5] For example, Hao et al. (2014) use evidence from VFP participants to assess the impact of XBRL adoption on the cost of equity,[6] and find a significant association between XBRL filings and cost of equity, whilst controlling for size and risk. Efendi et al. (2016) used an event study approach to find that share price variance increased when VFP participants filed their XBRL-based digital corporate reports on a different date to their HTML-based reports. The change in relative abnormal returns is interpreted as evidence that capital market users find the new 'mode' of accounting information incrementally informative. Similarly, using voluntary adopters' XBRL-based digital reporting data in Belgium, Kaya and Pronobis (2016) find evidence to support predictions that digital corporate reporting is associated with a decrease in borrowing cost and an increase in loan size.[7]

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[5] The US SEC established the VFP to serve as a test of XBRL's capacity for filing corporate financial information, and to help regulators understand the associated costs to filers and the usefulness of digital reporting for the corporate information supply chain (USSEC, 2005).
[6] Hao, et al. (2014) measure the cost of equity capital using the model proposed by Easton (2004) according to which cost of capital is a function of median analyst forecast of earnings 1 and 2 years ahead and current stock price.
[7] Borrowing cost is measured as the loan spread which they calculated as the firm's one year ahead interest rate less Belgium's benchmark rates (5-year yield on Belgian government bonds). Loan size is measured as a firm's one year ahead loan size less industry median loan size divided by standard deviation of firm cash flows over sample period.

Research into the early adoption of digital corporate reporting has looked at the capital market changes during the first 1-2 years immediately after an XBRL-based digital reporting mandate came into effect, predominantly focusing on US listed firms, and to a lesser extent on firms listed in China. In early adoption studies, digital reporting with XBRL was predicted to be associated with a decrease in the cost of capital (Liu et al., 2014a), an increase in analyst forecast accuracy and analyst following (Liu et al., 2014b; Liu et al., 2014c). These studies do not find evidence to support their predictions. Blankespoor et al. (2014) look more generally at the impact of digital corporate reporting and find that the US mandate is initially associated with an increase in the bid-ask spread and lower abnormal trading volume. The inference made is that the mandate initially only aided the larger, more sophisticated capital market participants who had the means to leverage the advantages of corporate XBRL-based digital data by, for example, rapidly incorporating filings into proprietary datasets, prediction models and conducting trend analysis across large samples. This, in turn, led to an overall decrease in market liquidity, and an increase in adverse selection and information asymmetry.

Explanations for the results analysing early adoption often refer to the implementation challenges involved in preparing XBRL-based digital reports, the resultant poor quality of digital accounting information, and the limited knowledge possessed by those using the information in the new digital format (Debreceny et al., 2010). These issues can be related to limitations of corporate information infrastructure (e.g., including the applications that support the production and processing of digital accounting information, data quality issues, taxonomy applicability, and efficiency of internal processes within firms), and organisational learning necessary for digital corporate financial reporting. Perdana et al. (2015) identify similar issues and confirm their significance by analysing social media discourse concerning XBRL implementation challenges in LinkedIn special interest and knowledge sharing groups between 2010-2013.

In contrast to early adoption studies, the research looking at the ongoing mandatory adoption of XBRL uses archival evidence from filers for periods after the first two years since mandatory adoption came into effect. This research finds support for predicted associations on a broader range of variables depicting capital market indicators. Additionally, the research is generally based on larger datasets sourced from a greater number of filers over wider timeframes, from a greater variety of jurisdictions, including the US, China, South Korea, and

Japan. Table 1 provides a summary of these studies, including the capital market indicators being studied, the measures used, the expected associations, and key findings.

<INSERT TABLE 1 HERE>

The body of research presented in Table 1 shows that there is consistent evidence that capital markets indicators have changed after XBRL adoption was mandated. These changes, measured using statistical estimation techniques and established econometric models, offer a body of empirical evidence that suggests XBRL-based digital corporate reporting is associated with a reduction in the information processing costs of capital market participants and improvements in capital market efficiency. Whilst it is important to note that the reviewed studies do not measure the actual information processing costs of the preparers affected by the digital reporting mandate, they argue that the cost reduction is attributable to the technological change, as a major exogenous factor in the sample periods.

The essence of the arguments put forth by this body of empirical research is that XBRL-based digital reporting improves the information set available to capital market participants, which enhances their fundamental analyses, and thereby improves market efficiency. There is some support that such benefits are unevenly distributed amongst capital market participants. In the early stages of adoption, digital reporting is found to benefit larger, more sophisticated institutional investors who have the means to more effectively utilise the analytic capability of XBRL (Blankespoor et al., 2014). As digital reporting becomes more established, it is inferred that smaller institutional investors gain a comparative advantage from improvements in their corporate knowledge bases comparative to larger institutional investors (Bhattacharya et al., 2018). Digital reporting is also inferred to reduce information asymmetry for non-domestic investors surrounding more complex or less established listed companies (Huang et al., 2020; Kim et al., 2018), but also between investors targeting local vis-à-vis non-local investments, where *local* refers to the geographical proximity between institutional investors and their investment target (Li et al., 2020). These findings suggest that the effects of digital reporting on capital market indicators are influenced by the utilisation rather than presence of digital reporting

information. This depends on how digital reporting information interacts with and offers an advantage to the existing information infrastructure of investors who may have their own proprietary databases and specialised data processing applications.

A related stream of research examines how differences in the nature of digital reporting, in terms of the granularity of tagging and the use of firm-specific reporting 'extensions', is associated with capital market indicators. More customised reporting, measured by XBRL extensions, is found to be positively associated with indicators of information efficiency (Li and Nwaeze, 2015), value relevance (Cormier et al., 2019) and negatively associated with the bid-ask spread (Li and Nwaeze, 2015). Li and Nwaeze (2018) find that additional XBRL disclosure extensions used by preparers in excess of what is used in the industry are positively associated with analyst following and forecast accuracy and negatively associated with forecast dispersion. Similar findings are replicated by Cormier et al. (2019) who also find support that the XBRL extensions are positively associated with analyst following. However, Chen et al. (2018a) find that firms using more XBRL extensions are associated with higher loan processing costs as reflected in different loan spreads.

Finally, Felo et al. (2018) find that whilst the detailed tagging of footnotes is associated with decreases in analysts' forecast errors and dispersion, and increases in analyst following, firms tagging their footnotes with customised extensions increase forecast errors and dispersion. Collectively, the findings offer contrasting evidence on whether more customised digital reporting is associated with improvements in capital market indicators based on their ability to convey more information and reduce information asymmetry, or whether customised digital reporting is associated with a deterioration in capital market indicators resulting from an increase in information processing costs and reduction in information comparability.

Summarising the different streams of capital market based research, the collective evidence tends support to the idea that the communication between listed firms and capital market participants of financial information has improved after XBRL mandate, and that the improvement is consistent with expectations of XBRL-based digital corporate reporting. In general, this research provides evidence of the impact of digital reporting by finding consistent associations between the adoption of XBRL-based corporate reporting and various capital market indicators.

The body of work seeking to understand the impact of XBRL-related digital reporting on the capital markets is set within the positivist, functionalist paradigm. Whilst its strengths lie in the volume of empirical observations and the internal reliability of econometric tests, it is restricted by its dependence on proxy measures, and the difficulty in distinguishing between association and causation. Due to constraints on research design, the archival capital markets-based research on digital corporate reporting also makes inferences about the usage of this new mode of delivery, rather than observing or measuring usage directly. It is not designed to precisely measure how and what digital reporting technology is changing in the disclosure, capital market and investment decision making processes that might be specifically responsible for the observed effects. For example, many capital markets participants use accounting information via large proprietary databases, such as those provided by Thomson Reuters and Bloomberg that may or may not source their information from digital corporate reports. Many studies assume that capital market participants are using digital corporate reports once available. Yet, XBRL filings represented only 61% of downloads from the US SEC's EDGAR system from 2012-15 for smaller listed firms whilst users downloaded 39% of filings in non-digital formats, such as PDF, HTML, and ASCII (Cong et al., 2018). As a consequence, micro-studies of how capital market participants actually use digital reporting might complement larger empirical macro-studies thereby providing support to the choice of proxies and offering insight into the nature of associations observed. Thus, future research and complementary methods could usefully provide further clarity in this area. For example, case studies with preparers using extensions might offer insights about the rationale, extension design processes, and expected outcomes. Similarly, case studies with users of financial information could also offer insight about how non-standard extensions are used to access and process information, compare alternatives and make investment decisions.

Whilst this body of research has focused on a number of jurisdictions, the vast majority of the studies have naturally focused on the location of its largest implementation, the US, whilst research looking at other jurisdictions where XBRL was mandated (e.g., China, South Korea, and Japan) is limited to few studies. Liu and O'Farrell (2013) examined six different national jurisdictions where XBRL was mandated and found evidence to support the moderating effect of select national cultural values on the relationship between XBRL adoption and information environment quality, measured by analyst forecast accuracy. This raises the question of whether

the consistent associations identified and assessed in the US-based studies are driven by the same underlying socio-economic, institutional and cultural factors that affect US-listed firms in the same way. Thus, validation of these findings across other jurisdictions that are in the process of introducing digital corporate reporting, including common and civil law jurisdictions, presents another useful avenue for further research.

7. Impact of digital corporate reporting and XBRL on audit and assurance

An adjacent body of research has looked at the audit and assurance implications arising from XBRL-based digital reporting. Digital corporate reporting would require individuals to exercise judgement over the 'tag' (i.e., the taxonomy element) to be applied to a particular reporting disclosure, particularly where reporters do not comply with the standard taxonomy and include their own reporting extensions. Although the main adopters of digital corporate reporting (e.g., the US SEC) have not imposed an assurance requirement to date, they have recognised that filers might seek assurance on a voluntary basis. This has therefore motivated debate about audit processes for assuring XBRL-based digital reports.

This research has explored how to associate an audit report with a digital corporate report (Cohen et al., 2014), and how to draw opinions on the fairness of presentation in a digital reporting environment (Boritz and No, 2016; Srivastava and Kogan, 2010). Other studies have explored how one can decide on the controls relating to the production of digital corporate reports (Boritz and No, 2016), the use and appropriateness of reporting extensions (Boritz and No, 2009, 2016), and the amount of tags to be sampled in an assurance engagement (Plumlee and Plumlee, 2008).

Researchers have also investigated how to apply audit materiality judgements to digital corporate reports given users can pick any line item for decision-making purposes. They contrast judgements of materiality based on how a specific line item affects user decision-making against materiality judgements made when considering the information contained across a set of financial statements (Plumlee and Plumlee, 2008; Srivastava and Kogan, 2010). Given the opportunity for XBRL to atomise reporting data and separate data from a specific placement in a linear traditional corporate report, literature has explored the possibilities of data-level assurance (Boritz and No, 2005; Cohen et al., 2014; Lymer and Debreceny, 2003), and the meaning of an

'error' at the data level (Plumlee and Plumlee, 2008). As XBRL technology unties data points from a corporate reporting document, the literature also explores the economics of the audit, speculating whether the user accessing audited data, rather than the reporting firm, should pay for the assurance (Alles and Gray, 2012).

A stream within this body of research has attempted to assess the association between the adoption of digital reporting and audit fees. Based on the premise that XBRL enhances accessibility and transparency of information in digital corporate reports, this research has used samples from jurisdictions where XBRL-based digital reporting has been adopted, including the US, Japan and China, and has found support for predictions that XBRL is inversely related with audit fees (Amin et al., 2018; Shan and Troshani, 2014, 2016; Shan et al., 2015). It has also found that the audit report lags of US listed firms were reduced by 0.4 to 3.4 % after the XBRL mandate was introduced in the US (Amin et al., 2018).

Given that no requirements for digital reporting assurance have been available to observe, much research into the impact of digital reporting on audit and assurance has focused on what might be technologically possible to implement, rather than what has actually been done. Given the increasing use of XBRL-based digital reporting, further research possibilities will perhaps arise as applications and digital reporting audit norms and practices develop over time.

8. Regulatory compliance: business-to-government reporting

A limited body of research has examined how businesses have been required to use digital reporting to meet their regulatory requirements (de Winne et al., 2011; Doolin and Troshani, 2007; Guilloux et al., 2013; Lizhong Hao and Kohlbeck, 2013; Robb et al., 2016; Troshani et al., 2018; Troshani and Lymer, 2010; Troshani et al., 2015). Business-to-government reporting has provided a fertile ground for the implementation of digital reporting given that companies have historically provided the same information to different regulators for compliance purposes. Digital reporting offered the potential for firms to report information once in XBRL-tagged formats that could be reused across different regulatory functions. From a regulatory perspective, digital submission of information promised more consistent, standardised reporting and greater scope for processing, monitoring and analysis. For both firms and government, digital reporting

offered a potential reduction in the administrative burden, and reduced longer-term regulatory compliance costs.

One stream within this body of research has focused on how digitally-based business-to-government reporting programmes were conceived. For example, Guilloux et al. (2013) analyse the debates concerning the technology chosen to implement digital business-to-government reporting in France (e.g., XBRL vis-à-vis other data standards, such as EDIFACT) while Troshani and Lymer (2010) examine the efforts of key actors, such as industry consortia and government agencies in Australia, to create supporter networks for developing a case for XBRL-based digital reporting.

Another stream has focused on how digitally-based business-to-government reporting programmes were implemented. For example, Troshani et al. (2018) look at the interactions between the Australian and Dutch 'Standard Business Reporting' programmes, in considering how regulators worked to harmonise corporate information obligations and underlying data definitions for developing national business-to-government reporting taxonomies. They find a significant reduction in the number of reportable information obligations, for example, from 200,000 to 4,500 in the Netherlands (98%), and from 33,535 to 6,636 (80%) in Australia, as regulators were able to reuse information to fulfil specific compliance monitoring requirements. They also compare harmonisation work carried out in Australia and the Netherlands to the work carried out in the UK. In the same stream, de Winne et al. (2011) look at the development of the digital reporting infrastructure as the product of public-private networks, while Troshani et al. (2015) examine the arrangements that had to be created that led to the institutionalisation of business-to-government reporting and underlying iXBRL technology in the UK.

Another stream has offered post-implementation impact evidence from digitally-based business-to-government reporting programmes. For example, Robb et al. (2016) investigate the perceptions of Australian stakeholders concerning the impact of the SBR programme in Australia. They identify improvements in the regulatory reporting process pertaining to both filers, in terms of efficiencies in report preparation processes, and users, in terms of decision-making effectiveness and risk assessment outcomes due to improved data accuracy and efficient aggregation capability.

In the same vein, Mousa and Pinsker (2020) examine the introduction of XBRL-based digital reporting at the US Federal Deposit Insurance Corporation (FDIC). In 2005, the US Federal Financial Institutions Examination Council (FFEIC) introduced a mandate requiring all US federally insured banking institutions to file their quarterly reports of condition and income (Call reports) to the FDIC in XBRL format. Mousa and Pinsker (2020) focus on the regulator's viewpoint and report early evidence of improvements in data collection and management, such as data accuracy and accessibility, comparability, data control and improved compliance assessment productivity due to the streamlining of processes at FDIC.

By contrast, Hao and Kohlbeck (2013) focus on the reactions of bank shareholders, as key users of the banks' financial information. They examine three indicators, including share price, trading volume, and systematic risk as means of measuring user reactions to the FFEIC's XBRL adoption mandate. Using data from the third quarter filings in 2005, they find that share prices and trading volume increased whilst the systematic risk in the banking industry decreased after XBRL mandate. The findings infer that bank shareholders benefit from mandates requiring digital business-to-government reporting through greater transparency and reduced uncertainty surrounding regulatory risk.

Overall, this body of research highlights the central role of regulators in establishing legitimacy for proposed digital reporting solutions and underlying technology, but also for driving the implementation work and subsequent adoption. Initially, regulators constructed the case for their digital reporting projects based on the premise that companies would appreciate the digital business-to-government reporting benefits and voluntarily adopt it as a superior alternative to traditional forms of reporting to government. The research shows that voluntary approaches were ineffective and that wider adoption only occurred as a result of regulatory mandate. Echoing arguments made in some of the capital markets and reporting behaviour studies concerning the critical role of corporate information infrastructure and supporting applications, this research also provides evidence concerning the critical role of XBRL-enabled applications in the adoption of digital business-to-government reporting.

Most of this research has focused on the major digital XBRL-based applications of business-to-government reporting in France, the UK, the US and multi-agency projects in Australia and the Netherlands using qualitative approaches. This leaves scope for research

examining the construction and implementation across other regulatory functions in other jurisdictions. Importantly, the business-to-government reporting projects discussed in this research have been in operation for several years. Further research could look into questions concerning how regulatory compliance has changed since implementation for both filers and regulators. Specifically, an area of increasing interest is how digital business reporting information is used by authorities to fulfil and enhance their regulatory mandates. Studies of the burgeoning field of 'RegTech' and 'SupTech' offer a potentially interesting avenue in which to explore how digital corporate data can transform corporate monitoring and supervision. This may also provide an opportunity to link to and further understand those studies suggesting that firms are changing their reporting behaviour due to their perceptions of enhanced regulatory monitoring enabled by digital reporting.

9. Concluding discussion

XBRL-based digital corporate reporting calls for significant changes to corporate reporting infrastructure which are purported to improve the accessibility, transparency, accuracy and comparability of information reported in corporate reports. These perceived advantages initially motivated regulators across the world to develop and implement digital corporate reporting projects to reduce the burden of regulatory compliance and improve regulatory monitoring and surveillance. In some cases, these developments were followed by mandates for preparers to adopt digital reporting by filing their statutory corporate reports to regulatory authorities in digital XBRL-based formats.

Much research has been published that has attempted to assess the costs and benefits of XBRL-enabled digital corporate reporting. Given that existing research is often fragmented, and noncumulative, we offer systematic review of the field. Driven by our desire to improve current understanding of the broader consequences of digital corporate reporting, we take an eclectic approach in reviewing published evidence in an attempt to synthesise existing digital corporate reporting impacts. The key aim has been to look at the broader implications of the evidence for key stakeholders across the reporting information supply chain, including users and the preparers of digital corporate reports, regulators, and standard-setters. We therefore appraise the literature to develop a common foundation of evidence, and seek to recognise linkages and gaps in extant studies in order to reconcile inconsistent findings and identify avenues for future research. In

doing so, we assess what stakeholders in the corporate reporting supply chain stand to gain (or lose) from XBRL-based digital reporting. Reviewing and appraising current evidence of the consequences of the early XBRL-based digital reporting implementations can also help better inform both ongoing and new digital corporate reporting policy-making initiatives.

We structured our analysis based on the different stages of the digital corporate reporting process, including digital corporate reporting regulation and standard-setting, impact on firm behaviour, usage of digital reporting information, capital market consequences of digital corporate reporting, impact on audit and assurance, and business-to-government digital reporting.

In the first stage of the information supply chain, regulations and accounting standards must be adjusted to cater for digital corporate reporting. Early research in this field focused on the rationale provided for digital reporting mandates whilst later studies examine the development of reporting taxonomies, an essential element of infrastructure required for digital corporate reporting. These later studies show how digitisation is actively influencing both the content of the standards, but also standard-setting processes, contrary to the earlier claims that digitisation is a passive, mechanical activity that does not impact accounting standards nor the meaning of corporate reports. However, many research questions remain, including the deeper understanding of nature of negotiations that occur amongst stakeholders and institutional effects in processes of accounting standard-setting, taxonomy development, and corporate reporting. Further research could examine ongoing regulatory and policy developments to understand how different taxonomies are constructed and how those taxonomies interact with accounting standards. Studies could also compare the effect of digital mandates on reporting practices between those jurisdictions that allow firms to freely extend the taxonomy with those jurisdictions that place some restrictions on taxonomy extensions.

In the second stage of the reporting information supply chain, research has focused on how digital reporting impacts the behaviour of preparers. Studies have found that the adoption of digital reporting in the US is associated with changes in the timeliness of reporting, the nature and extent of footnote disclosures, and changes in firm's reporting behaviour relating to reporting choices indicative of earnings management. Whilst research has highlighted the different ways in which firms prepare digital reports, future research could analyse how different

implementation approaches interact with observed changes in reporting behaviour. This may also consider the different regulatory regimes and approaches to taxonomy development that can influence how reporting firms react in their use of reporting extensions. Additionally, since digital corporate reporting facilitates capturing data at a granular level, examining tagged digital reporting data can improve understanding of how preparers are complying with accounting standards and policy choices in practice.

In the third stage of the reporting supply chain, focus is placed on the usage of digital reporting information. A number of experimental research studies have attempted to address how digital reporting information is used and how it may affect decision making. Future research could seek to offer further understanding on whether and how the usage of digital corporate reporting may be different from the corporate information communication channels currently used by contemporary investors and others. Further experimental research could also focus on designing experimental instruments that reflect the conditions in which professional and nonprofessional investors use digital corporate reporting information (e.g., large scale comparisons) and on how the nature of such information affects how investors make decisions.

In the fourth stage of the reporting information supply chain, a large body of research searches for associations between the adoption of digital reporting and capital market indicators. In general, these studies have evidenced that XBRL-based digital reporting is associated with improvements in a range of capital market indicators that proxy for conceptions of information efficiency and effectiveness. This evidence supports the proposition that digital reporting improves the information set available to capital market participants and reduces their information processing costs, which enhances their fundamental analyses and thereby improves market efficiency. A subset of studies that examine these associations between different groups of capital market participants, such as larger and smaller professional investors, suggest that the effects of digital reporting on capital market indicators are influenced by the utilisation rather than the mere presence of digital information.

A related stream of research examines how differences in the nature of digital reporting are associated with changes in capital market indicators. Studies offer contrasting evidence on whether more customised digital reports (i.e., using more taxonomy extensions) are associated with improvements in capital market indicators based on their ability to convey more

information and reduce information asymmetry, or whether they are associated with a deterioration in indicators resulting from a reduction in information comparability and an increase in information processing costs.

Future research and complementary methods could therefore usefully provide further advances in this area. Whilst capital market and the preparer behaviour research streams have both made important contributions to improve current understanding of digital corporate reporting effects, the research somewhat 'black-boxes' the chain of association and causality. More studies focused on how XBRL technology is changing disclosure patterns and practices may prove useful. Complementary research focused on the usage of corporate information could offer insight on how digital reporting information is used, and interacts with existing information infrastructures such as proprietary databases and specialised data processing applications. This may illuminate how the benefits of digital reporting are distributed across different types of users, and how more customised or more comparable digital reporting influences investment decisions.

The fifth stage of the reporting supply chain focuses on audit and assurance implications of digital corporate reporting. Given the current lack of audit requirements, research has predominantly looked at what visions of audit might be technologically possible and what might be adopted. As usage of digital reporting continues, research can examine how audit and assurance processes are changing as a result of XBRL-based reporting, and consider the implications of change. Given related advances in analytics and 'big' data analyses, there is greater scope to audit the whole population of transactions, beyond traditional samples. The impact of such changes on professional practices, institutions and relations offers scope for further interesting research.

The sixth and final stage of our analysis focuses on business-to-government digital reporting research. Reporting in digital, structured, reusable formats offers a compelling case for regulators as it facilitates compliance monitoring, surveillance, and risk assessment across large samples. Although regulators around the world have been key drivers of digital reporting, research into the impact of digital reporting in the regulatory domain has been limited to a small number of studies that report early, post-implementation evidence of regulatory reporting. These studies, focused on single and multi-agency projects, generally find that digital reporting offers

improved compliance monitoring due to improvements in data quality, and a reduction in the administrative burden for reporters, once they switch to the new digital reporting system, due to a simplification in compliance processes.

Research opportunities remain when considering how traditional regulatory monitoring processes have changed; how the changes are linked with the reported benefits over time, and the nature of unanticipated consequences resulting from the implementations. Further research in the nascent fields of 'RegTech' and 'SupTech' can explore how digital reporting can transform corporate monitoring and supervision.

Whilst the introduction of digital corporate reporting and XBRL technology has progressed in different ways across different jurisdictions around the world, it is clear from our review that regulatory mandates have strongly catalysed infrastructure development and adoption amongst preparers of digital corporate reports and users of digital corporate information. Although early adoption was 'pushed' onto companies by bodies and consultants with a stake in XBRL, it is likely in the future that digital reporting is more likely to be 'pulled' by regulators able to leverage the benefits it offers for corporate monitoring.

By considering research on digital reporting across a range of different fields based in different paradigms and using different methods, common themes emerge. The impact of digital corporate reporting is influenced by how it interacts and changes the current infrastructure of reporting firms, regulators and information users. These interactions and changes move our understanding of the impact of corporate reporting beyond one of technological determinism – standard-setters, regulators, reporting firms, information users and auditors are likely to be shaped but are also shaping the evolution of digital reporting. Additional research needs to looks at the implications of these interactions and changes on the accounting practice and the profession.

Whilst our review is constrained and limited by our selection, interpretation and presentation of the body of empirical research on digital reporting, we hope it offers food for thought and arguments to be contested.

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Figure 1. IFRS Taxonomy and IFRS Standards excerpts

IFRS Taxonomy excerpt	IFRS Taxonomy and IFRS Standards excerpt

…
 	
`<xsd:element id="ifrs-`
`full_CurrentAssets"`
`name="CurrentAssets"`
`nillable="true"`
`substitutionGroup="xbrli:item"`
`type="xbrli:monetaryItemType"`
`xbrli:balance="debit"`
`xbrli:periodType="instant"/>`
 	
…	

(a)	(b)

Figure 2. IFRS Foundations Annual Report 2016 - Excerpts (IFRSF, 2016)

Excerpt of Digital IFRS Foundation Annual Report in XBRL format	Excerpt of IFRS Foundation Annual Report in HTML format using iXBRL

…
 	
`<ix:nonFraction`
`contextRef="e2016"`
`format="ixt:numcommadot"`
`name="ifrs-full:CurrentAssets"`
`unitRef="Sterling" decimals="-3"`
`scale="3">15,618`
`</ix:nonFraction>`
 	
…
 	
`<ix:nonFraction`
`contextRef="e2015"`
`format="ixt:numcommadot"`
`name="ifrs-full:CurrentAssets"`
`unitRef="Sterling" decimals="-3"`
`scale="3">17,501`
`</ix:nonFraction>`
 	
…	

(a)	(b)

Table 1. Capital market indicators and digital corporate reporting

Capital market indicators	Measure	Setting	Expectation	Empirical findings	Study
Cost of equity capital	Based on OJ Model (Ohlson and Juettner-Nauroth, 2005): the cost of equity capital was calculated based on near and long term earnings growth, expected dividend per share, abnormal earning growth, and price per share.	China	Expected to decrease	Supported	Chen et al. (2015)
Cost of debt	Cost of Debt proxy: ratio of interest on debt maturing within 3 years after fiscal year end by S&P domestic credit rating.	US	Expected to decease	Supported	Lai et al. (2015)
Borrowing cost	Loan spread measured as firm's loan's interest rate less the LIBOR benchmark.	US	Expected to decrease	Supported	Chen et al. (2018a)
Information asymmetry	Monthly relative spread of quoted bid and ask share prices calculated based on Boone (1998) model.	South Korea	Expected to decrease	Supported	Yoon et al. (2011)
Information asymmetry	Change in standard deviation of daily stock returns for 30 days before and after report filing dates.	US	Expected to decrease	Supported	Kim et al. (2012)
Information asymmetry (2 day window after filing)	Average price impact event less average price impact benchmark, where price impact is twice the signed difference between the quoted midpoint five minutes after the transaction and the time of trade-quoted midpoint, scaled by the time-of-trade quoted midpoint. The average is based on all valid trades for the firm during the day using data from NYSE's Trade and Quote Database.	US	Expected to increase	Supported	Cong et al. (2014)
Information asymmetry	Post-earnings announcement drift (PEAD) used as proxy of information asymmetry. PEAD measured as buy-and-hold abnormal return, a function of return on a company on a specific trading day and average return in the industry to which the company belongs on the earnings announcement day. Calculated for three different windows between 1-120 days.	China	Expected to decrease	Supported	Chen et al. (2017)
Information asymmetry between local and non-	Measured as change in bias of institutional investors for local investments pre- and post-XBRL adoption. An investment is	US	Expected to decrease	Supported	Li et al. (2020)

local investors	defined as 'local' if an institutional investor's headquarters is located in the same (US) state as the target investment firm's headquarters. Excess local institutional ownership in the state of firm headquarters is measured as the difference between the percentage weight of a firm's local institutional holdings in its overall institutional holdings and the percentage weight of the state's institutional investors in the aggregate institutional portfolio. Effects are stronger for firms with greater information processing costs, fewer disclosures and lesser analyst following.				
Information environment quality and moderating effect of national culture	Analyst forecast accuracy is used as proxy of information environment quality and measured as the negative of the forecast error which is a function of absolute difference between actual EPS and consensus forecast EPS by year-start stock prices (Barniv, 2009). National cultural values used include professionalism, uniformity, conservatism, and security and are based on country scores from Braun and Rodriguez (2008).	Belgium, Italy, Japan, Singapore, South Korea, Spain	Moderation effect of culture values expected to be positive for uniformity, conservatism, security, and negative for professionalism	Supported	Liu and O'Farrell (2013)
Information inefficiency	PEAD, depicted as a market anomaly, is measured as the market-adjusted returns calculated from the buy and hold returns beginning on day i and ending on day j, less the buy and hold value-weighted market returns for the same period. Calculated for four different windows between 1-60 days.	US	Expected to decrease	Partially supported (PEAD is reduced following good news in the post-XBRL mandate period)	Efendi et al. (2014)
Information efficiency	Event returns volatility measured as the sum of the absolute values of daily abnormal returns around filing dates (1-2 days before and after XBRL filing). Information efficiency measured as the absolute deviation between actual return and expected return around filing dates (1-2 days before and after XBRL filing).	US	Both measures expected to decrease	Supported	Kim et al. (2012)

Information efficiency	Stock price informativeness used to capture whether XBRL filings reduced information processing costs using three different measures: - idiosyncratic volatility, estimated as stock return variation that is not attributable to any market-wide or industry-wide factors, but rather, to firm-related fundamentals. - price impact, estimated as coefficient from regressing the absolute daily stock return on daily trading volume. - analyst forecast dispersion estimated as annual average of standard deviation of forecasted EPS scaled by the absolute mean forecast EPS for each reporting quarter.	US	Expected to increase Expected to decrease Expected to decrease	Supported Supported Supported	Huang et al. (2020)
Trading volume (2 days window after filing)	Average trading volume event less average trading volume benchmark, where trading volume is the sum of shares traded in each transaction based on data from NYSE's Trade and Quote Database.	US	Expected to increase	Supported	Cong et al. (2014)
Market reaction around 12 legislative events leading to XBRL mandate	- Cumulative abnormal return for the overall market during the event window (3-day window, on and around event) relative to daily US market returns over a benchmark period for: - firms with less accessible information (measured as the number of analysts who provide at least one forecast over the prior year) - firms with greater information asymmetry (market depth measured as average magnitude of daily share returns divided by the dollar trading volume over the prior year; bid-ask spread measured as the annual average of daily ask less bid price divided by closing price over the fiscal year) - firms with greater financial reporting complexity (measured by number of business segments in different industries and financial report document file size) - firms with greater financial reporting opacity (three year moving sum of the absolute value of annual discretionary accruals)	US	Expected to increase Null Null Expected to increase	Supported Null rejected Null rejected Supported	Chen et al. (2018b)
Earnings-related stock price reactions	- Cumulative abnormal stock return in the 3-day window around the filing date. - Number of analysts following the firm.	US	Expected to increase Expected to	Supported Supported	Yen and Wang (2015)

			increase		
Information processing cost	Information processing costs proxied by firm share return synchronicity with market returns derived from the natural log transformation of R^2 from estimating a firm-year regression of weekly firm share returns on market and industry returns.	US	Expected to decrease	Supported	Dong et al. (2016)
Shareholder profile	Assessed in terms of breadth of shareholder ownership which is measured as the natural log of the total number of common shareholders in year $t + 1$.	US	Expected to increase	Supported	Kim et al. (2018)
Shareholder profile	Assessed in terms of foreign institutional investors' shareholding, measured as number of tradable and non-tradable shares held by foreign investors at the end of the year.	China	Expected to increase	Supported	Wang and Seng (2014)
Trading responsiveness of smaller users of information relative to larger users of financial information	Assessed by looking at three aspects of trading responses of large versus small institutions to firms' 10-K reports before and after the XBRL mandate: - abnormal trading volume, measured as dollar volume of shares traded. It is calculated as the average daily dollar value of shares of a firm traded by an institution over the three-day window centred on the firm's 10-K filing date (day 0) minus the average daily dollar value of shares of the same firm traded by the same institution over the pre-filing period of days -10 to + 1. - response speed to 10-K information, measured as the total dollar volume of shares of a firm traded by an institution during the three-day period centred on the 10-K filing date (days -1 to +1), divided by the total dollar volume of shares of the same firm traded by the same institution over the seven-day period starting from the day before the filing date (days -1 to + 5). - decision to trade or not trade around 10-K filing dates, measured as a dichotomous variable. Assigned 1 if abnormal trading volume is positive, 0 otherwise. The average value of this variable is higher in the post-XBRL period compared to the pre-XBRL period if an institution expands its 10-K information-induced trading coverage in the post-period relative to the pre-period.	US	Expected to increase	Supported	Bhattacharya et al. (2018)

Investment risk	Assessed as investor's expected future crash risk. The steepness of the option implied volatility (IV) skewness is used as a proxy for ex ante, expected crash risk. It is measured as the difference between the IV of out-of-the-money put options and the IV of at-the-money call options.	US	Expected to decrease	Supported	Zhang et al. (2019)
Value relevance	Uses Ohlson (1995) value relevance model to examine the association between book value per share, EPS, R&D expense, goodwill, property, plant and equipment, and share price movements.	US/Japan	Expected to increase	Supported	Shan and Troshani (2020)