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Internet financial reporting, infrastructures and corporate governance: An international analysis

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Abstract

Using a panel of 44 developed and developing countries, this paper analyzes the macro-environmental determinants of Internet financial reporting (IFR) within the context of corporate governance models, and thus, addresses the question of which governance model's disclosure demands are more associated with IFR. Both physical and institutional infrastructures are shown to be important determinants of a country's adoption of IFR. Along with the corporate governance structure, these infrastructures combine with IFR to enhance transparency and market efficiency, both major goals of financial reporting and disclosure. These findings point to requisite environmental infrastructures governments must provide or foster for firms within their confines to effectively adopt IFR and thus, reap the attendant benefits of disclosure. They also contribute to the debate on harmonization of international financial reporting by showing that requisite environmental infrastructures are a precondition for the success of any reporting system.

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1. Introduction

The realization of Internet's enormous benefits has led to its incorporation in many areas of production. Capital markets governance is one such area, as governments and regulatory bodies across countries have encouraged some Internet-based financial reporting and disclosure (e.g., SEC, 2002; Lymer and Debreceny, 2003, p. 104; and Regulation FD in the US). Financial reporting and disclosure are complementary means of ameliorating information asymmetry between managers and parties contracting with their firm, including shareholders, lenders, suppliers, customers, etc. (Ball, 2001) – and the resultant decline in opacity enhances financial markets efficiencies and reduces both cost of capital and investors' risks, among other advantages. Internet financial reporting (IFR) embodies this apt definition of "total disclosure",[1] and its adoption is a function of the demand for material information on firms by stakeholders. This demand is in turn systemically determined by the dominant corporate governance model in the country. Furthermore, the extent to which material information reaches stakeholders in a good form and time depends largely on the availability of requisite institutional and physical infrastructures that underpin IFR in the country.

The literature on financial reporting and disclosure depicts IFR as an embodiment of total disclosure that is aimed at reducing information asymmetry between shareholders and managers of a firm (Ashbaugh et al., 1999; Debreceny et al., 2002). It is an important way of resolving agency problems. Agency problems arise when managers entrusted with the responsibility of maximizing shareholders' wealth run the firm in ways that shareholders are unsure that managers' decisions are value-enhancing and not self-serving. These agency problems, when manifested

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[1] Ball (2001) defines "Total disclosure" to include both auditable company information (verifiability: relating to income statement, balance sheet and other financial statement items) and non-auditable information (future cash-flow-altering expectations: relating to R&D, M&A, managers' earnings forecast, and new market events). These varied kinds of information require a dissemination mechanism such as IFR which is characterized by content flexibility, reach, speed and economies of scale; particularly where stakeholders are dispersed and information asymmetry is important.

in value-decreasing investments or high opacity, tend to galvanize shareholders into the kind of activism aimed at increasing information on managerial decisions (Demsetz and Lehn, 1985; Rediker and Seth, 1995). Such transparency by management enhances the prudence of managerial decisions and congruency of shareholders and managers' interests; and ultimately mitigates agency costs (e.g., in the form of lower cost of capital) (Jensen and Meckling, 1976). In fact, the financial reporting and disclosure literature document a negative correlation between firms' increased disclosure and indicators of information asymmetry between firms and their stakeholders (Frankel et al., 1995; Botosan, 1997; Chen et al., 2007). Frankel et al. (1995) and Chen et al. (2007) highlight the point that the ultimate goal of increased disclosure is the reduction in cost of external finance (i.e., efficiency of financial markets) – whether this works through reduced information asymmetry premium, reduced liquidity premium or reduced agency cost that is attributable to enhanced corporate governance.

Guided by recent works on financial reporting and disclosure (Ball et al., 1999, 2000a,b; Kothari, 2000), we link the adoption of IFR to the corporate governance model for which it is most likely to meet the disclosure imperatives – i.e., under the *diffuse shareholder governance model* versus the *concentrated stakeholder ownership model*.[2] In the process, the need for either a governance model shift or a disclosure content modification for the adoption of IFR is highlighted. Potential requisite infrastructures for effective financial reporting and disclosure are discussed, with a sketch of how these infrastructures are linked to adoption of IFR.

Three key questions emanate from this framework of IFR adoption: (1) How important are macro-environmental factors in facilitating the adoption of meaningful IFR by firms in a country? In other words, upon accounting for the efficiency gain motivation for IFR adoption by individual firms, will firms in countries with varying enabling macro-environments be equally likely to adopt IFR? For IFRs to be "meaningful" and thus consistent with its depiction as an enhancer of total disclosure, it must, in content and form, be at par or better than paper-based financial reporting. (2) Do these varying cross-country macro-environments' resultant different corporate governance structures correlate differently with IFR adoption? For instance, given the agency literature's postulation that in the presence of information asymmetry managers are likely to choose a set of decisions that maximize their own utility, the adoption of IFR may be more useful in an environment characterized by the separation of ownership and control than otherwise. That is, the cross-country differences in corporate governance models and enabling physical and institutional infrastructures suggest a likelihood of international variation in the adoption of IFR, and consequently might require that it be discriminately embarked upon. (3) Upon taking into account prevailing macro-environments of a country, the dominant national corporate governance structure, and firm-specific efficiency gain motivations for adopting IFR, do firms' adoption of IFR still achieve the ultimate goal of enhanced efficiency of production (reduced cost of capital)?

These three main questions are subjected to robust empirical examinations. Briefly, there is strong evidence that both physical and institutional infrastructures determine the propensity of adopting IFR by a country, with four of the analyzed macro-environmental factors – computer/telecommunication infrastructure, financial market scope (economic), political and legal institutions – dominantly influencing a firm's adoption of IFR, even in the face of firm-specific efficiency gains of IFR usage. Further, the national corporate governance structure, which partly determines reach/speed of dissemination and content details of material information provided to firms' stakeholders, is found to play a role in the adoption of IFR. Importantly, IFR, as an embodiment of total disclosure, is found to retain its ultimate essence of reducing cost of capital even after considering other relevant factors such as macro-environmental infrastructures and dominant national corporate governance practice.

This study emphasizes the corporate governance context and thus, the agency cost mitigation of financial disclosure, by integrating the literatures on IFR adoption (Ashbaugh et al., 1999; Debreceny and Gray, 1999; and others) and the importance of financial disclosure and its linkages to infrastructure requirements (Ball et al., 1999; Kothari, 2000; Ball, 2001).[3] It examines financial disclosure across 44 governance environments (12 developed economies and 32 developing economies) and thus, provides useful comparative analysis. It breaks new ground by considering macro-environment predictors of firms' propensity to disclose financial information on the Internet. Prior works in the area focused primarily on firm-level analysis (Ashbaugh et al., 1999; Debreceny and Gray, 1999; Ettredge et al., 2002).[4] Importantly, we examine the robustness of the accepted notion that increased voluntary disclosure, by mitigating information asymmetry, ultimately reduces cost of capital (i.e., enhances market efficiency). Finally, the findings here contribute to the debate on harmonization of international financial reporting systems by showing, in agreement with Kothari (2000), Ball (2001) and others, that whichever reporting system is adopted will likely be ineffectual unless the enabling environments are provided first.

In the remainder of the paper, the background of the paper is presented: wherein the theoretical framework that underlines the pertinent testable hypotheses is laid out. Section 3 discusses the derivation of hypotheses. Next, the study's data are described.

[2] This grouping of corporate governance forms into two models is based largely on the prevalent corporate ownership structure in a country, as articulated by Kothari (2000): The diffuse shareholder model describes a governance arrangement where the corporation is owned mainly by widely dispersed, individually atomistic shareholders. The concentrated stakeholder ownership model describes governance arrangements where the corporation exhibits concentrated ownership by families, banks, government agents and workers.

[3] This integration is akin to Li's (2005) contextualization of information and communication technology application within relation-based and rule-based governance systems.

[4] Debreceny et al. (2002) is a notable exception. They consider the IFR-adopting firm's IT and disclosure environments in their analysis.

Section 5 presents tests and discussions of results. Section 6 concludes the paper by highlighting important theoretical and policy contributions, and areas needing further research.

2. Background and theory

At the onset, the pertinent question to ask is: why mandate that public companies report material information to all current and potential stakeholders of these companies? One of the universal key responsibilities of governments is to protect their citizens against harm and exploitation, including ensuring that firms that are permitted to source funds from the public provide to the public all material information. If all material information is to be made available to "all needing it," what medium efficiently disseminates the information and thus, fosters best corporate governance? From the standpoint of economics and social capital maintenance, these questions are universally valid. The Internet has undeniable provisions that add value to the disclosure process of firms, there are considerations to attaining these provisions that require we ponder the nature and relative proximity of target information-recipients to management and the adequacy of requisite infrastructures for effectively disseminating disclosures. Thus, the adoption of Internet technology in the disclosure process appears to be a function of these considerations: the corporate governance context and the adequacy of enabling infrastructures.

Recalling the well-known asymmetric information problems in financial markets, one can surmise that disclosure mechanisms which do not strive for total disclosure are likely to exacerbate the market failures or consequences attributable to information asymmetry – i.e., high cost of capital (Myers and Majluf, 1984; Greenwald et al., 1984; Stiglitz, 1985; Diamond and Verrecchia, 1991; and others). Therefore, the quest is about effectively limiting the asymmetric information problem that is characteristic of financial markets, and ascertaining which corporate governance model benefits more from the IFR's implied wideness of reach, comprehensiveness of content, and voluntary nature of disclosure and dissemination?

2.1. Advantages of Internet financial reporting (IFR)

To appreciate the complementary features of Internet as a disclosure dissemination medium, let us first look at some of its advantages. With increased globalization of production activities, viable and competitive firms now source external finance both domestically and internationally. Internet serves as a fantastic medium for delivering publicly listed firms' material information in a timely fashion to foreign and often sophisticated investors.

In the same vein that it provides timely release of material information to widely distributed current and potential investors, some Internet reports of companies provide software that permits Internet users to do on-the-spot and interactive financial analyses and communicate to firms in real-time at a relatively inexpensive cost. IFR permits firms to cheaply disseminate other company-specific information. It offers massive opportunities that are beyond investors-relations related benefits. As Wagenhofer (2003) notes: "By placing financial information on the firm's website, users can search, filter, retrieve, download, and even reconfigure such information at low cost in a timely fashion. The Internet allows for hyperlinks, search engines, multimedia, and interactivity. . . the Internet opens up new disclosure opportunities". Moreover, Wagenhofer notes that IFR offers equal access to all users and reduces the information advantages of some institutional investors relative to others (democratization of capital markets). In this study, we conservatively define IFR as not only containing equivalent detailed information as conventional paper-based reports, at the least, but also as a report presented in a format that enhances accessibility and/or flexibility of usage (Ettredge et al., 2002). A fuller definition follows in Section 3.1.

2.2. Challenges of Internet financial reporting

Amidst these IFR advantages, exist some limiting traits: Internet is more accessible to sophisticated current and potential stakeholders than to all in the public. This can have important securities markets efficiency-decreasing consequences (Tong, 2007). A special issue of the *European Accounting Review* (1999) reports on the use of Internet for financial disclosure in Europe. The consensus is that many large firms are increasingly using the Internet to voluntarily disseminate information than medium and small firms. The content issue of IFR is also highlighted as an important impediment.

Lymer and Debreceny (2003) provide one of the most comprehensive analyses on the content challenges of IFR in terms of possible breaches of the integrity of audited reports. They examine these challenges in countries with developed securities markets, where firms have voluntarily adopted IFR (e.g., US, UK, Canada, etc.). They note that unlike paper-based reporting, IFR (1) moves as well as leaves undefined the boundaries of auditors' effective authentication of financial reports. (2) The technology of the IFR, while permitting the disclosure of more information at more affordable costs than paper-based reporting, can impinge on the integrity of the information. Debreceny and Gray (1999) summarize this aspect of IFR challenges by the following questions: (i) Is the audit opinion safe from change by the client or other party? (ii) Should the Web-based auditor's report reside at the auditor's website? (iii) What weight should be given to an auditor's report date when documents on the Web can be changed?

Lymer and Debreceny suggest these challenges are responsible for the empirical finding that less than 40% of the hitherto surveyed IFRs contain auditor's endorsement. For interested readers, note that possible solutions proffered for these content related challenges of IFR are framed in the form of plugging the gap between IFR and the Internet reporting technology (IASC, 1999; Debreceny and Gray, 2001; Lymer and Debreceny, 2003, pp. 114–117).

A set of environmental challenges of IFR, including the digital divide, financial market scope, legal and political environment, is a major focus here. And the extent to which they are

considered for the successful adoption of IFR is articulated in the following conceptual model.

2.3. A theoretical framework of IFR adoption

The theoretical framework sketched here posits that the effective adoption of IFR is a function of both the corporate governance model that demands a specific kind of disclosure (content, reach and speed of delivery) and the requisite infrastructures which support that specific kind of disclosure. Inspired by Denis (2001), corporate governance is defined here as the set of identifiable arrangements that determine how the management of a corporation (agent) ensures that stakeholders' (equity holders, creditors, suppliers, government and employees) claims on the firm are not materially different than their intrinsic values. From this definition emanates three salient deductions: (1) a corporation is characterized by the separation of controllers and stakeholders, which raises the need for alignment of interests – agency issues; (2) the need for communicating controllers' effort in optimizing stakeholders' claims – disclosure issues; and (3) the realization that the composition of stakeholders affects management of issues 1 and 2 – ownership structure issues. These three issues form the basis of a governance model's link to effective adoption of IFR.

Issues 1 and 2 point to the imperatives for financial reporting and disclosure (Stiglitz, 1985; Diamond and Verrecchia, 1991; Levitt, 1999; La Porta et al., 2000; Mishkin, 2006; and others), while issue 3 suggests there will be variation in the details of the disclosure – heterogeneous information demands (Kothari, 2000; Ball et al., 2000a,b; Ball, 2001; and others) and thus, variation in the mode of disseminating the disclosure – arm's length and dispersed (IFR) or private (meeting reports, conference calls, and other personal communication media). It is therefore evident that IFR is a function of the prevailing corporate governance model and the availability of requisite institutional infrastructures that adequately support total disclosure. These infrastructures are, in turn, partly determined by the required details of the disclosure. The following schematic encapsulates these relationships. For the purpose of this schematic, Kothari's (2000) grouping of corporate governance models into the *diffuse shareholder* and the *concentrated stakeholder ownership models* is adopted.The contextualization of IFR adoption points to its newness as an information disclosure technology.[5] However, its level of adoption across countries varies; thus, adoption economics offers guidance on possible reasons for cross-country variation in IFR adoption (Bass, 1996; Li and Pinsky, 2005; Zattoni and Cuomo, 2008; and others). Bass' (1996) leading work and the bulk of adoption economics in the marketing literature focus on how consumers adopt new products. One can therefore view firms as the consumers of this new disclosure technology and ask what would motivate them to adopt it? This viewpoint suggests that firm-specific characteristics can explain why individual firms adopt IFR. Viewing adoption with a wider lens, Zattoni and Cuomo (2008) note that the adoption of new practices within a system may be explained either by efficiency gain possibilities or by social legitimation (institutional) pressures. Efficiency gain can be explained by the motivation for firms' voluntary and effective disclosure of information – i.e., reduction of informational opacity premium in cost of capital, as elucidated in Section 1. Social legitimation pressure is that "taken-for-grantedness" which suggests adoption of a new technology because it is socially expected, driven by a confluence of institutional dictates. The efficiency gain motivation points largely to firm-specific reasons for adopting a new technology while social legitimation implies that environmental factors also determine adoption of a new technology.[6]

Among others that have studied the adoption of IFR, Wagenhofer (2003) is prominent in enumerating the efficiency gains that accrue from Web-based dissemination of company information to its stakeholders and customers. Current works on IFR, have focused on this efficiency gain motivation and have found some consensus firm-specific determinants of IFR adoption (e.g., Ashbaugh et al., 1999; Debreceny and Gray, 1999; Lymer, 1999; Debreceny et al., 2002; Ettredge et al., 2002; Wagenhofer, 2003).

To sum up, we have sketched the link between the new disclosure technology (IFR), transparency and corporate governance enhancement; and thus, point to the role of institutions in the social legitimation (expectedness) of IFR adoption. Ball (2001) provides guidance on the possible nexus between an effective disclosure (embodied by IFR), and requisite environmental infrastructures for financial reporting and disclosure (total disclosure). He posits that the properties and quality of total disclosure are a function of the complementary interactions of the country's legal, economic and political infrastructures. In the following section, we elaborate a bit on the theoretical underpinnings of linkages sketched in Fig. 1, and present testable hypotheses emanating from the conceptual model.

3. Hypotheses and variable definitions

Ball's (2001) guidance enabled us to sketch the nexus between total disclosure (embodied by IFR), and requisite environmental infrastructures for total disclosure: labeled "Hypothesis I" in Fig. 1. To appreciate hypotheses around adoption of IFR, it is important that we define IFR first.

3.1. Definition of IFR

We define a meaningful adoption of IFR by partly following Debreceny et al. (2002, pp. 282–385). Using the top 30 listed

[5] According to Li and Pinsker (2005), IFR can be considered a new technology because it is a practice and material artifact which its adopters (publicly traded firms) perceive to be new (Ashbaugh et al., 1999; Debreceny et al., 2002; Ettredge et al., 2002).

[6] It is worth noting at this juncture the likelihood of conflicting motivations for IFR adoption by a firm. A firm in a country characterized by unstable and ineffective governance environment (political institution) and inadequate computer/telecom infrastructure might find that the efficiency gain of adopting IFR (as articulated by Wagenhofer, 2003) is but a possibility contingent on yet unavailable infrastructures.

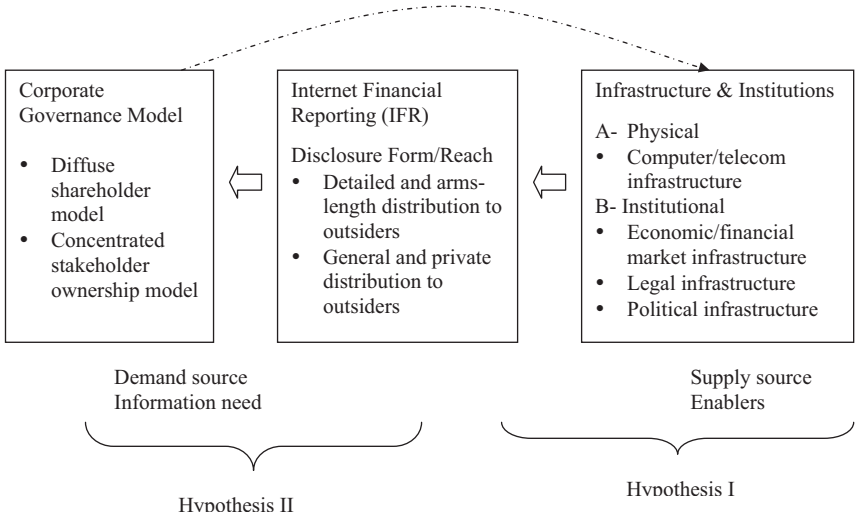

Fig. 1. This figure conceptualizes adoption of IFR within the context of macro-environment factors and dominant national corporate governance structures. Hypothesis I subsumes tests of Eq. (1) while Hypothesis II reflects tests of Eq. (2).

firms, by market capitalization, reported for each of the sample countries from the Osiris company reports of Bureau van Dijk for the period 1990–2008, we search company Web sites for availability of summary financial reports or better for each year. If a company has financial reports as detailed as those in traditional paper-based reports (and/or more dynamic, as with hyperlinks and videos), and they are presented in HTML and/or downloadable PDF forms, the firm is categorized as using IFR (identified as 1); if the Web reported content comprises either summarized financial reports or income statement and/or balance sheet in only HTML or PDF form, the firm is reported as partially reporting (identified as 0); and if it has no Web based report it is identified by 0. Then a country is classified as a meaningful IFR country (=1) if the number of firms identified as 1 as a proportion of the 30 top capitalization firms is greater than the median of this same ratio for all firms in the same economic development country-group (i.e., a developed or an emerging economy), and classified as a non-IFR country (=0) otherwise.[7]

This measurement scheme for IFR is conservative because we seek to classify a country as having adopted meaningful usage of IFR by the practice of 30 of its most sizeable firms (however these top 30 firms in most countries, particularly emerging market ones, dominate their national industrial space).[8] Our measurement scheme is further inspired by Ettredge et al. (2002) who observe that firms which publish their reports in both HTML and PDF formats are those that seek to exploit fully the capabilities of the Internet for financial reporting and disclosure. Alternatively, we simply report each country's IFR profile by computing the number of firms identified as 1 as a proportion of the 30 top capitalization firms. This form is used for identifying the evolving nature of IFR adoption among countries, as well as in some of the empirical tests.

3.2. Macro-environmental determinants of IFR adoption

Political environment. While discussing the economic importance of financial reporting and disclosure, Ball et al. (1999, 2000a,b) and Ball (2001) surmise that pushing for adoption of any form of accounting reporting standards is insufficient for achieving total disclosure if the political environment's influence on disclosure is not considered. Among other lacking complementary environmental infrastructures, these papers show how five East Asian countries (Hong Kong, Malaysia, Thailand, Singapore and China), respectively, failed to achieve efficient disclosure despite adopting best practice accounting reporting standards. Political environments that fostered cronyism, family pyramidal ownership of firms, corrupt contract enforcement, unconstrained granting of discretion to managers of state-owned enterprises to manipulate earnings reports for political expediency, etc., were counted important reasons for these failures. Such political environments lend themselves to private "within few block stakeholders" dissemination of disclosure, as opposed to the arms'-length dissemination mechanism (IFR) required by diffuse shareholder ownership environment from where the

[7] We specifically employed an accounting professional that is quite familiar with various frames of financial reports and what constitutes standard contents. Several search samples were examined for validation before search and classification exercise proceeded. Further, note that a few of the countries, particularly emerging market economies, have less than 30 listed firms; therefore, the base for computing percentage of IFR adoption was less than 30 for such countries.

[8] Our conservative IFR measurement is reasonably conceptualized and guided by extant literature. Like all empirical constructs it is not full-proof; a possible weakness is that a country with many listed companies (say >100 firms) may have all its top 30 firms using IFR because by virtue of the high fixed cost of adopting IFR mainly large firms have the wherewithal, whereas the top 30 firms of a country with fewer listed firms may have small firms in the mix. However, the countries with few listed firms are exclusively emerging market economies; generally their listed firms are, relatively speaking, their large firms. This regularity therefore mitigates this identified weakness to some extent. Further, note that during the late 1990s to 2008 all countries had some of their firms using some form of IFR; thus, those identified by 0 IFR had "partial" information reporting via IFR. We also examine an alternative construct which identifies "partial IFR" as 1, for robustness.

adopted good accounting standards emanate (e.g., US and UK). A stable political environment which encourages accountability, individual/group rights and governance effectiveness, would foster expectation of adoption of an effective disclosure mechanism such as IFR than a less stable one.

H1. A more stable political environment will be associated with high adoption of the IFR.

Political environment (PE) is computed as the average score of three political governance indicators – political stability and absence of violence, government effectiveness, and voice and accountability – put together for the World Bank by Kaufmann et al. (2008). Each governance dimension is scored from 2.5 (for highest outcomes) to −2.5 (for lowest outcomes).

Legal environment. The social legitimation explanation of innovation adoption can perhaps be best illustrated within the legal environment. It has become almost a common refrain that IFR is both far-reaching and cost effective as an information disclosure/dissemination mechanism (Ashbaugh et al., 1999; Debreceny et al., 2002; Ettredge et al., 2002; Wagenhofer, 2003; and others). Upon the believe that the Internet medium is most effective at disseminating material information quickly and with less content filtering by managers of firms (Verrecchia, 1983; Frankel et al., 1995), society may come to expect its adoption and perhaps legislate it. The South African JSE's demand for migrating financial reporting to the Internet on the claim of both a wider reach and cost effectiveness is a clear example. Thus, firms can adopt IFR in response to the demands of the legal environment. It is an effective legal environment which has good laws and rules on the books as well as enforces them that would be more successful at demanding and eliciting adoption of governance enhancement practice, such as IFR, than would a less effective legal environment. Therefore, we hypothesis that:

H2. An effective legal environment will be positively associated with the adoption of IFR.

Similar to the PE construct, legal environment (LE) is computed as the average score of three legal governance indicators – rule of law, regulatory quality and control of corruption – put together for the World Bank by Kaufmann et al. (2008). Each governance dimension is scored from 2.5 (for highest outcomes) to −2.5 (for lowest outcomes).

Financial market environment. Kothari (2000) provides an insightful summary of the literature on how legal environment of countries dictate resultant financial market types and the differential disclosure demands of the distinct markets. Relying largely on the seminal works of La Porta et al. (1997, 1998, 1999, 2000) alongside Ball et al. (1999, 2000a,b), Kothari notes the finding that international variation in investor protection laws, which is in turn tied to differences in origins of the legal environment, is related to international differences in the financing and ownership of firms. Several authors have gone further to show how important these legal environments are in producing the resulting financial institutions and markets of various countries (e.g., La Porta et al., 1997, 1998; Levine, 1999; Claessens and Laeven, 2003; Beck and Levine, 2004; Laeven and Woodruff, 2007). Arguably the consensus in the literature is that financial markets where ownership of firms is dispersed would require a disclosure mechanism that disseminates material information widely and quickly than financial markets where owners/stakeholders of firms are few and concentrated.

H3. We expect a large size/scope financial market, which proxy dispersed distribution of firms' ownership, to be positively related to IFR adoption.

Financial markets scope/environment (FMS) is measured by average of the ratio of publicly listed firms in a country to mean publicly listed firms in the group the country belongs, ratio of market value of equity securities outstanding in a country to the country's GDP, and ratio of annual value of equity securities traded in a country to the country's GDP. The data for these variables are culled from the International Finance Corporation, the International Monetary Fund and the World Development Indicator databases.

Physical infrastructure. In a *European Accounting Review* (1999) special issue on IFR, Lymer reports that only 15% of the UK population is a regular user of the Web. This accessibility picture is reflective of Internet use reality globally, wherein only the United States and perhaps Japan has a better picture. The majority of countries in the world, particularly developing ones, fare no better than the European picture. This is the well-known and documented "Digital Divide" – a codification of the fact that the majority of people who live in developing countries have no access to computers and far lesser have access to the Internet. A study by Chinn and Fairlie (2004) found that in 2001 there were 61 computers per 100 people in the US. In Europe and Central Asia, there were 18 computers per 100 people. In South Asia there were 0.5 computers per 100 people. They note that all countries with high Internet penetration rates, including Australia, are relatively wealthy with the exception of South Korea. They also highlight the skewed distribution of penetration rates across regions and countries: computer penetration rate in the US is 550 times larger than the penetration rate in Ethiopia. The study finds that income per capita accounts for 53.4% of the gap between the United States and Sub-Saharan Africa PC use, and 40.7% of the gap is accounted for by differences in telecommunications (largely physical) infrastructure. Therefore, the more available the physical infrastructure for IFR there is in a country, the more likely firms in the country are to adopt IFR.

H4. We expect a positive correlation between availability of computer/telecom infrastructure and IFR adoption.

We measure availability of computer/telecom infrastructure (CTI) in each sample country by averaging the number of fixed telephone lines per 100 people, estimated number of internet users per 100 people, and number of mobile-phone subscribers per 100 people. The data for this measure are drawn from the International Telecommunications Union (ITU) and Pyramid Research databases.

3.3. Firm-specific determinants of IFR adoption

Firm size. We follow mainly the guide from Debreceny et al. (2002) and Ettredge et al. (2002) in deriving our expectations

of firm-specific determinants of IFR adoption. Among others that have studied the adoption of IFR, Wagenhofer (2003) is prominent in enumerating the efficiency gains that accrues from Web-based dissemination of company information to its stakeholders and customers. IFR's reach of internationally dispersed stakeholders for example and its scope for using same medium to communicate mandated financial information, investors relation issues and product awareness, the net cost advantage of eliminating printing and distribution expenses versus Web site set-up expense, suggest that large size firms are more likely to adopt IFR than small, domestically focused firms (see Ashbaugh et al., 1999; Debreceny et al., 2002; Ettredge et al., 2002). Large firms generally have a reputational capital to protect and would want to appear, if not overtly, forthcoming in providing and disseminating information to the many and dispersed interest groups that follow the firms' activities than would small firms (Diamond, 1991).

H5. We expect firm size (Size) to be positively associated with the adoption of IFR.

As in Ashbaugh et al. (1999), Debreceny et al. (2002) and Ettredge et al. (2002), we compute firm size as the log of total asset or equity market capitalization.

External finance need. As noted in the introduction section, the financial reporting and disclosure literature document a negative correlation between firms' increased disclosure and indicators of information asymmetry between firms and their stakeholders (Welker, 1995; Frankel et al., 1995; Botosan, 1997; Healy et al., 1999; Ho and Wong, 2001; Chen et al., 2007). Frankel et al. (1995) highlight the consensus that the ultimate goal of increased disclosure is the reduction in cost of external finance – which among other channels, works through reduced information asymmetry premium. Therefore, firms which are disproportionately in need of external finance would be more welcoming of a disclosure mechanism, such as IFR, which permits dissemination of various types of information quickly, widely and relatively inexpensively, than firms that need little or no external finance.

H6. We expect high external finance need to be positively correlated with the adoption of IFR.

Borrowing a leaf from Rajan and Zingales (1998), we rely on flow-of-funds accounting of firms to define the extent to which a firm relies on external funding (EFD). It is computed as:

$$\text{External finance dependence} = \frac{\text{capital expenditure} - (\text{operating cash flow} + \text{depreciation})}{(\text{Operating cashflow} + \text{depreciation})}$$

A positive measure indicates that the firm relies on external finance to cover its capital investments needs (without considering working-capital which are usually smaller amounts, largely funded by current liabilities or relatively cheaper money market loans).

Profitability. Supposing efficiency gain is a firm's dominant motivation for adopting IFR, one would expect the most common representation of efficiency gain – profitability – to be positively correlated with IFR. Further, size can be a reflection of a firm's success, suggesting that large firms are likely to be profitable as well and thus, highly likely to adopt IFR (recall: Ashbaugh et al., 1999; Debreceny et al., 2002; Ettredge et al., 2002). Ettredge et al. (2002) document that profitable firms are more apt to post information quickly on their Web site; particularly as such firms' information releases are likely to be good news. Yet, the point was made above that financial constrained firms would be motivated to increase information disclosure in order to reduce informational opacity premium and access external capital at a lower cost. It logically follows that profitable firms may have sufficient internal equity (from retained earnings) such that they are not financially constrained, which in turn suggest absence of the need to increase information disclosure for low cost of capital.

H7. Profitability (Profit) is expected to be positively correlated with the adoption of IFR.

We measure profitability as the ratio of operating profit to total assets.

Based on the forgoing, our analysis of the determination of IFR adoption by firms in our panel of sample countries can be encapsulated in the following form:

$$\text{IFR}_{j,t} = a_0 + \beta_1 \text{ED}_{j,t} + \beta_2 \text{FSD}_{j,t} + \rho_t, \quad (1)$$

where $\text{IFR}_{j,t}$ is Internet financial reporting for country j ($j = 1, 2, \ldots, m$) in period t ($t = 1, 2, \ldots, n$), $\text{ED}_{j,t}$ and $\text{FSD}_{j,t}$ are the environmental and firm-specific determinants, respectively, of IFR adoption in country j at t.

3.4. Governance model linkage to IFR adoption

Relying largely on the seminal works of La Porta et al. (1997, 1998, 1999, 2000) alongside Ball et al. (1999, 2000a,b), Kothari (2000) notes the finding that international variation in investor protection laws, which is in turn tied to differences in legal origins of the laws, is related to international differences in the financing and ownership of firms. He highlights the role of legal origins on accounting standards, corporate governance models and their attendant disclosure systems. He recounts the work by Ball et al. (2000a,b) where they document that in "code-law countries, a 'stakeholder ownership' governance model is likely to be observed, with shareholders, managers and employees, the government, and banks (as shareholders or debt-holders) as major stakeholders. In the stakeholder governance model, demand for public disclosure of information is diminished because the stakeholders' agents participate in corporate governance. This solves much of the information asymmetry problems…" Therefore, there is little need for the kind of detailed information component, time-compressing, and disperse dissemination of disclosure for which IFR appears best suited. Given the concentrated ownership by a relatively few block-stakeholders prevalent in this governance model, a private type dissemination mechanism – conference call, press release, etc. – appears more appropriate.

"In common-law countries, a 'diffuse shareholder' governance model is more likely. In this model, diffuse ownership and separation of ownership from control are frequently encountered. Management and the board of directors generally are not large block-holders of debt or equity... This creates a demand for timely public disclosure of financial information, to mitigate the information asymmetry between managers and current and potential owners for monitoring the performance of the managers". The implication here is that in countries where both a common-law legal system predominates and production ownership is diffuse and separated from management, dissemination of disclosure must be detailed, time- and distance-compressing. It is in this nature of disclosure demand, by a diffuse shareholder governance model, that IFR appears more appropriate, given its characteristic flexibility for content form, speed of reach and economies of scale. In sum, the two preceding paragraphs show how demand for an IFR-embodied type of disclosure is a function of the demand emanating from the dominant governance model of the country – thus, the first block in Fig. 1 captures the "Demand source" – Hypothesis II. Therefore, expectations are that:

H8. Firms in a country characterized by the "diffuse shareholder corporate governance model" (CGM) will be more likely to adopt IFR than firms in a country characterized by a different governance model.

Following La Porta et al. (1997, 1998, 2000), Kothari (2000) and Ball (2001), CGM is identified as 3 if a sample country has a common-law legal origin, 2 if a country has a German/Scandinavian civil-law legal origin, 1 if a country has a French civil-law legal origin and 0 if other wise. Given the adoption of US type financial reporting and corporate governance practices by firms in globally integrated countries, it is acknowledged that a country's governance model can evolve, particularly if defined exclusively by La Porta et al's framework (Pagano and Volpin, 2000; Rajan and Zingales, 2003; Licht et al., 2005). For a more universally applicable alternative, we consider the less-evolving cultural value linked governance measures suggested by Licht et al. (2005); these CGM measures are reported in Table A2 in Appendix A.[9] Incorporating the corporate governance linkage to IFR adoption, gives the following general relationships which are also captured in the theoretical framework.

$$\mathrm{IFR}_j = \alpha_j + \beta_1 \mathrm{ED}_j + \beta_2 \mathrm{FSD}_j + \beta_3 \mathrm{CGM}_j + \varepsilon. \quad (2)$$

CGM_j represents country j's degree of embodying features of the *diffuse shareholder governance model*. The other variables are as defined in Eq. (1).

Finally, we round off this test development section by recalling the need to examine whether firms' adoption of IFR still elicits the claimed ultimate goal of enhanced efficiency of production (reduced cost of capital) after accounting for the prevailing macro-environment of a country, dominant national corporate governance structure, and firm-specific efficiency gain motivations for adopting IFR. The general form of this hypothesis can be captured as:

$$\mathrm{ME}_j = \alpha_j + \beta_1 \mathrm{IFR}_j + \beta_2 \mathrm{CGM}_j + \beta_3 \mathrm{IFR}_j * \mathrm{CGM}_j + \beta_4 \mathrm{ED}_j + \beta_5 \mathrm{FSD}_j + \varepsilon. \quad (3)$$

MEj represents market efficiency, which is defined by country j's lending–deposit spread for the country's debt market or the ratio of shares' value traded to market capitalization of the equity market of country j. If country j's debt market is efficient, it will reflect a small spread (cost of debt) and vice versa; the IFR and governance variable or infrastructure variables, respectively, are expected to relate negatively to spread. The equity market efficiency proxy represents the level of activity in the market. The more efficient a market is, the higher its level of activity will be. IFR, governance variable or infrastructure variables, respectively, are expected to relate positively to this ratio.[10]

4. Data

The sample is comprised of listed firms from 44 countries: 12 developed market economies and 32 emerging market economies. Though partly dictated by the availability of some important data, the distribution of sample countries is designed to be regionally representative – 5 from Africa & Mid East, 8 from East Asia, 3 from South Asia, 8 from Eastern Europe and 8 from Latin America, for emerging market economies; 3 from East Asia, 6 from Europe, 2 from North America and 1 from Oceana, for developed market economies. Firm-specific data are pooled from the Osiris company reports of Bureau van Dijk for the period 1995–2008. Country level data are from various sources, depending on the nature of the information needed – e.g., World Bank's Development Indicators and World Governance Index, the International Monetary Fund's International Financial Statistics and the International Telecommunications Union (ITU) and Pyramid Research databases. The period for data used in the IFR construct is a bit longer than the period for all remaining data: 1990–2008 versus 1995–2008. The reason for this is that many of the data for environmental variables on emerging market economies became available in useable time-series form only in the late 1990s. The number of listed firms

[9] Relying on Schwartz's and Hofstede's cultural value dimensions, within the context of cross-cultural psychology, Licht et al. (2005) derive corporate governance measures mapped across cultural regions. They demonstrate empirically how these measures both relate to La Porta et al.'s (1998) framework and capture well governance models meant to protect investors' rights via litigation (the courts). See Licht et al. (2005) for a fuller discussion of these two cultural region based corporate governance structure indicators.

[10] Efficient market theories are generally viewed via Fama's famous hypotheses, which takes as given the channels or processes through which asset prices reflect the relevant/material information about the issuer of the asset. Increased trading of the asset is a major means by which participants impound relevant information into the asset's price. This results in high liquidity and low transaction cost on the asset, which in turn, yield a low cost of capital (a major component of the discount factor for deriving the asset price). For more on these channels' linkage to market efficiency, see Kothari (2000), Bhattacharya and Daouk (2002) and Chen et al. (2007), among others.

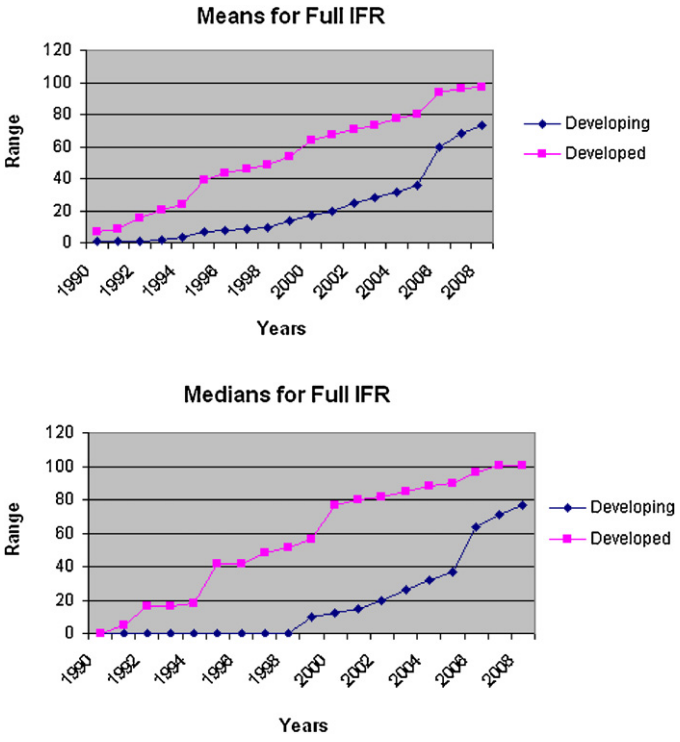

Fig. 2. This figure provides graphs of evolutionary mean and median levels of IFR adoption between developing (32) and developed economies (12) groups of sample countries. Range represents the percentage of IFR adoption per sample country's top 30 listed firms.

per country is dictated by number of firms which consistently listed in the Osiris reporting frame of Bureau van Dijk.

4.1. Evolution of IFR adoption

Given that the adoption of IFR is the focal point of this research, it is important to gauge the evolution of IFR usage across these widely distributed sample countries as well as appreciate possible factors associated with its dynamics. Table A1 in Appendix A presents a detailed country-by-country evolution of IFR adoption along a dichotomy of economic development levels. Three salient observations are evident: (i) Looking at the median IFR adoptions for both emerging market and developed market economies, the level of adopting IFR is much higher in developed economies than emerging economies. (ii) Developed economies commenced meaningful usage of IFR as early as 1991/1992 while emerging economies commenced such usage in 1999/2000 (see the median rows for both economic development groupings).

These two observations are further highlighted in Fig. 2. (iii) On a country-by-country basis, most early (and hugely) IFR users are Australia, Canada, Finland, France, Hong Kong, Japan, Netherlands, Sweden, Switzerland, UK and USA, almost all sampled developed economies while only Brazil, Ecuador, Korea, Malaysia, Turkey and South Africa were early adopters from the 32 emerging economy group. There is some evidence of variability in the adoption of IFR across countries (see the standard deviation rows of the Table A1).

5. Tests and discussion

Table 1 contains the descriptive statistics of variables used in analyzing issues engaged in this study. It is useful in flagging data issues that need to be addressed for effective empirical analyses; for example, standard deviations, skewness or kurtosis of profit and external financial dependence (Efd) informed their log transformation. Given the country level focus of the testable models of this study, it is expected that many of the macro-environment variables would likely be correlated. Therefore, we first, provide a pair-wise correlation profile of all variables in Table 2. As anticipated quite a few of the macro-environment variables are correlated. Consequently, multivariate models of the study are estimated using clustered standard errors random effect models and particularly panel logit models. Clustered standard errors control for potential correlation at the firm level while panel logits control for heterogeneity across firms, collinearity among variables, and firm dynamics (Baltagi, 2001). Further, the Breusch–Pagan test is conducted for all panel models to ascertain there are no random effects. In general, panels are also known to mitigate biases that can arise from aggregation.

Results of Eq. (1) are reported in Table 3. The main hypothesis around the importance of macro-environmental factors in IFR adoption by firms across various countries is largely supported, as is evident in models 1a–2b (i.e., Hypotheses 1–4). Along with computer telecommunication infrastructure (CTI) of a country, institutional infrastructures of political environment (PE) and financial market scope (FMS) significantly foster the adoption of IFR by firms. The legal environment (LE) is also found to be important but with a negative sign, suggesting that an effective legal environment rather discourages the adoption of IFR; thus, leading one to speculate that an effective legal environment might not require an additional information dissemination mechanism such as IFR. Only one of the firm-specific variables is positively associated with IFR adoption – large firms (in accord with Hypothesis 5). Profitable firms which generally would have little need for external funds appear not to seek adoption of IFR – i.e., this result clarifies Hypothesis 7.

Next we turn to the result of Eq. (2), which incorporates effects of the dominant national corporate governance structure (CGM) into the general determination of IFR adoption. Table 4 reports the result of Eq. (2). Recall that we had defined three different CGM constructs – CGM based on La Porta et al's (1997, 1998, 2000) legal origin definition, and CGM2 and CGM3, both based on geographic mapping of cultural value dimensions. As in Licht et al. (2005), these CGM constructs are different and might capture different aspects of corporate governance structure, though with some overlaps (according to Table 2, correlations between CGM1–CGM2 = −0.011, CGM1–CGM3 = 0.497, and CGM2–CGM3 = 0.435). The construct based on Schwartz's global survey of cultural value dimensions, CGM2, enters significantly positively (model 3a) in explaining adoption of IFR while that based Hofstede's multinational company survey, CGM3, enter significantly negatively (model 3c and 4c). Surprisingly, the construct based on the legal origin postulation does not enter in any of the models; this appears to justify the concerns about undue reliance on the legal

Table 1
Descriptive statistics of variables.

	Observations	Mean	Median	Standard deviation	Skewness	Kurtosis	Minimum	Maximum
Pe	7209	0.4692	0.5510	0.9010	−0.1631	1.7257	−1.5864	1.8550
Le	7209	0.6446	0.4773	0.9983	−0.0346	1.6252	−1.3932	2.0927
Fms	8004	0.7000	0.4824	0.6716	2.7928	20.017	0.0187	8.7007
Cti	7590	0.3577	0.3076	0.2489	0.3539	1.9320	0.0014	1.0690
Log Profit	7661	−1.6637	−1.6533	0.9090	−0.1658	7.2756	−9.8815	7.7282
Log Efd	1370	−0.3303	−0.2531	1.7485	−0.3291	4.4909	−9.0324	5.8683
Log Spread	7450	1.4540	1.4139	0.7332	0.0893	6.9715	−1.7918	5.3861
Full IFR	8565	0.4136	0.3667	0.3299	0.2756	1.8084	0.0000	1.0000
Full/partial IFR	8620	0.7262	0.9000	0.3445	−1.0239	2.5490	0.0000	1.0000
CGM1	8620	2.8858	3.0000	0.9376	−0.0890	1.6993	1.0000	4.0000
CGM2	7610	3.5716	3.7000	1.0533	0.0277	1.3822	2.3000	5.0000
CGM3	7189	3.6547	3.3000	1.3277	−0.4735	2.2712	1.3000	5.3000
Size	8474	7.0300	7.0760	1.0732	−0.3201	4.9260	0.0000	11.154
Profit	7837	0.5593	0.1857	25.673	88.336	7814.5	−41.938	2271.5
Efd	3943	−0.4894	−0.3105	28.543	−32.137	1429.0	−1324.3	353.65
Spread	7493	5.8385	4.0773	7.8144	8.6893	165.07	−6.9125	218.35

This table presents descriptive statistics of variables that are extensively used in the analyses that follow. Pe is political environment, which is defined as the average score of three political governance indicators – political stability and absence of violence, government effectiveness, and voice and accountability – put together for the World Bank by Kaufmann et al. (2008). Each governance dimension is scored from 2.5 (for highest outcomes) to −2.5 (for lowest outcomes). Le is legal environment, computed as the average score of three legal governance indicators – rule of law, regulatory quality and control of corruption – put together for the World Bank by Kaufmann et al. (2008). Each governance dimension is scored from 2.5 (for highest outcomes) to −2.5 (for lowest outcomes). Fms is financial market scope, measured as average of ratio of listed firms in a country to mean publicly listed firms in the group the country belongs, ratio of market value of equity securities in a country to the country's GDP, and ratio of annual value of equity securities traded in a country to the country's GDP. Cti is computer/telecom infrastructure computed by averaging the number of fixed telephone lines per 100 people, estimated number of internet users per 100 people, and number of mobile-phone subscribers per 100 people. Size represents individual firm's size which is computed as the log of total asset or equity market capitalization. Profit is the ratio of operating profit to total assets. Efd is a firm's degree of dependence on external finance; it is computed as ratio of the difference between capital expenditure and operating cash flow to operating cash flow. Full IFR stands for Internet financial reporting; it is defined as the percent of top 30 firms in each sample country that posts the equivalent of hardcopy based annual reports (or better) on the Internet in HTML and/or PDF format. Full/Partial IFR includes both Full IFR and any other level of Internet reporting by listed top 30 firms in each sample country. CGM national represents corporate governance model of sample countries: CGM1 is based on La Porta et al.'s (1997, 1998, 2000) legal origin definition, and CGM2 and CGM3, both based on geographic mapping of cultural value dimensions (see Table A2 for details). Spread is the proxy for cost of external capital, computed as the difference between national lending and deposit rates.

origin based construct of corporate governance models (Pagano and Volpin, 2000; Rajan and Zingales, 2003; Licht et al., 2005). Though the CGM results are mixed in terms of its effects on IFR, depending on how it is defined, these results nevertheless suggest, as hypothesized (H8), that corporate governance demands of information in both content detail and speed of delivery are important in determining adoption of IFR. Once more, the macro-environmental determinants of IFR remain consistently strong in most of the models of this table (models 3a–4c).

Finally, the analysis turns to whether firms' adoption of IFR still elicits the claimed ultimate goal of enhanced efficiency of production (reduced cost of capital) after accounting for the prevailing macro-environment of a country, dominant national corporate governance structure, and firm-specific efficiency gain motivations for adopting IFR. Therefore, Eq. (3) is estimated using the 2-Stage Least Square (2SLS). The 2SLS is used because the IFR has been shown to be endogenous to almost all of the macro-environment variables. Results in

Table 2
Simple correlations between test variables.

	Pe	Le	Fms	Cti	Size	Efd	Profit	CGM1	CGM2	CGM3	Me	Full-IFR
Pe												
Le	0.955											
Fms	0.428	0.484										
Cti	0.768	0.718	0.548									
Size	0.033	0.064	0.027	−0.093								
Efd	0.005	0.007	−0.014	−0.013	0.022							
Profit	−0.040	−0.019	0.054	−0.049	0.152	−0.003						
CGM1	0.412	0.538	0.677	0.491	−0.121	−0.033	−0.037					
CGM2	0.574	0.467	0.139	0.370	−0.143	0.038	−0.060	−0.011				
CGM3	0.590	0.522	0.403	0.554	−0.150	0.003	−0.121	0.497	0.435			
Me	0.440	0.418	0.518	0.529	−0.081	0.015	−0.146	0.369	0.121	0.478		
Full-IFR	0.608	0.510	0.572	0.786	−0.033	−0.011	−0.004	0.309	0.502	0.444	0.438	
Full/partial IFR	0.335	0.201	0.376	0.564	−0.008	−0.022	−0.004	0.177	0.368	0.236	0.276	0.783

Table 3
Macro-environment models of Internet financial reporting (IFR) adoption.

	Clustered standard error based estimates of random effect models		Panel logit based models	
	Model 1a	Model 1b	Model 2a	Model 2b
Pe			1.858*** (5.24)	1.837*** (5.18)
Le	−0.028 (−1.59)	−0.021 (−1.21)	−1.252*** (−3.98)	−1.244*** (−3.95)
Fms	0.070*** (7.79)	0.070*** (7.96)	0.255** (2.32)	0.262** (2.37)
Cti	1.222*** (22.22)	1.190*** (20.18)	2.743*** (5.99)	2.754*** (6.01)
Size		0.031*** (2.59)		−0.57 (−0.59)
Efd		0.000 (1.09)		−0.003 (−0.64)
Profit		−0.007* (−1.92)		0.030 (0.27)
Constant	0.014 (074)	−0.191*** (−2.57)	−1067*** (−5.50)	−0.690 (−1.00)
No. Of Obs.	3065	3065	3062	3062
Wald χ^2	877.79	1212.54	127.45	127.69
Pseudo R^2	63.66%	63.63%		
Likelihood ratio test			866.54	863.04

This table contains estimates of macro-environment and firm-specific determinants of IFR adoption. The variable definitions are consistent with those in Table 1. The panel logit model uses the binary variable version of the Full IFR which is computed as 1 if a country's average percent of top 30 firms identified as using Full IFR is greater than the median of same indicator for the group of countries (developing or developed) to which that country belongs, 0 if otherwise.

* Significance at the 10% confidence level.
** Significance at the 5% confidence level.
*** Significance at the 1% confidence level.

Table 5 (models 5a–6b) largely confirm, as hypothesized, that IFR is negatively associated with the spread between lending and deposit rates (an important proxy for cost of debt) in the sample countries. Importantly, not only does IFR significantly correlate with the measure of cost of funds, but also macro-environment factors, firm-specific factors and CGM that were significantly important in earlier models appear equally relevant in explaining cost of capital reduction, in accord with theory (Diamond and Verrecchia, 1991; Frankel et al., 1995; Botosan, 1997; Bhattacharya and Daouk, 2002; and others). In other words, these variables enter the equation largely with the expected signs. A negative sign suggests that the coefficient contributes in reducing the lending-deposit spread while a positive sign suggest the converse. The interactive effect of IFR and the governance structure was also examined (models 6a–6c); these effects are statistically significant, without altering the effects of the focus variables.

Table 4
Determinants of IFR adoption within corporate governance structure/model (CGM).

	Clustered standard error based estimates of random effect models			Panel logit based models		
	Model 3a	Model 3b	Model 3c	Model 4a	Model 4b	Model 4c
Pe	0.043 (1.53)	0.005 (0.13)	0.089** (2.44)	1.843*** (5.18)	0.0390 (0.87)	2.442*** (5.31)
Le	−0.066** (−2.55)	−0.085*** (−3.04)	−0.092*** (−3.15)	−1.262*** (−3.92)	−0.324 (−0.91)	−1.213*** (−3.35)
Fms	0.071*** (8.07)	0.078*** (8.38)	0.079*** (7.96)	0.256** (2.22)	0.179 (1.62)	0.438*** (3.80)
Cti	1.194*** (21.04)	1.137*** (17.96)	1.155*** (17.74)	2.756*** (6.01)	3.548*** (7.17)	1.885*** (3.78)
Size	0.029** (2.55)	0.036*** (3.10)	0.019 (1.63)	−0.054 (−0.56)	0.004 (0.40)	−0.177* (−1.72)
Efd	0.000 (1.12)	0.000 (0.87)	0.000*** (4.03)	−0.003 (−0.64)	−0.004 (−0.68)	−0.004 (−0.55)
Profit	−0.007* (−1.71)	−0.006 (−1.45)	−0.007* (−1.86)	0.030 (0.27)	0.031 (0.28)	0.027 (0.25)
CGM1	−0.010 (−0.76)			0.027 (0.20)		
CGM2		0.088*** (5.02)			−0.012 (−0.08)	
CGM3			−0.027* (−1.83)			−0.635*** (−5.28)
Constant	−0.143* (−1.95)	−0.474*** (−5.23)	0.022 (0.28)	−0.775 (−0.98)	−1.149 (−1.22)	2.152** (2.53)
No. of obs.	3065	2623	2490	3062	2624	2487
Wald χ^2	1309.54	1235.26	1172.39	127.35	89.59	101.23
Pseudo R^2	65.61%	72.39%	67.91%			
Likelihood ratio test				861.27	701.07	539.80

This table contains estimates of macro-environment and firm-specific determinants of IFR adoption, within the context of national corporate governance models. The variable definitions are consistent with those in Table 1. The panel logit model uses the binary variable version of the Full IFR which is computed as 1 if a country's average percent of top 30 firms identified as using Full IFR is greater than the median of same indicator for the group of countries (developing or developed) to which that country belongs, 0 if otherwise. Models a-c of the estimation reflects separate entries of the distinct corporate governance model constructs.

* Significance at the 10% confidence level.
** Significance at the 5% confidence level.
*** Significance at the 1% confidence level.

Table 5
2SLS (with clustered SE) effects of IFR and CGM on market efficiency (low cost of funds – lending-deposit spread).

	Independent effects of IFR and CGM			Models including interaction effects of IFR & CGM		
	Model 5a	Model 5b	Model 5c	Model 6a	Model 6b	Model 6c
IFR	−0.976 (−1.46)	−1.488** (−2.13)	−1.756*** (−2.51)	−8.361*** (−6.00)	3.773** (2.20)	−0.027 (−0.20)
Pe	−3.668*** (−3.22)	−4.860*** (−3.61)	−3.846*** (−3.26)	−2.681** (−2.28)	−5.096*** (−3.72)	−3.985*** (−3.21)
Le	1.910* (1.87)	1.282 (1.25)	1.048 (1.14)	0.859 (0.82)	1.404 (1.36)	1.209 (1.25)
Fms	0.353** (2.47)	0.374** (2.23)	0.401*** (3.11)	0.113 (0.87)	0.279* (1.70)	0.417*** (3.22)
Cti	−4.312*** (−2.93)	−4.640*** (−3.07)	−3.237** (−2.19)	−3.845*** (−2.75)	−4.717*** (−3.00)	−3.357** (−2.16)
Size	−0.805*** (−2.95)	−0.578* (−1.92)	−0.601*** (−2.46)	−0.777*** (−2.83)	−0.539* (−1.78)	−0.590*** (−2.46)
Efd	0.000 (0.15)	0.000 (0.03)	0.000 (0.09)	−0.000 (−0.22)	−0.000 (−0.13)	0.000 (0.07)
Profit	0.001*** (4.33)	0.001*** (5.41)	0.001*** (6.62)	0.001*** (3.84)	0.001*** (4.84)	0.001*** (7.77)
CGM1	−2.044*** (−3.83)			−3.100*** (−5.27)		
CGM2		2.334*** (5.39)			3.345*** (5.54)	
CGM3			0.471 (1.11)			0.754 (1.49)
IFR*CGM				2.721*** (7.23)	−1.1554*** (−3.44)	−0.511* (−1.65)
Constant	20.262*** (6.13)	6.573** (2.44)	12.117*** (5.93)	22.875*** (6.72)	3.306 (1.09)	11.151*** (5.51)
No. of obs.	2690	2446	2351	2699	2446	2351
Wald χ^2	141.03	148.90	157.14	150.86	145.45	183.30
Pseudo R^2	11.75%	13.03	6.33	12.13%	14.39%	6.01%

This table contains estimates of IFR effects on cost of capital (lending-deposit spread) with controls for national corporate governance structures, macro-environment and firm-specific determinants of IFR adoption. The variable definitions are consistent with those in Table 1. Models a–c of the estimation reflects separate entries of the distinct corporate governance model constructs or interaction effect of IFR and CGM.

* Significance at the 10% confidence level.
** Significance at the 5% confidence level.
*** Significance at the 1% confidence level.

5.1. Robustness check

As noted in the variable definition section, one can consider our definition of IFR (the main dependent variable in this study) to be restrictive. Consequently, we repeat the above analyses using an IFR construct that contained both of what we termed full-IFR and partial-IFR in Section 3.1. Our result (not reported here) is robust to this redefinition. Further, we also considered outliers. Results remain materially unchanged, with a rather marginal strengthening of most coefficients after the pruning of outliers. Finally, given the time-series nature of the data employed for this study, the data was checked separately for serial correlation by using GLS with correlated disturbances. No serial correlation problems were found.

6. Conclusion and discussion

The adoption of internet financial reporting (IFR) is addressed in the context of the economics of financial reporting/disclosure as a means of mitigating agency problems, with IFR adoption argued to be a function of both the dominant corporate governance model and the enabling infrastructures in the country. Three main insightful questions emanated from this contextualization of IFR adoption in a macro-environment perspective; these questions were subjected to robust empirical examinations. There is strong evidence that both physical and institutional infrastructures determine the propensity of adopting IFR by a country, with four of the hypothesized macro-environmental factors – computer/telecommunication infrastructure, financial market scope (economic), political and legal institutions – significantly influencing a firm's adoption of IFR, even in the face of firm-specific efficiency gains of IFR usage. Further, the national corporate governance structure, which partly determines reach/speed of dissemination and content details of material information provided firms' stakeholders, is found to play a role in the adoption of IFR. Importantly, IFR, as an embodiment of total disclosure, is found to retain its ultimate essence of reducing cost of capital even after considering the other relevant factors such as macro-environmental infrastructures and dominant national corporate governance practice.

This study emphasizes the corporate governance context and thus, the agency cost mitigation of financial disclosure, by integrating the literatures on IFR adoption (Ashbaugh et al., 1999; Debreceny and Gray, 1999; and others) and the importance of financial disclosure and its linkages to infrastructure requirements (Ball et al., 1999; Kothari, 2000; Ball, 2001). It examines financial disclosure across 44 governance environments (12 developed economies and 32 developing economies) and thus, provides useful comparative analysis. It breaks new ground by considering macro-environment predictors of firms' propensity to disclose financial information on the Internet. Prior works in the area focused primarily on firm-level analysis (Ashbaugh et al., 1999; Debreceny and Gray, 1999; Ettredge et al., 2002). Importantly, we examine the robustness of the accepted notion that increased voluntary disclosure, by mitigating information asymmetry, ultimately reduces cost of capital (i.e., enhances market efficiency). Finally, the findings here contribute to the debate on harmonization of international financial reporting systems by showing, in agreement with Kothari (2000), Ball (2001) and others, that whichever reporting system is adopted will likely be ineffectual unless the enabling environments are provided first.

This study having pointed towards a new useful direction to shift research on firms' information reporting and

Table A1
Country-by-country evolution of IFR adoption.

Country	Full IFR																		
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Developing countries																			
Argentina	0	0	0	0	0	0	10	10	10	10	13	13	17	20	30	40	70	73	77
Brazil	0	7	17	17	20	23	40	40	40	43	43	43	43	43	43	60	90	93	93
Bulgaria	0	0	0	0	0	0	0	0	0	0	0	0	38	50	63	63	88	88	88
Chile	0	0	0	0	0	0	0	0	0	30	33	33	43	43	50	53	63	70	77
China	0	0	0	0	0	0	0	0	0	13	13	17	20	20	23	23	37	43	53
Columbia	0	0	0	0	0	0	0	0	0	13	13	17	20	20	23	23	37	43	53
Czech Republic	0	0	0	0	8	17	17	17	25	25	29	33	33	38	46	54	79	83	83
Egypt	0	0	0	0	0	0	0	7	7	13	27	27	43	50	53	57	77	80	87
Ecuador	0	0	0	10	13	13	13	20	20	27	40	40	40	47	47	57	77	80	87
Hungary	0	0	0	0	0	5	9	9	9	23	36	45	45	50	55	59	68	73	77
India	0	0	0	0	0	0	0	0	0	0	0	7	13	23	20	23	63	80	87
Indonesia	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	7	60	60	67
Korea	0	0	0	17	30	33	33	37	40	43	50	57	60	63	73	77	90	100	100
Malaysia	0	0	0	0	17	17	17	17	17	33	43	47	50	50	53	57	90	97	100
Mexico	0	0	0	0	0	20	20	20	20	30	50	53	57	57	60	63	77	83	90
Nigeria	0	0	0	0	0	0	0	0	0	0	0	7	10	17	17	20	67	83	83
Pakistan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	60	60
Peru	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	37	37
Philippines	0	0	0	0	0	0	0	0	0	0	0	0	3	3	7	10	37	47	57
Poland	0	0	0	0	0	0	0	0	0	0	3	7	10	13	17	17	53	67	77
Romania	0	0	0	0	0	0	0	0	0	0	8	8	8	8	8	8	38	54	62
Russia	0	0	0	0	0	3	3	3	7	10	10	13	17	27	33	37	67	80	80
Saudi Arabia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	33	47	57
Slovakia	0	0	0	0	0	0	0	0	0	6	12	18	29	35	41	47	53	59	76
South Africa	20	20	20	20	20	30	37	37	37	37	40	40	53	57	57	77	87	90	93
Sri Lanka	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	60	63
Taiwan	0	0	0	0	0	17	17	27	27	27	33	33	33	37	63	63	77	77	77
Thailand	0	0	0	0	0	0	0	0	0	0	0	7	17	33	33	37	50	53	63
Turkey	0	0	3	3	3	17	20	20	23	27	30	30	33	37	47	47	70	83	90
Ukraine	0	0	0	0	0	0	0	0	0	0	6	13	25	25	25	31	50	63	63
Venezuela	0	0	0	0	7	10	10	10	10	13	17	20	20	23	27	27	33	47	60
Vietnam	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	20	20
Sum	20	27	40	67	118	205	246	272	291	424	551	627	782	892	1017	1138	1910	2172	2335
Median	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	12.55	15.00	20.00	25.83	31.67	36.67	63.33	71.36	76.67
Mean	0.63	0.83	1.25	2.08	3.70	6.39	7.68	8.51	9.09	13.24	17.23	19.58	24.43	27.88	31.77	35.58	59.67	67.88	72.98
Standard deviation	3.54	3.69	4.54	5.47	7.71	9.95	11.74	12.41	12.99	14.62	17.62	18.02	18.90	19.76	22.44	24.48	20.89	19.34	18.16
Developed countries																			
Australia	20	20	20	20	20	37	37	37	37	53	83	83	83	83	83	83	100	100	100
Canada	0	0	0	0	0	17	20	20	20	47	43	40	47	47	47	57	97	100	100
Finland	0	0	3	10	10	23	30	30	30	30	63	63	67	70	80	80	97	97	100
Hong Kong	17	17	33	40	53	53	53	47	73	73	83	83	90	97	100	100	100	100	100
France	0	0	0	0	0	30	33	50	50	50	77	80	80	83	87	87	93	93	97
Japan	0	10	30	37	40	67	87	87	87	87	90	93	97	100	100	100	100	100	100
Netherlands	0	0	0	0	0	17	27	27	27	27	33	40	43	43	53	57	93	100	100
Sweden	7	10	17	17	17	47	47	50	53	60	63	87	87	90	93	97	97	97	97
Switzerland	27	27	43	43	60	60	60	63	63	70	77	77	83	87	90	93	97	97	97
United Kingdom	0	0	23	60	60	60	70	70	70	70	80	80	80	93	93	93	100	100	100
United States	17	17	17	17	27	57	57	73	73	73	77	83	90	90	93	97	100	100	100
Singapore	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	17	50	67	73
Sum	87	100	187	243	287	467	520	553	583	640	770	810	847	883	927	960	1123	1150	1163
Median	0.00	5.00	16.67	16.67	18.33	41.67	41.67	48.33	51.67	56.67	76.67	80.00	81.67	85.00	88.33	90.00	96.67	100.00	100.00
Mean	7.22	8.33	15.56	20.28	23.89	38.89	43.33	46.11	48.61	53.33	64.17	67.50	70.56	73.61	77.22	80.00	93.61	95.83	96.94
Standard deviation	9.93	9.69	15.06	20.32	23.90	21.48	23.70	24.90	26.15	24.62	26.33	27.42	27.81	29.52	27.95	24.98	13.96	9.44	7.58

disclosure – macro-level versus micro-level analysis, leaves several rooms for further research at this macro-level. One of such new areas for further research intervention is the need to delve further into possible differences in the adoption of IFR across significantly disparate countries, for example the adoption variation between emerging market economies and developed market economies. The level of economic development, which is expectedly influential on macro-environmental

Table A2
Definitions of three different constructs of corporate governance model (CGM).

Country	Legal/Law Origin CGM1	Schwartz culture region	Ranking of culture region CGM2	Hofstede culture region	Ranking of culture region CGM3
Argentina	1	Latin A	3.7	Dev Latin	3.7
Australia	3	Eng Spkg	5	Anglo	5
Brazil	1	Latin A	3.7	Dev Latin	3.7
Bulgaria	0	E. Europe	2.7		
Canada	3	Eng Spkg	5	Anglo	5
Chile	1	Latin A	3.7	LessD Latin	1.3
China	2	Far East	2.3	Asian	3.3
Colombia	1	Latin A	3.7	LessD Latin	1.3
Czech Republic	2	E. Europe	2.7		
Ecuador	1	Latin A	3.7	LessD Latin	1.3
Egypt	1			Near Eastern	
Finland	2	W Europe	4.7	Nordic	5.3
France	1	W Europe	4.7	Dev Latin	3.7
Hong Kong	3	Far East	2.3	Asian	3.3
Hungary	2	E. Europe	2.7		
India	3	Far East	2.3	Asian	3.3
Indonesia	1	Far East	2.3	Asian	3.3
Japan	2	Far East	2.3	Asian	3.3
Korea, Rep. of	2	Far East	2.3	Asian	3.3
Malaysia	3	Far East	2.3	Asian	3.3
Mexico	1	Latin A	3.7	LessD Latin	1.3
Netherlands	1	W Europe	4.7	Nordic	5.3
Nigeria	3	African	3		
Pakistan	3			Near Eastern	
Peru	1	Latin A	3.7	LessD Latin	1.3
Philippines	1	Far East	2.3	Asian	3.3
Poland	2	E. Europe	2.7		
Romania	0	E. Europe	2.7		
Russian Federation	0	E. Europe	2.7		
Saudi Arabia	0			Near Eastern	
Singapore	3	Far East	2.3	Asian	3.3
Slovakia	2	E. Europe	2.7		
South Africa	3			Anglo	5
Sri Lanka	3	Far East	2.3	Asian	3.3
Sweden	2	W Europe	4.7	Nordic	5.3
Switzerland	2	W Europe	4.7	Germanic	4.3
Taiwan	2	Far East	2.3	Asian	3.3
Thailand	3			Asian	3.3
Turkey	1	E. Europe	2.7	Near Eastern	
Ukraine	0	E. Europe	2.7		
United Kingdom	3	Eng Spkg	5	Anglo	5
United States	3	Eng Spkg	5	Anglo	5
Vietnam	0			Asian	3.3
Venezuela	1	Latin A	3.7	LessD Latin	1.3

These CGM constructs are meant to reflect the "diffused shareholder governance model" the higher their value is and vice versa. CGM1 is based on La Porta et al's legal origin classification, where Common Law legal origin is deemed most reflective of the "diffuse shareholder corporate governance model" (=3), the German/Scandinavian Civil-Law origin is next (=2), Civil-Law French origin follows (=1), others (largely transition East European countries) have their CGM1 coded 0. CGM2 is constructed by averaging Schwartz's regional cultural dimensions of autonomy and egalitarianism while CGM3 is constructed by averaging Hofstede's power distance, uncertainty avoidance, and individualism dimensions. Eng Spkg is English speaking while LessD Latin is Less Developed Latin.

factors, might affect macro-environmental determination of IFR differently between these two economic groups.

Finally, this study adds to our concern about the unsettled issue of appropriate surrogates for national corporate governance models. As Licht et al. (2005) demonstrated, there is yet no comprehensive construct of national corporate governance model; existing ones such as La Porta et al.'s (1998, 2000) legal origin based construct must be viewed as nuanced and pertaining to certain aspects of a corporate governance structure. Therefore, there exists a need for perhaps a multidimensional definition of what would proxy well a national corporate governance structure.

Appendix A.

See Tables A1 and A2.

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