

## HOW DO YOU DISCLOSE? SOME EVIDENCE ON IT GOVERNANCE AND PERFORMANCE IN EUROPEAN BANKING SYSTEM

IDA CLAUDIA PANETTA\*, SABRINA LEO\*\*‡, FABRIZIO SANTOBONI\* and  
GIANFRANCO VENTO†

\**Sapienza University of Rome, Italy*

†*Regent's University London, UK*

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This paper examines the evolution of the attention paid by a sample of EU banks on IT governance. We propose an analysis based on IT public disclosure to contribute to the less explored strand of literature on IT governance transparency.

We explore if the attention paid by banks to this topic has grown after the crises and if the greater importance ascribed to IT governance is due to the Supervisors' pressure or the value-driven decisions. In particular, we test if, as for other corporate governance mechanisms, there is a verifiable linkage between IT governance (disclosure) and banks' performance.

*Keywords:* IT governance; IT governance disclosure; IT governance transparency; banks' performance; corporate governance.

JEL: G21, G30

### 1. Introduction

This paper investigates banks' attitude towards IT governance in a sample of major EU banks, deepening the underlying rationales and the possible impacts on banks' performance. In particular, we highlight if the renewed interest on IT governance paid by scholars and regulators — especially after the financial turmoil — also affected banks' disclosing behavior on this topic. We aim at testing if the increasing attention for IT governance by banks influence, like other corporate governance mechanisms, their performance in term of market-based and accounting-based indicators.

‡Corresponding author.

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Even though academics started to focus on IT in the 1960s did only in the late 1990s did this topic raise a systematic interest from scholars and practitioners. Ever since, the concept of IT governance has become the object of greater attention and analysis encompassing the mechanisms of corporate governance. To the extent that IT is a component of business, it is undeniable that the entire corporate governance includes IT governance.

However, IT governance merits distinct attention within other corporate governance mechanisms for two reasons:

- most organisations in today’s complex and competitive business environment rely heavily on IT to improve operating efficiency and sustain competitive advantage (Mata *et al.* 1995);
- IT governance can help firms to arrange and specify an efficient IT decision-making structure (Sambamurthy & Zmud 1999, Weill & Ross 2004, Xue *et al.* 2008, 2011) for a range of IT-related topics.

An effective governance of IT can support organizations in generating value-added from IT, contributing to the broader objectives of corporate governance (Weill & Ross 2004).

As in other sectors, IT is an intrinsic component of modern banks’ operational functioning. It has become the backbone of almost all banking processes, considering the growing role assumed in: (a) supporting management in strategic decisions; (b) facilitating the automated control environment on which core banking data are based; (c) developing new products and services to compete in the financial markets; (d) improving distribution channels.

Nonetheless, while IT has emerged as a strategic resource in today’s banking business environment, it can also raise critical issues.

Banks’ capacity to capture robust data for timely and automated risk identification increasingly relies on data and technology infrastructures. The lack of the ability of many banks to efficiently and effectively provide Senior Management with a real picture of the risks the organization faces — which was more evident during the global financial crisis — has led to a renewed attention to IT management from Regulators.

In light of the above, this study intends to contribute to the academic debate deepening IT governance mechanism in the banking sector, namely, IT governance transparency: which is defined as the attitude of firms to provide adequate and relevant IT governance information timely and in an effective manner to stakeholders, to improve management’s attitude in using IT (Millar *et al.* 2005, Eldomiaty & Choi 2006, Raghupathi 2007, Joshi *et al.* 2013). We rooted our research on the widely-shared assumptions that firms with good IT governance tend to disclose more on mechanisms related to IT (e.g. Clarkson *et al.* 2004).

In particular, we aim to highlight if the renewed interest on IT governance paid by scholars and regulators also influenced banks; furthermore, where this attitude

could be confirmed we explore if banks are moved by value-driven decisions or by regulatory constraints. Highlighting the possible behavioral changes and their driving forces, we form the premise to see if, like other corporate governance mechanisms, an increased focus on IT governance results in better performance of banks, as measured by both market-based and accounting-based indicators.

In order to grant the replicability of our study, we base our analysis on banks' public disclosure (this is an added value with respect to previous studies which use case studies and/or questionnaires to deepen IT governance practices). Moreover, we have developed an original descriptive framework of IT governance (ITGF) disclosure tailored to the banking sector to explore the attention paid to the topic in the banking sector. Using the ITGF, we performed a content analysis to measure the level of attention on IT governance through the years (2008–2015) and a cross countries, from both the banks' and Supervisors' perspectives.

This study provides several insights into the academic debate within the macro strand of literature on the corporate governance mechanisms, deepening the less analysed strand of IT governance and focusing on the banking sector from different perspectives.

In particular, the analysis falls in the strand of literature focused on the understanding of the impact of firms' corporate governance attributes on performances, that have gained a growing interest especially after the recent financial turmoil and mainly in EU countries.

The paper has the following structure: Sec. 2 provides the background of the research, including prior literature and the development of research questions, Sec. 3 describes the research methodology and the sample and data collection, while results are reported in Sec. 4. Section 5 summarizes the main conclusions and suggests future research.

## 2. Backgrounds and Development of Research Questions

### 2.1. *IT governance transparency: level of disclosure as a proxy of governance practices*

IT governance and its attributes and mechanisms are mainly conceptualized in the literature following corporate governance principles (Korac-Kakabadse & Kakabadse 2001, ITGI 2003, Weill & Ross 2004, Peterson 2004, Jordan & Musson 2004, Mähring 2006, Van Grembergen & De Haes 2009, Willson & Pollard 2009).

In the effort of identifying effective IT governance arrangements, scholars identify different mechanisms of IT governance (Sambamurthy & Zmud 1999, Kambil & Lucas 2002, Trites 2004, Weill & Ross 2004, Andriole 2009, Huang *et al.* 2010, Xue *et al.* 2011), focusing in particular on the role of the Board of Directors, on the effectiveness of the IT steering committee, on the relationship between IT control and firm performance, on the IT investment performance, and on IT audit issues (Trites 2004, Huff *et al.* 2006, Mähring 2006, Boritz & Lim 2008, Gu *et al.* 2008, Merhout & Havelka 2008). Less attention seems to be paid to IT governance transparency, defined as the ability of firms to provide adequate and relevant IT

governance information in a timely and effective manner to stakeholders (i.e. investors, policy makers, and regulatory bodies), to enable them to assess management's behavior in using IT (Millar *et al.* 2005, Eldomiaty & Choi 2006, Raghupathi 2007, Joshi *et al.* 2013). The existing literature proves that firms provide information on IT governance — voluntarily — if they obtain benefits such as reduced cost of capital (Barry & Brown 1985, 1986, Vanstraelen *et al.* 2003 Easley & O'Hara 2004), improvements in liquidity (Diamond & Verrecchia 1991, Kim & Verrecchia 1994), and better information intermediation (Bhushan 1989, Lang & Lundholm 1996).

Based on the study of Lang & Lundholm (1996) and Clarkson *et al.* (2004), we infer that the better IT governance firms have in place, the more they are incentivized to disclose. This allows us to base our analysis and our evaluation on banks IT governance on the level of disclosure regarding IT governance attribute.

It is important to bear in mind that corporate disclosure of IT governance does not adhere to any standardized or mandatory reporting format which could be used by banks. This is a fundamental premise to develop our research: as reported in the literature, the fact that banks' IT governance disclosure is voluntary and linked to the benefits that can ensure, leaves spaces for in-depth studies addressed to investigate if IT governance practices are in place. Establishing and measuring the relationship between IT governance mechanism and IT level of disclosure is challenging because it may overcome the main difficulties in measuring corporate governance mechanisms and more specifically IT governance ones without the access to internal resources; thus, in trying to solve this issue, the meta-objective of the paper is to establish a methodology for further research on this topic.

To the best of our awareness, also the existing IT governance literature does not propose any single standard framework to assess IT governance using disclosure practices: all empirical analysis are based on surveys and/or single case studies, i.e. on internal information. The only exceptions are Joshy *et al.* (2013) and Leo & Panetta (2018) that propose a different framework based on public information. Analyzing banks' from outside, we are aware that banks would not disclose on all aspects of their IT governance, also because they are not forced to describe specific procedures related to their IT strategy and so on.

Considering this theoretical premise, we expect to find some clues of specific structural IT governance mechanisms settled in each institution analyzed. For example, a bank might disclose the presence of Technology Committee to implement IT strategy, or of CIO to support business goals with IT management at the top level. The underlying assumption is that the dissemination of this kind of information makes sure stakeholders that the bank has an IT governance structure and that — probably — IT policies and procedures are established.

Therefore, our first research question is:

**Q1:** *Has the level of IT governance disclosure changed after financial turmoil?*

We expect an increase in the level of disclosure on banks' IT governance meaning greater attention at the firm level of IT governance issues also considering the growing importance of IT in the banking sector.

## **2.2. IT Governance disclosure and regulatory environment**

Since IT governance — like other aspects of banking business — can be influenced by the regulatory environment, it is essential to understand in which direction Regulators have recently moved. Indeed, there are no provisions at international level regulating directly IT governance: some of the more recent interventions (EBA, BCBS, EC) only indirectly affect IT governance allowing Regulators large degree of autonomy in discipline the issue at national level.

As mentioned above, the recent financial turmoil started in 2007 has catalyzed the attention, among others, on risk management and in particular on the processes, data management and the new emerging risks, such as IT risk.

The renewed interest in risk management has culminated in the necessity of reviewing the regulatory framework. In fact, at the international level the BCBS has

- started a comprehensive review of Basel II, culminated in the release of a reform package known as Basel III Framework (corresponding to Capital Requirements Regulation (CRR) and Capital Requirements Directive (CRD IV) in EU countries) which has affected — albeit indirectly — IT governance, emphasizing that risk management systems should have appropriate Management Information Systems (MIS);
- rolled out a new set of Principles with the aim of developing banks' Risk Data Aggregation and Risk Reporting, requesting banks to comply starting from 2016.

In the renewed Basel framework, there is no specific reference to IT-related risk and IT risk management processes, neither in other international regulatory intervention; IT risk is considered as a sub-type of operational risk (see art. 85 CRD IV).

Articles 4 and 321–325 of the CRR set out the measures that financial institutions should take to manage operational risk (and the related capital requirements), including risks related to cyber-attacks (CRR, CRD IV). Banks also need to have a contingency lens that ensures continuity of their business and limit losses in case of severe disruptions.

The CRD IV requires banks to perform a significant update to their IT risk management regarding:

- process: the implementation of the rules and standards into their business, leading to new opportunities and adapted business processes;
- data: under the new rules, banks will need to demonstrate data quality and traceability;
- technology: one of the most significant impacts from a technological standpoint is the ability to produce integrated reports, with consistent reporting across the company.

Furthermore, at a European level, the EBA Guidelines provide direction to the Supervisors for assessing banks' IT risk (EBA 2016) to reinforce the importance of an adequate IT risk management for banks: one more time, Regulators don't address to banks specific requests for an effective IT risk management but set a framework for Supervisors to monitor this topic at institution level.

Considering that all these changes in the regulatory environment may result in strategy overhaul, process review and IT system impact, we want to examine whether any differences in Regulators' awareness to IT concerns at the national level will induce differences in banks' IT governance to comply with regulatory prescriptions or guidelines, if any. Thus, the second research question is

**Q2:** *To which extent the Supervisors' behavior – if changed – has affected the attention paid by banks to the theme?*

We expect that Supervisors' habits highly condition changes in the banks' level of the disclosure.

### **2.3. IT Governance disclosure and bank performance**

Over time, previous studies focused on the relationship between corporate governance and performance have spanned using different types of analysis, moving from the use of the link with the agency costs, or transaction costs (Fama & Jensen 1983, Williamson 1985, Grossman & Hart 1986, Hart & Moore 1990, Shleifer & Vishny 1997, Zingales 1998), to the link with the decision-making dynamics (Zahra & Pearce 1989, Johnson et al. 1996, Hillman & Dalziel 2003, Zattoni 2006, Cafferata 2007, Miglietta 2007, Minichilli et al., 2009, Fortuna 2010); from the investigation of a positive correlation among the performance of listed companies and the implementation of corporate governance best practices (Becht et al. 2002, La Porta et al. 2002a, Bhojraj & Sengupta 2003, Gillan & Starks 2003, Gompers et al. 2003, Kiel & Nicholson 2003, Wood & Patrick 2003) to the impact of board characteristics on performance (Arnaboldi et al. 2018).

Furthermore, we notice that the most recent empirical studies conducted in different national contexts do not show convergent results. While researches carried out in Emerging Market shows a general positive correlation between corporate governance and market value of companies, for OECD countries, the results appear to be different. Gompers et al. (2003), in studying US context, show a strong positive correlation between specific "anti-scale" measures and Tobin's Q, while Larcker et al. (2007) find the existence of a weak positive relationship between Tobin's Q and common corporate governance indicators. Furthermore, Bhagat and Bolton (2008) report a positive relationship between a series of corporate governance measures and accounting values, while there is no evidence of a correlation between market values as performance indicators. Furthermore, Bauer et al. (2004) prove the absence of a significant relationship between corporate governance and performance variables, both in terms of market (Tobin Q) and accounting (ROA and ROE) variables.

Vice versa Drobetz *et al.* (2004) in a sample of German companies show a positive relationship between corporate governance variables and market value.

Two key takeaways emerge from the literature:

- the overall quality of a corporate governance system contributes to the increase in the economic and financial value of listed companies (Alexander *et al.* 2007, Schmid & Zimmermann 2008, Renders *et al.* 2010) measured through specific variables;
- the understanding the specific impact of certain variables on company performance is not supported by generally shared results.

Traditionally, literature has deepened IT issues relating to the banking sector analysing IT as a critical resource in improving operating efficiency in the banking system (Banker *et al.* 2009, Berger 2003, Chiasson & Davidson 2005, Chowdhury 2003, Fuß *et al.* 2007, Zhu *et al.* 2004).

Nonetheless, only a tiny strand of the recent literature has started to analyze banks' IT governance (e.g. Pardo *et al.* 2011). In fact, Information Technology with respect to the banking sector delved into considering its linkages with efficiency and with divergent results. Moreover, empirical evidence supports both the IT as key resource in improving banks' operating efficiency thesis (Banker *et al.* 2009, Berger 2003, Chiasson & Davidson 2005, Chowdhury 2003, Fuß *et al.* 2007, Zhu *et al.* 2004); and, at the same time, the presence of weak, or no existing, relationship between IT and productivity (CEA 2001, McKinsey Global Institute 2001, Beccalli 2007).

Academic studies have been on one side focused on the relationship between corporate governance and performance, and on the other side between IT investments and banks performance; in both cases, the lack of studies on the causal relationship between IT Governance and banks' performance allow us to address the following research question.

**Q3:** *Do IT Governance level of disclosure impact on banks' performance?*

We expect a positive relationship between banks' performance and IT governance practices expressed by the level of disclosure in this topic.

### 3. Research Methodology

#### 3.1. *The construction of IT governance disclosure index*

Our analysis is devoted at evaluating the IT governance practices in a sample of EU banks over time and across countries (Italy, Germany, France and Spain) to observe if the attention to this issue has increased and varies geographically (Q1), influenced by regulatory constraints (Q2), or changes at banks' level depending on value-driven decisions.

With the aim of answering our research questions, it is first of all necessary to define the measure of the different attitude of banks to IT governance concerns.

To this purpose, as mentioned above, we assume that the level of disclosure on this topic performed by each institution could be a proxy of the different way of behavior towards IT governance.

The level of IT governance transparency is measured from a unique dataset built up performing the content analysis (Weber 1985) on public disclosure documents of observed banks (see Sec. 3.3).

We perform the content analysis following the five stages reported in Table 1.

We construct a so-called IT Governance Framework (stage 3) according to previous scholars that contributes to assessing IT governance and based on our pilot study conducted on the Annual Reports of banks/Supervisors and main international regulation; Appendix A provides a brief description and supporting literature for each item included in the four focus areas/categories.

According to the prevalent literature, we suggest that the level of transparency of IT roles and responsibilities (IT Role & Responsibility, ITRR) can be used as a proxy of a good IT governance practices. In our opinion, the presence of the following roles is the necessary premise for an effective IT governance: (i) IT strategic roles; (ii) IT senior management; (iii) IT operational roles; (iv) IT control roles.

The definitions of corporate governance (OECD 1999, 2004), of which IT governance can be considered as a sub-set, present a need for leadership (strategic roles), direction (Senior Management) and control (roles). Therefore, IT governance must be driven from the highest levels within the organization not only from the IT department or business unit levels (operational roles) across the organization (Webb et al. 2006). In order for IT to be effectively governed, the presence of a variety of roles can be considered as a necessary premise.

Compared with previous studies, we improved the number of items related to control functions. Indeed, starting from the main three obligatory control functions in banks defined by Basel documents (risk control, compliance and internal audit), we have considered IT risk control, IT compliance, and IT audit; we presume that with a growing level of complexity and interdependencies of banks' technology and operating structures, IT control roles should be reinforced and, to some extent, performed internally.

Table 1. The main stage of content analysis performed in our study.

Stage	Description
1	Search in the relevant literature and in the regulatory framework on IT governance, the keywords (ITEMS) related to the topic (see Appendix A).
2	Test the list of the selected keywords on a pilot study conducted on banks' annual reports.
3	Group the selected set of items related to IT governance in four focus areas/categories (IT Role & Responsibility, IT Resources & Plans, IT Risk Management, IT Investment), which form our original IT governance framework.
4	Inspect the institutions' documents with the help of the software MAXQDA® in order to verify whether or not each item within ITGF is present.
5	Build up a unique dataset to be used to measure the level of IT governance disclosure.



With the second focus area (IT Resources & Plans, ITRP) we aim to investigate the relevance attributed to IT resources/process and infrastructures, in the belief that, due to both competitive and regulatory pressures, the relevance of IT management elements would increase, and consequently, the related information in the public documents.

In order to capture IT risk management practices (IT Risk Management, ITRM), we consider the main phases of risk management process: identification, evaluation, treatment and monitoring. The underlying hypothesis is that the main constituent of IT risk management should be communicated to all relevant stakeholders. With this indicator, we try to fix if banks disclose regard the presence of IT-related risk management policies/processes, and if IT risk is treated jointly or independently to the operational risk management framework.

The last focus area, ITINV is focused on IT budget/investments. Even though in the past two decades, practitioners and scholars (ITGI 2003, Weill & Ross 2004) have paid great attention to this topic, but the major part of these studies focused on the relationship between disclosure on IT financial matters and economic benefits for firms. In our research, we analyze IT investments as an attribute of IT governance disclosure, since budgeting and investments are the responsibilities of Top Management (ITGI 2003), and better IT governance practices are based on clear information on IT investments useful to assess the business value of IT.

Using the selected set of items, we inspect the institution documents to verify the presence and the frequency of each item (stage 4); this information was structured to define a unique dataset used to compute a total IT governance score which represents the number of times that each item is disclosed in the reports analyzed. Given the impossibility to discriminate if institutions write a short sentence or an entire section regarding IT governance in their reports, we decided to consider not only the presence of each item (0,1) but also the total number of times they are enumerated (frequency, item score). The underlying assumption is that the more institutions mention ITGF items, the higher is the level of disclosure. For example, if we find evidence of Internal Audit position five times in the Annual report, then an item score of 5 is assigned. By changing the level of aggregation considered, we can calculate different IT governance score: Total ITGF score, Category and sub-category score.

In order to analyse banks' behaviors, we calculate four IT governance indices, one for each focus area within ITGF (ITRR\_INDEX, ITRP\_INDEX, ITRM\_INDEX, ITINV\_INDEX); the indices are obtained dividing the category score by the number of expected items in each category (Bollen *et al.* 2006, Joshi *et al.* 2013, Leo & Panetta 2018):

$$ITy\_index = \frac{1}{N_y} \sum_{i=1}^{N_y} x_i,$$

where ITy\_Index is the IT governance Index related to  $y$  category (namely RR: Role and Responsibility; RP: Resources and Plans; RM: Risk Management; INV: Investment);

$x_i$  is the sum of the item scores within each category, and  $N_y$  number of items included in  $y$  category.

We use the sum of the four IT $y$ \_index to calculate the total ITGF Index for banks. This index and its components are used to compare the level of IT governance disclosure across time and countries.

In order to measure the changes in the attention paid by different Supervisors/Regulators to IT governance, we decided to perform the content analysis on a selected group of Supervisors' documents. Specifically, we considered items included in the first three ITGF-categories (ITRR, ITRP, ITRM), verifying whether each item is present (1 = present; 0 = not present) in the Authorities' Annual reports and/or national law. The underlying hypothesis is that in this kind of documents, it is possible to find evidence of a higher level of attention to IT governance paid by Supervisors. To the best of our knowledge, this kind of analysis was not previously performed.

Starting from the resulting original dataset, we build up a comprehensive ITGF\_INDEX for each Authority calculated as the sum of two specific IT governance indices:

- the index calculated on the national regulation of the analyzed countries (ITGF\_SUP\_REG), which means the presence of some set by national agencies on the IT governance related topics;
- the index calculated on the Supervisors' Annual Reports (ITGF\_SUP\_AR), which expresses the attention paid on banks' IT governance issues.

### 3.2. The panel data analysis: The fixed effects model

Aiming at evaluating the influence of Supervisors' attitude on banks' IT governance behavior, we infer the relationship between ITGF\_INDEX\_BANKS and ITGF\_INDEX\_SUPERVISORS (Q2) using panel data model estimates. We employ the panel data model also to verify the existence of some relationship between banks' performance and the level of IT governance disclosure (Q3).

To empirically test Q2, we compute a Fixed Effect Model as expressed in the following baseline model:

$$Y_{it} = \alpha + \beta X_{it} + \gamma z_{it} + \eta_i + \varepsilon_{it} \quad i = 1, 2, \dots, N, \quad t = 1, 2, \dots, T,$$

where

- $Y_i$  refers to the level of IT governance disclosure (ITGF\_INDEX\_BANKS) of bank  $i$  in year  $t$ ;
- $X_i$  is a matrix containing the  $k$  Supervisors' features (different ITGF\_INDICES for Supervisors);
- $z_i$  is the bank control variable (banks size measured by a natural Logarithm of Total Asset, LogTA);
- $\alpha, \beta$  and  $\gamma$ , that are the  $(1 + k)$  coefficient vectors, are to be estimated;

- $\eta_i + \varepsilon_i (U_{it})$  is the error term and is assumed to be independent of the  $k$  regressors and the bank-specific control variable. The noise  $\varepsilon_{it}$  has assumed identically and independently distributed, whereas  $\eta_i$  (the time-invariant component) represent unobserved firm-specific heterogeneity.

The model controls time effects through a full set of yearly dummies. The use of fixed effects helps to mitigate biases caused by time-invariant omitted variables correlated with the regressors which result in inconsistent parameter estimates. The use of lagged regressors in some model specification helps us to alleviate some of the endogeneity concerns.

We also employ the fixed effects model to verify the existence of some relationship between banks performance and the level IT governance disclosure (Q3) reached by banks. In this case,  $Y_i$  refers to bank performance indicators (ROA, ROE, Cost to Income, and Tobin Q), and  $X_i$  refers to bank disclosure indicators related with each sub-category (ITRR\_INDEX, ITRP\_INDEX, ITRM\_INDEX, ITINV\_INDEX). Being aware that bank performance is not affected only by the level of disclosure of IT Governance, we include in the regression model, in addition to LogTA, other explanatory variables linked to the business model, to the riskiness of bank assets and to the level of leverage, respectively:

- BUSS, Net Interest Rate Revenues to Intermediation Margin as a proxy of the business model;
- RIoASS, Loan Loss Provision to Gross Loan as a proxy of the quality of Loan portfolio;
- EtA, Equity to Total Asset as a measure of leverage.

See [Appendix B](#) for variable definition.

### 3.3. *The sample and the data collection*

We consider the five major banks of each country, including in the sample at least one G-SIB for each country: the final sample consists of 20 international banking groups (Table 2). Countries selected for our analysis are France, Germany, Italy and Spain due to the dimension of the national banking system in term of total assets, representing together around 73% of total assets of the EU banking sector (ECB, 2016). As mentioned, to perform the content analysis, we record data from different sources of public disclosure of banks included in the sample (398 documents), namely Annual Reports, Corporate Governance reports, Pillar III reports, CSR/Sustainability reports, if any.

In order to calculate Supervisors' ITGF\_INDEX, we perform the content analysis on the following types of sources:

- Supervisors' Annual Reports (30 documents in total, Table 3);
- Regulations which, during the period 2008–2015:

Table 2. Banks' sample composition and documents collected (2015).

Country	Total asset (bln €)*	Share of Euro area total assets*	Bank	G-SIB**	Total assets (mln €)	Share of total assets of countries banking system	No of documents analyzed	Listed (2008–2015)
France	6940	25%	BNP Paribas	X	1292206	19%	16 <sup>(1)(2)</sup>	X
			Société Générale	X	1334391	19%	15 <sup>(1)(3)</sup>	X
			Crédit Agricole	X	1529294	22%	8 <sup>(1)(2)</sup>	
			Crédit Industriel et Commercial		253976	4%	8 <sup>(1)(2)</sup>	
			Natixis		500257	7%	8 <sup>(1)(2)(3)</sup>	X
Germany	6955	25%	Deutsche Bank	X	1629130	23%	32	X
			Commerz Bank		532641	8%	23 <sup>(1)</sup>	X
			Landesbank Baden-Württemberg		234015	3%	23 <sup>(1)</sup>	
			Bayerische Landesbank		215711	3%	16 <sup>(1)(6)</sup>	
			Norddeutsche Landesbank		180998	3%	17 <sup>(7)</sup>	
			Girozentrale					
Italy	2724	10%	Intesa San Paolo		676496	25%	32	X
			Unicredit	X	860433	32%	32	X
			Monte dei Paschi di Siena		169012	6%	24 <sup>(4)</sup>	X
			UBI Banca		117201	4%	24 <sup>(1)</sup>	X
			Banco Popolare		120510	4%	15 <sup>(4)(8)</sup>	
			Banco Santander		1340260	37%	32	X
Spain	3664	13%	BBVA		397303	11%	24 <sup>(3)</sup>	X
			Banco Sabadell		208628	6%	20 <sup>(6)</sup>	
			Bankinter		58660	2%	14 <sup>(1)(9)</sup>	
			Banco Popular Español		158650	4%	15 <sup>(1)(2)(10)</sup>	X

Source: \*ECB (2016), p. 69; \*\*FSB (2015), p. 2; bank's website.

Notes: (1) no separated CG Report; (2) no separated Pillar III; (3) no separated CG Report; (4) CSR n.a.; (5) Separated CG Report for '09; Pillar III n.a. in English for '11–'15; CSR n.a. for '13–'14; (6) Reports available in English only since 2010; CSR n.a. '08–'10–'12–'13; (7) CSR available only for '15; CG Report n.a.; (8) CG Report n.a. in English; (9) Reports available starting since '11; Pillar III in English only for '15; (10) CSR '10 n.a.; AR, CG Report, Pillar III n.a. '11.

- put in place the Basel III framework;
- apply EBA Guidelines on internal Governance (GL44);
- specifically, refer to the BCBS (2013) Principles of effective Risk Data Aggregation and Risk Reporting (PRDARR)

Table 3. Supervisors' sample composition and documents collected.

Supervisor (acronym)	Country	No of annual report analyzed (Timespan)
Supervisory and Resolution Authority - Autorité de Contrôle prudentiel et de résolution (ACPR)	France	6 (2010–15)
Federal Financial Supervisory Authority - Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin)	Germany	8 (2008–15)
Bank of Italy - Banca d'Italia (BoI)	Italy	8 (2008–15)
Bank of Spain - Banco de España (BoS)	Spain	8 (2008–15)

Table 4. Regulations considered in ITGF\_Index for supervisors.

References	Italian implementation	French implementation	German implementation	Spanish implementation
EBA Guidelines on Internal Governance EBA/CEBS (2011)	<ul style="list-style-type: none"> <li>● Circular 288/2015</li> <li>● 15th update (2013) of Circular no 263/2006</li> <li>● 15th update (2015) of Circular no 285/2015</li> </ul>	<ul style="list-style-type: none"> <li>● Article 511.41 French Monetary and Financial Code (Code Monétaire et Financier), updated in 2014</li> </ul>	<ul style="list-style-type: none"> <li>● German Banking Act, 2012 (Kreditwesengesetz – KWG)</li> <li>● Circular 10/2012 MaRisk</li> </ul>	Adoption of the Guidelines as their own on 27 June 2012
BCBS Principles for Effective Risk Data Aggregation and Risk Reporting (2013)	<ul style="list-style-type: none"> <li>● 15th update (2015) of Circular no 285/2015</li> </ul>	Not Found	<ul style="list-style-type: none"> <li>● German Banking Act (Kreditwesengesetz – KWG)</li> <li>● Circular 10/2012 MaRisk</li> </ul>	Not Found
CRD IV - Directive 2013/36/EU of the European Parliament (2013)	<ul style="list-style-type: none"> <li>● 15th update (2013) of Circular no 263/2006</li> <li>● 15th update (2015) of Circular no 285/2015</li> </ul>	<ul style="list-style-type: none"> <li>● French Monetary and Financial Code (Code Monétaire et Financier), updated in 2014</li> </ul>	<ul style="list-style-type: none"> <li>● German Banking Act (Kreditwesengesetz – KWG)</li> <li>● Circular 5/2014 (BA)</li> </ul>	<ul style="list-style-type: none"> <li>● Ley 10/2014</li> <li>● Royal Decree 84/2015</li> <li>● Circular 2/2016</li> <li>● Law 14/2013 of 29 November 2013</li> </ul>
Other		<ul style="list-style-type: none"> <li>● Regulation 97–02 of 21 February 1997, relating to internal control in credit institutions and investment firms (revised in 2010)</li> </ul>		

also, any other specific regulation on IT governance, if available in English (see Table 4). Indeed, in order to ensure the viability of the analysis, in some cases, we chose to exclude some other important regulatory provision because of the native language availability only — different from English — which prevented us to perform a content analysis.

Regarding the banks’ performance indices, we collect data from Bloomberg. Unfortunately, the available data do not cover the entire time span of the analysis reducing the number of observations exploited to answer the research questions Q2 and Q3. In order to ensure data consistency, we use the same source of data instead of calculating indicators based on financial information. This should support the reliability of data and the replicability of our analysis.

#### 4. Results and Discussion

##### 4.1. *Has the level of IT governance disclosure changed after financial turmoil?*

Table 5 provides descriptive statistics for the ITGF-variables employed in this study. The mean for the overall IT disclosure index for banks (ITGF\_INDEX\_BANKS) is 2.50, representing that on average, during the period considered, banks disclosed on around 103 items of the 41 within ITGF; however, the variance of the index is broad among the sample. Similar considerations can be done for Supervisors’ ITGF index, even if the mean value and the range of variation are smaller than banks’ ones.

As shown in Table 2, the number of documents considered in the analysis differs consistently: from one bank to another from 8 documents for the French Crédit Agricole, Crédit Industriel et commercial to the 32 documents considered for the Italian Intesa Sanpaolo and Unicredit or Banco Santander and Deutsche Bank. Deepening the analysis at the country level (see Fig. 1), we have not found any evidence of the existence of regulatory constraints regarding the number of the reports to be produced by banks. At first sight, it is possible to affirm that some banks tend to disclose on IT governance more than others and this attitude is not

Table 5. ITGF Indices: Descriptive statistics.

Variable	Obs	Mean	Std. dev.	Min	Max
<b>ITGF INDEX FOR BANKS</b>					
ITRR_INDEX	160	0.4142045	0.6013609	0	6.090909
ITRP_INDEX	160	0.5011364	0.6338665	0	3.181818
ITRM_INDEX	160	1.166869	1.02928	0	7.285714
ITINV_INDEX	160	0.41875	0.3523841	0	2
ITGF_INDEX_BANKS	160	2.50096	1.799731	0	1.695844
<b>ITGF INDEX FOR SUPERVISORS</b>					
ITGF_SUP_AR	150	0.2640076	0.2170656	0	0.8262108
ITGF_SUP_REG	150	0.3960114	0.4942532	0	1.396011
ITGF_INDEX_SUPERVISORS	150	0.660019	0.5637494	0.02849	1.823362

related to the number of disclosed documents. For our analysis that means not having to normalize the index value calculated for banks by the number of documents provided by each institution: in fact, the correlation between the level ITGF\_Index and the number of documents analyzed is shallow (0.29), as shown in Fig. 1.

We then considered the percentage of IT governance items disclosed by banks and Supervisors in the sample (Table 6) grouped by sub-categories. Before analyzing the results of the Supervisors' behavior, we make it clear that it was impossible to

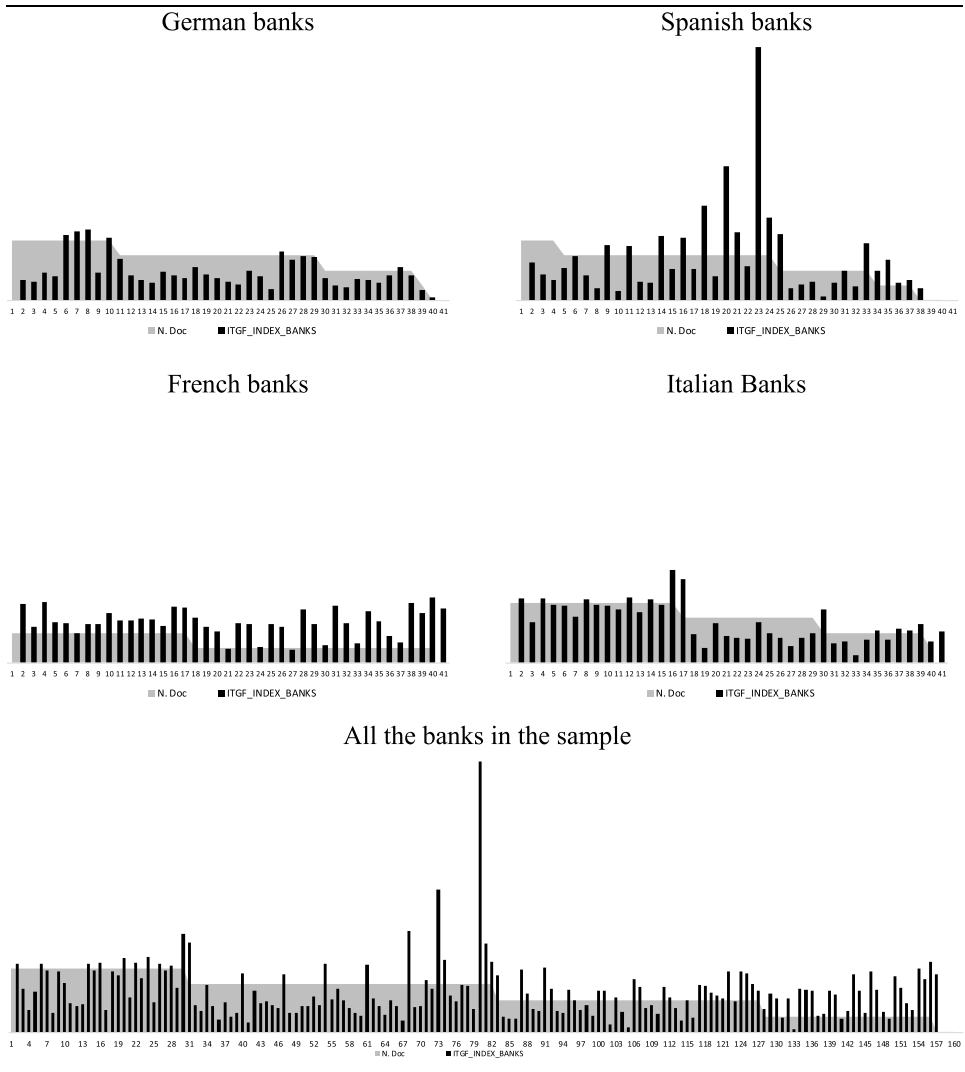


Fig. 1. Distribution of the sample by ITGF\_Index and number of scanned documents (country level and Total).

Table 6. Level of disclosure (Index\*) and percentage\*\* of banks and Supervisors\*\*\* disclosing IT governance items by sub-categories.

		Banks results								
CAT	SUB_CAT	2008	2009	2010	2011	2012	2013	2014	2015	
ITRR	A. IT Control roles	10%	10%	10%	20%	15%	10%	15%	25%	
	B. IT operational roles	60%	75%	80%	75%	75%	70%	80%	75%	
	C. IT senior management	35%	30%	20%	25%	25%	25%	40%	40%	
	D. IT strategic roles	5%	5%	10%	5%	5%	5%	10%	15%	
ITRP	A. IT plans/policy	15%	15%	15%	20%	20%	30%	40%	60%	
	B. IT processes	50%	40%	35%	45%	50%	55%	50%	55%	
	C. IT resources	65%	70%	50%	70%	60%	65%	80%	85%	
	D. IT standard/principles	25%	30%	25%	35%	30%	35%	55%	55%	
ITRM	A. Identification	50%	60%	55%	70%	75%	80%	85%	90%	
	B. Evaluation	—	5%	—	—	—	—	10%	30%	
	C. Treatment	80%	85%	85%	95%	90%	95%	100%	95%	
	D. Management	5%	5%	5%	5%	10%	—	20%	15%	
ITINV	A. IT information in financial statement	70%	80%	80%	75%	80%	85%	85%	85%	
	B. IT budget	—	5%	—	—	—	5%	5%	5%	
	C. IT expenses	55%	50%	30%	35%	35%	25%	45%	35%	
	D. IT hardware/software	5%	10%	15%	15%	15%	20%	15%	25%	
		Supervisors results								
CAT	SUB_CAT	2008	2009	2010	2011	2012	2013	2014	2015	
ITRR	A. IT Control roles	—	—	—	25%	—	25%	25%	25%	
	B. IT operational roles	50%	25%	50%	25%	50%	75%	75%	75%	
	C. IT senior management	25%	—	—	25%	50%	25%	25%	25%	
	D. IT strategic roles	—	—	—	—	—	—	—	—	
ITRP	A. IT plans/policy	—	—	25%	50%	—	100%	100%	100%	
	B. IT processes	—	—	25%	50%	75%	100%	75%	75%	
	C. IT resources	25%	25%	75%	75%	75%	75%	50%	75%	
	D. IT standard/principles	—	—	—	—	—	—	—	—	
ITRM	A. Identification	25%	25%	25%	25%	25%	50%	50%	100%	
	B. Evaluation	—	—	—	—	—	25%	25%	50%	
	C. Treatment	25%	25%	50%	25%	75%	100%	100%	100%	
	D. Management	—	—	—	—	—	50%	25%	25%	

Notes: \* ITGF INDEX calculated for each sub-category in the sample; \*\*Number of banks that disclose the Items by sub-categories within ITGF divided by the number of banks included in the sample; \*\*\*Number of Supervisors, which refer about the Items of each category and sub-categories within ITGF divided by the number of Authorities considered in the study.

find out the English version of dispositions which transposed CRD IV and EBA Guidelines into all national regulation (Table 4), namely:

- the Code monétaire et financier, updated in 2014, for France;
- 15th update to Circular 263/2006 and 285/2015, for Italy.

However, we performed the content analysis using the available version of the three documents: while in Italy we have some findings due to the use of English terms in



national legislation, for France we have found less evidence. Considering these limitations, we analyzed the percentage of Supervisors that enumerate the items included in ITRR, ITRP, ITRM categories (Table 6).

The results for banks highlight the following:

- a generalized lack of disclosure of organizational positions (see category ITRR); more attention paid to operational roles related to the insurance of business continuity; surprisingly there is no increase in IT control roles as expected;
- ITRP exhibits an increasing number of banks that disclose on IT resources (65–85%) starting from 2013, while not many banks refer about IT policy and IT plans;
- ITRM is the most reported focus area; an increasing number of banks in the sample (from 50% to 90%) referred directly to IT risk (*et similia*), starting to consider it as a specific category instead of being included under the operational risk. A relevant part of the interest by respondent banks is devoted to the treatment phase of Risk Management, and to Business Continuity plans and Information security as a whole;
- finally, ITINV indicates that most banks reported IT expenditure, but it seems related to accounting policies instead of disclosing investment plans. Perhaps this attitude is due to the strategic and competitive relevance to IT investments and the banks' need to preserve the related programs' details.

For Supervisors, we notice that starting from 2013, they focused on:

- IT operational roles for ITRR;
- IT plans/policies and IT resources for ITRP;
- Identification and Treatment for ITRM.

Comparing results between banks and Supervisors, we notice a similar behavior among the two groups regarding the sub-categories enumerated. This evidence allows us to verify the existence of an effective relationship between Supervisors' attitude and banks' behaviors (Q2).

#### **4.2. To which extent the Supervisors' behavior has affected the attention paid by banks on IT governance? (Q2)**

In order to estimate the relationship between ITGF\_INDEX for banks and Supervisors, we exploit the wherewithal of panel data models. Table 7 displays the summary of the panel data variables used at this stage of analysis.

At first glance, we note a “higher” variation of the dependent variable expressed by the standard deviation, which indicates the ITGF\_INDEX variation of the banks in the eight years analyzed. Considering the individual ITGF\_INDEX components, Table 7 shows different attitudes: while ITRR\_INDEX shows greater variability over time, the remaining three indices differ more on an individual level. Less evident are

Table 7. Panel data variables: Descriptive statistics.

Variable	Mean	Std. dev.	Min	Max	Observation
ITGF_INDEX_BANKS (Dependent variable)					
OVERALL	2.50096	1.799731	0	16.95844	$N = 160$
BETWEEN		1.259202	1.269968	6.38539	$n = 20$
WITHIN		1.312725	-0.919495	13.07401	$T = 8$
ITGF_INDEX_SUPERVISORS					
OVERALL	0.660019	0.5637494	0.02849	1.823362	$N = 150^*$
BETWEEN		0.4303221	0.3881766	1.42925	$n = 20$
WITHIN		0.4076006	-0.4843305	1.443495	$T - \bar{\text{bar}} = 7.5$
ITGF_SUP_AR					
OVERALL	0.2640076	0.2170656	0	0.8262108	$N = 150^*$
BETWEEN		0.0487958	0.2065527	0.3383191	$n = 20$
WITHIN		0.2113978	-0.0743115	0.7518993	$T - \bar{\text{bar}} = 7.5$
ITGF_SUP_REG					
OVERALL	0.3960114	0.4942532	0	1.396011	$N = 150^*$
BETWEEN		0.4314804	0.1495726	1.168091	$n = 20$
WITHIN		0.3030993	-0.7435897	0.8696581	$T - \bar{\text{bar}} = 7.5$

Note: \*This value is due to the lack of data for Supervisors in France in 2008 and 2009.

the differences between the Supervisor indices for which only ITGF\_SUP\_AR seems to have a different trend in the periods considered.

Starting from the baseline regression described in Sec. 3.2, we constructed three models by changing the independent variables, all related to Supervisors' behavior. In Model 1, we measured the direct relationship between ITGF\_INDEX in  $t$  of both Banks and Supervisors. In Model 2, we deepen the previous relationship considering the two components of ITGF\_INDEX\_SUPERVISORS in  $t$ : (a) ITGF\_SUP\_AR $_t$ , as a proxy of Supervisors' moral suasion; (b) ITGF\_SUP\_REG $_t$ , as a proxy of a prescriptive attitude of Supervisors. Finally, in the third Model, to alleviate some of the endogeneity concerns, we used 1-year lagged regressors, in particular: (i) ITGF\_SUP\_AR $_{t-1}$ , we decided to consider the time lag 1 bearing in mind that the more Supervisors "talk" about IT related issues, the more banks are incentivized to disclose the same topics in the following year; (ii) ITGF\_SUP\_REG $_{t-1}$ , which may reveal the behavior of banks in response to regulatory requirements on IT governance.

In all models, we use the control variable LogTa (logarithm of banks' Total Asset) as a proxy of the dimension of financial intermediaries. We consider LogTA for two reasons: first of all, to taking into account the idiosyncratic dimension of the phenomenon; furthermore, from an economic point of view, it could be possible that greater banks are more inclined to invest in IT and then to disclose about related issues. Additionally, we control for time effects using a set of yearly dummies.

Table 8 summarizes the estimation results. At first sight, the causal linkage between the behavior of Supervisors and banks is faded: in fact, the independent variable coefficient (ITGF\_INDEX\_SUPERVISORS) is not significant in the first

Table 8. Estimation results.

Variables	Model 1	Model 2	Model 3	
log TA	1.1924201	-0.4680892	-1.0687215	
ITGF_INDEX_SUPERVISORS	0.52882836			
ITGF_SUP_AR <sub>t</sub>		1.8402527**		
ITGF_SUP_REG <sub>t</sub>		-0.07546902		
ITGF_SUP_AR <sub>t-1</sub>			2.6423496**	
ITGF_SUP_REG <sub>t-1</sub>			-0.45296413	
Group Variable	Bank	Bank	Bank	
Time effect	Yes	Yes	Yes	
No of Obs	150	150	130	
No of Groups	20	20	20	
Prob > F	0.0000	0.0000	0.0000	
R-sq	within	0.3628	0.4003	0.4194
	between	0.1892	0.2014	0.2030
	overall	0.2920	0.1293	0.0492

Notes: \* $p < 0.05$  \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

Number of observations: in Model 1 and 2 the number of observations is 150 (instead of the expected 160) because of the lack of ITGF\_INDICES for Supervisors in France in 2008 and 2009. In Model 3 the use of time lag “ $t - 1$ ” further reduces the number of observations to 130. For the three Models, temporal effects are jointly significant at the statistical level.

model. Model 2 surprisingly reveal a more relevant and statistically significant effect of the moral suasion that seems to be more relevant on banks’ behavior compared with regulating prescription. Model 3 emphasizes the dependence of the bank level disclosure from moral suasion of Supervisors. We have to point out the absence of a significative relationship between regulation and the level disclosure on the IT issues; this is probably because if specific rules have to be respected by all institutions, there is less incentive to make more disclosure to obtain a competitive advantage.

Table 9. Panel data variables: Descriptive statistics.

Variable	Mean	Std. dev.	Min	Max	Observation
ROA (Dependent variable)					
OVERALL	0.0665534	0.5617581	-2.798024	0.967221	$N = 158$
BETWEEN		0.3184624	-0.695515	0.5708359	$n = 20$
WITHIN		0.4663377	-2.035956	1.253059	$T\text{-bar} = 7.9$
ROE (Dependent variable)					
OVERALL	0.6941024	13.32855	-88.22164	19.04437	$N = 160$
BETWEEN		7.336271	-20.31694	9.665191	$n = 20$
WITHIN		11.23382	-67.21059	28.87317	$T = 8$
TOBIN Q (Dependent variable)					
OVERALL	0.9824486	0.01841	0.930765	1.041509	$N = 136$
BETWEEN		0.0151621	0.9500173	1.008943	$n = 17$
WITHIN		0.0109981	0.9483929	1.015015	$T = 8$

Table 9. (Continued)

Variable	Mean	Std. dev.	Min	Max	Observation
COST TO INCOME (CtI) (Dependent variable)					
OVERALL	73.60547	62.18186	37.28814	816.895	$N = 159$
BETWEEN		26.12833	45.57781	170.1505	$n = 20$
WITHIN		56.66482	-33.27831	720.3499	$T\text{-bar} = 7.95$
logTA					
OVERALL	5.610556	0.4469408	4.728107	6.342901	$N = 160$
BETWEEN		0.4534606	4.750645	6.297207	$n = 20$
WITHIN		0.0564119	5.419876	5.834111	$T = 8$
BUSS					
OVERALL	55.04581	12.13888	21.33039	97.46016	$N = 130$
BETWEEN		11.90215	31.32288	86.48431	$n = 19$
WITHIN		5.608276	38.17159	68.47173	$T = 6.84211$
RloASS					
OVERALL	0.9305462	0.7440333	-1.242624	5.642381	$N = 160$
BETWEEN		0.4530873	0.3076893	1.738985	$n = 20$
WITHIN		0.5977753	-0.6886418	4.833942	$T = 8$
EtA					
OVERALL	5.363749	1.880298	1.365609	10.09669	$N = 160$
BETWEEN		1.672011	2.962556	8.918119	$n = 20$
WITHIN		0.9289657	3.121714	7.937428	$T = 8$
GDP					
OVERALL	0.0105144	0.0242993	-0.0396059	0.0486855	$N = 160$
BETWEEN		0.0100296	-0.0003004	0.0241161	$n = 20$
WITHIN		0.0222326	-0.0532076	0.0480501	$T = 8$
ITGF_INDEX_BANKS					
OVERALL	2.50096	1.799731	0	16.95844	$N = 160$
BETWEEN		1.259202	1.269968	6.38539	$n = 20$
WITHIN		1.312725	-0.919495	13.07401	$T = 8$
ITRR_INDEX					
OVERALL	0.4142045	0.6013609	0	6.090909	$N = 160$
BETWEEN		0.3392398	0.0681818	1.511364	$n = 20$
WITHIN		0.5016152	-0.7335227	4.99375	$T = 8$
ITRP_INDEX					
OVERALL	0.5011364	0.6338665	0	3.181818	$N = 160$
BETWEEN		0.5404211	0.0568182	2.238636	$n = 20$
WITHIN		0.3501279	-0.2943182	2.8875	$T = 8$
ITRM_INDEX					
OVERALL	1.166869	1.02928	0	7.285714	$N = 160$
BETWEEN		0.832239	0.0267857	3.678571	$n = 20$
WITHIN		0.6303081	-0.5831314	4.774011	$T = 8$
ITINV_INDEX					
OVERALL	0.41875	0.3523841	0	2	$N = 160$
BETWEEN		0.3002055	0.05	1.225	$n = 20$
WITHIN		0.1949843	-0.00625	1.19375	$T = 8$

Table 10. IT Governance and banks performances: Regression.

Variables	ROA			ROE			CtI			Tobin Q		
	Model 1a	Model 1b	Model 2a	Model 2b	Model 2c	Model 3a	Model 3b	Model 3c	Model 4a	Model 4b		
logTA	-1.1123839	-1.2548163	-33.4377*	-37.523929*	36.083071	44.36531*	-0.02652268	-0.03194607				
BUSS	-0.01283599*	-0.01300659*	-0.23380428	-0.2376359	0.3341042	0.38132996*	-0.00037644	-0.00033007				
RtoASS	-0.39592049***	-0.37586973***	-8.3264715***	-7.7123668***	-1.4042678	-2.6707802	-0.00036988	-0.00010351				
Eta	0.20324274***	0.22410578***	4.4518117***	5.0647856***	-2.741113	-4.0700645**	-0.00428645**	-0.0039854*				
GDP	-1.9107811	-1.7031722	27.670432	33.720802	-183.145***	-190.09881***	-0.10166277	-0.08490044				
ITGF_INDEX_	-0.02999239		-1.1423781		1.6845979*		0.00109441					
BANKS												
ITRR_INDEX		0.05748316		1.6729837		-4.8479694		0.00083639				
ITRP_INDEX		-0.08063864		-3.0133178		1.7442433		-0.00415297				
ITRM_INDEX		-0.09860521		-3.1308082		7.892014***		0.00263217				
ITINV_INDEX		0.17783845		4.5847232		-7.0507475		0.01272448*				
No of Obs	129	129	130	130	130	130	119	119	119	119		
No of Groups	19	19	19	19	19	19	17	17	17	17		
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
R-sq	Within	0.4553	0.4249	0.4466	0.1830	0.2691	0.1776	0.2369	0.2369	0.2369		
	Between	0.0078	0.0120	0.0152	0.0690	0.0425	0.0028	0.0000	0.0000	0.0000		
	Overall	0.0327	0.0145	0.0103	0.0660	0.0509	0.0031	0.0103	0.0103	0.0103		

Notes: \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

The number of observations changes consistently among different Models depending on the availability of Data; besides, in Tobin's Q Ratio Models the number of observation is further reduced due to the number of listed institution considered in the sample (see Table 2).

### 4.3. Does IT Governance impact on banks' performance? (Q3)

With the last research question, we investigate the causal relationship between the level of disclosure on IT governance and different banks' performance indicators (dependent variables); we choose ROA, ROE, Cost to Income (CtI) and Tobin's Q ratio, since they are the most used in literature. Table 9 displays the summary of the panel data variable used to answer Q3.

For each dependent variable, we define different models considering ITGF\_INDEX\_BANK in  $t$  (Model a) and ITGF indices related to each sub-category (Model b). For all models, we considered the possibility that performance might depend on the specificity of the bank size (LogTa), its business model (BUSS), the riskiness of both asset (RIoASS) and the financial structure (EtA). Besides, we consider the growth rate of GDP to verify the possible dependence in relation of the bank performance with the state of the economy in each country.

Looking at results reported in Table 10, we notice, even if with differences, all set Models are in higher dependence of performance from bank-specific characteristics.

Our findings related to ITGF\_INDEX\_BANK and different performance measures should be interpreted bearing in mind our theoretical premise: as mentioned above the underline assumption is that the level of disclosure on IT Governance issue can be used as a proxy of the relevance given to the topic in each financial intermediary considered.

Overall, the results suggest that there is no impact of attention paid to IT Governance on accounting-based return on asset and equity.

Results related to CtI reveal a positive and significant relation with ITGF\_INDEX\_BANKS as an all, and in particular with its component related to risk management sub-category ITRM\_INDEX.

The findings also indicate that ITINV\_INDEX has a positive, significant, even weak, influence on Tobins' Q ratio.

## 5. Concluding Remarks: Key Findings, Limitation and Future Research

IT governance establishes a significant point of attention for Supervisors and banks as the diffusion, and the complexity of IT continues to increase across the financial sector. Information Technology leads to critical issues: nearby the role assumed in supporting banking business, it can reveal its' dark side, as demonstrated during the recent financial turmoil. In this scenario, ensuring that IT processes are fully integrated into all business processes — risk management included — can be considered a strategic asset for banks and a new challenge for Supervisors. For instance, IT can ensure to provide Senior Management with a real picture of the risks the bank faces.

As far as the scope of this study is concerned, we have analyzed public corporate disclosure of IT governance practices across major EU banks. Adopting a IGTF governance disclosure, we conducted a content analysis to examine the level of attention paid to IT governance issues across the time (2008–2015) and countries

(Germany, Spain, France, Italy). It is important to underline that corporate disclosure of IT governance does not adhere to any standardized or mandatory reporting format which could be used by banks. This is an essential premise to develop our research: as reported in the literature, the fact that banks' IT governance disclosure is voluntary and linked to the benefits that can ensure, leaves spaces for in-depth studies addressed to investigate if IT governance practices are in place.

Similar considerations should be made on the Supervisors' side. There are no provisions at international level regulating directly IT governance: some of the more recent interventions concerning this issue (EBA, BCBS, EC) only indirectly affect IT governance, allowing regulators large degrees of autonomy to discipline the issue at national level; this permitted us to use the same methodology developed for banks to analyze the differences in the Supervisors' behaviors. One of the questions to which this study sought to answer is whether this awareness has been reached before by banks or by Supervisors. On this topic, it seems that banks have started to be "interested" before their "custodies", even if both have increased their attention during the period analyzed.

The following further key-points arise from the analysis: (i) banks, within the IT Governance Framework, seems paying more attention to IT Risk Management; (ii) among the others, Spanish banks included in the sample have recorded the most evident change in behaviors while Italian ones have revealed a more constant attention to the theme.

Furthermore, analyzing regression results, we find that banks change the level of disclosure on IT governance in response to Supervisors' moral suasion pressure instead to react to a specific prescription. The absence of a relationship is maybe because if specific rules are having to be respected by all institutions, there is less incentive to make more disclosure to obtain a competitive advantage.

Finally, our results give evidence of a nonsignificant impact of the ITG level of disclosure on banks performance reflected by ROA and ROE. While cost efficiency (CtI) and Tobin's Q Ratio seem to be sensitive to the level of disclosure on IT governance, and in particular respectively on component related to risk management, and on the level of disclosure on investment on IT.

The study contributes to the existing literature in several ways. It enriches the current understanding of IT governance in banks, focusing on the level and the content of IT governance disclosure. Secondly, it highlights the regulatory environment that favored IT governance practice in banks and tried to measure the intensity of this relationship. Moreover, it contributes to the governance disclosure literature providing an original methodological framework based on solid theoretical background.

The theoretical approach used in this study may well serve as a base for further analysis. The study may be replicated across other EU countries not included in our sample to get more significant results, from a statistical point of view and to complete the normative framework with the missing provisions.

## Appendix A. IT Index: Description of Items and Literature References

Table A.1.

Sub-category	Items	Description	Relevant literature
<b>ITRR Index</b>			
A. IT Control roles	1. It audit/EDP audit	Presence of IT and information assets related risk are on the agenda of the Audit or Risk Committee	Hadden and Hermanson (2003); De Haes & Van Grembergen (2008); Joshi et al. (2013)
	2. Information security control function	Presence of Control Function related to Information Security	Pilot study
	3. Business continuity management	Presence of responsible for business continuity	
B. IT operational roles	4. CERT/SOC	Presence of Computer Emergency Response Team/Security Operations Centre	
	5. Data management office/center	Presence of organisational position related to Data management	
C. IT senior management	6. IT service/function	Presence of specific organisational position	
	7. CIO	Presence of CIO or an equivalent position to IT and information assets at an executive level	Peterson (2004); De Haes & Van Grembergen (2008); Joshi et al. (2013)
	8. CISO	Presence of CISO to IT security at an executive level	Pilot study
	9. IT management	Presence of Senior Management dedicated to IT asset	
	10. Technology committee	Presence of a special committee which looks after IT and related technology architecture, projects, and governance issue at an executive level	Premuroso & Bhattacharya (2007); Joshi et al. (2013)
D. IT strategic roles			



Table A.1. (*Continued*)

Sub-category	Items	Description	Relevant literature
	11. Other IT committee	Presence of: (i) a committee looking after IT and information assets at the board level; (ii) a committee which monitors IT management, IT spending, and related cost allocations (IT steering committee); (iii) a committee which looks after strategic planning and investment decisions on IT and information assets (IT planning committee)	Sambamurthy <i>et al.</i> (1993); Karimi <i>et al.</i> (2000); Peterson (2004); Trites (2004); Van Grembergen & De Haes (2004); Nolan & McFarlan (2005); De Haes & Van Grembergen (2008); Joshi <i>et al.</i> (2013)
ITRP Index			
A. IT plans /policy	1. Information security policy	Presence of clear information and security policy	Trites (2004); Jordan & Silcock (2005); Joshi <i>et al.</i> (2013)
	2. IT plan/s		
	3. IT strategy	Presence of any reference to IT strategies	Pilot study
B. IT processes	4. EDP	Presence of explicit reference to Electronic Data Processing	
	5. IT resources governance	Presence of specific IT process and procedures in place	
	6. IT processes/procedures		
C. IT resources	7. IT/Data Infrastructure/Architecture	Terms related to the relevance assumed by data governance after the 2008 financial crisis, as a key resource to support strategic planning and tactical decision making	SSG (2010); BCBS (2013)
	8. IT resources/solution	Presence of explicit reference to IT resources and solutions	Pilot study
D. IT standard/principles	9. ITIL/COBIT/NIST	Presence of explicit reference to the adoption of any IT governance framework/standard	ITGI (2003); De Haes & Van Grembergen (2008); Joshi <i>et al.</i> (2013)
	10. ISO 27001-5		
	11. Other IT governance Standards		

Table A.1. (Continued)

Sub-category	Items	Description	Relevant literature
ITRM Index			
A. Identification	1. Cyber Risk/Attack IS Breach	Presence of reference to the identification of IT risk	Jordan & Silcock (2005); Joshi et al. (2013); Regulatory environment & practitioners debate
B. Evaluation	2. IT Fraud 3. IT Incident/failure 4. IT risk 5. IT risk/Business continuity/Cybersecurity model 6. IT risk appetite 7. IT risk assessment 8. IT risk report 9. Business continuity plan	Presence of elements related to the evaluation of IT risk	Pilot study
C. Treatment	10. Contingency plan 11. Disaster Recovery plan 12. Information/Cybersecurity plan	Presence of IT and related technology continuity plans; these plans, in case of disaster, are also expressed required by the regulatory framework	Jordan & Silcock (2005); Joshi et al. (2013)
D. Management	13. IT risk management 14. IT risk regulation/compliance	Presence of special program to mitigate IT risk  Presence of explicit reference to regulations and compliance requirements	Jordan & Silcock (2005); De Haes & Van Grembergen (2008); Merhout & Havelka (2008); Joshi et al. (2013)  Trites (2004); Jordan & Silcock (2005); Li et al. (2007)

Table A.1. (Continued)

Sub-category	Items	Description	Relevant literature
ITINV Index			
A. IT information in the financial statement	1. Expenses in the income statement	Presence of IT related expenses mentioned under the administrative cost	Joshi <i>et al.</i> (2013)
	2. Investment in the balance sheet	Presence of IT-related investment mentioned as intangible assets	
B. IT budget	3. IT budget	Presence of information regarded budget on IT and information assets	Takemura <i>et al.</i> (2005); De Haes & Van Grembergen (2008)
C. IT expenses	4. IT Expenses	Presence of information on the overall IT expenditure	Takemura <i>et al.</i> (2005); De Haes & Van Grembergen (2008)
D. IT hardware/software	5. IT hardware/software	Presence of information on IT hardware/software cost mentioned under the IT expenditure	Takemura <i>et al.</i> (2005)

## Appendix B. Variable Definitions

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Table B.1.

Variable	Definition	Source
ITGF_INDEX FOR BANKS ITRR_INDEX	IT governance Index related to <i>Role and Responsibility</i> category; it is calculated for each bank dividing: – the number of times that each item is disclosed in the reports analyzed; – also, the number of expected items comprised in RR category	Authors' calculation using content analysis results
ITRP_INDEX	IT governance Index related to <i>Resources and Plans</i> category; it is calculated for each bank dividing: – the number of times that each item is disclosed in the reports analyzed; – also, the number of expected items comprised in RP category	Authors' calculation using content analysis results
ITRM_INDEX	IT governance Index related to <i>Risk Management</i> category; it is calculated for each bank dividing: – the number of times that each item is disclosed in the reports analyzed; – also, the number of expected items comprised in RM category	Authors' calculation using content analysis results
ITINV_INDEX	IT governance Index related to <i>Investment</i> category; it is calculated for each bank dividing: – the number of times that each item is disclosed in the reports analyzed; – also, the number of expected items comprised in INV category	Authors' calculation using content analysis results
ITGF_INDEX_BANKS	Sum of ITRR, ITRP, ITRM, ITINV for each bank in $t$	Authors' calculation using content analysis results

Table B.1. (*Continued*)

Variable	Definition	Source
<b>ITGF INDEX FOR SUPERVISORS</b>		
ITGF_SUP_AR	IT Governance Index related to Annual Report of Supervisors; it is calculated for each Country dividing: – the number of times that each item is disclosed in the Supervisors' Annual Report analyzed; – also, the total number of expected items within the ITG Framework	Authors' calculation using content analysis results
<b>ITGF_SUP_REG</b>		
ITGF_SUP_REG	IT Governance Index calculated on the national regulation; it is computed for each Country dividing: – the number of times that each item is disclosed in the Regulatory Framework analyzed; – also, the total number of expected items within the ITG Framework	Authors' calculation using content analysis results
<b>ITGF_INDEX_SUPERVISORS</b>		
ITGF_INDEX_SUPERVISORS	Sum of ITGF_SUP_AR and ITGF_SUP_REG for each Country in $t$	Authors' calculation using content analysis results
<b>CONTROL VARIABLES</b>		
logTA	Log of Total Asset	Authors' calculation using Bloomberg Data
EtA	Equity to total Asset	Authors' calculation using Bloomberg Data
RloASS	Loan Loss Provision on Gross Loans	Authors' calculation using Bloomberg Data
BUSS	Index computed dividing: – Net Interest Revenues (NIR) – also, the NIR plus revenues linked to fee and commission	Authors' calculation using Bloomberg Data
GDP	Growth rate of GDP	Authors' calculation using Eurostat Data
<b>PERFORMANCE INDICATOR</b>		
ROE	Return on Average Equity	Bloomberg
ROA	Return on Average Asset	Bloomberg
ChI	Cost to Income	Bloomberg
T-Q	Market value of the company divided by the replacement value of the firms' asset	Bloomberg

*Note:* The table defines the variables used in the study and the source of the data.

### Appendix C. Correlation Matrix

Table C

	ITRR	ITRP	ITRM	ITINV	ITGF_INDEX_BANKS	ITGF_INDEX_SUPERVISORS	ITGF_INDEX_SUPERVISORS1	ITGF_SUP_AR1	ITGF_SUP_REG	ITGF_SUP_REG1	logTA	BUSS	RtoASS	EaA	Chi	ROE	ROA	Tobin Q	GDP		
ITRR	1.0000																				
ITRP	0.3906	1.0000																			
ITRM	0.5428	0.2766	1.0000																		
ITINV	0.1417	-0.0408	-0.1110	1.0000																	
ITGF_INDEX_BANKS	0.8099	0.6329	0.8290	0.1653	1.0000																
ITGF_INDEX_SUPERVISORS	0.6173	0.5571	0.6999	0.1206	0.8296	1.0000															
ITGF_INDEX_SUPERVISORS1	0.2039	0.0292	0.3741	-0.0113	0.2872	0.2379	1.0000														
ITGF_INDEX_SUPERVISORS1	0.2013	-0.0211	0.3506	-0.0689	0.2453	0.2620	0.8084	1.0000													
ITGF_SUP_AR1	0.2692	0.1848	0.3360	-0.0068	0.3433	0.2223	0.4929	0.2878	1.0000												
ITGF_SUP_REG	0.2742	0.2095	0.3612	-0.0669	0.3584	0.2501	0.4334	0.5080	0.6922	1.0000											
ITGF_SUP_REG1	0.1144	-0.0478	0.2791	-0.0099	0.1768	0.1699	0.9241	0.7818	0.1231	0.1807	1.0000										
logTA	0.1077	-0.0909	0.1986	-0.0094	0.1153	0.1690	0.7375	0.9215	-0.0257	0.1611	0.8397	1.0000									
BUSS	0.1864	0.1870	0.3096	0.3034	0.3646	0.4439	0.2727	0.2658	-0.0061	0.0226	0.3137	0.2571	1.0000								
RtoASS	-0.0385	0.0698	-0.2043	-0.1721	-0.1347	-0.2158	-0.3956	-0.4342	0.0138	-0.1220	-0.4419	-0.4108	-0.1836	1.0000							
EaA	-0.0704	0.1620	0.1019	-0.2820	0.0366	0.0053	-0.0883	-0.1357	0.0884	-0.0143	-0.1395	-0.1848	-0.0239	0.0451	1.0000						
Chi	0.1344	0.4262	0.1425	-0.3175	0.2144	0.1878	-0.1632	-0.1691	0.1986	0.1989	-0.2733	-0.2453	-0.3657	0.2593	0.2018	1.0000					
ROE	-0.0546	-0.0787	-0.0796	0.2051	-0.0516	0.0486	-0.0789	-0.0106	-0.0810	-0.0860	-0.0544	0.0483	0.0848	-0.2677	-0.0693	-0.2662	1.0000				
ROA	0.1602	-0.0343	0.1698	-0.0037	0.1378	0.1462	0.1177	0.1475	0.0067	0.0372	0.1313	0.1188	0.0659	-0.0546	-0.4505	0.1773	-0.3065	1.0000			
Tobin Q	0.1271	-0.2415	0.1439	0.0994	0.0544	0.0116	0.0822	0.2026	0.0513	0.1538	0.0692	0.1052	0.1819	-0.0628	-0.0918	-0.3851	-0.1582	0.2976	0.3953	1.0000	
GDP	0.1656	-0.0238	0.0128	0.2555	0.1043	0.1228	0.2726	0.2175	0.1795	0.1934	0.2321	0.2037	0.1411	-0.0597	-0.3494	-0.2547	0.0444	0.1129	0.0441	-0.0212	1.0000

Note: The table reports correlations for the regressors used in the analysis. Definitions of the variables are in Appendix B.

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