IT GOVERNANCE IN THE BANKING SECTOR: EVIDENCE FROM ITALY, GERMANY, FRANCE AND SPAIN

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ABSTRACT

The paper analyzes Information Technology (IT) governance disclosure on a sample of the major 20 EU banks (from Italy, Germany, France and Spain) to observe if, how and where banks report on their IT governance issues. Since IT governance (like other aspects of banking business) can be influenced by regulatory environment, we examine whether any differences in supervisor attitude to IT concern will induce differences in IT governance across countries.

IT is an intrinsic component of banks' operational functioning; it is a key resource in developing and supporting banking services, enabling institutions' strategies, and it is essential for almost all banking processes and distribution channels. IT and data architectures are also becoming even more necessary to improve banks' risk management process, and support the broad management of financial risks. Due to this increasing relevance of IT, it is necessary to pay more attention to IT governance as an integral part of banking corporate governance, making sure that IT processes are fully integrated into the life cycle of business process and used as an enhancer of organizational strategy and goals.

Recurring to IT governance transparency, as a key mechanism of corporate governance, we: i) elaborate an original IT governance framework; ii) perform a content analysis on banks public disclosure and a selected number of supervisors' official documents (2008-2015) to build up IT governance indices; iii) run a multidimensional analysis to detect causal relationships between variables.

Our analysis indicates that differences in the level of IT governance disclosure are bank specific and not related to country's institutional settings; we also observed an increasing consistent attention of both supervisors and banks to IT issues starting from 2013.

Key words: Banks, Corporate Governance, IT Risk Management, Regulation, financial crises

JEL: G21, G30

1. INTRODUCTION

Even though first scientific research regarding IT governance was developed in the 1960s, only in the late 1990s, this topic obtained a systematic attention 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. Literature provides various definitions and a range of constructs to describe the concept of IT governance in the form of different structures, processes, domains, facets, and elements, in analogy with corporate governance. In fact, the entire corporate governance includes IT governance since business and IT are two sides of the same coin. However, IT governance merits a distinct attention within other corporate governance mechanisms for two reasons:

- most organizations in today's complex and competitive business environment relies 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 for a range of IT-related topics, such as IT investment, IT principles, and IT

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infrastructure management (Sambamurthy & Zmud, 1999; Weill & Ross, 2004; Xue, et al., 2008 and 2011).

Therefore, the 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.

While IT has emerged as a strategic resource in today's banking business environment, it can also raise critical issues, such as effective IT decision making and management control, IT investment priorities, and IT risk management. In particular, regarding the latter, one lesson learned from the financial crisis that began in 2008 was that banks' IT and data architectures were, on the one hand, necessary to improve banks' efficiency and risk management process, and, on the other hand, deeply inadequate to support the broad management of financial risks. 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 true 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. Regulators do not address banks' specific requisites for effective IT governance and IT risk management, even though these changes may result in strategy overhaul, process review and IT system impact on the banking industry.

Being aware that risk management systems have failed in many cases due to inadequate corporate governance mechanism rather than the failures of the IT systems *strictu sensu*, in this paper, we want to highlight if banks have begun to ascribe greater importance to the coordinated management of all IT resources, in other words to IT governance. We explore the attention paid to IT governance in four EU countries by analyzing a sample of banks and national supervisors, to point out if, the interest in this topic grew after the crises.

Unlike previous studies which use case studies and/or questionnaires to deepen IT governance practices, we base our analysis on banks' public disclosure. We rooted our research on the largely shared assumptions that firms with good IT governance tend to disclose more on related mechanisms (e.g. Clarkson et al., 2004).

To observe if the attention to IT governance has increased in the last years, we have developed an original descriptive framework of IT governance (ITGF) disclosure tailored to the banking sector.

Using the ITGF, we performed a content analysis to measure the level of attention to IT governance through the years (2008-2015) and cross countries from both banks and supervisors.

This pilot study provides several insights into the academic debate within the macro strand of literature on the corporate governance mechanisms, and more specifically in the less analyzed strand of IT governance focusing on the banking sector.

The paper is organized as follows: section 2 provides the background of the research, including prior literature and the development of research questions, section 3 describes the research methodology and the sample and data collection, while the main results are presented in section 4. Finally, section 5 summarizes the main conclusion and suggestions for future research.

2. BACKGROUNDS AND DEVELOPMENT OF RESEARCH QUESTIONS

Traditionally, literature has deepened IT issues relating to the banking sector, analysing IT as a key resource in improving operating efficiency in the banking system (Banker et al., 2009; Berger, 2003; Chiasson & Davidson, 2005;

Chowdhury, 2003; Fuβ et al., 2007; Zhu et al., 2004). Only a very small strand of the recent literature has started to analyze banks' IT governance (e.g. Pardo et al., 2011).

Broadly speaking, IT governance provides structures, processes, and relational mechanisms to control and monitor the effectiveness of IT (Peterson, 2004; De Haes & Van Grembergen, 2009; Willson & Pollard, 2009). IT governance and its mechanisms are conceptualized in the literature following corporate governance principles (Korac-Kakabadse & Kakabadse, 2001; ITGI, 2003; Weill & Ross, 2004; Peterson, 2004; Jordan & Musson, 2004; Mähring, 2006; Raghupathi, 2007; Van Grembergen & De Haes, 2009; Heart et al., 2010). Decision rights, accountability, and risk management are some linked mechanisms included in more recent research (Brown, 1997; Sambamurthy & Zmud, 1999; Weill & Ross, 2004; Brown & Grant, 2005; Parent & Reich, 2009; Huang, et al., 2010).

In the effort of trying to identify effective IT governance arrangements, scholars have deepened the significance of 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), such as the role of the Board of Directors, the effectiveness of the IT steering committee, IT control and firm performance, IT investment performance, and IT audit issues (Trites, 2004; Huff et al., 2006; Mähring, 2006; Boritz & Lim, 2008; Gu et al., 2008; Merhout & Havelka, 2008; Prasad et al., 2009).

While most of the principles of corporate governance are integrated into the major IT governance literature, scholars seem to have paid less attention to IT governance transparency. It is 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). As demonstrated in the existing literature, 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), an improvement 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 more good IT governance firms have in place, the more they are incentivized to disclose.

Based on this theoretical premise, the first three research questions that we try to answer are:
Q1: Has the level of IT governance disclosure changed after financial turmoil? We expect an increase in the level of disclosure of IT governance, considering the growing importance of IT in the banking sector.
Q2: What topics of IT governance are publicly disclosed? Considering the relevance of IT governance as a whole, we do not expect differences among areas of disclosing.

To our knowledge, there is no specific study on IT governance disclosure in the banking sector, except of the contribution of Joshi et al. (2013).

Since IT governance - like other aspects of banking business - can be influenced by regulatory environment, is important to understand in which direction regulators and supervisors have moved. As mentioned above, the recent financial turmoil that started in 2007 has catalyzed the attention, among others, to risk management and to the processes, data management and the new emerging risks, such as IT risk. More specifically, from an IT governance perspective, Parent and Reich (2009) identify several types of IT risks such as IT project risk, IT competence risk, IT infrastructure risk, business continuity, and information risk, which can have adverse impacts on business.

Generally, all banks have mechanisms and measures for the assessment of IT risk in certain forms, depending on the regulations at the local level.

The renewed interest in risk management has culminated in the necessity to review the regulatory framework. In fact, at international level the Basel Committee on Banking Supervision (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 to develop 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, the same as in other international regulatory intervention; IT risk is considered as a sub-type of operational risk (see art 85 CRD IV).

Furthermore, in Europe, to reinforce the importance of adequate IT risk management for banks, the EBA Guidelines provide direction to the supervisors for assessing banks' IT risk (EBA, 2016): once again, regulators do not address banks' specific requests for an effective IT risk management, but rather 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 supervisors' attitude to IT concern at the national level, will induce differences in banks' IT governance and the level of investments in IT projects to comply with regulatory prescriptions or guidelines, if any. Thus, the last research question is:
Q3: To which extent the supervisors' behavior – if changed - has affected the attention banks paid to the topic of IT governance disclosure? We expect that changes in the banks' level of disclosure are highly conditioned by supervisors' habits.

3. RESEARCH METHODOLOGY

Our analysis aims to evaluate the IT governance practices in a sample of EU banks and to observe if the attention to this issue has increased over time (2008-2015) and/or varies across sample countries (Italy, Germany, France and Spain). Geographical differences can be surely influenced by regulatory approach used by supervisors at national level.

The first three research questions are oriented towards analyzing the level (Q1) and the content (Q2) of disclosure on IT governance performed by each institution. To investigate IT governance transparency, we use content analysis to build up the dataset to be employed in the empirical analysis (Weber, 1985) from public disclosure documents of the banks included in the sample.

We first identified a set of items related to IT governance grouped in four focus areas/categories (IT Role & Responsibility, IT Resources & Plans, IT Risk Management, IT Investment). The resulting original IT governance framework (ITGF) is elaborated by adapting and enriching the Joshi et al (2013) approach to fit our purpose. For each focus area under ITGF, the items were selected on the basis of current literature (see Tables 1), including the terms which emerged from regulatory environment and practitioners debates and from a pilot study we have conducted on banks' annual reports. Using the selected set of items within the ITGF, we inspect the institutions' documents using the program MAXQDA to verify whether each item is present. Appling dichotomous coding technique (1=present; 0=not present) we build up a unique dataset to be used to measure the level and the content of IT governance disclosure. It was possible to compute:

- a *total IT governance score*, which represents the number of times that each item is disclosed in the reports analyzed. Without the possibility 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 (item score). The underlying assumption is that the more banks and supervisors mention ITGF items, the higher the level of disclosure is. For example, if we find evidence of Internal Audit position 5 times in the Annual report, then it is assigned an item score of 5. By simply changing the level of aggregation

considered, we can calculate different IT governance scores: Total IGF score, Category and sub-category score;
- for banks, 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):

$$ITy_{-index} = \frac{1}{N_y}\sum_{i=1}^{Ny} x_i$$

where: ITy_{-Index}=IT governance Index related to y category (namely RR: Role and Responsibility; RP: Resources and Plans; RM: Risk Management; INV: Investment);x_i= 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 ITy_indices 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 (Q1). From the dataset, it is also possible to investigate how banks disclose details on IT governance (Q2).

In order to measure the changes in the attention paid by different authorities to IT governance, we performed the content analysis on a selected group of supervisors' documents. We considered items included in the first three categories (ITRR, ITRP, ITRM), verifying whether each item is present (1=present; 0=not present) in the authorities' Annual reports or national law. The underlying hypothesis is that in this kind of documents it is possible to find signals of a greater level of attention to IT governance paid by supervisors. 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 in the Annual Report of supervisors, which expresses the attention paid to IT governance issues (ITGF_SUP_AR); it is calculated dividing the Annual Report score to the total number of expected items within the ITG framework;
- the index calculated on the national regulation of the analyzed countries, which means the presence of constrains set by national agencies on the IT governance related topics.

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 (Q3) using an OLS regression and panel data model estimates. The analysis, at this stage, can be considered as a pilot study to test banks' and supervisors' behaviors on IT governance issues, and it is to be enriched in further studies.

The existing IT governance literature does not propose any single standard framework to assess IT governance using disclosure practices: all empirical analysis, except for that of Joshy et al. (2013), are based on surveys and/or single case studies, in other words they are based on internal information. Analyzing banks from outside, we are aware that banks would not disclose on all aspects of their IT governance, because they are not forced to describe specific procedures related to their IT strategy and so on. Following Lang & Lundholm (1996) and Clarkson et al. (2004), we assume that the more good IT governance banks have in place, the more they are encouraged to disclose.

Considering this theoretical premise, we expect to find some clues of specific structural IT governance mechanisms in place 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 ensures stakeholders that the bank has an IT governance structure and that – probably - IT policies and procedures are in place.

In order to develop content categories, we construct the so-called IT Governance Framework according to previous scholars contributions in assessing IT governance, based on our pilot study conducted on the Annual Reports of banks/ supervisors and on main international regulation. Table 1 provide a brief description and supporting literature for each item included in each of the four focus areas/categories.

According to prevalent literature (Table 1), we suggest that the level of transparency of IT roles and responsibilities (IT Role & Responsibility, ITRR) can be used as a proxy of good IT gover-

nance practices. In our opinion, the presence of the following roles is the necessary premise of 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 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 rather than only from the IT department or business unit levels (operational roles) across the organization (Webb et al., 2006). For IT to be effectively governed, the presence of a variety of roles can be considered a necessary premise. Compared with previous studies, we improved the number of items related to control functions: 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. The underlying assumption is 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.

With the second focus area (IT Resources & Plans, ITRP) we aimed 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 same would happen with the related information in the public documents.

To capture IT risk management practices (IT Risk Management, ITRM) we constructed an index that considers the main phases of

Table 1. ITGF indices: items and literature references

CAT and SUB-CATEGORY		ITEMS	RILEVANT LITERATURE
ITRR	A. IT control roles	1. It audit/EDP audit; 2. Information security control function	Sambamurthy, et al., 1993; Karimi et al., 2000; Hadden & Hermanson, 2003; Van Grembergen & De Haes, 2004; Trites, 2004; Peterson, 2004; Nolan & McFarlan, 2005; Premuroso & Bhattacharya, 2007; De Haes & Van Grembergen, 2008; Joshi et al. 2013 Pilot study
	B. IT operational roles	3. Business continuity management; 4. CERT/SOC; 5. Data management office/center; 6. IT service/function	
	C. IT senior management	7. CIO; 8. CISO; 9. IT management	
	D. IT strategic roles	10. Technology committee; 11. Other IT committee	
ITRP	A. IT plans/policy	1. Information security policy; 2. IT plan/s; 3. IT strategy	ITGI, 2003; Trites, 2004; Jordan & Silcock, 2005; De Haes & Van Grembergen, 2008; SSG, 2010; BCBS, 2013; Joshi et al., 2013 Pilot study
	B. IT processes	4. EDP; 5. IT resources governance; 6. IT processes/procedures	
	C. IT resources	7. IT/Data Infrastructure/Architecture, 8. IT resources/solution	
	D. IT standard/ principles	9. ITIL/COBIT/NIST; 10. ISO 27001-5; 11. Other IT governance Standards	
ITRM	A. Identification	1. Cyber Risk/Attack IS Breach; 2. IT Fraud; 3. IT Incident/failure; 4. IT risk	Trites, 2004; Jordan & Silcock, 2005; Li et al., 2007; De Haes & Van Grembergen, 2008; Merhout & Havelka, 2008;Regulatory environment & practitioners debate; Pilot study; Joshi et al., 2013
	B. Evaluation	5. IT risk/Business continuity/Cyber security model; 6. IT risk appetite; 7. IT risk assessment; 8. IT risk report	
	C. Treatment	9. Business continuity plan; 10. Contingency plan; 11. Disaster Recovery plan; 12. Information/Cyber security plan	
	D. Management	13. IT risk management; 14. IT risk regulation/compliance	
ITINV	A. IT information in financial statement	1. Expenses in income statement; 2. Investment in balance sheet	Takemura et al., 2005; De Haes & Van Grembergen, 2008
	B. IT budget	3. IT budget	
	C. IT expenses	4. IT Expenses	
	D. IT hardware/ software	5. IT hardware/software	

risk management process: identification, evaluation, treatment and monitoring. The basic assumption 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 information regarding IT-related risk management policies/ processes in place, and if IT risk is treated jointly or independently with respect to the operational risk management framework.

The last focus area ITINV, is concentrated on IT budget/investments. In the past two decades, practitioners and scholars (ITGI, 2003; Weill & Ross, 2004) have paid a great attention to this topic, but the major part of these studies is 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.

Countries selected for our analysis are France, Germany, Italy and Spain due to the dimension of the national banking system in terms of total assets, representing together around 73% of the total assets of the EU banking sector (ECB, 2016). For each country, we considered three major banks, being sure to include in the sample at least one G-SIB for each country: the final sample consists of 20 international banking groups. As mentioned in the previous pages, to perform the content analysis, we recorded data from different sources of public disclosure of banks included in the sample (398 documents), namely: i) Annual Reports; ii) Corporate Governance reports; iii) Pillar III reports; iv) CSR/Sustainability reports, if any. To calculate ITGF_Index for supervisors we perform the content analysis on the following types of sources: i) Supervisors' Annual Reports (30 documents in total); ii) Regulations which, during the period 2008-2015 a) put in place the Basel III framework; b) apply EBA Guidelines on internal Governance (GL44); c) specifically refer to the BCBS (2013) Principles of effective Risk Data aggregation and Risk Reporting; d) and any other specific regulation on IT governance, if available in English. Even though other important regulatory provisions were found in the analyzed countries, it was impossible to perform content analysis because of the language barrier and the fact that the regulations were not written in English..

4. RESULTS AND DISCUSSION

Table 2 provides descriptive statistics for the variables employed in this study. The mean for the overall IT disclosure index for banks is 2.50, 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 the ones for the banks. Figure 1 illustrates the evolution of IT Governance Indices calculated for the sample of banks and grouped by country: what is almost evident is a generalized increase of IT governance disclosure through the years with more intensity starting from 2013; the ITINV_Index does not denote any particular evidence since it shows depressed values cross year and cross country; the only exception is represented by German banks for which the contribution of the ITINV_Index to the ITGF_Index is more relevant. It is also possible to highlight some differences deeply analyzing the results in different countries for ITRR and ITRP focus areas. For instance, Spanish banks in the sample have started to pay greater attention to all items related to ITRR in 2015 compared to previous years and other countries. Spain also differs from other countries because of the presence of a larger number of roles and responsibilities related to IT governance. Italian banks registered a slight upward trend in time for all indices, being particularly prominent for ITRP. Items included in ITRM, as expected, are the most disclosed even if the phenomenon is more evident starting from 2013. Despite differences registered among the four analyzed countries, it seems that IT governance disclosure has increasingly changed after financial turmoil and more consistently in the last three years considered in the analysis (Q1).

To answer Q2 we considered the percentage of IT governance items disclosed by banks in the sample (Table 3) grouped by Sub-Categories. In addition, owing to the way in which the

Table 2. Descriptive statistics

VARIABLE	OBS	MEAN	STD. DEV.	MIN	MAX
BANKS	160			1	20
ITGF_INDEX_BANKS	160	2.50096	1.799731	0	16.95844
ITRR_INDEX	160	.4142045	.6013609	0	6.090909
ITINV_INDEX	160	.41875	.3523841	0	2
ITRM_INDEX	160	1.166869	1.02928	0	7.285714
ITRP_INDEX	160	.5011364	.6338665	0	3.181818

VARIABLE	OBS	MEAN	STD. DEV.	MIN	MAX
SUPERVISORS	160			1	4
ITGF_INDEX_SUPERVISORS	150	.660019	.5637494	.02849	1.823362
ITGF_SUP_AR	150	.2640076	.2170656	0	.8262108
ITGF_SUP_REG	150	.3960114	.4942532	0	1.396011

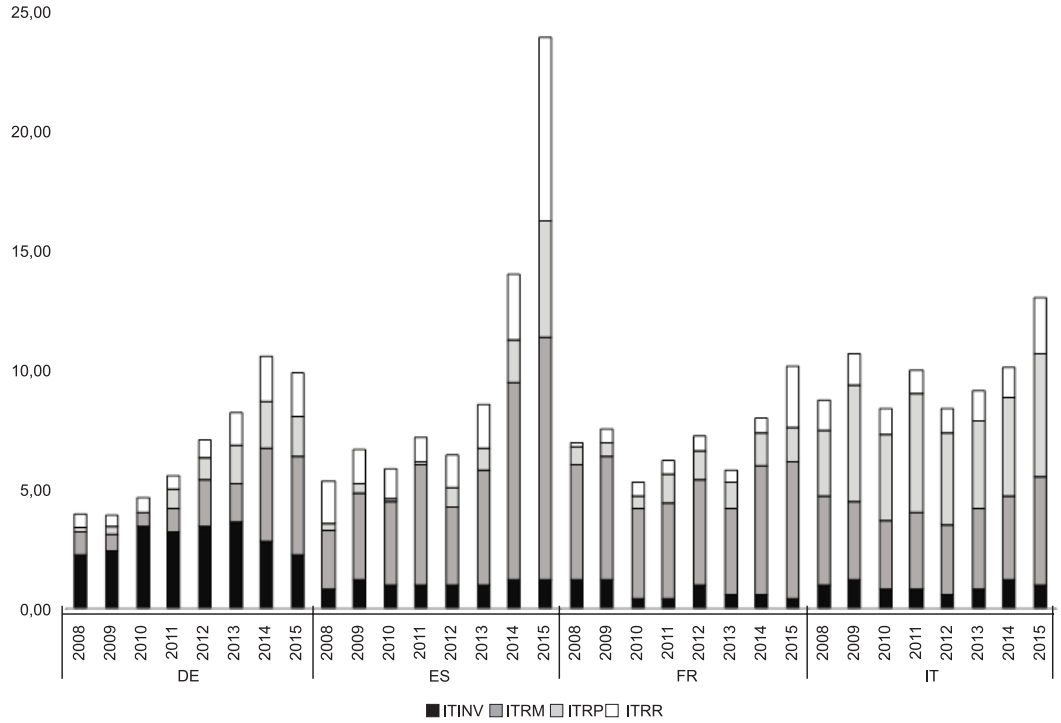

Figure 1. Evolution of banks' IT governance indices*: distribution by country**

Note: * ITGF_Index is the sum of the indices related to the four categories (ITRR_Index, ITRP_Index, ITRM_Index, ITINV_Index); the level of ITGF_Index corresponds to the height of the bar. **The value of indices for each country is calculated as the sum of banks' indices, included in the sub-sample.

disclosure index is calculated, it was possible to measure the ITGF disclosure at Sub-Categories level. The results highlight the following:

- a generalized lack of disclosure of organizational positions (see category ITRR); instead, more attention is 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 to the Information security as a whole;
- finally, ITINV indicates that most banks reported IT expenditure, but it seems basically 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.

We than analyzed the percentage of supervisors that enumerate the items included in ITRR, ITRP, ITRM categories (Table 4). In particular, we notice that starting from 2013, Supervisors focused on: i)

Table 3. Level of disclosure (Index*) and percentage** of banks disclosing IT governance itemsby sub-categories

CAT	SUB_CAT	2008		2009		2010		2011		2012		2013		2014		2015	
		Index	% of banks	Index	% of banks	Index	% of banks	Index	% of banks	Index	% of banks	Index	% of banks	Index	% of banks	Index	% of banks
ITRR	A. IT control roles	0,27	10%	0,27	10%	0,18	10%	0,36	20%	0,27	15%	0,18	10%	0,27	15%	0,91	25%
	B. IT operational roles	3,55	60%	4,27	75%	5,73	80%	5,18	75%	5,09	75%	6,18	70%	7,36	80%	13,18	75%
	C. IT senior management	0,91	35%	0,91	30%	0,45	20%	0,73	25%	0,91	25%	1,00	25%	1,91	40%	2,18	40%
	D. IT strategic roles	0,09	5%	0,09	5%	0,18	10%	0,09	5%	0,09	5%	0,09	5%	0,45	10%	3,18	15%
ITRP	A. IT plans/policy	0,27	15%	0,27	15%	0,45	15%	0,55	20%	0,45	20%	0,82	30%	1,18	40%	2,18	60%
	B. IT processes	2,09	50%	3,73	40%	2,73	35%	4,27	45%	3,27	50%	3,36	55%	4,55	50%	6,82	55%
	C. IT resources	2,09	65%	3,09	70%	1,73	50%	3,55	70%	4,36	60%	4,64	65%	4,09	80%	7,09	85%
	D. IT standard/ principles	1,18	25%	1,64	30%	1,36	25%	1,64	35%	1,27	30%	1,09	35%	1,82	55%	2,27	55%
ITRM	A. Identification	2,50	50%	2,93	60%	2,86	55%	3,79	70%	4,07	75%	5,71	80%	11,43	85%	12,14	90%
	B. Evaluation	0,00	-	0,07	5%	0,00	-	0,00	-	0,00	-	0,00	-	0,14	10%	1,29	30%
	C. Treatment	14,36	80%	16,57	85%	13,07	85%	17,21	95%	16,50	90%	16,57	95%	18,86	100%	25,00	95%
	D. Management	0,07	5%	0,07	5%	0,07	5%	0,07	5%	0,14	10%	0,00	-	0,71	20%	0,43	15%
ITINV	A. IT information in financial statement	4,20	70%	4,60	80%	4,80	80%	4,60	75%	4,80	80%	5,00	85%	5,20	85%	5,20	85%
	B. IT budget	0,00	-	0,20	5%	0,00	-	0,00	-	0,00	-	0,20	5%	0,20	5%	0,20	5%
	C. IT expenses	3,20	55%	3,00	50%	2,20	30%	2,60	35%	3,40	35%	2,60	25%	3,20	45%	1,80	35%
	D. IT hardware/ software	0,20	5%	0,40	10%	1,00	15%	1,00	15%	0,60	15%	0,80	20%	0,80	15%	1,00	25%

*Note: * ITGF_Index calculated for each sub-categoryin the sample; **Number of banks that disclose the items by sub-categories within ITGF divided by the number of banks included in the sample.*

Table 4. Percentage* of supervisors enumerating IT governance keywords

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%

**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.*

IT operational roles for ITRR; ii) IT plans/policies and IT resources for ITRP; iii) Identification and Treatment for ITRM. Comparing the results between banks and supervisors we noticed a homogeneous behavior between 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 (Q3).

To estimate the relationship between the ITGF_ Index for banks and supervisors we exploit the panel data models. Table 5 displays the summary of panel data variables; at first sight, we notice a higher "within" variation of the dependent variable expressed by the Standard Deviation, which means a huge bank' ITGF_ Index variation over eights years analyzed. In model 1 (Table 6) we performed the two-way panel estimation and tested for significance of individual effects: we notice that the between temporal variability (*sigma_u*) is quite high, while a higher value recorded by *sigma_e* means a great within variability in a model in which both individual and temporal heterogeneity is considered.

Table 5. "Within" and "between" variation in panel data

VARIABLE		MEAN	STD. DEV.	MIN	MAX	OBSERVATION	
ITGF_INDEX_BANKS (DEPENDENT VARIABLE)	OVERALL	2.50096	1.799731	0	16.95844	N =	160
	BETWEEN		.4059309	1.893936	2.740455	n =	4
	WITHIN		1.764843	-.1618002	16.79664	T =	40
ITGF_INDEX_SUPERVISORS	OVERALL	.660019	.5637494	.02849	1.823362	N =	150
	BETWEEN		.4843116	.3881766	1.42925	n =	4
	WITHIN		.4076006	-.4843305	1.443495	T =	37.5

Using the two-way model, the causal link between the behavior of supervisors and banks is further faded: in fact, the independent variable coefficient is not significant in this model.

Table 6. Model 1: Panel estimation method, FE two-way

```
Fixed-effects (within) regression               Number of obs      =       150
Group variable: Year                            Number of groups   =         8

R-sq:                                           Obs per group:
     within  = 0.5793                                         min =        15
     between = 0.7377                                         avg =      18.8
     overall = 0.5336                                         max =        20

                                                F(20,122)          =      8.40
corr(u_i, Xb)  = 0.1104                         Prob > F           =    0.0000
```

ITGF_Index	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
IT_SUP_Tot	.5042199	.4528599	1.11	0.268	-.3922615	1.400701
dummy1	-2.896654	.5964795	-4.86	0.000	-4.077445	-1.715863
dummy2	-1.828038	.5948705	-3.07	0.003	-3.005644	-.6504325
dummy3	-2.640051	.5948705	-4.44	0.000	-3.817657	-1.462446
dummy4	-1.983526	.7691291	-2.58	0.011	-3.506094	-.4609582
dummy5	-2.35661	.5948705	-3.96	0.000	-3.534215	-1.179004
dummy6	-2.834369	.5948705	-4.76	0.000	-4.011975	-1.656764
dummy7	2.23852	.5948705	3.76	0.000	1.060915	3.416126
dummy8	-3.091318	.7691291	-4.02	0.000	-4.613886	-1.56875
dummy9	-2.351686	.5964795	-3.94	0.000	-3.532477	-1.170896
dummy10	-1.257336	.7691291	-1.63	0.105	-2.779903	.2652323
dummy11	-1.183505	.5964795	-1.98	0.049	-2.364295	-.0027138
dummy12	-.0288961	.5931541	-0.05	0.961	-1.203104	1.145312
dummy13	-2.172918	.5964795	-3.64	0.000	-3.353709	-.9921271
dummy14	-2.304221	.5931541	-3.88	0.000	-3.478428	-1.130013
dummy15	-2.758667	.5964795	-4.62	0.000	-3.939458	-1.577876
dummy16	-1.784175	.7691291	-2.32	0.022	-3.306743	-.2616076
dummy17	-2.353734	.5931541	-3.97	0.000	-3.527941	-1.179526
dummy18	-1.948028	.7691291	-2.53	0.013	-3.470596	-.4254604
dummy19	-2.093831	.5931541	-3.53	0.001	-3.268039	-.9196235
dummy20	0	(omitted)				
_cons	3.93556	.458944	8.58	0.000	3.027034	4.844086
sigma_u	.69830456					
sigma_e	1.1863081					
rho	.2573301	(fraction of variance due to u_i)				

F test that all u_i=0: F(7, 122) = 3.75 Prob > F = 0.0010

Note: Dummies correspond to banks included in the sample. Dummy20 is suppressed to avoid collinearity trap. Corr (u_i, Xb) reflects endogeneity of the explanatory variables being not equal to zero; F test that all u_i

Table 7. Model 2: ITGF_Bank_Index FE estimates

```
Fixed-effects (within) regression               Number of obs      =       130
Group variable: Years                           Number of groups   =         7

R-sq:                                           Obs per group:
     within  = 0.2690                                         min =        15
     between = 0.3062                                         avg =      18.6
     overall = 0.2607                                         max =        20

                                                F(3,120)           =     14.72
corr(u_i, Xb)  = 0.0610                         Prob > F           =    0.0000
```

ITGF_Bank	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
LogTa	1.928248	.3300119	5.84	0.000	1.274848	2.581649
ITGF_SUP_REGt_1	-.6876107	.3623297	-1.90	0.060	-1.404998	.0297768
ITGF_SUP_ARt_1	2.824193	.9657071	2.92	0.004	.9121598	4.736226
_cons	-8.523788	1.816785	-4.69	0.000	-12.1209	-4.926681
sigma_u	.73795083					
sigma_e	1.5357701					
rho	.18757878	(fraction of variance due to u_i)				

```
F test that all u_i=0: F(6, 120) = 3.62                     Prob > F = 0.0025
```

To deepen the relationship between the behavior of banks and supervisors, we decided to consider the two components of ITGF_INDEX_SUPERVISOR. In this model (Model 2) we added the independent variables using LogTa (logarithm of banks' total asset) as a proxy of the dimension of financial intermediaries. This for done two reasons: first because in Model 1 we notice the relevance of the idiosyncratic dimension of the phenomenon; and also, because, from an economic point of view, it could be possible that larger banks are more inclined to invest in IT and then to disclose therelated issues. The two independent variables are: i) ITGF_SUP_AR measured in t-1; we decided to consider the time lag 1 assuming this index could be considered as a proxy of supervisors' moral suasion: the more supervisors "talk" about IT related issues, the more stimulated banks are to disclose the same topics in the following years; ii) ITGF_SUP_REG, also measured in t-1; this component may reveal the behavior of banks in response to regulatory requirements in this matter.

Looking at the new estimates (Table 7), we can observe a relevant and statistically significant effect of banks' dimension of the dependent variable and, surprisingly, the moral suasion seems to be more relevant for banks' behavior compared withregulations.

In conclusion, referring to Q3 we registered a larger dependence of ITGF_BANK_INDEX on idiosyncratic factors than on supervisors' attitude. Model 2, even if characterized by a generalized lower R^2, better specifies a minor dependence of the ITGF_BANK_INDEX from regulatory provision.

5. CONCLUDING REMARKS: KEY FINDINGS, LIMITATION AND FUTURE RESEARCH

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 revised descriptive framework of

IT governance disclosure developed by Joshi et al (2013), we conducted a content analysis to examine the level of attention paid to IT governance issues over time (2008-2015) and across countries (Germany, Spain, France, Italy). One of the questions which this study sought to answer is whether banks or supervisors first became aware of this topic. It seems that banks have started to be "interested" before their "custodies" even though both have increased their attention. The following key points arise from the analysis: i) banks, within the IT Governance Framework, seems to be paying more attention to IT Risk Management; ii) among the others, Spanish banks included in the sample registered the most evident change in behaviors while the Italian ones demonstrated more constant attention to the topic. The study contributes to the existing literature in several ways. It is intended to enrich the current understanding of IT governance in banks, focusing on the level and on the content of IT governance disclosure. Secondly, it highlighted the regulatory environment that favored IT governance practice in banks and tried to measure the intensity of this relationship. In doing so, it enriched IT governance disclosure literature providing an original methodological framework based on a 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 the rest of EU countries using a bigger dataset; it would allow us to get more significant results from a statistical point of view. Furthermore, regarding the analyzed countries, it would be possible to complete the normative framework with the missing provisions.

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