Metadata of the chapter that will be visualized online

Chapter Title	IT Governance: Who Cares More? First Evidence from EU Banks and Supervisors	
Copyright Year	2018	
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Abstract	This chapter analyses IT governance disclosure for a sample of 12 EU banks (from Italy, Germany, France and Spain) to observe if, how and where banks report on their IT governance issues and to verify if after the crises, banks have started to pay more attention to IT governance. Since IT governance (like other aspects of banking business) can be influenced by the regulatory environment we examine whether any differences in Supervisors' attitude to IT issues induce differences in IT governance across countries. Regarding IT governance transparency, as a key mechanism of corporate governance, we: i) outline 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; and iii) run a multidimensional analysis to detect causal relationships between variables.	

Chapter 4
IT Governance: Who Cares More? First Evidence from EU Banks and Supervisors

Sabrina Leo and Ida Claudia Panetta

4.1 Introduction

Even if first scientific research regarding the concept of IT governance was developed in the 1960s, only in the late 1990s did this topic obtain systematic attention from scholars. From then on, the concept of IT governance has become an object of greater attention and has been analysed in the broader context of corporate governance mechanisms. The literature provides various definitions and a range of constructs to describe the concept of IT governance (see Table 4.1) in the form of different structures, processes, domains, facets, and elements, analogous to the study of corporate governance in general.

It is important to note however that IT governance merits distinct attention within other corporate governance mechanisms for two reasons:

- most organizations 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 for a range of IT-related topics, such as IT investment, IT principles, and IT infrastructure management (Sambamurthy and Zmud 1999; Weill and Ross 2004; Xue et al. 2008, 2011).

Therefore, the effective governance of IT can support organizations in generating value-added objectives on top of IT, thereby contributing to the broader objectives of corporate governance (Weill and Ross 2004).

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B. Díaz Díaz et al. (eds.), *Corporate Governance in Banking and Investor Protection*, CSR, Sustainability, Ethics & Governance,
https://doi.org/10.1007/978-3-319-70007-6_4

t1.1 **Table 4.1** IT governance: most cited definitions

t1.2 Authors (year)	Definitions of IT governance
t1.3 ITGI (2003, p. 10)	[it ensured that] the organization's IT sustains and extends the organization's strategy and objectives
t1.4 IT Governance Institute (2003, p. 11)	[. . .] consists of the leadership and organizational structures and processes that ensure that the organization's IT sustains and extends the organization's strategies and objectives
t1.5 Weill and Ross (2004, p. 8)	[. . .] is decision rights and accountability framework to encourage desirable behaviour in using IT
t1.6 ISO/IEC 17799 (2005)	[. . .] is integral part of organizational management and responsibility of managing and supervising boards and it consists of leadership, organizational structure and processes that ensure IT is used as enhancer of organizational strategy and goals
t1.7 Webb et al. (2006, p. 7)	[. . .] is the strategic alignment of IT with business such that maximum business value is achieved through the development and maintenance of effective IT control and accountability, performance management and risk management
t1.8 Spremić (2009, p. 906)	[. . .] implies that IT processes are fully integrated into life cycle of business process and it influences on quality of service and business agility

IT, as for other industries, is an intrinsic component of banks' operational functioning too; and 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; and d) the improvement of 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. 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, 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. Two are the relationships between risk management and IT that are most relevant:

- risk management in banks is increasingly supported by IT: for instance, databases allow the recording and analysis of risk events, systems support models for risk quantification, internal rating models, etc.;
- the more that IT penetrates the banking processes, the greater the dependence of business activities on IT, which, in turn, increases the relevance of IT risk management.

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—more

evident during the global financial crisis—has led to a renewed attention on IT management from regulators.

For instance, at the international level BCBS and EBA have intervened defining a set of new rules (e.g. Basel III framework) and guidelines (e.g. Principles for effective risk data aggregation and risk reporting) which affect—albeit indirectly—IT governance. However, regulators do not specifically address banks requisites for effective IT governance and risk management systems, even so these changes likely result in strategy overhaul, process review and IT systems impact on the banking industry.

Given the awareness that risk management systems have failed in many cases due to inadequate corporate governance mechanism rather than the failure of IT systems *strictu sensu*, in this chapter we wish 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 payed to IT governance in four EU countries by a sample of banks and national Supervisors, to point out if, after the crisis, the interest on this topic as well as the level of investments in IT has increased.

In contrast to previous studies which use case studies and/or questionnaires to investigate IT governance practices, we base our analysis on banks' public disclosure. We root 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 few years, we develop an original descriptive framework of IT governance (ITGF) disclosure tailored to the banking sector.

Using the ITGF we perform a content analysis to measure the level of attention on IT governance through the years (2008–2015) and cross countries from both banks and Supervisors.

This study, to the extent that constitutes a pilot study, provides several insights into the academic debate within the macro strand of literature on corporate governance mechanisms, and more specifically on the less analysed topic of IT governance focusing on the banking sector.

The chapter is organized as follows: Sect. 2 provides the background of the research, including the existing literature and development of research questions, Sect. 3 describes the research methodology and the sample and data collection, the main results are presented in Sect. 4; finally, Sect. 5, presents the conclusions and outlines areas for future research.

4.2 Background and Development of Research Questions

4.2.1 IT Governance and Transparency

Traditionally, the literature has deepened our understanding of the role of Information Technology issues in the banking sector and typically analyses linkages with

efficiency: the results demonstrate that on the one hand IT is considered a key resource in improving banks' operating efficiency (Banker et al. 2009; Berger 2003; Chiasson and Davidson 2005; Chowdhury 2003; Fuβ et al. 2007; Zhu et al. 2004); and, on the other , the presence of a weak or non-existent relationship between IT and bank productivity (CEA 2001; McKinsey Global Institute 2001; Beccalli 2007).

More recently a limited part of literature has started to look at IT in the banking sector from another perspective: 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 and Van Grembergen 2009; Willson and Pollard 2009). IT governance and its mechanisms are conceptualized in the literature following corporate governance principles (Korac-Kakabadse and Kakabadse 2001; ITGI 2003; Weill and Ross 2004; Peterson 2004; Jordan and Musson 2004; Mähring 2006; Raghupathi 2007; Van Grembergen and De Haes 2009; Heart et al. 2010); and decision rights, accountability, and risk management are some linked mechanisms included in more recent research (Brown 1997; Sambamurthy and Zmud 1999; Weill and Ross 2004; Brown and Grant 2005; Parent and Reich 2009; Huang et al. 2010).

In trying to identify effective IT governance arrangements, scholars have extended their analysis to different areas of IT governance (Sambamurthy and Zmud 1999; Kambil and Lucas 2002; Trites 2004; Weill and Ross 2004; Andriole 2009; Huang et al. 2010; Xue et al. 2011), covering areas 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 and Lim 2008; Gu et al. 2008; Merhout and 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. The latter is defined as the ability of firms to provide adequate and relevant IT governance information in a timely and effective manner to stakeholders (investors, policy makers, and regulatory bodies), to enable them to assess management's behaviour in using IT (Millar et al. 2005; Eldomiaty and 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 a reduced cost of capital (Barry and Brown 1985, 1986; Vanstraelen et al. 2003; Easley and O'Hara 2004), an improvement in liquidity (Diamond and Verrecchia 1991; Kim and Verrecchia 1994), and better information intermediation (Bhushan 1989; Lang and Lundholm 1996).

Based on the study of Lang and Lundholm (1996) and Clarkson et al. (2004), we infer that the more firms have good IT governance in place, the more they are incentivised to disclose.

Based on this theoretical premise, the first two research questions that we try to answer are:

Q1 Has the level of IT governance disclosure changed after financial turmoil?
Q2 What topics of IT governance are publicly disclosed and where (in which public document) the information on IT governance topics can be found?

In our knowledge, there is no specific study on IT governance disclosure in the banking sector, except the contribution from Joshi et al. (2013) that demonstrate differences in level of disclosure are related to varying institutional settings.

4.2.2 Changes in the IT Risk Management Regulation Framework

Since IT governance (like other aspect of banking business) can be influenced by the regulatory environment, it is important to understand in which direction Supervisors and Regulators have moved. As mentioned above, the recent financial turmoil has catalysed attention, among others, on risk management and in particular on the processes, data management and the new emerging risks such as IT risk.

IT risk is differently defined across time and countries as shown in the Table 4.2. In the banking sector, it is generally considered as a key type of operational risk; subject to very specific challenges given that the financial system has become more complex and interconnected (EBA 2015a).

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, for the assessment of IT risks all banks have mechanisms and measures in placein certain forms depending on regulation at the local level.

Table 4.2 IT-related-risk: main definition

Authors (year)	Definitions
Loch et al. (1992)	[. . .] IT operational risk could result in the disclosure, modification, destruction, or denial of use of IT resources
Straub and Welke (1998, p. 442)	[. . .] define "systems risk" as uncertainty related to using computer-based systems and interpret this risk to be "broadly construed to mean modification, destruction, theft, or lack of availability of computer assets such as hardware, software, data, and services"
Jordan and Silcock (2005)	An IT risk is something that can go wrong with IT and cause a negative impact on the business
ITGI (2008)	[. . .] IT risk is business risk – specifically, the business risk associated with the use, ownership, operation, involvement, influence and adoption of IT within an enterprise
Goldstein et al. (2011, p. 610)	[. . .] IT operational risk is any threat that may lead to the improper modification, destruction, theft, or lack of availability of IT assets
EBA (2015b)	[. . .] operational risk related to information and communication technologies

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

- started a comprehensive review of Basel II, culminating in the release of a reform package known as the 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 process, (nor in other international regulatory intervention); IT risk is considered as a sub-type of operational risk (art 85 CRD IV).

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

The CRD IV requires banks to perform a major update to their IT risk management in terms of:

- process: the implementation of rules and standards in 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 biggest impacts from a technological standpoint is the ability to produce integrated reports, with consistent reporting across the company.

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): one more time, regulators don't address banks specific requests for an effective IT risk management system, but set a framework for Supervisors to monitor this topic at an institutional level.

Considering that all these changes in the regulatory environment may result in strategy overhaul, process review and IT systems impact, we want to examine whether any differences in Supervisors' attitude to IT concerns at the national level, will induce differences in banks' IT governance, and level of investments in IT projects. So, the last research questions are:

Q3 To what extent—if any-has Supervisors' behaviour beens affected by the attention paid by banks to this theme?

Q4 Have Supervisors' indications influenced the banks' level of IT systems investment?

4.3 Research Methodology

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

The first two research questions are oriented towards analysing the level (Q1) and the content (Q2) of disclosure of 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). Information is obtained from public disclosure documents of banks included in the sample (see Sect. 3.2).

To carry out the content analysis, we identify a set of items related to IT governance grouped into 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 (see Sect. 3.1).

For each focus area under ITGF, the items were selected on the basis of current literature (see Tables 4.3, 4.4, 4.5 and 4.6), including terms that have emerged from the regulatory environment and practitioner debate as well as on a pilot study we conducted on bank 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 (1 = present; 0 = not present) and how many times it is enumerated. We then build up a unique dataset to be used to measure the level of IT governance disclosure. In particular for each institution (bank and Supervisor) it was possible to compute:

- a *total IT governance score*, which represents the number of times that each item is disclosed in the reports analysed; for example, if we find evidence of Internal Audit position five times in the Annual report, then it is assigned an item score of 5. As it is difficult 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. The total IT governance score (or focus area score) is obtained by simply adding the scores related to items within ITGF (or within focus areas).
- a *total IT governance disclosure index* (ITGF_Index) and four IT governance indices, one for each focus area within ITGF (ITRR_Index, ITRP_Index, ITRM_Index, ITINV_Index) are constructed. The indices are obtained by simply adding the score of each focus area divided by the number of items in each category (Bollen et al. 2006; Joshi et al. 2013):

t3.1 **Table 4.3** ITRR Index: description of items and literature references

t3.2 N°	Items	Description	Relevant literature
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 and Van Grembergen (2008), Joshi et al. (2013)
t3.3			
t3.4 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	
t3.5			
4	CERT/SOC	Presence of Computer Emergency Response Team/Security Operations Centre	
t3.6			
5	Data management office/ centre	Presence of organizational position related to Data management	
t3.7			
6	IT service/ function	Presence of specific organizational position	
t3.8			
7	CIO	Presence of CIO or an equivalent position with respect to IT and information assets at an executive level	Peterson (2004), De Haes and Van Grembergen (2008), Joshi et al. (2013)
t3.9			
t3.10 8	CISO	Presence of CISO with respect to IT security at an executive level	Pilot study
9	IT management	Presence of senior management dedicated to IT asset	
t3.11			
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 and Bhattacharya (2007), Joshi et al. (2013)
t3.12			
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, et al. (1993), Karimi et al. (2000), Peterson (2004), Trites (2004), Van Grembergen and De Haes (2004), Nolan and McFarlan (2005), De Haes and Van Grembergen (2008), Joshi et al. (2013)
t3.13			

$$\text{IT Y\_Index} = \frac{1}{Ny} \sum_{i=1}^{Ny} (x_i)$$

241 Where IT $Y_{\_Index}$ = IT governance Index related to the focus area/categories Y
242 (namely GF: entire Governance Framework; RR: Role and Responsibility; RP:
243 Resources and Plans; RM: Risk Management; INV: Investment); x_i = Sum of

Table 4.4 ITRP Index: description of items and literature references

N°	Items	Description	Relevant literature
1	Information security policy	Presence of a clear information and security policy	Trites (2004), Jordan and Silcock (2005), Joshi et al. (2013)
2	IT plan/s		
3	IT strategy	Presence of any kind of reference to IT strategies	Pilot study
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		
7	IT/Data infrastructure/ Architecture	Terms related to the relevance assumed by data governance after 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
9	ITIL/COBIT/ NIST	Presence of explicit reference to the adoption of any IT governance framework/ standard	ITGI (2003), De Haes and Van Grembergen (2008), Joshi et al. (2013)
10	ISO 27001-5		
11	Other IT governance Standards		

the item scores within each focus area/categories, and N_y number of items included in Y focus area/categories.

These indices are used to compare the level of IT governance disclosure across time and countries (Q1). From the dataset, it is also possible to have a look at how and where banks disclose details on IT governance (Q2).

To measure changes in attention paid by different Authorities to IT governance, we perform content analysis on a selected group of Supervisors' documents. We consider items included in the first three focus areas (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 these kinds 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 a comprehensive ITGF_Index for each Authority.

To evaluate the influence of Supervisors' attitude on banks' IT governance behaviour we investigate the relationship between ITGF_Index_Banks and ITGF_Index_Supervisors (Q3) using an OLS regression model estimates.

Finally, we calculate the banks' level of investments in IT systems (ITEXP), as a proxy of banks' efforts to maintain IT systems and security at adequate levels and infer that related internal controls remain "robust". We measure the level of investments in IT considering all expenditure (registered both in the Balance

t5.1 **Table 4.5** ITRM Index: description of items and literature references

t5.2 N°	Items	Description	Relevant literature
1	Cyber risk/ Attack IS breach	Presence of reference to identification of IT risk	Jordan and Silcock (2005), Joshi et al. (2013), Regulatory environment & practitioners debate
t5.4 2	IT fraud		
t5.3 t5.5 3	IT Incident/ failure		
t5.6 4	IT risk		
t5.7 5	IT risk/Business continuity/Cyber security model	Presence of elements related to the evaluation of IT risk	Pilot study
t5.8 6	IT risk appetite		
t5.9 7	IT risk assessment		
t5.10 8	IT risk report		
t5.11 9	Business continuity plan	Presence of IT and related technology continuity plans; these plans, in case of disaster, are also expressed required by regulatory framework	Jordan and Silcock (2005), Joshi et al. (2013)
t5.12 10	Contingency plan		
t5.13 11	Disaster recovery plan		
12	Information/ Cyber security plan	Presence of special program to mitigate IT risk	Jordan and Silcock (2005), De Haes and Van Grembergen (2008), Merhout and Havelka (2008), Joshi et al. (2013)
t5.14 t5.15 13	IT risk management		
t5.16 14	IT risk regulation/compliance	Presence of explicit reference to regulations and compliance requirements	Trites (2004), Jordan and Silcock (2005), Li et al. (2007)

t6.1 **Table 4.6** ITINV Index: description of items and literature references

t6.2 N°	Items	Description	Relevant literature
t6.3 1	Expenses in income statement	Presence of IT related expenses, mentioned under the administrative cost	Joshi et al. (2013)
t6.4 2	Investment in balance sheet	Presence of IT related investment, mentioned as intangible assets	
t6.5 3	IT budget	Presence of information regarded budget on IT and information assets	Takemura et al. (2005), De Haes and Van Grembergen (2008)
t6.6 4	IT Expenses	Presence of information on the overall IT expenditure	Takemura et al. (2005), De Haes and Van Grembergen (2008)
t6.7 5	IT hardware/ software	Presence of information on IT hardware/ software cost mentioned under the IT expenditure	Takemura et al. (2005)

Sheet and Income Statement) made by banks to maintain an adequate level of the efficiency of the system. The level of investments in IT over time is normalised by Total Assets to obtain the ITEXP_Index. We use this index to verify if there is an influence of Supervisors' indications on the banks' level of IT investments (Q4).

The analysis, at this stage, can be considered as a pilot study (with a limited sample size) to test banks' and supervisors' behaviour on IT governance issues.

4.3.1 IT Governance Framework: Development of Categories

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

Considering this premise, we expect to find some clues of specific structural IT governance mechanisms in place in each institution analysed. For example, a bank might disclose the presence of a 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 clear to stakeholders that the bank has an IT governance structure and that—probably–IT policies and procedures are in place.

To develop content categories, we construct a so-called IT Governance Framework according to previous scholars contributions in assessing IT governance and base this on our pilot study conducted on the Annual Reports of banks/Supervisors and on key international regulations; Tables 4.3, 4.4, 4.5 and 4.6 provide a brief description and highlight the supporting literature for each item included in each of the four focus areas/categories.

According to the prevalent literature (Table 4.3) we suggest that the level of transparency on IT roles and responsibilities (IT Role & Responsibility, ITRR) can be used as a proxy of good IT governance practices. In our view it is possible to summarise previous scholars' contribution on the relevance of IT roles assigned among firms, focusing on the following:

- IT strategic roles;
- IT senior management;
- IT operational roles;
- IT control roles.

The definitions of corporate governance (OECD 1999, 2004), of which IT governance can be considered a sub-set, presents a need for leadership (strategic roles), direction (Senior Management) and control (roles). Therefore, IT governance must be driven from the highest levels within the organisation not only from the IT department or business unit levels (operational roles) across the organisation (Webb et al. 2006). In order for IT to be effectively governed the presence of a variety of roles can be considered a necessary premise (Table 4.3).

Compared with previous studies, we extend 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 consider 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.

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 public documents (Table 4.4).

To capture IT risk management practices (IT Risk Management, ITRM) we construct an index that considers the main phases of risk management processes: 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 determine if banks disclose 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 (Table 4.5).

The last focus area ITINV, concentrates on IT budget/investments. In the past two decades, practitioners and scholars (ITGI 2003; Weill and Ross 2004) have paid great attention to this topic, but the major part of these studies typically focus on the relationship between the disclosure on IT financial matters and economic benefits for firms. In our research, we analyse 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 (Table 4.6).

4.3.2 *The Sample and the Data Collection*

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). For each country, we consider the three major banks, being sure to include in the sample at least one G-SIB for each country: the final sample consists of 12 international

banking groups (Table 4.7). As mentioned in the previous pages, to perform the content analysis, we record data from different sources of public disclosure of banks included in the sample (281 documents), namely:

- Annual Reports;
- Corporate Governance reports;
- Pillar III reports;
- CSR/Sustainability reports, if any.

To calculate the ITGF_Index for Supervisors we perform the content analysis on the following sources:

- Supervisors' Annual Reports (30 documents in total, Table 4.8);
- Regulations which, during the period 2008–2015:
  - put in place the Basel III framework;

Table 4.7 Banks' sample composition and documents collected (2015)

Country	Total assets (bln €)[a]	Share of Euro area total assets[a]	Bank	G-SIB (2015)[b]	Total assets (mln €)	Share of total assets of countries banking system	N° of documents analysed
France	6940	25%	Crédit Agricole	×	1,529,294	20%	8(1)(2)
			BNP Paribas	×	1,292,206	17%	16(1)(2)
			Société Générale	×	1,334,391	17%	15(1)(3)
Germany	6955	25%	Deutsche Bank	×	1,629,130	21%	32
			CommerzBank		532,641	7%	23(1)
			Landesbank Baden-Württemberg		234,015	3%	23(1)
Italy	2724	10%	Unicredit	×	860,433	22%	32
			Intesa San Paolo		676,496	17%	32
			Monte dei Paschi di Siena		169,012	4%	24(4)
Spain	3664	13%	Banco Santander	×	1,340,260	48%	32
			BBVA		397,303	14%	24(3)
			Banco Sabadell		208,628	7%	20(5)

Note: (1) no separated CG Report; (2) no separated Pillar III; (3) no separated CSR Report; (4) CSR n.a.; (5) Separated CG Report for 2009; Pillar III n.a. In English, for the period 2011–2015; CSR n.a. for the period 2013–2014

Source: [a]ECB (2016), p. 69; [b]FSB (2015), p. 2; bank's website

t8.1 **Table 4.8** Supervisors' sample composition and documents collected

t8.2 Supervisor (acronym)	Country	N° of annual report analysed (time span)
t8.3 Supervisory and Resolution Authority—Autorité de Contrôle prudentiel et de résolution (ACPR)	France	6 (2010–2015)
t8.4 Federal Financial Supervisory Authority—Bundesanstal für Finanzdienstleistungsaufsicht (BaFin)	Germany	8 (2008–2015)
t8.5 Bank of Italy—Banca d'Italia (Bol)	Italy	8 (2008–2015)
t8.6 Bank of Spain—Banco de España (BoS)	Spain	8 (2008–2015)

357 • apply EBA Guidelines on internal Governance (GL44);
358 • specifically refer to the BCBS (2013) Principles of effective Risk Data
359 aggregation and Risk Reporting (PRDARR);
360

361 and any other specific regulation on IT governance, if available in English (see
362 Table 4.9).
363 Even if we find other important regulatory provisions in the analysed countries,
364 it was difficult to perform further content analysis because of the absence of English
365 translations.

366 4.4 Results and Discussion

367 Table 4.10 provides descriptive statistics for the variables employed in this study.
368 The mean for the overall IT disclosure index (ITGF_Index) is 2.85, representing
369 that on average, during the period considered, banks mentioned around 117 times
370 items within ITGF (consisting of 41 items); however, the range of the index is broad
371 among the sample (from 0.3 to 17). Similar considerations can be done for
372 Supervisors' ITGF index (from 0.03 to 1.8) even if the mean value and the range
373 of variation are smaller than for banks.
374 Table 4.11 provides the evolution of IT Governance Indices calculated for the
375 banks' sample and grouped by country (Q1). Looking at the results it is evident that
376 there is a generalized increase of IT governance disclosure through the years with
377 more intensity starting from 2013 and for Risk Management issues. ITINV_Index
378 doesn't indicate any particular evidence since it shows depressed values across the
379 year and across country.
380 It is also possible to highlight differences across countries. For instance, Spanish
381 banks in the sample have started to pay greater attention to ITRM categories in
382 2012 and give more importance to all items related to ITRR and ITRP focus areas in
383 2015. Spain differs from other countries, also because of the presence of a larger
384 number of roles and responsibilities related to IT governance.

t9.1 **Table 4.9** Regulations considered in ITGF_Index for supervisors

t9.2 References	Italian implementation	French implementation	German implementation	Spanish implementation
t9.3 EBA Guidelines on Internal Governance EBA/CEBS (2011)	• Circular 288/2015 • 15th update (2013) of Circular no 263/2006 • 15th up date (2015) of Circular no 285/2015	• Article 511.41 French Monetary and Financial Code(Code Monétaire et Financier), update in 2014	• German Banking Act, 2012 (Kreditwesengesetz–KWG) • Circular 10/2012 MaRisk	Adoption of the Guidelines as their own on 27 June 2012
t9.4 BCBS Principles for effective Risk Data Aggregation and Risk Reporting (2013)	• 15th update (2015) of Circular no 285/2015	Not found	• German Banking Act (Kreditwesengesetz-KWG) • Circular 10/2012 MaRisk	Not found
t9.5 CRD IV—Directive 2013/36/EU of the European Parliament (2013)	• 15th update (2013) of Circular no 263/2006 • 15th update (2015) of Circular no 285/2015	• French Monetary and Financial Code (Code Monétaire et Financier), update in 2014	• German Banking Act (Kreditwesengesetz–KWG) • Circular 5/2014 (BA)	• Ley 10/2014 • Royal Decree 84/2015 • Circular 2/2016 • Law 14/2013 of 29 November 2013
t9.6 Other		• Regulation 97-02 of 21 February 1997, relating to internal control in credit institutions and investment firms (revised in 2010)		

t10.1 **Table 4.10** Descriptive statistics

t10.2 Variable	Obs	Mean	Std. dev.	Min	Max
t10.3 ITGF_Index_Banks	96	2.847257	2.082997	0.2909091	16.95844
t10.4 ITRR_Index	96	0.4554924	0.7064599	0	6.090909
t10.5 ITINV_Index	96	0.4666667	0.3802123	0	2
t10.6 ITRM_Index	96	1.329454	1.114778	0	7.285714
t10.7 ITRP_Index	96	0.5956439	0.7446337	0	3.181818
t10.8 ITEXP_Index	96	0.0012736	0.0010066	0	0.0056655
t10.9 ITGF_Index_Supervisors	90	0.660019	0.5650148	0.02849	1.823362

t11.1 **Table 4.11** Evolution of banks' IT governance indices[a]: distribution by country[b]

t11.2	2008	2009	2010	2011	2012	2013	2014	2015
t11.3 *ITGF_Index*								
t11.4 France	6.91	7.42	5.22	6.13	7.15	5.77	7.93	10.07
t11.5 Germany	3.93	3.88	4.64	5.5	6.97	8.11	10.47	9.79
t11.6 Italy	8.67	10.56	8.3	9.91	8.28	9.04	10.03	12.92
t11.7 Spain	5.27	6.62	5.83	7.09	6.38	8.46	13.85	23.72
t11.8 Total	24.77	28.48	23.99	28.62	28.79	31.38	42.29	56.5
t11.9 *ITRR_Index*								
t11.10 France	0.18	0.55	0.55	0.55	0.64	0.55	0.64	2.55
t11.11 Germany	0.55	0.45	0.64	0.55	0.73	1.36	1.91	1.82
t11.12 Italy	1.27	1.27	1.09	1	1	1.27	1.27	2.36
t11.13 Spain	1.73	1.45	1.27	1	1.36	1.82	2.73	7.64
t11.14 Total	3.73	3.73	3.55	3.09	3.73	5	6.55	14.36
t11.15 *ITRP_Index*								
t11.16 Germany	0.18	0.36	0	0.82	0.91	1.55	1.91	1.64
t11.17 Spain	0.27	0.36	0.09	0.09	0.82	0.91	1.73	4.82
t11.18 France	0.73	0.55	0.55	1.18	1.18	1.09	1.36	1.45
t11.19 Italy	2.73	4.82	3.55	4.91	3.82	3.64	4.09	5.09
t11.20 Total	3.91	6.09	4.18	7	6.73	7.18	9.09	13
t11.21 *ITRM_Index*								
t11.22 France	4.8	5.13	3.73	4	4.33	3.53	5.33	5.67
t11.23 Germany	1	0.67	0.6	0.93	1.93	1.60	3.85	4.13
t11.24 Italy	3.67	3.27	2.87	3.2	2.87	3.33	3.47	4.47
t11.25 Spain	2.47	3.60	3.47	5	3.20	4.73	8.20	10.07
t11.26 Total	11.93	12.67	10.67	13.13	12.33	13.2	20.85	24.33
t11.27 *ITINV_Index*								
t11.28 France	1.20	1.20	0.40	0.40	1.00	0.60	0.60	0.40
t11.29 Germany	2.20	2.40	3.40	3.20	3.40	3.60	2.80	2.20
t11.30 Italy	1	1.20	0.80	0.80	0.60	0.80	1.20	1
t11.31 Spain	0.80	1.20	1	1	1	1	1.20	1.20
t11.32 Total	5.20	6.00	5.60	5.40	6.00	6.00	5.80	4.80

t11.33 Note: [a]ITGF_Index is the sum of the indices related to the four focus areas (ITRR_Index, ITRP_Index, ITRM_Index, ITINV_Index)
[b]The value of indices for each country is calculated as the sum of banks' indices included in the sub-sample

Italian banks recorded a slight upward trend over time for all indices particularly for the ITRP_Index.

To answer to Q2 we analysed the percentage of IT governance items disclosed by banks in the sample (Table 4.12) and the documents in which they are disclosed (Table 4.13). Considering data reported in the following Tables we notice a lack of disclosure of organizational positions (see category ITRR); more attention is paid instead to IT services/functions and to Operational roles relating to business continuity.

ITRP exhibits an increasing attention to IT resources and to Electronic Data Processing starting from 2013. While few banks refer to IT policy and IT plans.

Within ITGF, ITRM is the most reported focus area; an increasing number of banks in the sample refer directly to IT risk, starting to consider it as a specific category instead of being included under operational risk. Business continuity plans and Information security are critically important.

Finally, ITINV, indicates that in the most part banks report IT expenditures, but this seems mainly related to accounting policies instead of disclosure about investment plans. Maybe this attitude is due to the strategic and competitive relevance of IT investments and the need for banks to preserve the related programs' details.

Table 4.13 represents the banks' preferences regarding the documents used to disclose about IT governance (Q2). Considering the general content of the four types of documents we would expect to find more evidence regarding items grouped as follows:

- ITRR and ITRP in the CG Report;
- ITRM in the Pillar III Report;
- ITINV in the Annual Report.

Looking at the results it is evident that banks included in the sample use the Annual Report as the most important document to disseminate information on IT governance issues. It is true for ITRR and ITRP categories as well as ITRM. Surprisingly, banks do not refer to RM practices in the Pillar III Report but—again—prefer the Annual Report.

As expected information related to the ITINV focus area is described in the Annual Report, even if we note that some banks often include IT expenses in the CSR Report, suggesting that banks assign to IT investment a specific role in value creation for all stakeholders.

Before analysing the results of the Supervisors' behaviour, we would like to point out that it was not possible to find out the English version of dispositions which transposed CRD IV and EBA Guidelines into national regulation (Table 4.9), namely:

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

Nevertheless, 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 no results. Considering these

t12.1 **Table 4.12** Percentage[a] of banks disclosing IT governance items

	Categories	Items	2008	2009	2010	2011	2012	2013	2014	2015
t12.3	ITRR	IT audit/EDP audit	–	–	–	–	8%	8%	17%	25%
t12.4		Information security control function	–	–	–	–	–	–	–	8%
t12.5		Business continuity management	17%	25%	25%	33%	25%	50%	33%	33%
t12.6		CERT/SOC	25%	25%	42%	25%	25%	25%	42%	42%
t12.7		Data management Office/centre	8%	–	17%	25%	25%	8%	8%	25%
t12.8		IT service/Function	58%	50%	25%	33%	50%	42%	58%	67%
t12.9		CIO	25%	17%	8%	–	8%	17%	25%	25%
t12.10		CISO	–	–	–	–	–	–	17%	42%
t12.11		IT management	25%	25%	8%	25%	17%	8%	17%	25%
t12.12		Technology committee	–	8%	8%	8%	8%	8%	17%	25%
t12.13		IT committee	–	–	8%	–	–	–	–	–
t12.14	ITRP	Information security policy	–	–	–	–	–	–	–	–
t12.15		IT plan	17%	17%	–	8%	17%	17%	25%	42%
t12.16		IT strategy	–	–	–	17%	–	25%	42%	33%
t12.17		EDP	17%	25%	25%	25%	33%	50%	50%	42%
t12.18		IT resources governance	17%	17%	8%	8%	8%	8%	17%	33%
t12.19		IT processes/ procedures	17%	17%	17%	33%	33%	33%	33%	50%
t12.20		IT/Data Infrastructure/Architecture	42%	58%	42%	67%	67%	67%	92%	75%
t12.21		IT resources/ solutions	25%	17%	8%	25%	33%	33%	25%	50%
t12.22		ISO 27001-5	8%	8%	8%	8%	8%	17%	17%	25%
t12.23		ITIL/COBIT/NIST	25%	25%	17%	33%	25%	17%	42%	33%
t12.24		Generic standards	–	–	–	–	–	–	–	–
t12.25	ITRM	Cyber risk/Attack IS breach	–	–	8%	25%	25%	25%	33%	67%
t12.26		IT fraud	–	–	–	–	8%	8%	8%	17%
t12.27		IT incident/failure	58%	67%	42%	67%	50%	50%	67%	75%
t12.28		IT risk	33%	42%	25%	33%	58%	67%	83%	83%
t12.29		IT risk/Business continuity/Cyber security model	–	8%	–	–	–	–	–	17%
t12.30		IT risk appetite	–	–	–	–	–	–	–	8%
t12.31		IT risk assessment	–	–	–	–	–	–	–	17%
t12.32		IT risk report	–	–	–	–	–	–	8%	8%
t12.33		Business continuity plan	67%	67%	67%	83%	75%	75%	75%	75%

(continued)

Table 4.12 (continued) t12.34

Categories	Items	2008	2009	2010	2011	2012	2013	2014	2015	
	Contingency plan	67%	58%	67%	58%	58%	58%	58%	58%	t12.36
	Disaster recovery plan	25%	17%	17%	17%	17%	17%	8%	25%	t12.37
	Information/Cyber security plan	50%	25%	33%	33%	42%	42%	75%	75%	t12.38
	IT risk management	8%	8%	8%	8%	8%	–	33%	17%	t12.39
	IT risk regulation/ compliance	–	–	–	–	–	–	8%	–	t12.40
ITINV	Expenses in income statement	58%	67%	67%	67%	67%	67%	67%	67%	t12.41
	Investment in balance sheet	58%	58%	58%	58%	58%	58%	67%	67%	t12.42
	IT budget	–	8%	–	–	–	–	–	–	t12.43
	IT expenses	67%	58%	33%	33%	42%	33%	50%	42%	t12.44
	IT hardware/ software	8%	17%	25%	17%	8%	25%	17%	8%	t12.45

[a]Number of banks that disclose the Items of each category within ITGF divided by the number of banks included in the sample t12.46

limitations, we analyse the percentage of Supervisors that enumerate the items included into three focus areas (Table 4.14): ITRR, ITRP, ITRM. Comparing results between banks and Supervisors we notice a homogeneous behaviour between the two groups regarding the items enumerated.

This evidence allows us to deepen our understanding of the existence of a relationship between Supervisors' attitude and banks' behaviours (Q3).

We estimate the relationship between the ITGF_Index for banks and Supervisors using OLS regression with control variables equal to Country (dummies 1–4), the banks' size effect expressed by the natural logarithm of Total Asset (LogTa) and annual GDP growth: given the impossibility to control for bank and/or time fixed effect—due to the limited sample size-, we decided to control for geographical differences (Country and GDP) and banks' size. We use the 0 constant model to avoid the dummy variable trap. The model estimates, reported in Table 4.15, provide the following results:

- the coefficient of ITGF_Index_Supervisors is significantly positive as expected (1.75) and its magnitude suggests that changes in banks' behaviour are positively related to Supervisors' attention to IT;
- the selected control variables, with the exception of GDP, have a strong high influence on the dependent variable; in particular, it seems that larger banks pay more attention to IT issues (LogTa 3.54).

The model demonstrates good explanatory power expressed by the R-squared (0.81) and F test (although the F test for zero slopes in the absence of a constant is not easily interpretable).

t13.1 **Table 4.13** Distribution IT governance items by type of documents

t13.2			2008		2009		2010		2011		2012		2013		2014		2015	
t13.3	CAT	DOC	n.	%	n.	%	n.	%	n.	%	n.	%	n.	%	n.	%	n.	%
t13.4	ITRR	AR	28	68	26	63	26	67	24	71	30	73	33	60	40	56	97	61
t13.5		CG	–	–	1	2	1	3	–	–	1	2	4	7	11	15	21	13
t13.6		PIII	3	7	3	7	5	13	4	12	5	12	10	18	13	18	15	9
t13.7		CSR	10	24	11	27	7	18	6	18	5	12	8	15	8	11	25	16
t13.8		Total	41	100	41	100	39	100	34	100	41	100	55	100	72	100	158	100
t13.9	ITRP	AR	23	53	27	40	29	63	39	51	39	53	42	53	63	63	80	56
t13.10		CG	6	14	9	13	1	2	13	17	8	11	10	13	12	12	20	14
t13.11		PIII	3	7	16	24	11	24	13	17	20	27	20	25	19	19	30	21
t13.12		CSR	11	26	15	22	5	11	12	16	7	9	7	9	6	6	13	9
t13.13		Total	43	100	67	100	46	100	77	100	74	100	79	100	100	100	143	100
t13.14	ITRM	AR	104	58	111	58	104	65	125	63	115	62	123	62	187	60	189	52
t13.15		CG	12	7	18	9	15	9	16	8	12	6	19	10	33	11	56	15
t13.16		PIII	31	17	40	21	40	25	52	26	55	30	53	27	73	23	89	24
t13.17		CSR	32	18	21	11	1	1	4	2	3	2	3	2	19	6	31	8
t13.18		Total	179	100	190	100	160	100	197	100	185	100	198	100	312	100	365	100
t13.19	ITINV	AR	10	83	12	80	9	69	8	67	9	60	7	47	8	62	5	63
t13.20		CG	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	13
t13.21		PIII	–	–	1	7	1	8	1	8	5	33	5	33	4	31	–	–
t13.22		CSR	2	17	2	13	3	23	3	25	1	7	3	20	1	8	2	25
t13.23		Total	12	100	15	100	13	100	12	100	15	100	15	100	13	100	8	100

t13.24 CAT = ITGF categories; DOC = type of documents [AR = Annual Report; CG = Corporate Governance Report; PIII = Pillar III report; CSR = CSR report]; n. = number of items found in each type of documents under each ITGF category; % = n. divided by Total Items of each ITGF category

AU2

Table 4.14 Percentage[a] of supervisors enumerating IT governance keywords t14.1

Categories	Items	2008	2009	2010	2011	2012	2013	2014	2015	
ITRR	IT audit/EDP audit	–	–	–	25%	–	25%	25%	25%	t14.3
	Information security control function	–	–	–	–	–	–	–	–	t14.4
	Business continuity management	–	–	–	–	25%	25%	25%	25%	t14.5
	CERT/SOC	25%	–	–	–	–	–	–	–	t14.6
	Data management Office/centre	–	–	–	–	–	–	–	–	t14.7
	IT service/ Function	50%	25%	50%	25%	50%	75%	75%	75%	t14.8
	CIO	25%	–	–	–	–	–	–	–	t14.9
	CISO	–	–	–	–	25%	–	–	–	t14.10
	IT management	–	–	–	25%	50%	25%	25%	25%	t14.11
	Technology committee	–	–	–	–	–	–	–	–	t14.12
	IT committee	–	–	–	–	–	–	–	–	t14.13
ITRP	Information security policy	–	–	–	–	–	25%	25%	25%	t14.14
	IT plan	–	–	25%	25%	–	75%	100%	75%	t14.15
	IT Strategy	–	–	–	25%	–	50%	25%	50%	t14.16
	EDP	–	–	–	25%	50%	50%	50%	50%	t14.17
	IT resources governance	–	–	–	–	–	50%	50%	50%	t14.18
	IT processes/ procedures	–	–	25%	25%	50%	50%	75%	50%	t14.19
	IT/Data infrastructure/Architecture	–	–	50%	75%	50%	75%	50%	75%	t14.20
	IT resources/ solutions	25%	25%	25%	25%	50%	50%	50%	50%	t14.21
	ISO 27001-5	–	–	–	–	–	–	–	–	t14.22
	ITIL/COBIT/ NIST	–	–	–	–	–	–	–	–	t14.23
	Generic standards	–	–	–	–	–	–	–	–	t14.24
ITRM	Cyber Risk/Attack IS Breach	–	–	–	–	–	–	–	75%	t14.25
	IT fraud	–	–	–	–	–	–	–	–	t14.26
	IT incident/failure	25%	–	–	–	–	25%	25%	25%	t14.27
	IT risk	25%	25%	25%	25%	25%	50%	50%	75%	t14.28
	IT risk/Business continuity/Cyber security model	–	–	–	–	–	25%	25%	25%	t14.29
	IT risk appetite	–	–	–	–	–	–	–	–	t14.30
	IT risk assessment	–	–	–	–	–	25%	25%	50%	t14.31
	IT risk report	–	–	–	–	–	–	–	–	t14.32

(continued)

t14.33 **Table 4.14** (continued)

t14.34 Categories	Items	2008	2009	2010	2011	2012	2013	2014	2015
t14.35	Business continuity plan	–	–	–	–	50%	75%	75%	75%
t14.36	Contingency plan	–	25%	25%	–	75%	100%	75%	75%
t14.37	Disaster recovery plan	25%	–	25%	25%	25%	50%	50%	50%
t14.38	Information/Cyber security plan	–	–	–	–	25%	25%	25%	75%
t14.39	IT risk management	–	–	–	–	–	50%	25%	25%
t14.40	IT risk regulation/compliance	–	–	–	–	–	25%	25%	25%

t14.41 [a]Number of supervisors which refer about the Items of each category within ITGF divided by the number of authorities considered in the study. We remind that—at this stage of the analysis—four supervisors are included in the sample

452 Regarding the last research question (Q4), we measure the level of investments
453 in IT systems (IT Expenditure, ITEXP_Index) considering all expenditures made
454 by banks; we expect an increasing level of investments, considering, on one hand,
455 the growing level of business complexity expressed by banks' dimension, and, on
456 the other, the increase in Supervisors' attention to IT concerns. Furthermore, we
457 control for Country dummies and we considered the influence of the annual GDP
458 growth rate.
459 Looking at the level of ITEXP_Index, it seems that banks in the sample have
460 invested adequately in the maintenance of existing IT infrastructure, instead of
461 commissioning large-scale and expensive IT change programmes. In fact, the Index
462 remains substantially steady over the time within each country (Table 4.10). To
463 assess if there is a relationship between the level of investment made by banks and
464 the increasing level of attention paid to IT governance concerns by Supervisors we
465 perform an OLS regression; the results are summarised in Table 4.16 and show the
466 absence of influence of increased Supervisors' attention to IT on bank IT invest-
467 ment policy (the coefficient is not significant). There is a more significant link
468 between banks size and the level of IT investment made, even if the intensity of this
469 relation is not so high.
470 In addition, the level of investment does not depend on the state of the economy
471 (GDP); this suggests that IT investments are not pro-cyclical.

AU3 t15.1 **Table 4.15** Model OLS estimates of ITGF_Index_Banks

t15.2 **Source**	**SS**	**df**	**MS**		Number of obs = 90	
t15.3					F(6, 84) = 51.23	
t15.4 Model	928.674208	7	132.667744		Prob > F = 0.0000	
t15.5 Residual	214.941063	83	2.58965136		R-squared = 0.8121	
t15.6 Total	1143.61527	90	12.7068363		Adj R-squared = 0.7962	
t15.7					Root MSE = 1.6092	
AU4 t15.8 **ITGF_Index_Banks**	**Coef.**	**Std. Err.**	**t**	**P > |t|**	**[95% Conf.**	**Interval]**
t15.9 ITGF_Index_Supervisors	1.753872	0.4240605	4.14	0.000	0.9104329	2.597312
t15.10 GDP	15.37453	8.117	1.89	0.062	−0.7698561	31.51892
t15.11 LogTa	3.542551	0.5545266	6.39	0.000	2.43962	4.645482
t15.12 dummy1	−19.80093	3.28289	−6.03	0.000	−26.33047	−13.27139
t15.13 dummy2	−17.30702	3.127079	−5.53	0.000	−23.52665	−11.08738
t15.14 dummy3	−22.25799	3.510357	−6.34	0.000	−29.23995	−15.27603
t15.15 dummy4	−17.59086	3.183921	−5.52	0.000	−23.92335	−11.25817

t15.16 Note: Dependent variable = ITGF_Index_Banks, the level of IT governance disclosure recorded by banks. Independent variable = ITGF_Index_Supervisors, level of IT governance disclosure of Supervisors. Control variables = LogTa, logarithm of banks' Total Asset; Countries dummy variables (dummy1 = Germany, dummy2 = Spain, dummy3 = France, dummy4 = Italy); and GDP, the annual GDP growth rate
We estimate OLS regression with dummy variables and no constant

t16.1 **Table 4.16** Model 2 OLS estimates of ITEXP_Index

t16.2 **Source**	**SS**	**df**	**MS**		Number of obs = 90	
t16.3					F(7, 83) = 28.01	
t16.4 Model	0.00017228	7	0.000024611		Prob > F = 0.0000	
t16.5 Residual	0.00007294	83	0.0087879		R-squared = 0.7026	
t16.6 Total	0.000245219	90	0.027247		Adj R-squared = 0.6775	
t16.7					Root MSE = 0.00094	
t16.8 **ITEXP_Index**	**Coef.**	**Std. Err.**	**t**	**P > |t|**	**[95% Conf.**	**Interval]**
t16.9 ITGF_Index_Supervisors	0.0005165	0.000247	2.09	0.040	0.0000252	0.0010079
t16.10 LogTa	0.0012927	0.000323	4.00	0.000	0.0006502	0.0019352
t16.11 GDP	−.0003268	0.0047284	−0.07	0.945	−0.0097315	0.0090779
t16.12 dummy1	−0.0065061	0.0019124	−3.40	0.001	−0.0103098	0.0027024
t16.13 dummy2	−0.0061942	0.0018216	−3.40	0.001	−0.0098174	0.0025711
t16.14 dummy3	−0.0073953	0.0020449	−3.62	0.001	−0.0114625	0.0033281
t16.15 dummy4	−0.0062605	0.0018547	−3.38	0.001	−0.0099495	0.0025715

t16.16 Note: Dependent variable = ITEXP, level of investment in IT disclosed by banks. Independent variables = ITGF_Index_Supervisors, the level of IT governance disclosure of Supervisors; LogTa, logarithm of banks' Total Asset. Control variables = Countries dummy variables (dummy1 = Germany, dummy 2 = Spain, dummy 3 = France, dummy 4 = Italy); GDP, the annual GDP growth rate
We estimate OLS regression with dummy variables and no constant.

4.5 Concluding Remarks: Key Findings, Limitation and Future Research

IT governance represents an important aspect to monitor for both supervisors and banks as the reach and complexity of IT continues to increase across the financial sector. IT sits in a critical part of banks as it is the backbone of all banking processing. In fact, while IT plays a key role in supporting banking business, it has also revealed its dark side during the recent financial turmoil: banks have shown an inadequate ability to exploit the potential that IT can ensure to provide Senior Management with a true picture of the risks the bank faces. Therefore, IT governance, 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.

One of the questions to which this study sought to answer is whether this awareness has been reached before by banks or by Supervisors.

As far as the scope of this study is concerned, we have analysed 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 conduct a content analysis to examine the level of attention paid to IT governance issues across 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 standardised or mandatory reporting format which could be used by banks. This is an important 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 it can ensure, leaves space for further research to investigate if IT governance practices are in place.

Similar considerations can be made on the Supervisors' side. There are no provisions at the 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 regulate the issue at a national level. This permits us to use the same methodology developed for banks to analyse the differences in Supervisors' behaviour.

Even if at this stage the analysis can be considered as a pilot study (with a limited sample size), we can summarize some key findings: i) banks have an increasing level of IT disclosure, more evident starting from 2012; ii) banks, within the IT Governance Framework, seem to pay more attention to IT Risk Management; and iii) prefer Annual Reports to release information on IT governance topics; iv) there is a positive relationship between Supervisors' and banks' attention to IT; while v) there is no evidence of Supervisors' influence on bank IT investments. At this stage of the study, these results can't be considered statistically strong, because: i) the sample includes a limited number of both banks and Supervisors; ii) the unavailability of all the national regulatory provisions in English. Consequently, we cannot exclude alternative explanations, such as the presence of causality bias.

Despite this, 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 highlights the regulatory environment that favours IT governance practices in banks and tries to measure the intensity of this relationship. In so doing, our anlaysis adds to the 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 basis for further analysis. The study may be replicated across the rest of EU countries using a larger dataset and this would allow the findings to be statistically more robust.

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