

Journal of the Association for Information Systems

JAIS 

Special Issue

Innovating Financial Information Infrastructures: The Transition of Legacy Assets to the Securitization Market

Antonios Kaniadakis

University of Central Lancashire
akaniadakis@uclan.ac.uk

Panos Constantinides

University of Warwick
Panos.Constantinides@wbs.ac.uk

Abstract

The introduction of mortgage securitization in the UK as a new type of financial innovation to help banks raise funds took the form of transferring existing legacy mortgage assets into the emerging securitization chain. In this paper, we explore the role of financial information infrastructure (FII) innovation as a process that enabled this transition and we ask what the implications for the calculation of financial risk were. New empirical evidence from a qualitative case study research in a U.K. bank shows that instead of focusing on the re-calculation of risk of the pre-existing legacy assets, the bank's innovative efforts were centered around validating the accuracy of the data available on those assets as an independent process. Our contribution is twofold. First, we show that FII are built with specific financial functions in mind that are formulated in the context of managerial and political decisions. Second, we show that data validation, although not a direct calculation of risk, constitutes an effort to order risk calculation practices. This is important in understanding the role of FII innovation as a mechanism by which FII become an integrating and standardising force in securitization markets.

Keywords: Information Infrastructures, Mortgage Securitization, Calculation, Risk, Legacy Assets.

* Eric Monteiro was the accepting senior editor. This article was submitted on 28th January 2013 and went through two revisions.

Innovating Financial Information Infrastructures: The Transition of Legacy Assets to the Securitization Market

1. Introduction

The practice of mortgage securitization, which constitutes the main innovation in mortgage financing since the 1970s (Fligstein & Goldstein, 2010; Quinn, 2009), was heavily implicated in the emergence of the 2008 financial crisis. In the US, securitization emerged in the 1970s as a political campaign of the Federal Government to seek additional means to finance the housing needs of the American people. In other words, securitization was an invention of the U.S. Government during the Lyndon Johnson administration in order to implement their housing policy; that is, to increase the housing stock for the baby boomers' generation, to increase the rate of home ownership, and to help lower the income people need to afford housing (Quinn, 2009). For these purposes, the U.S. Government created the government-sponsored enterprises (GSEs) Fannie Mae, Freddie Mac, and Ginnie Mae to buy multiple individual mortgages and re-package them into mortgage-backed securities (MBS) (Fligstein & Goldstein, 2010).

Although securitization emerged as a "social policy innovation" as part of the U.S. Government's budgetary politics (Quinn, 2009) and although it was reinforced by the deregulation of savings and loans banks (Fligstein & Goldstein, 2010), it gradually evolved beyond the arena of the U.S. federal public policy and into other national, business, and techno-organizational contexts. Indeed, soon after its invention, private actors adopted the practice and, in 1977, the first private label (non-government sponsored) U.S. MBS was issued by the Bank of America. Then, from 1985 onward, banks began securitizing other types of consumer debts, such as auto loans, credit card receivables, and so on (MacKenzie, 2011; Rosenthal & Ocampo, 1988).

By the 1990s, mortgage securitization practices spread to the UK and Europe and, as they did, they mobilized context-specific technological, economic, social, cultural, and legal forces that created the U.K. and E.U. mortgage securitization markets (Wainwright, 2009). These forces were fundamentally different from the ones in the US. For example, in contrast to the U.S. markets, the U.K. Government was not directly involved in the development of a secondary market for U.K. mortgages; the market was rather the outcome of financial institutions (Wainwright, 2009) such as mortgage lenders, investors, credit rating agencies, and so on. What is significant about this new phase in the history of securitization is that it does not spread to the UK and Europe as a social policy to assist home ownership, but rather as a "financial innovation" for banks to raise capital. Indeed, while banks in the past used savings and deposits from individual customers to fund loans, today, banks seek funding from outside sources, vaguely referred to as "capital markets". European banks and building societies, then, started considering securitization as a way to engage capital markets. In the UK more specifically, securitization was used exclusively as a funding tool until the late 1990s (Wainwright, 2009).

The transfer of securitization in Europe in the early 1990s was a relatively new idea. What was challenging about U.K. and European securitization, however, was not the idea itself (which travelled relatively freely as North American investment banks started promoting securitization in Europe), but rather the practices involved in converting the idea into an organizational framework and a product (Wainwright, 2009). For U.K. mortgage lenders with large amounts of legacy assets (e.g., individual mortgage loans) and established lending practices, this was particularly challenging for various reasons. Firstly, the strategic decision to adopt securitization practices for the purposes of fundraising was not straightforward. As we show in our case study, this was a highly political decision, not in the U.S. sense of public policy, but in the sense of internal organizational politics between the treasury of the bank and the board of directors. The reason for this is that, in the 1990s, securitization was still a new innovation in the UK and most of the adoption risk fell on the shoulders of early adopters (Fincham et al., 1994); additionally, the housing crash of the 1990s led to heavy losses by the centralized lenders, something that made U.K. bankers doubt securitization's viability as a useful tool. Securitization's reputation as a celebrated tool for fundraising was thus thrown into disrepute (Wainwright, 2009). Secondly, for U.K. lenders, securitization was not only about financial innovation of exotic and complicated products (Tett, 2009); it was also about a slow and mundane process of techno-organizational adaptation and change, a large part of which refers to the development of relevant information infrastructures. Indeed, as soon as the strategic (and political) decision was

made by senior managers of U.K. banks to enter into the emerging securitization chain, banks had to overcome the challenge of developing a new information infrastructure that was adapted to their existing practices in order to “plug into” a part of the securitization markets¹ and access diverse sources of funds. The new information infrastructure would enable U.K. banks to perform the transition from the legacy assets and existing lending practices into the emerging securitization chain and successfully pursue specific mechanisms of fund raising that were invented in different contexts (e.g., U.S. securitization).

This process of developing information infrastructures to support this type of financial innovation remains relatively unexplored in the literature, with only a few shining exceptions (Markus, Dutta, Steinfield & Wigand, 2008; Poon, 2009). In this paper, by combining insights from existing research in information infrastructures and economic sociology, we explore how financial information infrastructure (FII) innovation mediates the transfer of legacy mortgage assets into emerging securitization markets. We also explore the implications of this process for the assessment of loan quality and the calculation of financial risk. We do so in the context of a U.K. bank’s efforts to enter securitization markets in the mid-1990s.

Our contribution is twofold. First, by drawing on Callon’s (2007) concept of performativity, we argue that the role of FII is to perform the financial function prescribed by the economist (as economic agent or practitioner rather than as scientist) and not to facilitate capital flow in the generic way. The significance of this renewed understanding is that FII are built with specific financial functions in mind that are formulated in the context of managerial and political decisions. Second, we discuss the implications of our findings for practices of risk calculation. More specifically, drawing on Kalthoff (2005), we show that data validation, although not a direct calculation of risk, constitutes an effort to order risk calculation practices. This is important in understanding the role of FII innovation as a mechanism by which FII become an integrating and standardising force in securitization markets.

In Section 2, we discuss the logic of securitization, the practices of risk calculation involved in it, and the relevant role of financial information infrastructures. In Section 3, we discuss the significance of the particular case, and our methods of data collection and analysis. In Sections 4 and 5, we present and discuss our findings, and, in Section 6, we conclude the paper.

2. Securitization and Financial Information Infrastructures

2.1. The Logic of Securitization and Practices of Risk Calculation

The main difference of securitization markets from other types of markets is that, unlike other products, securitization assets constitute “promises to pay” within a given period of time and therefore their value depends on the “credibility of the promisor” (Carruthers & Stinchcombe, 1999) and not on certain intrinsic characteristics related to their form and functionality. It is this credibility that realizes the value of the asset and helps it to be bought and sold easily in the market (Carruthers & Stinchcombe, 1999). Thus, to a large extent, the making of securitization markets is synonymous with the making of financial credibility, while the absence of it is understood as risk.

Mortgage finance can be distinguished into “primary” and “secondary” mortgage markets (Cummings & DiPasquale, 1997). In the primary markets, individual borrowers obtain loans from lenders, while, in the secondary markets, lenders sell these mortgages to investors (Cummings & DiPasquale, 1997; Markus et al., 2008). Mortgage securitization refers to the secondary mortgage markets and it can be understood as a practice of pooling and bundling together a stream of “promises to pay” arising from mortgage repayments that are repackaged and sold to investors. Investors however, as new securitization market participants, also need reassurance and evidence of credibility in the products that they invest in. To produce such knowledge, market participants (lenders, rating agencies) collectively engage in a series of risk-calculating practices that produce this credibility. Such practices include mortgage underwriting, pooling, and credit rating.

¹ The financial press uses the metaphor “plumbing” to talk about this infrastructure (Economist, 2012).

Underwriting is a loan-origination process (Markus et al., 2008), part of the primary mortgage lending practices, by which a lender calculates the risk and decides whether to offer a mortgage loan to an individual borrower. Underwriting of individual loans is implicated in securitization markets in the sense that it may be used to reassure investors in the secondary markets about the quality of the underlying loans via the consistency of the underwriting standards (Akhavain, Frame, & White, 2005). These standards are represented in credit scores (i.e., “assessments of the odds that a consumer might default on a loan expressed as a probability”) (Poon, 2009, p. 657). Credit scores and data generated during the underwriting process are then made available to securitizers in the secondary markets who use them to make decisions on which loans to select for securitization (i.e., pooling). In this sense, pooling is the practice of transferring assets (i.e., individual mortgage loans) from the context of primary mortgage market to the secondary securitization market. It has been shown, however, that pooling large numbers of home mortgages reduces the amount of information needed to understand their value, so instead of compiling idiosyncratic information about each individual home and borrower, a lender need only use aggregate information about means and variables of pool mortgages (Carruthers & Stinchcombe, 1999). Pooling, then, renders the value of a loan more generally knowable and encourages those with little particular knowledge of the individual mortgage to invest their money (Carruthers & Stinchcombe, 1999). Finally, credit rating is the process by which the rating agencies² produce opinions on the risk of securitization products that become publicly available and creates public consensus about value and reassurance to market participants (Carruthers & Stinchcombe, 1999; MacKenzie, 2011). Credit ratings are usually expressed through a system of “tranching” (see Figure 1).

CREDIT RATINGS ¹				
		MOODY'S	STANDARD & POOR'S	FITCH
INVESTMENT GRADE	STRONGEST	Aaa	AAA	AAA
	↓	Aa	AA	AA
		A	A	A
		Baa	BBB	BBB
NON-INVESTMENT GRADE	↑	Ba	BB	BB
		B	B	B
		Caa	CCC	CCC
		Ca	CC	CC
		C	C	C
		WEAKEST	C	D

* These credit ratings are reflective of obligations with long-term maturities.

Figure 1. Tranching system for credit rating (SIFMA, 2013)

To summarize, underwriting, pooling, and credit rating are practices that help to calculate risk and construct credibility in mortgage markets. This credibility is essential for securitization as a funding tool to work because it opens the avenue toward capital markets. Potential investors, then, would be convinced to invest in these products and help the originating bank to raise the desired funds. In Section 2.2, we discuss how the development of financial information infrastructures may act as

² The role of rating agencies as market makers is highly controversial, especially after the crisis when they received heavy criticism in relation to their conflicting interests and role (Sinclair, 2010) that questioned the reliability of their ratings. Post-crisis, the securitization industry indeed admitted that they rely on rating agencies' too much and that investors should develop their own credit assessments and valuation principles (Transparency initiative, 2008), while the rating agencies argue that their ratings are “just opinions” that the investors may choose to take into account or not.

platforms on which to integrate primary and secondary mortgage markets and help banks adapt their existing practices with the emerging capital markets (i.e., emerging U.K. securitization).

2.2. The Role of Financial Information Infrastructures in Mortgage Securitization

Financial information infrastructures are ubiquitous, mediating information and communication technologies (ICT) that:

provide the adequate information flows and databases to “create, set up, control and maintain the network of exchanges and relevant contracts”... that build up the fabric of economic institutions such as markets and firms. (Ciborra, 2007, p. 36)

Recent information systems research understands FII innovation as an integrative and standardizing force in the mortgage markets. More specifically, the development of FII in mortgage finance and in financial markets more generally has been described as a collective action (Markus, Steinfield, Wigand & Minton, 2006) or a computerization movement whereby technical apparatuses are adopted and reframed according to different contexts and actors' interests (Markus et al., 2008). Poon (2009), for instance, shows the successive “movements” and “translations” that took place as the FICO infrastructure spread through the U.S. mortgage industry. Scott and Zachariadis (2012), in their historical analysis of the evolution of SWIFT, also show that, because the SWIFT infrastructure offered such benefits as “speed of messaging, lower costs, increased volumes, more secure transactions and standardisation”, interests in establishing common standards began to spread across banks and types of services, including securities.

By means of a process of innovation-during-diffusion (or “innofusion” (Fleck, 1988)), the spreading of FII across different levels and practices of mortgage finance constituted a political, social, and technical force toward the infrastructural integration of primary and secondary markets. This impacted the practices of risk calculation. Indeed, primary and secondary mortgage markets were placed on the same platform of risk calculation (Poon, 2009, p. 665). That is, FII contributed to a vertical integration that allowed single loans and pools of loans to be represented by the same metric (Poon, 2009, p. 671). As part of the same process, underwriting tools that produced credit scores for individual consumers expanded to become a central technology of securitization as they were diffused and adopted by securitizers and rating agencies (Poon, 2009). The expanding and evolving FII that were integrating primary and secondary mortgage markets created an avenue for individual banks to adapt their business models and techno-organizational practices and thus gain access to the capital markets that would become available through mortgage securitization. In other words, a way for banks to make the transition to securitization was through FII innovation, which meant to find a way to successfully plug into the expanding FII in the securitization markets.

Recent research in economic sociology and more specifically in the social studies of finance has provided insights and useful concepts that enhance understanding of what type of information infrastructure innovation would be necessary in order for the transition to securitization to be effective. More specifically, more detailed attention is paid to the role of financial data and their dissociation from the “reality” of the assets they refer to. This means that FII enabled the integration of primary and secondary mortgage markets by standardizing financial data, which, in turn, enable the rationalization of decision-making (e.g., decision to lend or decision to invest or decision on selecting loans for securitization) as separated from broader social processes and the reality they represent (Preda, 2006). Indeed, trust and authority in financial decisions are dissociated from individuals and transferred to technology; trustworthy data in securitization, therefore, are data produced or recorded by an authoritative technology, which enables them to be transferred from primary to secondary markets without losing their properties (Preda, 2006, p. 756). To be able to plug into part of a securitization chain and make securitization work as a funding mechanism, therefore, banks would need to build authoritative FII.

In information infrastructure research, trust and authority is reflected in the notion of transparency (Bowker & Star, 1999; Rolland & Monteiro, 2002; Star & Ruhleder, 1996; Timmermans, Bowker, & Star, 1996). Star and Ruhleder (1996, p. 113) argue that an “infrastructure is transparent to use in the sense that it does not have to be reinvented each time or assembled for each task, but *invisibly* supports those tasks” (emphasis added). They add: an “infrastructure takes on transparency by plugging into other infrastructures and tools in a standardized fashion”(Star & Ruhleder, 1996, p. 113). Such efforts towards more transparency can be understood, in the context of a long tradition in information infrastructure research, as an attempt to better align and integrate disparate systems and institute more control over organizational processes (e.g., Henderson & Venkatraman, 1993; Weill & Aral, 2006; Weill & Broadbent, 1998).

These infrastructures can be seen as constituting a distributed socio-technical calculative apparatus that can be theoretically understood as a set of rules, conventions, and tools (e.g., Bowker & Star, 1999; MacKenzie & Wajcman, 1999; Preda, 2006). Indeed, technical tools (e.g., ICTs) configured in financial practices (i.e., underwriting, credit rating, pooling) and in broader institutional relations between rating agencies and lenders constitute “machineries of knowing” (Knorr-Cetina, 1999) that generate knowledge on financial products for the benefit of market participants and help them calculate the relevant risk.

The literature conceptualizes FII innovation as an integrating force in securitization whereby authoritative and transparent FII constitute a platform for a distributed effort to calculate risk and install credibility. Banks that wish to enter the securitization markets are faced with challenges related to how to innovate their information infrastructures in order to plug into the broader FII more effectively and achieve a transparency that would create credibility and trust in the market. Building on literature from information systems and economic sociology, we further explore FII innovation as an integrative force. More specifically, in Section 4, we present new evidence on the role of FII innovation to enable the transition from primary mortgage lending practices to securitization markets.

3. Methodology

3.1. Research Site/Case Study Selection

To answer our key research question, we selected one of the U.K.’s major securitizers to study the role of FII innovation in the transition from traditional mortgage lending practices into emerging securitization markets. This was an ideal choice for various reasons. First of all, the growth strategy of this particular bank back in the mid-1990s and early 2000s was dependent on fundraising and their appetite to access capital markets. As we show in Section 4, this appetite for funds was initially related to the bank’s need to fund mortgages, while later it was directed towards strengthening the rest of their balance sheet. For this reason, they were attracted by a “diversification of funding” approach. Securitization seemed like a perfect mechanism for these purposes, which would allow them access to funds from a variety of alternative sources (i.e., expand the range of investors from various sectors), especially just as retail savings were also declining. Additionally, this bank had a long-term established mortgage lending business, and, together with subsequent mergers and acquisitions, they were holding several legacy mortgage platforms that were developed in different time frames and independently from what would later become their securitization business. The challenge of how to adapt all this pre-existing but fragmented infrastructure into the securitization chain was of particular interest to us. Another interesting fact about this U.K. bank was that they had managed to complete one of the first securitization transactions in Europe. As we show in Section 4, they did so by using a single mortgage platform that had embedded a securitization functionality in it. This platform had been acquired by a North American bank a few years back and served as a pilot to the further development of their securitization business. This provides further context and insights about how securitization “as a technology” (Wainwright, 2009) was transferred from the US to the UK.

Finally, apart from being pioneers in European securitization and from offering opportunities to examine the way in which FII mediate securitization, the selected bank was a successful and infamous institution that managed to do quite well even in the period of the 2007-2009 crisis and

while the securitization markets were more or less inactive. Indeed, as the financial crisis was affecting U.K. institutions in the form of liquidity shortage, the selected bank was not affected as much as other banks and building societies. While it participated along with other banks on the special liquidity scheme (SLS) of the Bank of England (all banks were required to do so as part of the measures designed to improve the liquidity position of the U.K. banking system in general), they did not find it necessary to participate in the other U.K. Government-backed schemes (namely, the credit guarantee scheme and the asset purchase scheme). Although the U.K. bank was eligible, they did not issue any debt guaranteed by this scheme and they managed to do securitization transactions during and after the crisis by using their master trust structures³. From March 2007 until December 2008, they completed three issuances, while, in 2009 alone, they managed to raise about £1.5 billion from securitization. The success of this specific bank was attractive to us as most other research at the time was targeting organizations that failed or were failing.

3.2. Exploring the Field and Gaining Access

To secure access to the specific institution, we had to overcome certain challenges. First of all, there was the challenge of identifying the appropriate institution with the appropriate characteristics on which to build our case study around because our research was not particularly targeting this specific bank from the research project's inception. Second, we had to gain access to relevant rich qualitative data covering at least the last 15 years, about the time that securitization was transferred to the UK. Before the selection of the case firm, a deeper exploration and engagement with the field was necessary.

The time frame in which the fieldwork was carried out (between 2010 and 2012) was rather peculiar in the financial sector. Soon after the 2008 collapse of the subprime mortgage market in the US, the problem started to spread beyond the U.S. subprime mortgage sector in other markets and geographic locations (BIS, 2008). By the time the credit crisis hit the UK, it had been transformed into an asset valuation crisis and consequently into a liquidity crisis, which led to the well-known Northern Rock events. This manifestation of the crisis in the UK heavily implicated lending and securitization practices, and securitization markets appeared to have frozen overnight. This environment created difficulties for the researchers but also opportunities. On the one hand, U.K. securitizers were very sceptical of granting access to researchers that were interested in securitization; on the other hand, due to the shutdown of the securitization markets, a lot of bank executives had left (or even lost) their posts and they either moved to other institutions or they had become independent consultants running their own business. These people with many years of experience in U.K. securitization but with no official affiliation with any of the major players thus created a pool of potential informants that would not be under pressure not to talk given the circumstances. As it turned out, they were quite keen to get their story out.

Additionally, although securitization was indeed implicated in the financial crisis, it had become a very popular topic with policy makers and professional associations. The Association of Financial Markets in Europe (AFME), the European Securitization Forum (ESF), the Council of Mortgage Lenders (CML), the International Financial Services London (IFSL), the Committee for the European Securitization Regulators (CESR), and the Financial Information Services Division (FISD) of the Software and Information Industry Association (SIIA) were all actors that were involved in post-crisis discussions, events, conferences, seminars, and workshops about the current situation and what needed to be done to revive the securitization markets. The popularity of securitization and the willingness of people from these organizations to meet with us and discuss issues around FII in securitization opened another window of opportunity for accessing the field. Indeed, these organizations opened up links with specific banks that would offer us access for an in-depth case study. More specifically, one of the aforementioned organizations used their email lists to circulate an email that we had put together explaining our research and requesting information. On the email list there were still people that had moved institutions but were still in the finance sector as independent

³ Master trusts were first introduced by the Bank of Scotland and they are used as special purpose vehicles (SPVs) originated by lenders. In master trusts, an originator (U.K. bank) transfers a pool of receivables to the trust in return for which the trust will issue, at the outset, at least one class of trust certificates plus a residual interest in the trust. The originator will sell the certificates to investors and retain the residual interest (Schwarcz, 2007).

consultants (see above). Several of them replied and expressed interest. After having meetings with some of them, we identified a key individual who was in the unique position to offer us access to one of the major U.K. securitizers, our selected firm. This key informant was part of setting up the securitization infrastructure in the U.K. bank more than 15 years ago. Although this individual was no longer working in the U.K. bank, he kept very good relations with them and introduced us to other individuals from the bank's treasury, the securitization division, and even with others who also used to work in the bank back in the mid-1990s and had now left the organization. We therefore formed quite a unique relationship with key (former and existing) employees of the bank in question, which gave us extremely useful insights in how they developed FII for their securitization business back in the mid-1990s. Access to study this bank, therefore, was the outcome of a continuous effort on behalf of the researchers and a gradual process based on the establishment of relations of trust with specific individuals in (and affiliated with) the bank. The confidence of these individuals on the robustness of the bank's processes and capabilities and their relative success during the 2008 financial crisis was also a catalyst in lifting some of the scepticism surrounding access to their securitization division.

3.3. Data Collection and Analysis

We follow an interpretive case study approach (Walsham, 2006; Yin, 1994). The unit of analysis (the case) is largely defined in the context of a specific firm (U.K. bank) and particularly in relation to its technological, organizational, and business elements around mortgage securitization. Initially, our approach in engaging the field was clearly as "outside researchers" rather than "involved researchers" (Walsham, 2006). As the fieldwork progressed, however, there was a slight shift from the former to the latter. Our relationship with our case firm was far from being considered as "action research"; nevertheless, some involvement activities took place. For instance, we had the chance to present to the treasury department some of our initial findings during one of our visits. Such involvement activities were both part of a feedback process but also a reassuring mechanism that would help the continuation of our fieldwork. Our data collection process spans over a period of 2 years, between 2010 and 2012.

Overall, our data includes 35 interviews, 20 of which are with individuals from different historical periods of the U.K. bank, while the rest are with people from the broader sectoral environment (regulatory organizations, rating agencies, analytics firms and IT suppliers, CIOs. and securitization people from other investment banks and building societies). These interviews also contributed to our understanding of the sectoral and industrial dynamics around securitization and the FII issues involved. Interview data were supplemented with information from email communications with the above interviewees and other informants that we did not have the chance to meet personally. Industry press and commentaries were also used and could be found in plethora on the Internet and other specialist magazines. Securitization transaction documents were also used, which are publicly available on the Internet. Non-publicly available data from U.K. bank executives were also provided (e.g., power point presentations from executive meetings, ICT architecture of the securitization unit showing different asset platforms, etc). We had four company visits, two in the treasury department of the U.K. bank, and another two in the securitization division. During these visits, we had the opportunity to log on to the computer system and were shown the whole process of selecting assets for securitization. Finally, the first author had the opportunity to attend a specialist conference (Global ABS in 2010) in which he learnt about the current debates in the securitization sector and engaged in networking and negotiating fieldwork access with participants.

To analyze the data from the case study, we followed a process-based approach by paying attention to key events in the evolution of the securitization sector (especially the key role of FII in innovations of practice) (Langley, 1999). Our analytical strategy included a combination of theory application and analysis of theoretical themes emerging from the data (Langley, 1999).

Specifically, we initially coded the data by drawing on our theorization of FII as standardizers and integrators of financial markets. We allowed the theory to "speak" before the data was a conscious strategy because we were drawing on legitimate research on the financial industry that had already established strong links between theoretical constructs and actual phenomena (e.g., Markus et al.,

2006; Markus et al., 2008; Poon, 2009; Preda, 2006, 2009). This helped us to develop a more critical appreciation of the concepts we were using. We then allowed the data to “speak” on behalf of the theoretical constructs in an effort to build on and extend the existing literature. We discuss theoretical implications of our findings after the case.

4. Empirical Case

4.1. Transition of Legacy Assets to Securitization via FII Innovation: Evidence From a U.K. Bank

In this section, we present our empirical case study by focusing on how the U.K. bank approached the challenge of transferring their legacy mortgage business into securitization markets by innovating relevant FII.

4.1.1. Securitization as a Fundraising Tool

As we mention throughout the paper, in its early days in the UK, securitization was treated as a new type of financial innovation coming from the US that would initially help U.K. banks raise funds and later as a tool to work around capital allocation regulations (Wainwright, 2009). As with any new innovation, securitization posed certain risks and U.K. bankers were somewhat sceptical, especially after the housing crash of the 1990s. The risks associated with this uncertainty first fell on the shoulders of early adopters, such as the U.K. bank, and the decision to enter the securitization chain had to come after a series of internal political negotiations in each of the large banks. This was the situation in our selected bank and the politics involved had to do initially with the strategic decision to enter securitization and later on with the technical capabilities of the bank’s mortgage platforms and choices around FII development.

A team of in-house experts, along with the U.K. bank’s treasury, started developing a vision around securitization as a viable tool for funding. An interviewee explained:

There was the vision within [U.K. bank] and in particular within the treasury of the [U.K. bank] that securitization was going to be a useful element in the bank’s ability to raise funding and to manage its capital allocation.

The same interviewee explains how this team of individuals within the bank were perceiving securitization as something innovative and new: “I might have a slightly biased view on that but I think that that’s where the real innovation was taking place; that sort of thinking within the organization at the time”.

He also explains how the scepticism that surrounded the U.K. mortgage sector in these early days. Indeed, securitization in the UK was not a tool for social policy but rather an innovative and initially risky financing technique that would help the banking institution to raise capital:

There weren’t anybody at the time that thought that this [securitization] was the way forward but obviously in subsequent years we saw a number of other entrants in the market and were focused on the fact that securitised funding was probably a way that was going to make sense for them.

The U.K. bank’s board of directors (BoD) were aware and were sharing some of this scepticism. For this reason, the challenge of the emerging securitization team and the treasury was to prove to the BoD that securitization was indeed useful as a strategic move to engage capital markets. For this reason, they decided to complete a first pilot transaction using only a single mortgage platform⁴ that they had recently acquired and that had already a securitization functionality embedded in it as an extension of their automated underwriting tool. This was a case of how securitization practice was transferred from North America to the UK in the form of built-in functionality in single mortgage

⁴ The mortgage platform consisted of the U.K. residential mortgage loans of a North American bank, acquired by the U.K. bank in 1994 and was re-named into “CAN mortgages” (see Figure 2).

platforms. The specific platform included an automated mortgage application system (mortgage lending) and a mortgage borrower system⁵ (securitization). The first transaction tested whether this infrastructure worked. Another interviewee involved in this first pilot transaction explained how the securitization team within the U.K. bank needed to prove that it worked as a funding tool:

There was the bet “let’s try to prove that this works” and if it does we have made available to the group another stream of funding for mortgage assets. Given that there was a lot of hunger for mortgage market share and the ability to grow mortgage assets... There was a recognition there [by the BoD]...

So, in these early days, when there was uncertainty around the usefulness of securitization as a funding tool, the U.K. bank tested their existing securitization capabilities on a limited set of assets. This first test was used to build the internal credibility of securitization by convincing the BoD of the bank that it would be a useful tool for fundraising. In Section 4.1.2, we discuss the politics involved in the subsequent development and technical integration of the bank’s FII.

4.1.2. Technical Integration of FII

The first securitization of about £250 million was issued in early 1998 and was followed by others in the sector. In the following years, securitization transactions in Europe grew steadily (ESF, 2006). Following the success of the first securitization, the treasury expressed the wish to expand their securitization capability to its other platforms. The BoD, however, did not share this vision and enthusiasm. The success of the first transaction was credited (internally and in the market) to the specific CAN platform that put on the spot the other mortgage platform that the U.K. bank had built over the years. One interviewee explained:

The treasury had a vision that wasn’t necessarily shared across the organization. It took an awful lot of work for the board to get comfortable with expanding the capability to do this type of transaction [...] politically, early on in the process of acquiring this platform, its performance, its ability to write business was overshadowing what the [U.K. bank] had created itself. There was not the political will to expand it at this time.

The expansion and integration of FII in the U.K. bank, then, initially met a resistance from the board of directors; however, given the success of the first transaction they were eventually convinced and, in 2001, the U.K. bank formed a joint venture with a data services company (a ten-year £217 million deal) for the integration of the U.K. bank’s asset platforms. The data management company recommended to expand the securitization capability of CAN mortgages to the other mortgage platforms (i.e., to use its securitization functionality and the technology underlying it as the building block for the wider mortgage system). This way, the CAN platform merged with the U.K. bank’s pre-existing one and with one from a building society (BGSOC mortgages) that the U.K. bank had acquired in 1996. All these databases fed into a central, larger platform (OCDB), which was operated through the underwriting and securitization tools that were replicated from CAN mortgages. The U.K. bank integrated into OCDB not only their mortgage assets but also credit cards and unsecured personal loans (UPL).

Figure 2 shows how the platforms were integrated and how the securitization functionality, extending from their existing automated underwriting tool, was replicated to the larger mortgage system. They created a centralized database (OCDB), which all of the underlying systems that were likely to become subject of securitization fed data into. The automated securitization functionality was subsequently overlaid on top of that database.

⁵ In the same system, therefore, one could see information from before the mortgage was granted to the administration of a mortgage on an ongoing basis and whether it was securitized or not.

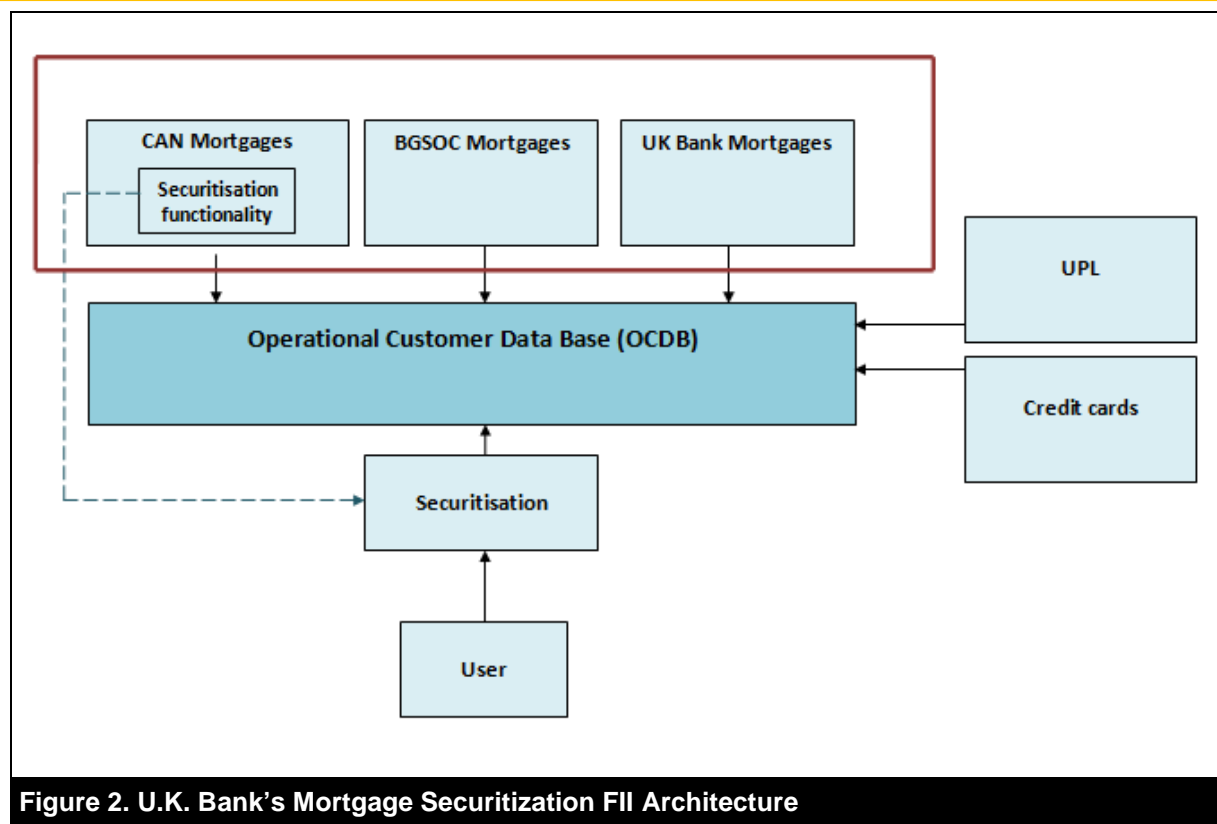


Figure 2. U.K. Bank's Mortgage Securitization FII Architecture

The technical integration of the existing platforms of legacy mortgage assets and the extension of their underwriting tools from calculating the risk of individual loans into selecting those loans for securitization did not automatically mean that the U.K. bank had achieved authoritative and transparent FII that would enable them to successfully plug into the securitization chain. The bank needed to overcome the issue of legacy assets.

4.1.3. The Issue of Legacy Assets

A key problem with the development of FII for securitization was how to select and transfer loans already on the bank's books in the securitization market and start moving them onto investors. This was challenging because the legacy assets residing in the bank's platforms were not underwritten in the same timeframe and under the same criteria as loans underwritten according to the rules and requirements set by the emerging securitization market. Indeed, the U.K. bank had a number of diverse assets spread through multiple databases that had been developed or acquired over the years through mergers and acquisitions consisted of loans with different maturities and with different kind of data available). One of our interviewees explained:

In banks like the [U.K. bank], it is not unusual to see portfolios of assets that are very mature, that are performing and have been performing for a number of years, but which don't have that much information readily available. In the interest of integration they move those loans onto another system...you will find these legacy assets residing on a system where some of the information that would be regarded as key information today for a newly originated loan, is not there for those assets.

Different underwriting criteria produced different kind of data that were not standardized and homogenized. This would create problems when the bank would want to select which assets to securitize. One of our interviewees offered an example:

If I have a loan where the borrower's annual income is stated as £100, that is more likely to be a mistake than it is to be a genuine case of "we have an advanced mortgage of many thousands of pounds based on an income of £100". That is going to be an error. However, if you have a situation that is flagged as a first time buyer but the information you have tells you that they are not a first time buyer, that's less likely to be a manifest data mistake in the way the understated income is. So, one of them falls into this category of an error of input, and the other one falls into the category of "this is flagged in a way that would make me look at it from a credit point of view slightly differently". This is a case where you'd want to ask an "are you sure" kind of question.

The technical integration of the bank's existing mortgage platforms made available a variety of legacy assets that had been underwritten in different timeframes and under different criteria. The heterogeneity of the legacy assets made it difficult for the bank to successfully plug into the securitization chain because the underwriting criteria of the market did not match with the bank's internal criteria of loan quality. This was the main problem that the FII developers tried to tackle.

4.1.4. Validating Data and Plugging into the Securitization Chain

To deal with these issues, the U.K. bank established an internal process to standardize the data of the legacy assets that became available through the technical integration. As FII were becoming part of securitization, a process to compare data on the paper file from when the loan had been underwritten with what appeared on the new system was established. One of our interviewees described this process:

We used to take each individual file and we had a team of people who would go through a series of blank screens and re-key some elements of the data from the paper file where the mortgage had been underwritten on... Once they'd done that they went through a process of re-populating screens that were blank and then they would hit a button and the system would make a comparison of what they had input, to what had been input when the loan was written and it would throw out exception reports of where the difference is, and that was our way of ensuring that there was a high degree of data integrity and quality.

This way, underwriting data both from old and new loans were validated in the emerging context of securitization. In order to successfully plug into the securitization chain and homogenize internal lending criteria with those accepted in the market, the FII developers in the U.K. bank turned to rating agencies. Indeed, the validation process was based on a selective process by which the U.K. bank's securitization team identified "key elements of the data" on which to focus their validation. The guide for doing so were the templates that the rating agencies were using at that time for the rating process. An interviewee explained:

We weren't looking at this [validation] blind, we basically looked at their [rating agencies'] template of data requirements for rating a securitization and we identified if there were any gaps in our system... And then we would focus our energy on capturing the key elements of data that could have an impact on the rating process... those that were more likely to give you a less efficient transaction.

Therefore, the validation process, which sought to validate whether the data on the system were accurate, was filtered through the rating agencies' templates for rating transactions. This way, the bank's new FII was interfacing between internal data about loan quality and external criteria set by the rating agencies about what constitutes a loan that meets the criteria for securitization. Aligning internal criteria with market criteria would help reassure market participants that, as data were transferred into securitization, they had not lost their properties. This way, the U.K. bank adapted their internal practices to the securitization market.

4.1.5. Data Validation and Risk Calculation

A major finding of this research concerns the relationship between the process of data validation described in Section 4.1.4 and the practices of risk calculation involved in securitization. Our data show that the transition from the internal (legacy) criteria of loan quality to the external (market) was simply a question of re-validating data rather than re-calculating the risk or the price of individual loans. Indeed, the validation process was done independently from any risk calculation practices involved in the decisions to lend individual loans. As an interviewee explained:

Let's be clear, this validation was not about the lending decision. The lending decision had already been made at this point. The validation was purely about the integrity of the data. And it was never intended to be something that its primary purpose was to question the lending decision of the individuals. It was about how good is my data on this system. Am I recording the right information the right way? The purpose of the team was to validate data on a case that had already been approved.

The separation of the validation process from risk calculation practices was also mirrored in the organizational structure of the new securitization unit. Organizationally, the securitization unit in the U.K. bank was an extension of their pre-existing mortgage lending business, which was structured into regional mortgage processing centers. The securitization unit was initially built as one of those centers. In it, there were people in charge of mortgage underwriting, others in charge of completing administration processes as new mortgages came on board, and others responsible for securitization (executing and marketing the deal). Moreover, in this unit, the bank established an independent team of people, "the validators", devoted to data standardization. To keep them separate from any involvement in lending decisions and risk calculation, they specifically recruited people outside the finance industry (about two dozen). One of our interviewees explained who the validators were:

We had a diverse group of people doing this validation. When we set this team up, we didn't want everyone to have a detailed lending background because we wanted them to understand what it was we were trying to achieve, which was all about data validation and integrity.

The practices involved in the securitization of mortgages were considered in and of themselves as a risk calculation process. An interviewee involved in the marketing of securitization deals stated that "the whole process [originating and marketing a deal] is a risk analysis process. And at the end of the day you're presenting the facts of your deal for the investor to determine if it's appropriate risk for them to take". However, the validation process, the main issue that the FII developers in the bank focused on, organizationally and in practice was not even about securitization (i.e., producing a risk analysis) but rather about enabling the transition to securitization. Another interviewee explained:

Although this [validation] was a securitization function, that part of validation process was as far as they [validators] went. They weren't in control of the process to actually securitise the assets. They were simply part of that process to get there.

In Section 5, we discuss the significance of the data validation process for transferring legacy assets into securitization markets and for calculating risk.

5. Discussion: The Role of FII Innovation in Mortgage Securitization

The paper provides new empirical evidence to the understanding of the role of information infrastructure innovation in mortgage securitization. Our findings show that the specific purpose of the infrastructure developed by the U.K. bank was to help them plug their existing mortgage lending business into the emerging securitization chain. More specifically, the new information infrastructure enabled the U.K. bank to transition from the legacy assets and existing lending practices into the emerging securitization chain and to successfully pursue other forms of fund raising. With a few exceptions (Markus et al., 2008; Poon, 2009), this process of developing information infrastructures to support this type of financial function has not been adequately explored in the literature.

FII in securitization are arranged as a socio-technical agencement (i.e., assemblage), a combination of heterogeneous elements (i.e., human actors, technical devices, algorithms, criteria) that have carefully adjusted to one another (Callon, 2007). In the agencement concept, there is no divide between human agents (those who arrange or assemble) and things that have been arranged: material objects and technologies co-exist with human agents and one cannot exist or be understood without the other. However, there are multiple agencements in relation to securitization. Their form and shape depends on the socio-economic, political, and technical circumstances and on the particular phase of the history of securitization. In the US, for instance, the socio-technical agencement of securitization initially took the form of a political program of the Federal Government and later on it became a collective process of standardization to establish market criteria for risk calculation (Markus et al., 2008; Poon, 2009). In the UK, in the hands of financial organizations and with the absence of the government's involvement, securitization took the form of financial innovation, initially for fund raising in the capital markets and later on for responding to capital allocation regulations (Wainwright, 2009).

The role and purpose of FII innovation in this process was to enable certain mechanisms. In our case, this translated in helping transfer existing legacy assets to the securitization chain in order for them to be sold to investors for the purpose of raising funds. The transfer of assets across institutions via FII innovation is an elegant example of Callon's (2007) concept of performativity, which takes a more literal, rather than a linguistic, sense in this case. Performativity, as a concept, emerged through contributions in linguistics to show how language can be a constructive force in society. Later on, the concept was adopted by economic sociologists to explain how economics as a field not only describe financial markets but also play a big role in performing them. Thus, the concept took a more literal meaning. Indeed, performativity in economics is much more than an economist's speech act or a "performative utterance" (Austin, 1962) as we would understand it in the traditional sense. Callon (2007) distinguishes between economists as scientists who describe a market economy from a distance (describers) and economists who "naturally fit into the innovation process and are immersed in the economy" (inventors) (Callon, 2007, p. 314). It is this second category that is of relevance to our case. Performativity, then, as shown in our case study, was a process by which economists as economic agents or inventors rather than as describers (Callon, 2007, p. 314-315) prescribed specific functions to technical tools, which then performed these functions. We argue, therefore, that the role of FII in mortgage securitization in the U.K. bank was to perform the financial function prescribed by an economist (as an inventor rather than as describer) and not to just facilitate capital flow in a generic way.

This is significant because it shows that FII are designed with specific functions in mind. Our data show that these functions were the outcome of managerial and political negotiations. Indeed, "prescribing" these functions on the FII was based on broader socio-economic and political circumstances, but was also the result of internal organizational politics. In the U.K. bank, the securitization team together with the bank's treasury had political negotiations with its board of directors about the decision to enter securitization, the direction of FII innovation, and the functions that they would perform (i.e., to transfer legacy assets to capital markets).

Beyond these observations, the process of making the transition to securitization posed more specific challenges to the FII developers in the U.K. bank. The main issue was how to align their internal criteria for individual loan quality with what is accepted in the market as a loan that meets the criteria for securitization. In tackling this issue, the bank focused their FII innovation on a separate practice of data validation. More specifically, they set up a group of people—independently from mortgage underwriting and actual securitization practices—to validate the data on the loans that were being held in their newly integrated platforms based on the rating agencies' securitization templates. In other words, the focus of FII innovation was on data validation as a practice independent from risk calculation practices involved in securitization (mortgage underwriting, pooling, credit rating). By means of this organizational and operational separation of data validation from other activities of risk calculation, the FII developers made a clear statement about their purpose, which was not to calculate or re-calculate the risk of the legacy assets in light of securitization but to transfer those assets in the credit markets. Why and how is data validation and the transfer of the assets related to

risk calculation? The answer to this question lies at the core of understanding the role of information infrastructures in calculation.

The intervention of FII as a tool for risk calculation marks the shift in the notion of calculation from “calculation of something” to “calculation with something”, (i.e., to take into consideration, to count on something, but also to form a judgement with something upon something) (Kalthoff, 2005 quoting Heidegger, 1954). This denotes the inseparability of calculation practices from the tools used for their performance, as emphasised in the concept of socio-technical agencement discussed above. Calculation, however, is not a one-off independent process. It happens within certain economic, market, and techno-organizational contexts, each of which represents a different level of “calculation with something”. In our case study, for example, as legacy assets were transferred from the context of primary mortgage markets onto the context of secondary capital markets, there were two different levels of “calculation with something” corresponding to these different contexts. One was the level of calculating the risk of an individual mortgage loan using certain underwriting tools, while the other level was the one of calculating the risk involved in a securitization deal where multiple such loans were bundled together. Because securitization calculative practices emerged as an extension of the mortgage lending calculative practices, they formed a “chain” of calculation (cf. Kalthoff, 2005) where one level set the ground for the next via FII innovation.

Indeed, one level of calculation (individual mortgage underwriting) sets up another level of calculation (risk calculation in securitization); one economic representation (existing data on legacy assets) sets another economic representation (validated data according to rating agencies’ templates for securitization); one interpretation (decision to lend individual loans) sets another interpretation (decision on which of these loans to securitize). As we moved from one point on the chain of calculation to another the role of FII was to frame the performance of risk calculation as an epistemic activity (cf. Kalthoff, 2005), to question the objects under focus and frame these objects’ limits. In our case study, therefore, FII innovation was not directed toward calculating the risk of the underlying mortgage assets in light of securitization, but rather toward enacting a system for ordering the risk calculation of assets and toward revealing those assets as objects that are calculable in a securitization context.

Ordering the risk calculation of assets and revealing them as calculable objects means that FII transforms them into uniform materialities that can be measured and calculated by other agents, potentially in other contexts. In turn, this sets in motion a wide set of risk calculation practices, all of which are represented by the FII and their ability to integrate data about those practices. In other words, FII become the means by which representation of securitization assets is framed and is expected to be framed; FII become authoritative (cf. Preda, 2006) and transparent (cf. Star & Ruhleder, 1996). Data validation then, in the context of our case study, although it was not a calculation in the direct sense of the operation with things already in place, it was a process of setting the boundaries of calculable objects and bringing them into existence. The boundaries were decided based on the market’s criteria (rating agencies’ templates). Validation was not the end of the story, but the starting point of a different level of “calculating with something”; it was a process by which new economic representations were established (cf. Kalthoff, 2005). Validation reframed existing data and made them meaningful (made them matter) for risk calculation in securitization. An interviewee offered an example of this transition:

A decision to lend and the quality of the information recorded in an information system are two very different things. Let’s say for example that a borrower’s income gets mistaken. There’s a zero missing at the end so a 100,000 salary is keyed as 10,000. This may not necessarily matter in terms of the lending decision, but it does matter in terms of the quality of that data when you go to subsequently securitise the asset.

This again points to the role of FII as an authoritative technology that informs decisions in the newly formulated context of securitization and the importance of transferring trustworthy data from pre-existing contexts (Preda, 2006). Indeed, securitization constitutes a new “cognitive frame” (Beunza & Stark, 2004) in which legacy data take on new meaning. In conclusion, the transfer of legacy assets

into the securitization markets by means of FII innovation in the U.K. bank could be understood as an episode of moving up the calculation chain, enacted by a continuous emergence of new levels of “calculating with something”.

6. Conclusions

With the advent of securitization in the UK as a new financial innovation, traditional mortgage lenders began to consider it as a new tool to raise funds to support other activities. The decision to adapt to its practices was strategic and political; in practice, securitization took the form of transferring a number of pre-existing legacy mortgage loans (individual mortgage loans held in the banks books for a long time) onto the emerging securitization chain. In this paper, we explore the role of FII innovation as a mechanism that enabled the transition from the primary mortgage markets to the emerging securitization markets and the implications of this transition for the calculation of financial risk. The emerging infrastructure for securitization can be understood as a calculative platform where market participants are collectively engaged in practices of calculating the risk of securitization products. Our results show, however, that the FII innovation process that would enable the U.K. bank to plug into this infrastructure was not based on re-calculation of the risk of the legacy assets but rather on the validation of the accuracy of those assets as an independent process. In our analysis, we discuss how the focus on data validation as a separate process from established risk calculation practices would enhance securitization. We show that validation was a FII innovation process that would prepare the assets for calculation. In this sense, there is a distinction between the role of FII in risk calculation and the role of FII innovation as a process that orders the process of calculation. This analysis contributes to a better understanding of the mechanisms by which FII become an integrating and standardizing force in securitization markets. More specifically, an important lesson for FII developers that can be drawn from this research is to become aware of the different contexts and the different calculative levels in which information on mortgage assets becomes meaningful, and to become aware of the role of FII innovation as a mechanism to transfer data between these contexts and plug into emerging practices.

Acknowledgements

The empirical research for this paper was funded by the Association of Information Technology Trust and was conducted by the first author while employed at the London School of Economics and Political Science (Information Systems and Innovation Group). Many thanks to Chrisanthi Avgerou, Frank Land, and Susan Scott for their guidance and for commenting on early drafts of the paper. Special thanks to the anonymous reviewers that helped us with their detailed comments and suggestions to refine our contribution. Finally, we are indebted to all the anonymous interviewees from The City that agreed to share with us valuable insights on the inner workings of the financial sector while in the midst of the most severe financial crisis in history. Without them overcoming the then widespread feelings of distrust and suspicion, this research would not have been possible.

References

- Akhavein, J., Frame, W. S., & White, L. J. (2005). The diffusion of financial innovations: An examination of the adoption of small business credit scoring by large banking organizations. *The Journal of Business*, 78(2), 577-596.
- Austin, J. L. (1962). *How to do things with words*. Oxford: Clarendon Press.
- Beunza, D., & Stark, D. (2004). Tools of the trade: The socio-technology of arbitrage in a Wall Street trading room. *Industrial and Corporate Change*, 13(2), 369-400.
- BIS (2008). 78th annual report, chapter VI: Financial Markets
- Bowker, G., & Star, S.L. (1999). *Sorting things out*. Cambridge, MA: MIT Press.
- Callon, M. (2007). What does it mean to say that economics is performative? In D. MacKenzie, F. Muniesa, & L. Siu (Eds.), *Do economists make markets? On the performativity of Economics* (pp. 311-357). Princeton University Press.
- Carruthers, B., & Stinchcombe, A. (1999). The social structure of liquidity: Flexibility, markets, and states. *Theory and Society*, 28(3), 353-82.
- Ciborra, C. (2007). Digital technologies and risk: A critical review. In O. Hanseth, & C. Ciborra (Eds.), *Risk, complexity and ICT* (pp. 23-45). Edward Elgar Publishing.
- Cummings, J., & DiPasquale, J. (1997). A primer on the secondary mortgage market. *City Research*. Boston. Retrieved January 20, 2014, from <http://www.cityresearch.com/pres/smm.pdf>
- Economist (2012). Of plumbing and promises: the back office moves centre stage. The Economist. Special Report on Financial Innovation. Retrieved January 20, 2014, from <http://www.economist.com/node/21547993>
- ESF (2006). European Securitization Forum Data report, Autumn 2006. Available at: <http://www.securitization.net/pdf/Publications/ESFDataRprt1006.pdf>
- Fincham, R., Fleck, J., Proctor, R., Scarbrough, H., Tierney, M., & Williams, R. (1994). *Expertise and innovation: Information technology strategies in the financial services sector*. Oxford: Clarendon Press.
- Fleck, J. (1988). *Innofusion or diffusation?: The nature of technological development in robotics* (Edinburgh PICT Working Paper No. 4). Edinburgh University: Edinburgh PICT Centre/RCSS.
- Fligstein, N., & Goldstein, A. (2010). The anatomy of the mortgage securitization crisis. In M. Lounsbury, & P.M. Hirsch (Eds.), *Markets on trial: The economic sociology of the U.S. financial crisis: Part A (Research in the Sociology of Organizations, Volume 30)* (pp. 29-70). Emerald Group Publishing Limited.
- Henderson, J.C., & Venkatraman, N. (1993). Strategic alignment: Leveraging information technology for transforming organizations. *IBM Systems Journal*, 38(2-3), 472-484.
- Kalthoff, H. (2005). Practices of calculation: Economic representations and risk management. *Theory, Culture and Society*, 22(2), 69-97.
- Knorr-Cetina, K. (1999). *Epistemic Cultures: How the sciences make knowledge*. Cambridge, MA: Harvard University Press.
- Langley, A. (1999). Strategies for theorising from process data. *Academy of Management Review*, 24(4), 691-710.
- MacKenzie, D. (2011). The credit crisis as a problem in the sociology of knowledge. *American Journal of Sociology*, 116(6), 1778-1841.
- MacKenzie, D., & Wajcman J. (eds) (1999). *The social shaping of technology* (2nd ed.) Open University Press.
- Markus, M. L., Steinfield, C. W., Wigand, R. T. & Minton, G. (2006). Industry-wide IS standardization as collective action: The case of the US residential mortgage industry. *MIS Quarterly*, 30(Special Issue), 439-465.
- Markus, M. L., Dutta, A., Steinfield, C. W. & Wigand, R. T. (2008). The computerization movement in the US home mortgage industry: Automated underwriting from 1980 to 2004. In K. Kraemer & M. Elliott (Eds.), *Computerization Movements and Technology Diffusion: From Mainframes to Ubiquitous Computing* (pp. 115-144). Medford, NY: Information Today.
- Preda, A. (2006). Sociotechnical agency in financial markets: The case of the stock ticker. *Social Studies of Science*, 36(5), 753-782.
- Preda, A. (2009). *Framing finance: The boundaries of markets and modern capitalism*. University of Chicago Press.

- Poon, M. (2009). From new deal institutions to capital markets: Commercial consumer risk scores and the making of subprime mortgage finance. *Accounting, Organization and Society*, 34(5), 654-674.
- Quinn, S. (2009). *Towards a market for mortgage-backed securities: Credit lending, the federal budget, and the politics of debt management* (Working paper). University of California Group of Economic History.
- Rolland, K. H., & Monteiro, E. (2002). Balancing the local and the global in infrastructural information systems. *Information Society*, 18(2), 87-100.
- Rosenthal, J. A., & Ocampo, J. M. (1988). *Securitization of credit: Inside the new technology of finance*. New York: Wiley.
- Scott, S. V., & Zachariadis, M. (2012). Origins and development of SWIFT, 1973-2009. *Business History*, 54(3), 462-482.
- SIFMA. (2013). *Bond basics*. Retrieved January 20, 2014, from <http://www.investinginbonds.com/learnmore.asp?catid=46&id=8>
- Sinclair, T. J. (2010). Credit rating agencies and the global financial crisis. *Economic Sociology, The European Electronic Newsletter*, 12(1), 4-9.
- Star, S. L., & Ruhleder, K. (1996). Steps toward an ecology of infrastructure: Design and access for large information spaces. *Information Systems Research*, 7(1), 111-134.
- Szwarcz, S. L. (2007). *Structured finance: A guide to the principles of asset securitization* (3rd ed.).
- Transparency Initiative (2008). Ten industry initiatives to increase transparency in the securitization market. Retrieved January 20, 2014, from <http://www.icmagroup.org/assets/documents/Ten%20Initiatives%20-%20Executive%20Summary%20-%20Final.pdf>
- Tett, G. (2009). *Fool's Gold*. Little Brown.
- Timmermans, S., Bowker, G., & Star, S. L. (1996). Infrastructure and organizational transformation: classifying nurses' work. In W. Orlikowski, G. Walsham, M. Jones, & J. DeGross (Eds.), *Information technology and changes in organizational work* (pp. 344-370). London: Chapman and Hall.
- Wainwright, T. (2009). Laying the foundations for a crisis: Mapping the historico-geographical construction of residential mortgage-backed securitization in the UK. *International Journal of Urban and Regional Research*, 33(2), 372-88.
- Walsham, G. (2006). Doing interpretive research. *European Journal of Information Systems*, 15(3), 320-330.
- Weill, P. & Broadbent, M. (1998). *Leveraging the new infrastructure*. Harvard Business School Press.
- Weill, P. & Aral, S. (2006). Generating premium returns on your IT investments. *MIT Sloan Management Review*, 47(2), 38-48.
- Yin, R. (1994). *Case study research: Design and methods*, (2nd ed). Beverly Hills, CA: Sage Publishing.

About the Authors

Antonios KANIADAKIS is a Lecturer in Information Systems and Management at the University of Central Lancashire (Cyprus Campus) where he leads the BA (Hons) in Business Administration program. He was trained as a Sociologist in Greece and Canada and he received a PhD in Science, Technology & Innovation Studies from the University of Edinburgh's Institute for the Study of Science, Technology & Innovation. His research focuses on social and economic aspects of information systems innovation, predominantly in the area of finance. He is an experienced ethnographer and has held research posts at the London School of Economics and Political Science, The Open University and the University of Edinburgh.

Panos CONSTANTINIDES is an Associate Professor of Information Systems and Director of the MSc Information Systems Management & Innovation (ISMI) at the Warwick Business School. Previously, he held positions at Lancaster University's Management School (LUMS), and the Judge Business School at the University of Cambridge, where he also earned his PhD. His research focuses on IT innovation across different organizational settings, while placing emphasis on such topics as the coordination of multidisciplinary teams, professions and the accountability of practice, and the consequences of service innovation.