Global Diffusion of the Non-Traditional Banking Model and Alliance Networks: Social Exposure, Learning and Moderating Regulatory Effort

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Availability	
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Alexander Cuntz[1] & Knut Blind[2] (2010)

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JEL Class. G11, G15, G21, G28

Introductory note

Systemicness has been forwarded many times as being one of the influencing factors for the current financial crisis. In this context, the overall effect of the subprime mortage crisis on the financial sector followed by the downturn of the real economy is assumed to have worsened the situation due to the multiple interdependencies of national banking and finance systems on the global level including (among others) interbank lending and cross-boarder trading of financial instruments on international marketplaces on the one hand, past and present (strategic) alliances and other forms of co-operation among banks and financial institutions, on the other. Most recently, it has been stated in a *Science* special issue on network perspectives that *"[..] networks show a high connectivity among financial institutions that have mutual share-holdings and closed loops involving several nodes. This indicates that the financial sector is strongly interdependent, which may affect market competition and systemic risk and make the network vulnerable to instability*" (Schweitzer et al., 2009).

More precisely, the expected excess of risk-bearing behavior that is commonly associated with business operations of banks today in the worldwide financial system seems to have its *antecendents* in a subtle change of the traditional customer-loan based banking business model in the last two decades (Vitols, 2009; Edwards and Mishkin, 1995). Some US bankers joke that, formerly, success in banking used to be based on following the "3-6-3" rule – i.e. taking in deposits from local customers at a 3 percent interest rate, charging a 6 percent rate on business and home loans, and being on the

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golf course by 3 pm. Under this type of business model, understanding bank balance sheets also used to be simple, since most liabilities were accounted for by customer deposits and most assets by customer loans. Starting in the 1980 and 1990s, however, under the influence of financial deregulation and innovation (White, 2000), the traditional model has been transformed; something that became observable in a decreasing role of interest-based or loan income share on the bank's financial statement. The following innovative banking operations and financial instruments may partially account for this overall change in business model, exemplarily here for the US, even though most likely viable across the globe (Clarke, 2010):

> *One innovation is a shifting from an "originate to hold" to an "originate to distribute" business model i.e. banks make loans with the intention of reselling them to other investors rather than holding them to maturity. In the US, the first securitization of consumer loans occurred in 1985 and of credit card receivables in 1987. US Federal Reserve Board statistics show that by 2008 the amount of loans as a percentage of assets at the ten largest US banks decreased to 51 percent. A second trend is the larger involvement of banks as short-term traders of various types of financial products, including the establishment of large departments specialized in trading activities. The percent of assets held for trading by the largest ten banks in the US increased from about 4 percent in the mid-1980s to 12 percent of the assets currently. A third innovation is the bank's engagement in more complex financial products. In particular, the amount of derivatives held by US banks has exploded over the past decade and a half, from a notional amount of less than $ 100 billion in 1994 (when reporting requirements on the value of derivatives were imposed on banks) to more than $ 8 trillion at the end of 2008. A fourth development is the increasing use of funding sources other than "core deposits" from the traditional customer base, including the wholesale commercial paper market, loans from other banks, and repurchase agreements on securities. These "managed liabilities" are now almost as important as core deposits, now accounting for 41 percent of the funding for US banks* (Vitols, 2009).

Interestingly, adoption of such an innovative business model poses large operational risk on banks – not only in terms of short-term expected profitability of such a model but as well in terms of the long-term *content* of the business model *itself*, potentially harming stability of national and international financial systems. As financial innovations embedded in this business model are most frequently of private origin having strong, both, positive and negative externalities for the financial system –in contrast to pure public good character of scientific innovation – they potentially serve as an impetus to growth but were mostly followed by crisis in the last two decades (Boyer, 2010)[i]. Hence, understanding further what factors have shaped the diffusion of this banking business model should be a central concern of policy-makers on national and supranational level and bank managers in order to adjust regulatory effort associated to risk-bearing of banking institutions as well as to assess the long-term effects of future pioneering behavior of banks and expected diffusion patterns. In this way, it seems valuable to identify and differentiate the drivers that motivated banks to adopt this type of business model.

The traditional literature on diffusion of innovation mostly suggests that decisions on adoption either stem from specific characteristics of adopters, e.g. risk averseness, and *internal* feedback mechanisms from prior to future adopters, or elsewise may stem from changes in external factors such as prices or quality changes i.e. changing framework conditions of an overall system. Young (2009) identifies three broader classes of diffusion models that include such internal feedback mechanisms - drawn from the literature on marketing, sociology and economics -, i) contagion, ii) social influence and iii) social learning, respectively. He summarizes that while social learning models

have decision-theoretic roots and are, hence, most plausible from an economics standpoint as adopters use information rationally gathered by prior adopters, models of contagion as well as social influence bear the notion of *exposure* rather than utility maximization. Anyhow, none of the above models must suffice as a sole explanatory concept for diffusion i.e. we do not postulate that bank adoption is due to either herding behavior or rational choice.

Nevertheless, this categorization of diffusion models only applies to situations where there is informational feedback between members of a group who interact more or less *at random*. If information flows run through a *fixed* network of strategic alliances, say in this context between banks which are near neighbors (in a social, strategic or geographical sense), then clearly a network-based analysis is needed that accounts for the effects of peers, embeddedness in the network and overall network structure on bank's adoption decisions. In our context, financial networks of strategic alliances seem to have three generic *functions*: i) the exchange of information on innovative design of business operations, i.e. know-how on the development of financial instruments, and forming a organizational learning (or herding) environment on expected profitability of the latter (Borgatti and Foster, 2003), as well as ii) offering exclusive demand and supply relations that may create submarkets and additional market power for exchange and distribution of such financial instruments[ii], and iii) a system level function that (the former being at work on an agent level) integrates and synchronizes national financial markets into higher-order (at the extreme, global) financial systems. Hence, we are interested in the effect of *existing* network structures on similarity of adoption behavior more than the causality of emergence and the evolution of these structures i.e. the primary motivation to form strategic alliances among institutions or variance in actor performance due to structure, respectively.

More generally, in contrast to e.g. most literature on social capital where inter-firm links are regarded as *opportunities* in terms of access to financial and intellectual resources creating competitive advantage, from a diffusion perspective network ties and network structure arguably put *constraints* on the patterns of adoption and aggregate diffusion (again, Borgatti and Foster, 2003). However, it is not self-evident from a scientific standpoint how to define the social environment shaping different levels of exposure for network actors. The *boundaries* of a social group(s) affecting individual adoption behavior of banks – at any scale - may consist of a set of direct or indirect ties in the network, and / or potentially will depend on the overall system of competitive banks on a national or even global level. In order to tackle these structural definition and level-of-analysis problems we identify peer groups for the individual bank as being *immediate* neighbors i.e. direct ties in the strategic alliance network, and banking institutions being exposed to (and potentially constrained by) an identical national regulatory and similar competitive environment as well as direct and indirect effect of *neighboring* financial systems at country level within and outside the network and their respective regulation.

Even though national regulation aimed at limiting risk-bearing behavior of financial institutions e.g. based on compulsory (customer) deposit insurance existed since 1934 (for the US) and emerging economies quickly succeeded such regulation, global diffusion of this new type of banking model evolved with considerable pace and presumably was not hindered by supranational regulation as non-existent or only in its infancy. Different to the traditional regulatory concept of central banks as being lenders of last resort curing financial crises *ex post*, existing deposit insurance and accounting or prudential standards can be seen as an *ex ante* regulatory instrument to prevent financial

instability of institutions and overall systems (Boyer, 2010). In a similar fashion, other ex ante regulation currently in the debate such as establishment and strengthening of supervisory authorities, restrictions on entry to the profession or certification of new financial instruments may reduce the bailing out by Central Banks, and hence, significantly help to reduce economic and social costs of crises making financial markets more transparent and stable in the long-run.

Thus, we seek to understand the impact of (alliance) network exposure on the speed and extent of adoption of the business model as being one explanatory factor for diffusion controlling for actor specific characteristics and embeddedness in the network. Furthermore, we wish to explain how existing national regulation moderated this relationship and whether it succeeded in its risk-limiting mission by moderating global adoption patterns and risk-bearing behavior among financial institutions. We find strong support for the role of network exposure, the impact of regulatory effort on patterns of adoption and the role of country clusters for diffusion in the financial sector.

The paper structures in the following manner: We begin the next section with a review of the relevant literature and development of hypothesis. We then continue with a section describing the sample and the data sources we use. The following section illustrates the empirical design and gives results. Lastly, we close by discussing improvements and implications for future studies, and conclusion.

Literature review and hypothesis

We begin this section by reviewing the literature on i) business models and innovation, and, ii) technology adoption under uncertainty. We continue, more specifically, with empirical and theoretical work in the area of iii) diffusion in networks and related studies of strategic alliances, iv) financial innovation and diffusion of financial innovation, and lastly, v) regulatory effort in the financial sector. This leads us, then, to derive a set of hypothesis on the diffusion effect of network exposure and regulation for different levels of the analysis in the context of global diffusion of the non-traditional banking business model.

Firstly, one way of thinking about business models is that they provide a set of generic level descriptors of how a firm organizes itself to create and distribute value in a profitable manner while they tend to incorporate the possibility of innovation (Baden-Fuller and Morgan, 2010). Hence, radically changing the business model will potentially change the value of the *technology* to the business model and its resource requirements i.e. these are a variety of strategic elements - resources, capabilities, products, customers, technologies, markets and so forth. Nevertheless, one should not restrict business model innovation to changes in resources as this may additionally require new arrangement of organization and integrative effort of the main elements of the firm's activity. Regarding a reshaping of traditional banking business models [iii] this process may coincide with the establishment of trading and investment departments within banking institutions, customer acceptance on new financial products as well as a gathering sufficient experience on these particular markets across time depending on the *entrepreneurial* more than operational capacities of bank management (Penrose, 1959). As some authors argue in this line of reasoning, "*creating value from technology is not simply a matter of managing technical uncertainty; there is significant uncertainty in the social domain as well, and in the many possible ways of mapping between the domains*

(Chesbrough and Rosenbloom, 2002)". Hence, changes within the resource or competency set may subsequently change other elements of the very same component; some value proposition - stemming from revenue and cost volume and structures as being an observable first sign of business model evolution - may create productive opportunities for further value propositions; and modifications in the *internal* organization or the web of *external* organizational links as in our example of strategic alliances may directly impact other parts of the organizational system. To summarize, as in any other industry sector, specific business models in the financial sector function like "recipes": they serve as practical models of technology that are ready for copying (or *adoption*), but also open for variation and innovation.

Secondly, while most "classic" models of technology adoption under uncertainty predict that risk aversion delays adoption (Stoneman, 1981), the results of Tsur et al. (1990) indicate that risk aversion positively affects adoption. This seemingly counterintuitive result is explained by the fact that although mean profit at time t is negative, compensation occurs in future periods as a result of the decline in future risks which results from the learning process. Therefore, the higher the risk aversion, the greater is the appreciation of these future declines in risk. If the current mean profit is positive, risk aversion leads the decision maker to diversify in order to reduce undesired income risk. A similar approach to this concept focusing on financial innovation is described in (Persons and Warther, 1997).The important difference between the former models and the latter is that, in those models, the adopting firm captures the future benefits of the information generated by adoption i.e. adoption in their model produces an informational externality because *other* firms benefit from the information generated when a firm chooses to adopt. Lastly, looking at risk and its effect on diffusion from a network perspective, complex models of risk-sharing networks, suggesting that independent of individual risk attitude structural positions may explain variance in risk exposure, emergent risk-sharing networks (underlying e.g., alliance networks) can potentially change adoption behavior among agents (Bramoullé and Kranton, 2007; Bloch et al., 2008). To summarize, individual risk averseness may have positive implications for the speed of adoption of technology or business practices. Nevertheless, incorporating complexity to this concept – in terms of information and risk-sharing among many agents - may deliver ambigious results.

Thirdly, we next look at the theoretical and empirical literature on diffusion in networks, and strategic alliances in particular – mostly outside the scientific domain of finance and banking - and respective adoption and learning environment implications for our concept. As mentioned earlier in the introduction, diffusion in fixed inter-firm or interpersonal networks offers an alternative structural approach to understanding patterns and drivers of adoption[iv]. In the extended version of the "classic" two-step flow model put into an innovation perspective (Rogers, 1995) it is argued that firms or individuals within a network pass from i) knowledge of innovation, ii) to persuasion, iii) to a decision to adopt or reject an innovation, iv) to implementation, and then, v) to confirmation of this decision. Hence, in decision *process* whether or not to adopt an innovation depends mainly on the communicated experience of others much like themselves who have already adopted. In the network context, Valente (1995) succeeds in separating individuals (and their characteristics) who do not adopt - *even though* being exposed to early adopting peers - from others that are late adopters *because* not being exposed. This means that exposure – however we will define - may not be associated with adoption for everyone, but may be most influential during middle stages of diffusion, when awareness and uncertainty about its relative advantage are both high (Carley, 2001). From a social learning perspective the focus of diffusion studies and business model adoption is on learning

by means of observational modeling (Bandura, 1977) - whereas the observer's behavior is *not exactly* the same as the bank's or a peer group's model, but rather a mimicry of the underlying business model. Adoption behavior in networks, hence, lends itself to sociological theories of isomorphic institutional change (DiMaggio and Powell, 1983) as well as the board interlocks literature and related adoption of organizational structures (Palmer et al., 1993). Nevertheless, the economic debate on social learning rather focuses on heterogeneous actor characteristics, among others, risk aversion, discount rates and the amount of information that is available for each of the parties involved. There is considerable empirical evidence that learning and accumulating information on experience of others linked in networks does in fact occur (Young, 2002; Kapur, 1995). In the network case of strategic alliances (Kraatz, 1998; Davis, 1991; Kogut, 2000) these are (sets of) firm-subjective evaluations of an innovative business model or strategy likely to be transmitted by opinion leaders and early adopters among banking institutions via strategic and *contracted* relationships. In this sense, we are neglecting uncertainty and risk associated with the formation of an alliance and the selection problem in the first place which maybe equally structural in nature. However, as (Greve, 1995) argues, the effect of social influence on diffusion may be moderated by other factors such as firm size, organizational structures and the level of competition among network members. Another example of learning mechanisms and the likely effect on innovation performance in alliance networks is Powell et al. (1996) suggesting that collaborations among biotechnology firms form inter-organizational learning cycles in the following manner: Because information is dispersed among organizations and is the source of competitive advantage, in this particular industry, R&D collaborations provide firms with experience managing ties and access to more diverse sources of information which in turn increase firms' centrality and their subsequent ties. To summarize, social influence or learning may influence the adoption of innovation in networks, most likely depending on the diffusion stage of the overall system and as far as adoption is seen as a process itself. Diffusion studies, in general, seek to explain *homogeneity* in firm attributes, beliefs or business practices, also as a function of social ties. From a structuralist's convergence perspective, the mechanisms *generating* similarity between two organizations have to do with sharing the *same* environments or recognition of each other as appropriate role models. In opposition, from a contagion standpoint, ties are perceived as conduits or roads along which information or resources *flow*. On the one hand, seen from the point of view of the group as a whole, firms are likely mutually influencing and informing each other in a process that creates increasing homogeneity within structural *sub*groups. On the other hand, from the point of view of a single bank, the adoption of a practice is determined by the proportion of nodes surrounding the business that have adopted, while the timing of adoption is a function of the lengths of paths connecting the bank to other adoptees (Borgatti and Foster, 2003). From the micro view of the individual banking institution this leads us to state that, controlling for risk attitude, firm size and embeddedness of banking institutions,

Hypothesis I

A high (low) share of adopters among peer banks increases (decreases) the bank-specific likelihood of adoption of network agents.

However, we also expect aggregate, *system* level diffusion feedback on micro level decisions to adopt among networked and non-networked institutions within and across country-boarders, stemming from the integrative (market) function of the alliance network and agents co-existing in similar or potentially *converging* regulatory and competitive environments. In other words, this implies that

adoption behavior across actor groups within a national banking (sub)system is likely to influence and will be influenced by alternate financial systems across country-boarders (at the extreme, in a system of global scale), both changing individual decision-making towards adoption. Hence, we argue that,

Hypothesis II

A high (low) share of adopters among peer national banking systems increases (decreases) the bank-specific likelihood of adoption of national agents within and outside the network, directly and indirectly, respectively.

Fourthly, in contrast to the abundance of empirical work on innovation e.g. in manufacturing or agriculture, there are relatively little quantitative sector-specific studies of financial innovation and diffusion of financial innovation (Frame and White, 2004) even though some work by established innovation scholars in the field of indicator development and design with the objective to deliver new insights on the sources of innovation and characteristics of innovators exists (Lerner, 2002; 2006). Most of the literature on adoption behavior of banks deals with the decision to incorporate underlying "physical" technologies in banking operations originating in the area of telecommunications and data processing (Sullivan, 2000, or the ATM case by Saloner and Sheperd, 1995, mentioned earlier). Nevertheless, a small number of supply-side studies (e.g., Akhavein et al., 2005) also analyze the diffusion of new products or new services, process or organizational innovation directly stemming from and diffusing via financial intermediaries (such as banks, insurance companies, etc.) and via financial facilitators (such as stock brokers, market makers or financial advisors, etc.). As a first result from both strands of this literature, larger or relatively more profitable banking institutions are generally more likely to be adopters than smaller or less profitable institutions, respectively. Similarly, explanatory variables indicating network externality effects such as number of a bank's branches or the extent of customer-user relations may trigger a positive and faster decision on adoption. One of the essays maybe closest to our work both methodologically as well as from its content is by Molyneux and Shamroukh (1996), who introduce *exogenous* factors with a focus on regulatory as well as demand changes and their respective effect on diffusion patterns in the context of junk bonds underwriting and note issuance facilities (NFI) underwriting. They find a significant role of these *exogenous* factors for the former, while NFI seemed largely dependent on bandwagon effects from competing institutions. In our context, this may be seen as first but limited evidence on, on the one hand, a potential peer effect of market (and, hence, potentially network) structure on adoption behavior. On the other hand, Molyneux and Shamroukh's work, imply that regulatory effort (in terms of expanding severity) in some specific innovation context seems to facilitate diffusion and most likely induces evasive innovative behavior of financial institutions. As mentioned before (Persons and Warther, 1997) present a simple model of the adoption of financial innovations that reproduces the *boom and bust* patterns, showing that even though all information is public and all participants are rational, apparently *irrational* behavior emerges in equilibrium. When firms will pass up an innovation today, then they are likely to adopt the next period after receiving unfavorable information about the innovation. In addition, on an average, the model implies that the last firms to adopt an innovation will lose money, while the end of an innovation wave is completely unpredictable. To summarize, there seems to be only very little theoretical and eventually weak empirical evidence on diffusion and adoption patterns of innovation

in the financial sector while there is no (to the best of our knowledge) explicit evidence on diffusion in financial networks.

Fifthly, and lastly, with respect to regulation and innovation in the financial sector, regulatory effort may address specific types of financial institutions or sub-segments of the financial sector, as well as it may comprehend various forms of regulation including e.g. safety-and-soundness, insurance /safety or information regulation. White (2000) suggests that, ideally, with imperfections being present in regulatory processes, as well as in market processes, there are no assurances of purity for motives in regulation nor of efficiency of outcomes. All judgments about the necessity for and efficacy of regulation, in his view, should have an empirical basis and cannot be settled solely by *a priori* reasoning about the imperfections of markets or of governments. In the very same paper, published almost ten years ago, he reveals himself as being a thoughtful advocate of strengthening regulation in finance - and highly prophetic in the light of the current crisis and its policy response, as

> *"specifically, the safety-and-soundness scrutiny of bank regulators should be strengthened in a period of rapid innovation and heightened competitive pressures, because the owners and managers of faltering banks may be tempted to take "shoot-the-moon" risks at the expense of depositors (or deposit insurers). [Footnote by the author: The incentives for this risk-increasing strategy arise because, in a limited liability legal environment, the owners of the bank receive all of the upside gains from risk-taking but are limited in their liability for losses (which are borne by the liability holders, such as depositors or the deposit insurer that stands in their shoes)]. Primary among the improved safety-and-soundness regulatory instruments should be improved capital standards, including better ways of measuring capital (i.e., the employment of a market value accounting framework) and of measuring risks (e.g., financial stress tests)."* White (2000, pp. 31)

Focusing on specific forms of regulation, Demirgüc-Kunt et al. (2005) point out that at present almost all country have an *implicit* deposit insurance scheme in place since governments get pressed for relief at the outbreak of large systemic banking distress. Where an explicit insurance relying on central bank law, banking laws or constitutional rights and so on, defining beginning date, coverage limits, how (if any) they are going to funded and regulation how bank failure is resolved, does not exist, countries most likely have implicit insurance schemes. According to economic theory, while deposit insurance may increase bank stability by reducing self-fulfilling or information-driven depositor runs, it may decrease bank stability by encouraging risk-taking and moral hazard behavior on the part of banks (Diamond and Dybvig, 1983; Allen and Gale, 1998). Empirically, Demirgüç-Kunt and Detragiache's cross-country study (2002) finds that explicit deposit insurance tends to be detrimental to bank stability, the more so where bank interest rates have been deregulated and where the institutional environment is weak. They interpret the latter result to mean that, where institutions are good it is more likely that an effective system of prudential regulation and supervision is in place to offset the lack of market discipline created by deposit insurance and create financial instability (Cull et al., 2005; Chernykh and Cole, 2010). In addition, the adverse impact of deposit insurance on bank stability tends to be stronger the more extensive is the coverage offered to depositors. Nevertheless, other international evidence suggests that countries establishing deposit insurance and that enforce strict bank capital adequacy requirements experience a smaller output cost of crises (Angkinand, 2009). Ferńandez and Gonźalez (2005), addressing beneficial and interacting regulatory effects, find that the adverse impact from insurance schemes on risk taking can be reduced by enhancing the effectiveness of accounting and auditing systems. To summarize, even

though not explicitly discussed in this branch of the literature at present, we may hypothesize whether we would expect a positive moderating mechanism stemming from regulatory efforts and related moral hazard behavior on risk-bearing willingness in adoption patterns within financial networks. In other words, the early introduction and scope of regulatory on deposit insurance schemes as well as accounting and auditing rules most likely increases the speed of diffusion of such risk-associated practices on bank and aggregate country levels.

Hypothesis III

The more (less) strict and precocious national financial regulatory effort the higher (lower) the country-specific likelihood of adoption of its agents.

Sample description

In this section, we will start off with a short description of data sources and matching approach. Next, we will present the identification strategy and design for indicators on adoption and on network characteristics. Lastly, we will illustrate the network of strategic alliances and summarize the sample by giving descriptive statistics on the panel variables we use in the analytical sections following this one.

Data sources.

Our sample contains micro-level company account data of banks and financial institutions (both public and private) worldwide coming from BankScope database in the time period from 1995 to 2008. This data comprehends information on ownership and ratings data as well as financial statements of institutions among more than 22.000 entities. A second source of information on banks and financial institutions is THOMPSON's SDC database and its module on strategic alliances and joint ventures[v] including bilateral and collateral inter-firm relations. Using ticker information from BankScope and the SDC database – after uniquely matching sources- we are able to identify a subset of banks and financial institutions networked in strategic alliances of more than 300 companies. In this process we excluded, on the one hand, fully public entities such as central banks, and, on the other hand, parties in alliances contracting on a specific time frame. The latter only accounts for approximately 4% of the overall sample of networked entities in alliances. In addition, the majority of these cases contains information on periods of contracting-time that seems rather implausible, e.g., stating duration of 50 years or explicitly containing potentially false or misleading information, zero or negative values. Furthermore, we excluded cases where all or some entities involved did not disclose their identity in the database. Interestingly, the remaining 96% of alliances in the sample were contracted on an open basis i.e. having no specific end date.

On country level, we collected information from OECD and World Bank databases. OECD income statement and balance sheet data contains among other fairly new financial (*soundness*) indicators on capital adequacy analysis, i.e. more specifically annual regulatory capital to risk-weighted assets according to European Central Bank (ECB) and International Monetary Fund (IMF) core accounting guidelines, among 33 member countries, accession / dialogue candidates and several other

countries. Furthermore, the data also includes annual information on country's interest rate levels as well as total financial assets / size of consolidated national investment funds. In addition, we extended the sample with data from the World Bank's panel on national deposit insurance regulation among more than 180 member countries. WB's country panel comprehends information on quality e.g., in terms of coverage amounts, enforcement and coinsurance requirements, and enactment or timing of such regulatory effort.

Indicators of adoption behavior.

IMF describes the change of the generic banking business model as well as it observes significant changes in international capital market, as

> *"banking systems in the major countries have gone through a process of disintermediation—that is, a greater share of financial intermediation is now taking place through tradable securities (rather than bank loans and deposits). Both financial and nonfinancial entities, as well as savers and investors, have played key roles in, and benefited from, this transformation. Banks have increasingly moved financial risks (especially credit risks) off their balance sheets and into securities markets—for example, by pooling and converting assets into tradable securities and entering into interest rate swaps and other derivatives transactions—in response both to regulatory incentives such as capital requirements and to internal incentives to improve risk-adjusted returns on capital for shareholders and to be more competitive"* (Häusler, 2008).

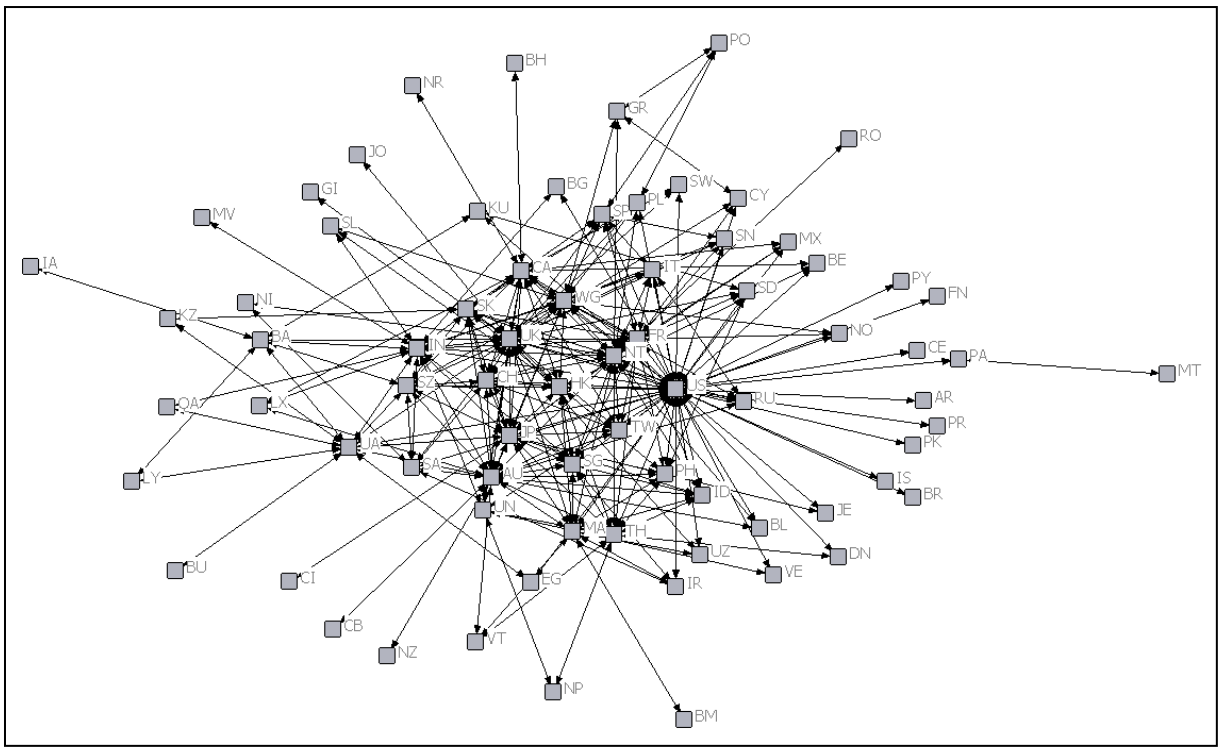
This leads us to consider two types of indicators for bank-level adoption of the non-traditional model as exemplified elsewhere in the literature (Vitols, 2009): i) the annual changes in the share of interest income on loans to operating income (memo), and, inversely, ii) the annual changes in the share of non-interest income to gross revenues. Supposingly, the former is a good indicator for the adoption of this model as being the percentage of income derived from interest (*versus* other sources of income such as trading profits, fees and commissions, etc.), while the latter indicator is just the inverse of the former and, hence, should most likely deliver identical or at least similar implications. A major difficulty in terms of analyzing adoption behavior of banking and financial institutions is to set up a resilient concept of what determines a (significant) change of banking business behavior. However we will define the non-traditional business model of banking a definition of behavioral change is likely to identify either *too many* or *too little* adopters at time *t* in the population depending on the average amount of time such a change is assumed to require as well as the parameter treshold that will qualify to adoption, not withstanding cyclical effects of the overall financial system. To tackle at least some of these problems, we apply transition probability matrizes (TPM) in order to identify relevant probability patterns of *travelling* of observations across growth percentiles and time, as it is done in some of the recent empirical literature on firm growth and related growth distributions (Capasso et al., 2009). Tables xy and xy in the appendix show TPMs for both indicators. Given critical values of transition probabilities should be significantly higher than .10 as the literature (Hoel et al., 1987) suggest – one sees that observations generally shift *three* percentiles across the overall panel's time (starting in 1996 to 2008), if we neglect the boundaries of the distribution and their extreme mobility behavior. Acknowledging that zero growth occurs within the 6^{th} to 7^{th} percentiles in the original distribution, shifting of growth distributions related to the share of interest income from loans imply a general negative reallocation effort of these interest income sources at a decreasing speed across time. With respect to non-interest income where zero

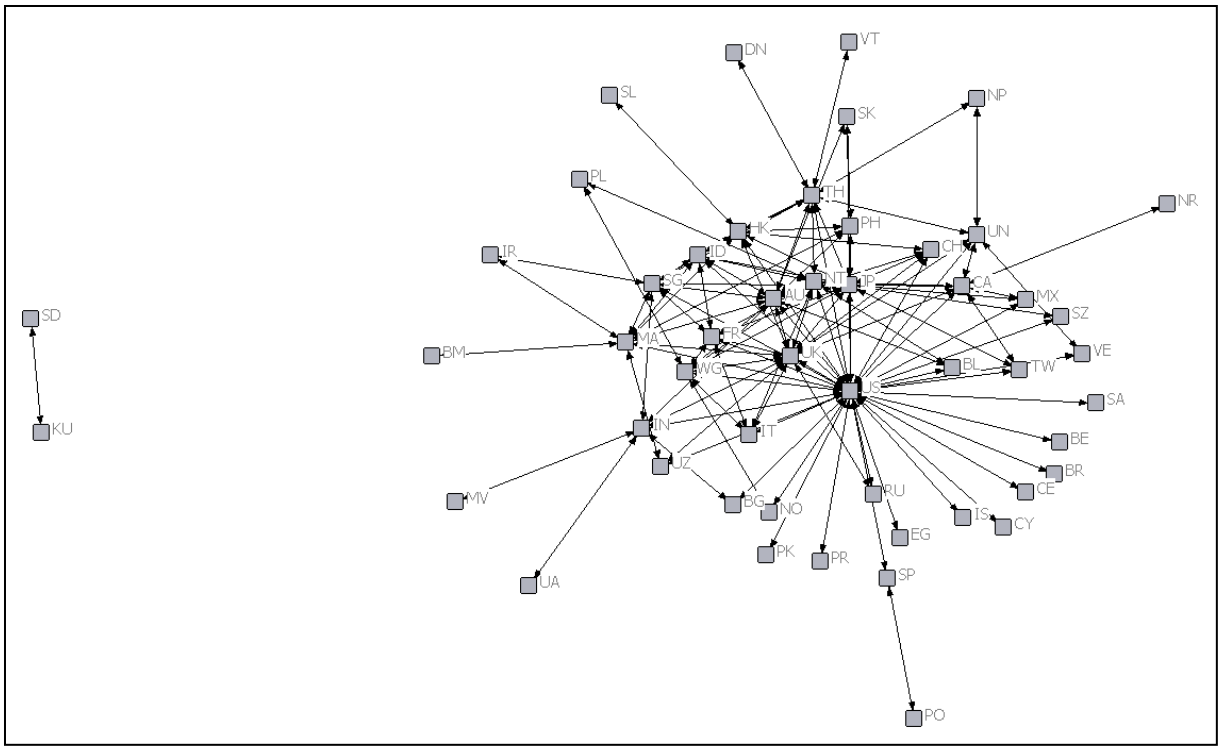
growth occurs in the 3rd to 4th percentiles observations exhibit either positive or negative growth rates. In any case, given observations transition with *monotonicity* to higher or lower, respectively, percentiles, it will still suffice the above threshold definitions of adoption. Furthermore, we can control for a general shifting of the overall population of growth rates at each time *t*, i.e. we abstract from cyclical effects, as individual mobility of an observation references the distribution in *t+1*. Anyhow, this leaves us with the issue of configuring the average implementation time in the context of the adoption-process. Hence, we proceed pragmatically with the latter by testing different specifications of time in the analytical sections following this one, i.e. implementation requiring *two* consecutive periods in order to transition 3 growth percentiles[vi].

Network indicators.

As dealing with patterns of diffusion potentially stemming from networked agents, we are naturally interested in the *quality* and *intensity* of signals being sent from peer agents and the overall network. Following earlier work from Valente (2005), we assume that a firm's network exposure at time t is the proportion or number of adopters (as defined in the last paragraph) in each firm's network providing information, persuasion and influence with regard to the non-traditional business model. More formally, network exposure E_i is, $E_i=\sum (w_{ij}\, y_i) / \sum (w_i)$, where *w* is the inter-firm network weight matrix and *y* is the vector of adoptions. As we argued above and notwithstanding issues of group definition, we focus our analysis on the group of immediate neighbors in the undirected network of strategic alliances i.e. direct links among agents. Furthermore, we introduce a social learning perspective to contagion serving as an additional signal of profitability at *t+1* by studying median pre-tax profits of banks and financial institutions among neighbors within these groups. In order to capture some of the potential exposure effects of indirect links and, hence, the overall network structure, we integrate a commonly used measure for network embbededness or centrality of the agent i.e. the degree (exemplarily, table xy in the appendix ranks the top 30 financial agents and their country affiliation using degrees based on total stock of alliances). It is defined, more technically, as the number of edges incident to the node or vertex, with loops counted twice, and basically counts the number of ties to all other actors in the network. In this way, the degree may partially be associated with intensity of overall adoption signals perceived while shares of surrounding adopters and average profitability may to some extent account for quality. At a second stage of the analysis that focuses on aggregate networks among countries emerging from patterns between national groups of agents, we conduct similar measurement on mean adoption rates among peer countries. Here, individual banks and financial institutions in a specific country are exposed to a social *international norm* arising within its transnational context. Figure xy exemplarily illustrates the undirected networks among countries using the total stock of strategic alliances from 1995 to 2008, as well as the original network in 1995. It can be seen that the network has considerably grown in terms of new countries involved and, most likely, in terms of its density. Analogously to the micro-level analysis, we account for embeddedness of the agent's country in global financial markets by its degree.

Figure xy. network evolution on country level: comparing country level networks based on (1) total stock for overall period (1995 – 2008) and, (2) early-stage total stock for the period (1995 – 1998)





Descriptives.

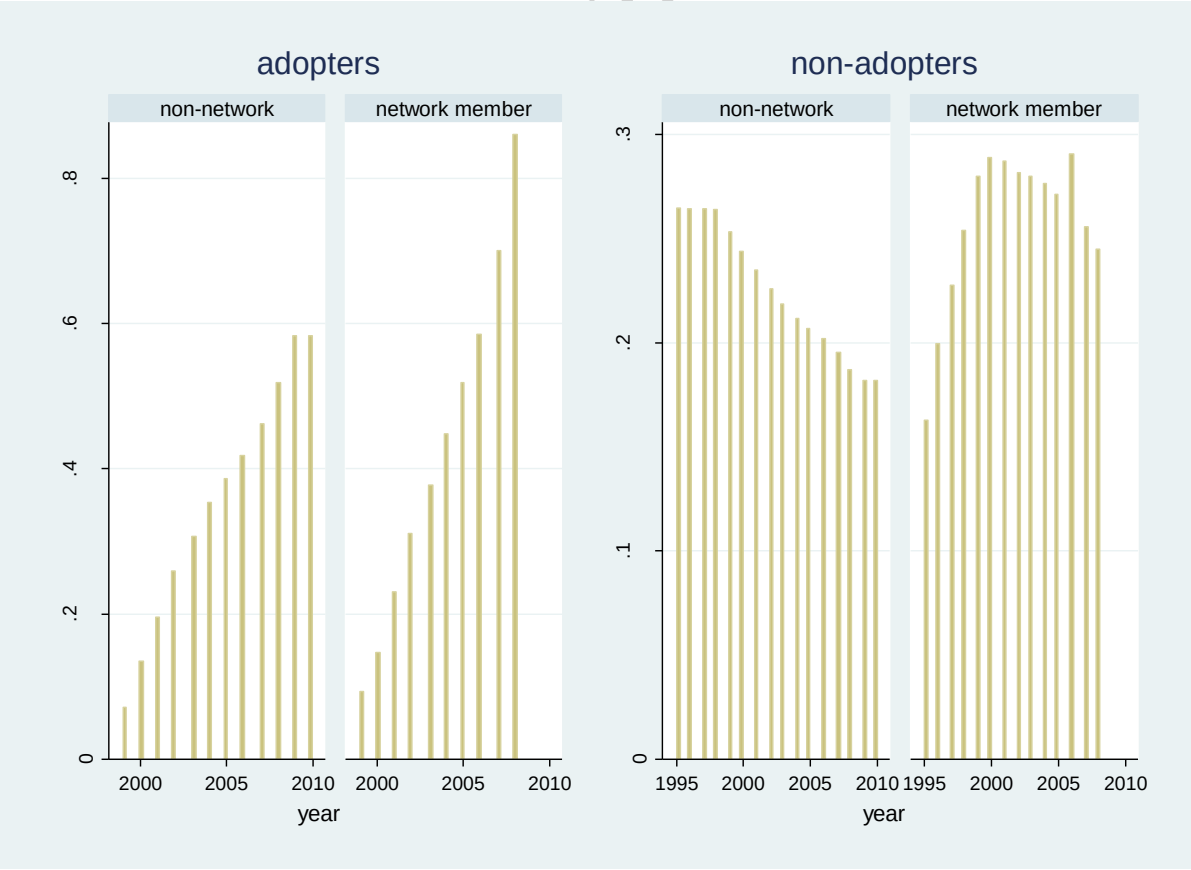
At this stage, we have identified and designed indicators on adoption and related network exposure and proceed with preliminary descriptive statistics on the two sample populations (see Fig. xy), also including regulatory indicators as well as measures of diffusion variance between country groups, the latter being an issue that we will discuss in the following section. A first sample is involving observations that are part of the network of strategic alliances evolving across 1995 to 2008; the other also comprehends non-networked as well as networked observations among banks and financial institutions worldwide. From a first look at both samples, on an *average*, we find that the network subsample involves larger corporate entities (having higher amounts of total assets) and a greater share of adopters, while countries of networked agents are less central (having a lower degree) with reference to the global country level network. Furthermore, figure xy in the appendix offers an alternative view on some of the variables of interest studying correlations in the overall sample. Lastly, figure xy presents patterns of diffusion among networked and non-networked agents. Here, we find first evidence on the growth of the network overcompensating adoption levels in early years of observation within the network, i.e. more banks entering the network, simultaneously increasing densities of non-adopters *and* adopters.

table. xy summary statistics for overall sample of (non-) networked observations and subsample of networked observations

	overall sample of (non-) networked observations					subsample of networked observations				
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
adoption based on loan interest income share	361312	.0813646	.2733946	0	1	3020	.1211921	.3264044	0	1
adoption based on non-interest income share	361312	.147482	.3545862	0	1	3020	.3188742	.4661173	0	1
loan interest income to income	57945	2.121.302	407.021	-1.490.761	6.697.118	957	1.374.161	1.146.333	-1.152.353	2.080.118
non-interest income to revenue	93000	3.038.146	3.930.401	-964	995.73	1948	3.825.171	3.203.982	-466.7	486.2

total assets	101651	1.09e+07	8.51e+07	22	3.81e+09	1713	1.50e+08	3.72e+08	6606	3.81e+09
mean pre-profit (peer banks)	694	1957219	5143249	-4.83e+07	3.65e+07	694	1957219	5143249	-4.83e+07	3.65e+07
mean adopters (peer banks) based on loan interest income share	918	.1990839	.3480079	0	1	918	.1990839	.3480079	0	1
mean adopters (peer banks) based on non-interest income share	918	.494253	.4457817	0	1	918	.494253	.4457817	0	1
degree(bank level)	2350	.7548936	2.025.888	0	14	2338	.7463644	2.009.881	0	14
degree(country level)	256753	2.442.027	1.744.116	1	50	2529	1.726.097	1.404.217	1	50
mean pre-profit (country group)	256036	266846.3	592425.4	-1279168	6957256	2489	280788.9	503933.5	-1279168	6957256
mean adopters (country group) based on non-interest income share	256753	.1813381	.1721004	0	.9166667	2529	.2381716	.1788681	0	.7607656
mean adopters (country group) based on loan interest income share	256753	.0850491	.1019636	0	.7	2529	.1150311	.1085664	0	.7
coverage deposit rate / capital ratio	145517	83.358	3.535.966	.1103918	1.955.029	758	618.213	4.103.357	.1103918	2.301.235
enactment pre1990	361333	.7344416	.4416307	0	1	3020	.5864238	.4925558	0	1
reg.cap.to risk weight.ass.	32064	1.324.197	245.412	2.434	25.34	356	1.309.082	2.605.127	8.839	25.34

Figure xy : adoption and non-adoption density curves for diffusion among networked and non-networked agents,



History event analysis

Empirical strategy.

In order to test for the hypotheses related to the adoption decisions we use a Cox proportional hazard model that estimates the probability of survival, i.e. probability of not adopting, past time t. It has the property that it leaves the baseline hazard unparameterized $h_0(t)$, i.e. there is no assumption about the shape of the hazard over time. This semi-parametric model, with coefficients $ß_1,..,ß_k$ and respective variables $x_1,..,x_k$, the hazard at time t is of the general form

$$h(t|x) = h_0(t) \exp (ß_1 x_1 + \dots + ß_k x_k) .$$

Nevertheless, as we expect observed explanatory variables not to explain all the variability in the observed time to event, we introduce a more complex version of Cox's original model with shared Gamma frailty (Clayton, 1978). Here, frailty α_i may be caused by unobserved relevant risk factors from unexplained heterogeneity that is *shared* among individual observations *j*, with $j = 1,\dots,n_i$, i.e. banks or financial institutions forming a group within a specific country *i, with* $i = 1,\dots,n$. Hence, we define the model with shared frailty, as

$$h(t|x) = h_0(t)\, \alpha_i \exp (ß_1 x_{ij} + \dots + ß_k x_{ij}) ,$$

with $\mathbf{E}(\alpha_i) = 1$ and $\mathbf{V}(\alpha_i) = \theta$.

For $\vartheta_i = \log \alpha_i$, the hazard can be rewritten as,

$$h(t|x) = h_0(t)\, \alpha_i \exp (ß_1 x_{ij} + \dots + ß_k x_{ij} + \vartheta_i) .$$

Basically, this model will serve us as a vehicle of *multilevel* analysis within the context of a regular Cox regression model adjusting for and estimating within-group correlations, i.e. log country frailty effects ϑ_i (Guo and Rodriguez, 1992) In order to secure the validity of the model assumptions made, namely on proportional hazard and gamma distribution of α, we run several tests to qualify our approaches[vii], e.g., among others, Weibull testing. Furthermore, we partially can control for problems of endogeneity by lagging variables that account for any structural features presumably influencing agent behavior in *t+1*, i.e. all variables serving as network indicators.

In the next section, we will briefly discuss our findings on network exposure and regulation and their potential effect on patterns of diffusion and adoption, each based on estimations of: i) standard Cox regressions, moving on to ii) shared frailty models, i.e. controlling for country clusters.

Analysis results on network exposure.

As suggested above, survival of agents in the context of non-traditional business model diffusion refers to agents that do not adopt past time t whereas adoption is associated with the hazard pattern. We proceed with arranging and estimating several (standard and shared frailty) Cox model specifications, for different types of indicators of regulation (dependent variables) and adoption (explanatory variable) [for noninterest income, models 1-4, and for loan interest income, models 5-8 in the appendix], and on different levels of the analysis [on micro level, models 9-10 in the appendix].

Firstly, let us consider the hazard ratios associated with bank-specific characteristics. While there is weak or no significant evidence on the effect on adoption from risk attitude as proxied by the level of noninterest income and loan interest income at time t, there seems to be excess risk ranging from 7 to 10% related to firm size as measured by log total assets, at the 1% level in any specification, including specifications where we control for between-group effects. Even though the traditional literature on diffusion of innovative practices mostly suggests that small rather than larger corporations have the organizational flexibility to adopt (Damanpour, 1992), the estimated hazard ratio may be partially explained by larger corporations operating and competing on global financial markets and, thus, being informed and more prone to adopt profitable business models. Interestingly as opposing the first impression from diffusion distributions above, in the multivariate analysis context, we do find a weak (negative) or no significant *direct* effect from network membership. The former is estimated within the model specification based on the adoption criteria of noninterest income activities and regulatory deposit insurance coverage, reducing risk exposure by approximately half. One reason that can explain a risk reduction is that a number of networked firms is likely to have adopted before the period at risk, i.e. before 1998. Alternatively, variance in results may stem from the network subsample being relatively small in comparison to the overall sample.

Secondly, with respect to the set of indicators on network exposure, for models using our noninterest income adoption definition [1-4 and 9] our results imply that there is indeed a strong influencing effect from the share of direct-tied adopters, both, for peer effects among banks and among related countries. This content-related effect gets even more pronounced when we control for country groups, while the intensity of such signals as proxied by degree in most cases is not significant and can, thus, be neglected. If having any effect, we estimate a positive hazard ratio for the latter, i.e. increasing the probability of adoption relative to agents with lower degrees. However, for models using our income from loan interest income adoption definition [5-8 and 10] we have some countervailing evidence. Rather than a strong excess risk we find in most of these specifications a radical reduction of risk stemming from the share of surrounding adopters. This shift changing the direction of the peer effect astonishes, we argue that it can be justified by the difference in explanatory variables themselves. Both indicators are likely to measure slightly different aspects of the non-traditional business model, having a relatively weak correlation (see table xy). If we consider now how these signals are *processed* by banks and financial institutions in all model specifications, we do not find any or convincing evidence on social learning. Neither the information of past mean / median profit in the peer group at time *t-1*, nor the interaction between profitability and shares of adoption in *t* seem to be relevant risk factors. To summarize, this leaves us with mixed but, nevertheless, convincing overall evidence qualifying hypothesis I and II on network exposure and its effect on adoption. More precisely, exposure to peers influences the risk adoption rather than it creates a learning environment for agents in our specific banking context, while the role of information transmission in terms of intensity is less important.

Table xy. Standard and shared frailty model cox regressions using overall sample of non- and networked banks and financial institutions, *noninterest income indicator*, both types of regulatory effort, models 1-4

	(1) _t	(2) _t	(3) _t	(4) _t
noninterest to revenue,t	1.003***	1.003***	1.003***	1.003***
	(5.17)	(6.51)	(3.34)	(3.28)
ln(total assets),t	1.103***	1.096***	1.080***	1.076***
	(8.63)	(7.84)	(3.42)	(3.05)
degree,t-1	0.999	1.004	1.006	1.014
	(-0.63)	(0.80)	(0.28)	(0.32)
mean adopters (country group),t-1	11.55***	43.35***	110.3***	870.7***
	(3.70)	(4.40)	(4.07)	(4.32)
mean pre-profit (country group),t-1	1.000**	1.000	1.000***	1.000***
	(-2.12)	(-0.81)	(3.37)	(3.57)
interact mean adopters x pre-profit	1.000*	1.000*	1.000	1.000
	(-1.67)	(-1.87)	(0.89)	(0.37)
network membership,t	0.553***	0.571***	1.136	1.064
	(-2.96)	(-2.79)	(0.38)	(0.18)
coverage deposit rate / capital ratio,t	1.100**	1.105**		
	(2.39)	(2.17)		
enactment pre1990,t	3.599***	2.950**		
	(3.20)	(2.49)		
interact coverage x enactment	0.909**	0.906**		
	(-2.39)	(-2.16)		
reg.cap.to risk weight.ass.,t			0.973	1.037
			(-1.16)	(0.86)
frailty θ		0.0287***		0.2481***
N	12901	12901	6150	6150

Exponentiated coefficients; *t* statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Regulatory effort.

Firstly, as the theoretical discussion on Hypothesis III summarizes we expect financial regulation to have a net positive impact on the diffusion of the business model as being associated with extensive moral hazard behavior. Nevertheless, we find that this effect depends on the type of regulatory effort. For model specifications having timing and coverage of deposit insurance as an explanatory factor, and, however we define adoption criteria, there is a strong excess risk effect from strictness and early issuance of this regulation type. While the relative effect for strictness is weaker than for early enactment across models, controlling for theta moderates the latter effect. Interestingly, when we look at the interaction term, it is advised to regulate both ways, early *and* strict. This may reduce the risk of adopting non-traditional business models by 2 to 17%, depending on the specific model

we apply. Specific results on early adoption of regulation and related to the interaction term coincidence with past studies on regulatory convergence across the globe with respect to deposit insurance as well as statements on particular WB data properties (Demirgüc-Kunt et al., 2005). They argue that early and strictly regulating countries have been more likely to put in place *other* and *additional* regulation more directly addressing risk-associated business practices, e.g., supervision of hedge funds at the turn of the century. One example of such regulatory *packages*[viii] includes the introduction of specific safety-and-soundness regulation i.e. regulatory capital to risk-weighted assets accounting, often in addition to deposit insurance. With respect for the former type of regulation our estimations suggest that there is either no significant effect in the case of noninterest income adoption or there is a reduction of risk from such regulation (which in some ways mimics some of the size effects we measured) in the case of loan income adoption. However, this effect loses significance when we integrate country group effects into the specifications which nicely lead us to discuss frailty effects for country groups.

Secondly, we find in the ϑ estimates an implication that within-group effects for countries matter for diffusion patterns. Independent of regulatory type and adoption criteria we apply, association or clustering parameters ϑ are significant on a 1 % level and positive. In other words, the conditional hazard effect theta for a bank or financial institutions suggest that knowledge of another bank's adoption in the *same* country, in the noninterest income (loan interest income) case, would actually increase the probability of adoption by 2.8 up to 25 % (107 up to 128 %). Furthermore, such within-country-group effects are relatively stronger for regulatory capital to risk-weighted assets accounting than for deposit insurance regulation. Table xy in the appendix displays and ranks specific frailties for countries based on our non-interest income indicator. Even though these should be interpreted with care given the particular context they arise, rankings suggest that controlling for all other aspects explaining adoption some economies seem to be more subject to conditional risk than others, e.g., on an average this holds for emerging more than industrialized economies with a few exceptions.

Discussion and implications for future studies

Even though the empirical results in the last section deliver interesting insights on the historical case, there is some room to improve the specific design of some of its indicators. To begin with, we do not exactly measure the content and use of specific financial innovation, i.e. specific financial instruments, but (due to data restrictions) but linger with the measurement of generic aspects of a business model which does only to some extent allow to establish the functions we have associated with alliance networks. Furthermore, some types of innovations may have been adopted more frequently or may have imputed different results from those we obtained.

Another issue is how we modeled and measured the indicator on profitability among peer agents in the learning process. Firstly, pre-profits among many other indicators of profitability could have been measured not on an absolute basis but using growth rates and accounting for medium-term variance in profitability. Similarly, agents in learning environments may require a longer period of observation before responding and fully believing peer information. So, testing for different specifications of time lags might put the procedural part of the adoption decision on more reliable empirical ground.

Lastly, future work might also consider investigation related to the variance in crisis outcomes in most recent years as well as earlier financial crisis, i.e. looking at loss distributions, depending on factors such as early or late adoption of non-traditional banking on bank and country levels, or the potential loss reducing effects of regulation. In this same line of reasoning, a longer and continuous development of the panel data might allow to assess the expected effects stemming from policy responses to the recent crisis.

Conclusion

Direct and, more prominently, indirect alliance network exposure to peer banks or countries influences the risk adoption rather than it creates a learning environment for agents in our specific banking context, while the role of information transmission in terms of intensity is less important. Furthermore, we find reliable evidence that regulation moderates the diffusion of new banking practices whereas the direction of the effect on adoption will most likely depend on the particular type of regulation issued. Similarly, our results suggest that national effort towards financial regulation may be fully legitimized due to country-specific frailty levels i.e. moderating *domino* effects in national patterns of diffusion. So, even though supranational, regulatory harmonization and supervision has been discussed critically in the existing literature (White, 2000)[ix], network exposure effects as measured may be something that should be accounted for by policymakers – as they lead to a *systemic* effect on adoption – i.e. any (first-mover) national regulation is likely feedback on the risk associated with diffusion of adverse business practices elsewhere in the world, making national regulation - at the extreme, and given systemicness – a "classic" public good problem on global scale. In any case, alliance networks in the financial sector spanning across countries may serve as an indicator for systemicness among countries and may support forecasting supranational interdependencies and structures in global finance.

Literature

Boyer, Robert, “Financial versus productive innovations: Origins of the present Crisis and Possible Ways Out of It”, Plenary paper for the International Schumpeter Conference 2010 on INNOVATION, ORGANISATION; SUSTAINABILITY AND CRISIS, Aalborg, June 21-24,2010

Young, H. Peyton, “Innovation Diffusion in Heterogeneous Populations: Contagion, Social Influence, and Social Learning”,The American Economic Review, December 2009

Saloner,Garth and Shepard, Andrea, “ Adoption of Technologies with Network Effects: An Empirical Examination of the Adoption of Automated Teller Machines”, The RAND Journal of Economics Vol. 26, No. 3 (Autumn, 1995), pp. 479-501

Bramoullé,Yann and Kranton , Rachel ”Risk-sharing networks”, Journal of Economic Behavior & Organization, Volume 64, Issues 3-4, November-December 2007, Pages 275-294;

Bloch, Francis ;Garance, Genicot and Debraj, Ray “Informal insurance in social networks Francis Bloch”, Journal of Economic Theory Volume 143, Issue 1, November 2008, Pages 36-58

Borgatti, Stephan P. and Foster, Pacey C. “The Network Paradigm in Organizational Research: A Review and Typology”, Journal of Management , Volume 29, No.6, 2003

Baden-Fuller, Charles and Morgan, Mary S. “Business Models as Models”, Long-Range Planning, Volume 43, April-June 2010, Pages 156-171

Demil, Benoît and Lecocq, Xavier,” Business Model Evolution: In Search of Dynamic Consistency”, Long Range Planning 43 (2010), Pages 227-246

Chesbrough, Henry and Rosenbloom, Richard S. ”The Role of the Business Model in Capturing Value from Innovation: Evidence from Xerox Corporation’s Technology spin-off Companies” Industrial and Corporate Change, Volume 11, No. 3, Pages 529-555

Stoneman, P. "Intra-firm Diffusion, Bayesian Learning and Profitability", Economic Journal, Volume 91, No. 326, June 1981, Pages 375-388

Tsur, Yacov; Sternberg, Menachem and Hochman, Eithan “Dynamic Modelling of Innovation Process Adoption with Risk Aversion and Learning”, Oxford Economic Paper, Volume 42, 1990, Pages 336-355

Persons, John C. and Warther, Vincent A. “Boom and Bust Patterns in the Adoption of Financial Innovations “, The Review of Financial Studies, Volume 10, No. 4, Winter 1997,Pages 939-967

Vitols, Sigurt, “Diffusing Innovations and Risks: Why the Financial Crisis spread to Europe”,WZB Mitteilungen, Heft 125, September 2009.

Edwards, Franklin R., and Mishkin,Frederic S., “The Decline of Traditional Banking: Implications for Financial Stability and Regulatory Policy”,FRBNY Economic Policy Review, July 1995

Clarke, Thomas, “Recurring Crises in Anglo-American Corporate Governance, Contributions to Political Economy” (2010) 29, 9-32

White, Lawrence J., “Technological Change, Financial Innovation, And Financial Regulation in the U.S.:The Challenges for Public Policy”, New York University, 2000

Valente, Thomas W. ” Network Models of the Diffusion of Innovations”, Hampton Press, lnc, Cresskill, NJ, 1996.

Valente, T. W. (2005). Network models and methods for studying the diffusion of innovations. In: P. J.Carrington, J.Scott & S.Wasserman, eds. Models and Methods in Social Network Analysis, pp. 98–116. Cambridge: Cambridge University Press.

Roger, Everett M. ”Diffusion of innovations”, Fourth Edition, New York, 1995

DiMaggio, Paul J. and Powell, Walter W. “American Sociological Review”, Vol. 48, No. 2, April 1983, Pages 147-160

Young, Peyton H. “The Diffusion of Innovations in Social Networks”, Department of Economics, John Hopkins University, Center on Social and Economic Dynamics, the Brookings Institution, The Santa Fe Institute, April 2002

Kapur, Sandeep “Technological Diffusion with Social Learning”, The Journal of Industrial Economics, Volume 43, No. 2, June 1995, Pages 173-195

Kraatz, Matthew S., “Learning by Association? Interorganizational Networks and Adaptation to Environmental Change”, in: The Academy of Management Journal, Volume 41, No. 6, December 1998, Pages 621-643

Davis, Gerald S. “Agents without Principles? The Spread of the Poison Pill through the Intercorporate Network”, Administrative Science Quarterly, Vol. 36, No. 4, December 1991, Pages 583-613

Kogut, Bruce “The Network as Knowledge: Generative Rules and the Emergence of Structure” Strategic Management Journal, Volume 21, Issue 3, March 2000, Pages 405–425

Greve, Henrich R. “Jumping Ship: The Diffusion of Strategy Abandonment”, Administrative Science Quarterly, Volume 40, No. 3, September 1995, Pages 444-473

Powell, Walter W.; Koput, Kenneth W. and Smith-Doerr, Laurel “Interorganizational Collaboration and the Locus of Innovation: Networks of Learning in Biotechnology”, Administrative Science Quarterly, Volume 41, No. 1 , March 1996, Pages 116-145

Frame, W. Scott and White, Lawrence J. ”Empirical Studies of Financial innovation: Lots of Talk, Little Action?”, Journal of Economic Literature, Volume XLII, March 2004, Pages 116-144

Lerner, Josh “Where Does State Street Lead? A First Look at Finance Patents 1971 to 2000”, The Journal of Finance, Volume 57, No. 2, April 2002, Pages 901-930

Lerner, Josh ” The New Financial Thing: The Origins of Financial Innovations”, Journal of Financial Economics, Volume 79, Issue 2, February 2006, Pages 223-255

Person, John C. and Warther, Vincent A. “Boom and Bust Patterns in the Adoption of Financial Innovations”, The Review of Financial Studies, Volume 10, No. 4, Winter 1997, Pages 939-967

Demirguc-Kunt, Asli; Karacaovali, Baybars and Laeven, Luc "Deposit Insurance Around the World: A Comprehensive Database", World Bank Policy Research Working Paper No. 3628, June 2005

Douglas, Diamond and Dybvig, Philip "Bank Runs, Deposit Insurance, and Liquidity" Journal of Political Economy, Volume 91, No.3, 1983, Pages 401-19.

Franklin, Allen and Gale, Douglas "Optimal Banking Crises", Journal of Finance, Volume 53 No.4, 1998, Pages 1245-1284.

Cull, Robert J.; Senbet, Lemma W. and Sorge, Marco "Deposit Insurance and Financial Development" Journal of Money, Credit, and Banking, Volume 37, No. 1, February 2005, Pages 43-82

Chernykh, Lucy and Cole, Rebel A. "Does deposit insurance improve financial intermediation? Evidence from the Russian experiment", Journal of Banking and Finance, 2010

Angkinand, Apanard P. "Banking regulation and the output cost of banking crises" Journal of International Financial Markets, Institutions and Money Volume 19, Issue 2, April 2009, Pages 240-257

Fernandez, Ana and Gonzalez, Francisco "How accounting and auditing systems can counteract risk-shifting of safety-nets in banking: Some international evidence", in: Journal of Financial Stability, Volume 1, No.4, 2005, Pages 466-500

Guo, Guang and Rodriguez, German "Estimating a Multivariate Proportional Hazards Model for Clustered Data Using the EM Algorithm, with an Application to Child Survival in Guatemala", in: Journal of the American Statistical Association, Volume 87, No. 420, December 1992, Pages 969-976.

Häusler, Gerd "The Globalization of Finance", in: Finance of Development, Volume 39, No.1, March 2002.

Schweitzer, Frank; Fagiolo, Giorgio; Sornette, Didier; Vega-Redondo, Fernando; Vespignani, Alessandro and White, Douglas R. "Economic Networks: The New Challenges", in: Science 325 (5939), 422, July 2009.

Penrose ET. The Theory of the Growth of the Firm. Oxford University Press: New York, 1959.

Olson, Mancur , The Logic of Collective Action: Public Goods and the Theory of Groups (Revised edition ed.), Harvard University Press, 1965.

Granovetter, M. "The Strength of Weak Ties", in: American Journal of Sociology, Vol. 78, Issue 6, May 1973, pp. 1360-1380 (1973).

Carley, Kathleen M.. —Learning and using new ideas: A socio-cognitive perspective, in: J. Casterline (ed.), Diffusion Processes and Fertility Transition. Washington, DC: National Academy Press, pp. 181–209, 2001.

Bandura, A. (1977). Social Learning Theory. New York: General Learning Press.

Donald A. Palmer, P. Devereaux Jennings, Xueguang Zhou, "Late Adoption of the Multidivisional Form by Large U.S. Corporations: Institutional, Political, and Economic Accounts.", in: Administrative Science Quarterly, Vol. 38, No. 1 (Mar., 1993), pp. 100-131.

Sullivan, Richard J. "How Has the Adoption of Internet Banking Affected Performance and Risk in Banks?", in: Finan. Industry Perspect. Fed. Reserve Bank Kansas City, pp. 1-16, 2000.

Akhavein, Jalal, W. Scott Frame, and Lawrence J. White “The Diffusion of Financial Innovations: An Examination of the Adoption of Small Business Credit Scoring by Large Banking Organizations,” in: Journal of Business, 78, 577–596, (2005).

Asli Demirgüç-Kunt and Enrica Detragiache, “Does deposit insurance increase banking system stability? An empirical investigation”, in: Journal of Monetary Economics, Volume 49, Issue 7, October 2002, Pages 1373-1406.

Marco Capasso, Elena Cefis and Koen Frenken,. "Do Some Firms Persistently Outperform ?," LEM Papers Series 2009/15.

P. G. Hoel, S. C. Port, and C. J. Stone, Introduction to Stochastic Processes. Waveland Press, Inc. 1987

Clayton, D.G. A model for association in bivariate life tables and its application in epidemiologicalstudies of familial tendency in chronic disease incidence. Biometrika 65, 141 – 151, (1978).

Damanpour, F. (1992). Organizational size and innovation. Organization Studies, 13(3), 375

Appendix

Table xy. Transition probability matrix for growth rates using noninterest income to total revenue indicator

	1	2	3	4	5	6	7	8	9	10
1	14,76	9,32	5,93	5,03	4,47	4,71	5,38	7,36	12,40	30,64
2	8,59	10,07	9,41	8,91	8,41	9,17	10,99	11,84	12,84	9,76
3	5,74	7,74	11,05	11,36	11,68	11,95	12,49	11,58	10,63	5,78
4	4,30	7,33	10,36	12,30	13,58	13,19	13,43	11,56	8,68	5,25
5	3,73	6,48	10,36	12,56	13,68	14,95	13,22	11,80	8,63	4,59
6	3,69	7,31	9,92	13,28	12,95	16,09	13,00	10,91	8,68	4,17
7	4,05	8,90	10,87	13,55	13,07	11,94	12,70	11,65	8,63	4,64
8	6,34	11,43	13,79	11,77	10,93	10,04	10,73	9,99	9,30	5,68
9	11,63	17,71	13,68	9,70	7,69	6,45	7,44	8,16	9,21	8,35
10	34,70	14,48	6,80	4,74	3,55	3,71	4,38	5,07	8,35	14,22

Table xy. Transition probability matrix for growth rates using loan interest income to total income indicator

	1	2	3	4	5	6	7	8	9	10
1	16,11	10,07	7,60	6,81	5,54	6,81	7,27	7,96	9,53	22,29
2	4,98	8,92	9,11	8,95	11,60	12,40	10,98	10,58	11,60	10,88
3	3,63	7,30	9,80	12,09	12,76	12,71	11,31	11,74	11,09	7,57
4	2,82	6,82	10,57	11,04	12,41	12,22	13,34	13,15	10,98	6,66
5	3,30	7,74	9,64	10,90	13,05	12,99	11,71	12,67	12,12	5,88
6	2,61	9,51	9,40	10,57	12,20	12,07	13,02	13,26	11,90	5,46
7	3,76	10,28	10,25	11,01	11,39	11,63	12,18	12,72	10,36	6,41
8	4,36	9,11	12,15	11,47	10,30	11,55	12,58	11,33	9,96	7,19
9	9,33	13,02	11,73	11,18	11,12	9,18	9,15	7,65	8,34	9,31
10	43,18	13,26	6,62	5,06	4,01	2,99	3,26	2,85	4,90	13,88

Table xy. Ranking of top 30 financial agents in the network and respective country affiliation, based on degree measures on agent level and total stock of alliances (1995 – 2008)

Institution name	Country affil.	degree
Sumitomo Mitsui Banking Corporation	JP	14
UFJ Bank Ltd	JP	13
Bank of Tokyo	JP	11
Sumitomo Trust & Banking Company Ltd	JP	10
Bank of Yokohama, Ltd	JP	10
American Express Company	US	9
Acom Co, Ltd	JP	9
Dai-Ichi Kangyo Bank Ltd	JP	8
Shinsei Bank Limited	JP	8

Tokai Bank Ltd.	JP	7
Mizuho Trust & Banking Co., Ltd	JP	7
Mitsubishi UFJ Trust and Banking Corporation	JP	5
Royal Bank of Canada RBC	CAN	5
Standard Chartered Plc	UK	4
Bank of America Corporation	US	4
Westpac Banking Corporation	AU	4
Australia and New Zealand Banking Group	AU	4
Asahi Bank Ltd	JP	4
Chuo Mitsui Trust & Banking Co Ltd	JP	4
Komercijalna Banka A.D. Skopje	MAC	4
Machhapuchchhre Bank Ltd	NP	3
JP Morgan Chase & Co.	US	3
Commonwealth Bank of Australia	AU	3
ING Groep NV	NE	3
Bank of Montreal-Banque de Montreal	CAN	3
National Australia Bank Limited	CAN	3
Canadian Imperial Bank of Commerce CIBC	CAN	3
UFJ Trust Bank Ltd	JP	3
US Bancorp	US	3
ABSA Group Ltd	SA	3

Table xy correlations among var.s, overall sample of (non-) networked observations (n=2845)

	adoption based on loan interest income share	adoption based on non-interest income share	loan interest income to income	non-interest income to revenue	Total assets	degree (country level)	mean pre-profit (country group)	mean adopters (country group) based on non-interest income share	mean adopters (country group) based on loan interest income share	coverage deposit rate / capital ratio	enactment pre1990
adoption based on loan interest income share	1										
adoption based on non-interest income share	0.4663	1									
loan interest income to income	-0.0086	0.0497	1								
non-interest income to revenue	0.1237	0.0772	-0.0080	1							
total assets	0.0354	-0.0178	-0.0044	0.0427	1						
degree(country level)	0.2508	0.3230	0.0588	-0.0801	0.0545	1					
mean pre-profit (country group)	0.3066	0.1552	-0.0207	0.1714	-0.002	0.0170	1				
mean adopters (country group) based on non-interest income share	0.4451	0.3932	0.0016	0.0405	0.0216	0.4101	0.5858	1			
mean adopters (country group) based on loan interest income share	0.4250	0.4166	0.0054	0.0022	0.0199	0.4400	0.3911	0.9568	1		
coverage deposit rate / capital ratio	-0.2435	-0.1010	0.0052	-0.2359	0.0102	0.2819	-0.6965	-0.4332	-0.2902	1	
enactment pre1990	-0.0239	-0.0706	-0.1199	0.0527	-0.0474	-0.0958	0.2173	0.0720	0.0060	-0.0943	1
reg.cap.to risk weight.ass.	-0.0915	0.0904	-0.0436	-0.1542	-0.0279	0.5196	-0.5463	-0.2487	-0.1213	0.7164	-0.0003

Table xy. Standard and shared frailty model cox regressions using overall sample of non- and networked banks and financial institutions, *loan income indicator*, both types of regulatory effort, models 5-8

	(5)	(6)	(7)	(8)
	_t	_t	_t	_t
loan interest to income,t	1.002	1.000	1.000	1.000
	(0.56)	(0.12)	(-0.25)	(-0.05)
ln(total assets),t	1.139***	1.135***	1.094***	1.105***
	(8.18)	(7.92)	(3.52)	(3.60)
degree,t-1	0.999	1.179***	0.904***	1.007
	(-0.07)	(3.99)	(-3.05)	(0.07)
mean adopters (country group),t-1	8.08e-13***	120.6	0.00585**	8.66e-08***
	(-7.48)	(0.79)	(-2.24)	(-4.01)
mean pre-profit (country group),t-1	1.000***	1.000***	1.000***	1.000
	(2.58)	(-4.60)	(3.96)	(0.18)
interact mean adopters x pre-profit	1.000	1.000***	1.000***	1.000**
	(1.09)	(-3.21)	(4.11)	(2.06)
network membership,t	1.127	1.155	1.276	1.157
	(0.31)	(0.37)	(0.72)	(0.42)
coverage deposit rate / capital ratio,t	1.154***	1.063		
	(2.67)	(0.90)		
enactment pre1990,t	7.897***	3.039		
	(3.50)	(1.21)		
interact coverage x enactment	0.827***	0.928		
	(-3.35)	(-0.92)		
reg.cap.to risk weight.ass.,t			0.897***	1.122*
			(-4.66)	(1.85)
frailty θ		1.0734***		1.2864***
N	9952	9952	4641	4641

Exponentiated coefficients; *t* statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table xy cox regressions using network subsample on micro/bank level, noninterest income and loan income indicators, models 9 and 10

	(9) _t	(10) _t
noninterest to revenue,t	0.992	
	(-0.58)	
loan interest to income,t		0.962
		(-0.09)
degree(bank level),t-1	1.554**	0.746
	(2.20)	(-0.73)
mean adopters (peer banks),t-1	16.02***	0.512
	(2.92)	(-0.52)
mean pre-profit (peer banks),t-1	1.000**	1.000
	(2.10)	(-1.16)
interact mean adopters x pre-profit	1.000	1.000
	(-1.54)	(0.51)
N	147	85

Exponentiated coefficients; *t* statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table xy. Country ranking based on frailty effects (*ranking least frail country first*), noninterest adoption criteria and each types of regulation

deposit insurance regulation		regulatory capture regulation	
country code	frailty effects ϑ	country code	frailty effects ϑ
VE	-.1957287	SW	-.985311
US	-.1578685	NT	-.4926733
NO	-.1323755	SZ	-.2803427
AR	-.1255883	SP	-.2565324
BR	-.1071345	IT	-.2411003
CA	-.0686969	NO	-.1533411
SZ	-.0631957	NZ	.1649643
FR	-.0371388	SK	.3021305
RU	-.0363852	BL	.3530522
SK	-.0240919	PL	.635167
NT	-.0117106		
GR	-.0064645		
SP	-.0036154		
MX	.0020284		
BA	.0239571		
IN	.0393897		
IT	.0754873		

DN	.1318671
PL	.133943
WG	.1674289
JP	.263378

Endnotes.

[i] Powerful private innovation may generate intense spillover that threatens macroeconomic stability as evidenced by the 1987 stock market crash, the Long Term Capital Management (LTCM) and Enron collapses, the Internet bubble and finally the subprime crisis.

[ii] The second network function established bears a weak notion of critical mass or network externality effects, in our case for the success and distribution of new financial instruments, as was described earlier by (Saloner and Shepard, 1995). Similarly, given new financial instruments e.g., derivate instruments, are exchanged *mutually* this may add the function of risk-sharing (Bramoullé and Kranton, 2007) among banks to alliance networks.

[iii] Interestingly, some authors argue that from a management perspective business model adoption and adjustment should ultimately consider the criteria of *sustainability* (of the model chosen) i.e. a central task is to "*monitor the risks and uncertainties that could impact the firm's business model on a permanent basis, which requires regular analysis of both the environment and of the organization's internal drifts*" (Demil and Lecocq, 2010).

[iv] At the extreme, following Olson's "logic of collective action" (1965) and the idea of critical mass on system level, diffusion in our case may even spur illogical individual adoption behavior, as individual pursuit of banks may cause a disadvantaged systemic outcome (e.g., in terms of risk excess) at the collective level. A (constant or varying) threshold on individual bank level may offer a different explanatory for adoption - even though critical mass and threshold may be potentially interrelated phenomena (Granovetter, 1978; Valente, 1995).

[v] We accessed both data sources and last updated on August, 31st, 2010. The same holds for World bank data on countries as well as deposit insurance; the latter data is accessible via http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/0,,contentMDK:20699211~pagePK:64214825~piPK:64214943~theSitePK:469382,00.html.

[vi] Estimation results for alternative specifications of these adoption criteria (that yield very similar results) can be obtained by the authors upon request.

[vii] Again, test results can be obtained by the author upon demand.

[viii] Both variables having a correlation of .71 being one of the reasons that made us run separate regression models.

[ix] As White (2000) puts it, "*the gains can come from the harmonization of information regulation (e.g., in standardizing accounting frameworks and reporting requirements), so as to reduce the transactions costs of both the purveyors and users of financial services that cross national boundaries. Also, harmonization that serves as a guise for reducing protectionist barriers or governmental subsidies for financial firms among countries can be beneficial. But even the harmonization of information regulation carries the dangers that worthwhile local variations may be squelched and/or uniformity may be achieved at wholly inappropriate levels. More important are the dangers that international harmonization efforts could become smokescreens for international regulatory regimes that are protectionist and anti-competitive; unfortunately, there are precedents (in airlines, ocean shipping, and telecommunications) for this type of protectionist international regulatory regime to arise.*"

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