What do we know about market discipline in insurance?

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Abstract: Market discipline will be one of the three building blocks of Solvency II, but not much attention has been paid to this aspect, either by academics or practitioners. The aim of this paper is to summarize the knowledge on market discipline in insurance and in other sectors of financial services. Looking at banking is especially interesting, since much more study has been done of market discipline in that field and much can be learned from that work. Based on existing knowledge, we develop a framework for market discipline in insurance that includes the most important drivers and impediments to market discipline. The results highlight a significant need for future research. The findings are of relevance not only for European insurers and regulators, but also for institutions outside Europe.

Outline

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1. Introduction

An important new dimension of the regulatory environment in banking and insurance is the explicit reliance on market discipline. Market discipline, i.e., the influence of customers, brokers, auditors, rating agencies, and investors on firm behavior, is one of three pillars both under Basel II and Solvency II. Even though these regulations are at present focused on European institutions, their influence extends around the globe. The expectation is that a transparent market will require less overt intervention by regulators as market participants themselves force appropriate firm behavior. The extent to which market discipline can be relied on for successful regulation, however, depends on the strength of its influence.

Likely due to the fact that Basel II has been in force for several years, most research into the ability of market discipline to regulate financial services has focused on banking (see, e.g., Martinez Peria and Schmukler, 2001; King, 2008). However, Solvency II is due to be implemented in the near future and thus market discipline is becoming a very relevant topic for insurance practitioners. Given that market discipline will be one of the three main elements of Solvency II, it is surprising how little work has been done on the subject.[1]

The aim of this paper is to summarize the knowledge on market discipline in insurance and in other sectors of financial services. Looking at banking is especially interesting, since much more study has been done of market discipline in that field and much can be learned from that work. Based on existing knowledge, we develop a framework for market discipline in insurance that includes the most significant drivers and impediments to market discipline. Our results also highlight a significant need for future research.

The results should help to provide a clearer understanding of market discipline as a mechanism of direct and indirect *monitoring* and *influencing* by *customers*, *investors*, and *intermediaries*. There are significant differences between banking and insurance with regard to market discipline. We also identify important differences between lines of business and legal forms in the insurance industry, which reveal that market discipline might be weak in some cases (e.g., in personal lines with complex products or with mutuals) and strong in other cases (e.g., in commercial lines or with stocks). We thus find a number of reasons why a "one-size-fits–all" model is inappropriate for market discipline in the insurance industry. Also, the impact of new reporting requirements on competition, e.g., on small insurers, needs to be analyzed. The re-

[1] Related papers such as Harrington (2004), Harrington (2005), and Nocera (2005) will be discussed in detail throughout the paper. Another excellent introduction to market discipline in German language is Hartung (2005). Furthermore, in light of Solvency II coming closer more empirical studies on market discipline in insurance are developed recently such as, e.g., Eling and Schmit (2009). Also experimental evidence from behavioral insurance (Wakker, Thaler, and Tversky, 1997; Albrecht and Maurer, 2000; Zimmer, Schade, and Gründl, 2009; Zimmer, Gründl, and Schade, 2009) is relevant for market discipline.

sults of this analysis will be useful for insurers, regulators, and policymakers that are currently revising regulatory standards both in Europe and in other markets. The article should not be understood as arguing in favor of any particular type of regulation; it should rather be viewed as an outline of potential impediments to market discipline regulators may face in their efforts to enhance market discipline.

This paper is organized as follows. In Section 2 we review definitions and characteristics of market discipline that will highlight significant differences between insurance and other financial services sectors. In Section 3 we consider existing literature, especially in the banking field, and derive drivers of and impediments to market discipline in insurance. Section 4 concludes with potential policy implications and a summary of future research needs.[2]

2. Classification, definition, and measurement of market discipline

2.1. Classification of regulatory measures: From regulatory discipline to market discipline

In most countries, financial institutions are highly regulated. The justification relied on for this extensive governmental intervention includes, among other things, that business and society are dependent on the financial services sector for personal and business transactions and that this sector is subject to strong systematic risk, with potentially devastating effects on the entire economy (see, e.g., Santomero, 1997). Solvency regulation is thus considered of great importance. Regulatory frameworks to monitor and control default risk are now firmly in place, both nationally and internationally. So the question today is no longer "Why should financial services be regulated?" but "How can we regulate financial services in order to prevent them from excessive risk-taking, potentially leading to default?" (see De Ceuster and Masschelein, 2003).

Table 1 reviews four main mechanisms employed during the last decades in an effort to limit the default probability in the financial services sector. Historically, solvency regulation focused on different types of safety nets, including deposit insurance schemes in banking (such as the Federal Deposit Insurance Corporation (FDIC) in the United States after the Great Depression) and guarantee funds in insurance. Until the early 1990s, many countries in the European Union addressed default risk by limiting competition via market entry restrictions and price and product regulation (see Eling, Klein, and Schmit, 2009). Rules for capital adequacy, imposing certain minimum capital requirements, either on an absolute or risk-adjusted basis

[2] Throughout this work, we analyze the role of both investors and customers in market discipline and do not focus on just one of these stakeholders. However, given the importance of customer market discipline in insurance (as will be explained in detail below), much of the analysis will focus on customers. We also do not refer to a specific country and try to develop results that are valid for the United States, Europe, and other markets. It is, however, important to keep in mind that differences across countries, such as governance mechanisms, insolvency experiences, and cultural norms, will affect the level of market discipline.

(e.g., Solvency I, U.S. RBC Standards) (see Eling, Schmeiser, and Schmit, 2007, for an overview), have also been introduced.

None of these market interventions is without disadvantages. Safety nets can create moral hazard since the risk reduction the parties face leads them to take riskier actions or fail to take precautionary measures (see Demirguc-Kunt and Detragiache 2002; De Ceuster and Masschelein, 2003). Distortions to competition, such as price and product regulation, decrease efficiency and limit innovation in financial services markets. Capital adequacy rules are subject to adverse incentives, a problem illustrated in the recent financial crisis by AIG and its credit default swap business motivated by regulatory and rating arbitrage.[3]

Instrument	Idea	Examples	Problems
Safety nets	In case of default, lender of last resort or insurance scheme	FDIC in the U.S. after the Great Depression	Provides moral hazard incentives
Limit competition	Restrictions on market entry, among others	EU until 1994	Decreases efficiency and limits innovation
Capital adequacy	Imposition of requirement to have sufficient capital	Pillar 1 of Basel II and Solvency II	Capital arbitrage (e.g., securitization)
Market discipline	Increase transparency and disclosure requirements	Pillar 3 of Basel II and Solvency II	Does it really work? (-> See Section 3.3.)

Table 1: Regulatory mechanisms

Recently, regulators have begun to incorporate a new market-based element into regulatory regimes by increasing transparency and disclosure requirements, with Basel II's incorporation of "market discipline" among its three regulatory pillars as the most notable example. Market discipline is often understood as the influence that customers, brokers, auditors, rating agencies, and investors exert on firm behavior, and regulators hope that this tool could be a major building block of Solvency II, leading to a strong and solvent insurance industry (see Eling and Schmit, 2009). In essence, regulators see two main advantages to market discipline, which is, theoretically, brought into play by greater disclosure requirements. Firstly, stakeholder monitoring should improve due to availability of more information and, secondly, improved monitoring will influence insurer behavior, i.e., the stakeholders are expected to use their market power to influence management decisions with regard to risk taking.

The question of whether the government should directly intervene in financial regulation (by means of safety nets, competition constraints, or capital adequacy) or whether it would be better to rely on market discipline to do the same job is reflective of a well-known macroeconomic debate and two related schools of thoughts. On the one side are the Keynesian economists, who advocate government intervention to achieve a desired situation (e.g., low levels of unemployment; in our case, a safe and sound industry at a reasonable cost). On the other side

[3] AIG sold credit-default swaps for several hundred billion dollars to banks, which was an easy way for the banks to lower their capital requirements since AIG had a "triple A" rating. AIGs immense credit risk potential was not assessed, since the risk of credit-default swaps was not adequately recognized in insurance regulation frameworks. See Eling and Schmeiser (2010).

are the neoclassical economists, epitomized by Adam Smith and Milton Friedman, who are proponents of the invisible hand of the market. These economists see the market as the more efficient mechanism and the regulator's job is simply to eliminate all market distortion so that the market mechanism can work efficiently by rewarding risk-oriented business policy, e.g., in that safe (risky) companies can collect higher (lower) premiums.

Which approach is best is a question that has never been answered, neither in economics nor in solvency regulation. In the case of Solvency II, European Union regulators advocate a combination of both in their proposals for capital adequacy (Pillar 1) and market discipline (Pillar 3). At first glance, this seems like a good idea to combine the advantages of both approaches. However, disadvantages are also evident. Combining two approaches always runs the risk that a little of everything will be done, but not enough of anything (just like the "stuck in the middle" problem described by Porter (1980)). Furthermore, costs must be taken into consideration: requiring insurers to employ extensive financial models (Pillar 1), as well as increased reporting requirements (Pillar 3) are both going to impose a substantial financial burden on insurers. The cost of regulation might thus outweigh its benefits.[4] This argument is especially relevant for small insurers that might be pushed out of the market by requirements too costly to meet.

2.2. How should market discipline be defined?

Neither in academia nor in practice is there any clear understanding of what exactly market discipline is. In the banking context, Covitz, Hancock, and Kwast (2004) note that the definition of market discipline has evolved over the last decades from simply considering the risk sensitivity of debt prices and spreads to accounting for the effects of this risk sensitivity on managerial decisions. Notable also is the fact that neither the Basel Committee (Basel II) nor CEIOPS (Solvency II) have ever provided a clear definition of "market discipline," even though both view it as an important foundation of their regulatory frameworks. In the few papers on this topic in the insurance literature, market discipline is often defined as the incentives provided by risk-sensitive customer demand. Epermanis and Harrington (2006), however, point out that the term also can be used more broadly to encompass incentives for risk management provided by capital markets, including the goal of preserving franchise value to benefit equityholders.

In the more developed banking literature, there is widespread agreement that market discipline involves two distinct components (see Flannery, 2001; Bliss and Flannery, 2002,

[4] There is no evidence as to whether the costs of Solvency II are higher than its benefits, but it is important to keep these two aspects (costs and benefits) in mind when talking about new regulation. We are also not aware of a study that analyzes the costs and benefits of Basel II, which has be in force for some years. Future research might thus try to estimate the costs and benefits of both these systems.

Forssbæck, 2009), which highlight the expectation that regulators have with regard to market discipline: (1) the ability of market participants to accurately assess the condition of a firm (*monitoring*) and (2) their ability to impact management action that reflects those assessments (*influencing*). Market discipline thus has an indirect and direct dimension (see Forssbæck, 2009). Monitoring captures the information aspect of market discipline, i.e., current and prospective bank claimants inform themselves about the bank's condition and set prices for their claims accordingly. Influence refers to the mechanism by which banks, in order to avoid the adverse consequences of stronger discipline (such as higher financing costs, closer monitoring by market participants as well as regulators, and, ultimately, liquidity problems as a consequence of some sources of financing being cut off) decrease their risk exposure or avoid increasing it in the first place.

With regard to the first component, monitoring in the insurance industry is fundamentally different from monitoring in other industries as regulators and many other market participants screen the risk taking of insurers. Maybe even more than in banking, intermediaries such as agents, brokers, rating agencies, or reinsurers screen the financial strength and service quality of insurers. Due to the post-insolvency assessment funding mechanism of many guaranty funds and potential contagion effects of financial problems among insurers, insurers in selected lines also have an incentive to monitor each other (see Downs and Sommer, 1999). Overall, it thus seems that there are enough market participants willing to monitor risk taking in insurance.

The second component, influencing, is more difficult to evaluate. We need to know which market participants have enough market power to influence management decisions. In the past several years, the idea that rating agencies in particular have substantial market power and so can influence management decisions gained a fair amount of momentum, but this idea is now suspect due to the recent financial crisis and the revelation that rating agencies badly underestimated the risk situation of some market participants. The finance literature sets out numerous reasons why we should view with some doubt the ability of market participants to influence managers (Bliss and Flannery, 2002). Among these are asymmetric information, costly monitoring, principal-agent problems, and conflicts of interest among stakeholders. Another impediment to market discipline is a legal environment that makes shareholder activism, e.g., a hostile takeover, difficult. From the perspective of the shareholders, monitoring and incentive contracts can be combined to mitigate the agency problem between shareholders and managers. There are also other mechanisms that may induce managers to act in the best interests of the shareholders, such as reputational concerns, competitive labor markets, and the threat of takeover, dismissal, or bankruptcy (see Aggarwal and Samwick, 1999). But as we

will discuss in more detail below, the insurance sector has a number of unique characteristics that limit the influencing component (e.g., limited risk of a bank run). Furthermore, especially in personal lines, individual policyholders are relatively small in terms of contract volumes, which limits their ability to affect management decisions. Overall, it thus seems that the second component of market discipline, influencing, is not without its difficulties in the insurance sector and needs more study.

While most definitions of market discipline in the banking context include the monitoring and influencing components, Harrington (2004) and Nocera (2005) add another interesting dimension that is especially relevant in the insurance context. They differentiate between product market discipline *(customer-driven market discipline)*, i.e., the extent to which demand by policyholders is sensitive to insolvency risk and thereby motivates insurers to manage their risk, and financial market discipline, i.e., *investor-driven market discipline*. Product market discipline is observable in the insurance sector, but investor-driven market discipline is difficult to observe because of the specific legal form/ownership structure (majority of insurers not publicly traded) and financing (very few traded debt instruments). Additionally, for customers and investors, there is another monitoring and influencing element in the insurance sector, i.e., intermediaries such as brokers or agents who are involved in the customer's buying decision. We thus define market discipline as the ability of *customers*, *investors*, and *intermediaries* to *monitor* and *influence* the management of insurance companies.

Market discipline adds a new dimension to the regulatory process since, in the past, the regulator was seen as the only official institution with authority to discipline financial services companies. There are a number of market participants that might potentially monitor risk taking, but questions as to whether sufficient information is available and which market participants have enough power to influence managers remain unanswered.[5]

2.3. How should market discipline be measured?

Table 2 reviews different facets of market discipline and derives measures for quantifying it. Based on the definition developed in the last section, we distinguish between "direct" and "indirect" monitoring and influencing. While in theory, customers and investors directly influence management decisions, intermediaries have a direct as well as an indirect influence. An example of this sort of effect is when customers or investors react to market signals set by intermediaries (e.g., changes in ratings). Given that intermediaries might have an indirect influence on customers and investors, they might also have a direct influence on company man-

[5] It is difficult to define what sufficient information is because the amount of information and the level of understanding depend on the stakeholder (shareholders, customers, intermediaries, …). Also, the potential disciplining measures depend on the respective stakeholder group (decrease in stock prices, lapse, recommendations to customers, …). See also Crocket (2002).

agement. Managers might, e.g., wish to do everything in their power to prevent a rating downgrade since this would have a negative impact on future premium growth or bond yields. In the banking literature, investor-driven market discipline is usually studied either by analyzing stock prices or yields on debt instruments (see, e.g., Martinez Peria and Schmukler, 2001; King, 2008). But the insurance sector is fundamentally different from the banking sector in regard to legal form and financing. Many companies are mutual insurers and most insurers that are organized as stocks are not traded on the capital market. Furthermore, for many of the insurance companies that are traded on the stock exchange, we do not find liquid markets, since only a small fraction of the stocks are in free float. Stock prices are thus of only limited use when evaluating risk sensitivity in insurance.[6] The financing of insurance companies is also very different from that of other providers in the financial services industry in that debt instruments typically are not traded on the capital market. The debenture spreads and equity prices typically considered as market elements disciplining management behavior for the banking industry thus, for the most part, do not exist in the insurance industry.[7]

Who?	Customers and investors (direct monitoring and influencing)			Intermediaries (direct and indirect monitoring and influencing)		
	Customers	Investors-stockholders	Investors-bondholders	Rating agencies	Auditors/ analysts	Agents/ brokers
How?	Risk-sensitive customer demand	Risk-sensitive stock prices	Risk-sensitive bond yields	Product and company ratings	Recommendations to investors	Recommendations to customers
Measurement	Growth in premiums and policies / lapse	Equity prices	Debt yields	Rating changes	New recommendation	New recommendation
Relevance in insurance	High	Limited	Limited	High	Limited	High

Table 2: Facets of market discipline

An alternative way to measure market discipline is by looking at it as customer-driven. To this end, the few existing studies on market discipline in insurance consider premium growth and lapse. Epermanis and Harrington (2006) and Eling and Schmit (2009) both analyze premium growth around rating changes as a proxy for market discipline. Zanjani (2002) considers changes in lapse rates following rating changes. But there are also limitations in measuring customer-driven market discipline. For example, premiums are not the price of insurance, but

[6] Reinsurers are different from insurers in that many of them have stocks traded on capital markets. Furthermore, many large holdings, such as Allianz SE, are listed on the capital market. Overall, however, the number of liquid stocks is very limited compared to other sectors of the financial services industry. A broad empirical analysis based on stock prices is thus difficult.

[7] There are some debt instruments that we might think of, such as credit-default swaps or hybrid instruments (e.g., participating certificates). The number of observable instruments and the number of companies involved in such transactions is again, however, very small. Catastrophe bonds or other forms of alternative risk transfer are not suitable since these are issued in special purpose vehicles and thus not linked to the default risk of the sponsor.

the price times quantity. Typically, we cannot observe insurance prices, i.e., the premium rates per unit of coverage. And even if such information were available, it would be very difficult to compare insurers since the underlying expectations of claims costs used for calculating rates might be very different and are not observable (see Harrington, 2004). A potential proxy for insurance prices used in literature is the relation of insurer premiums to realized claims (see Sommer, 1996; Phillips, Cummins, and Allen, 1998).

From the above discussion we can conclude that market discipline focuses on the risk sensitivity of the customer demand (for insurance coverage) and investor willingness to pay (for equity and debt). To measure market discipline, we thus need to identify market signals that affect the risk sensitivity of customers or investors. The second step is then to evaluate whether this signal has a significant impact on our measures of market discipline, i.e., demand and willingness to pay. Table 3 reviews a selection of potential signals and their influence.

Market signal with regard to risk situation (input variable)	Signal given by	Market reaction (output variable and direction of impact)
Investor-driven market discipline		
Annual and interim reports with outlook	Company	*Investors willingness to pay reflected in* Stock prices (+) Bond yields (-)
Ad-hoc disclosure*	Company	
Director´s dealings	Company	
Analysts comments	Analysts	
Company financial strength ratings	Rating agencies	
Takeover bids	Competitor	
Customer-driven market discipline		
Product ratings	Rating agencies	*Customer demand reflected in*: Premium growth (+) Lapse (-)
Surplus participation	Company	
Complaint statistics	Regulator	
Statistics published by associations	Insurance associations	

* For example, new important project or cash call; +/- indicates a positive/negative direction of impact by a signal, e.g., a better outlook in the interim reports has a positive effect on stock prices

Table 3: Measuring market discipline

Table 3 can be used to formulate hypotheses with regard to the disciplining impact. We would, e.g., expect that a better company rating has a positive influence on equity prices (i.e., an increase in price) and a negative influence on the debt yields (i.e., the spread over the risk-free interest rate would decrease). In Table 3, we consider three main sources of market signals: the company, the intermediaries, and the regulator (other sources of information such as institutions for consumer protection or recommendations by friends are also important, but will not be discussed in detail).

Table 3 shows many signals that might affect market discipline. But what are the right signals and how should they be sent? As to the first part of this question (what signal?), regulators collect a great deal of information that is not available to the public, but of high interest. For example, in banking, U.S. regulators calculate CAMEL ratings.[8] These are not made publicly available since regulators fear they could set off a bank run. A comparable rating calculated

[8] CAMEL stands for **C**apital Adequacy, **A**sset Quality, **M**anagement Ability, **E**arnings, Asset-**L**iability Management.

by insurance regulators and one that is also not publicly available is the IRIS (Insurance Regulatory Information System) score, also calculated by U.S. regulators. The insurance industry does not have a comparable risk of bank run[9] so that such an argument cannot be used as a justification for not publishing information. As to the second part of the question (how to send?), some regulators provide standardized databases of information on companies in a timely fashion that are available to the public. An example is the EDGAR (Electronic Data-Gathering, Analysis, and Retrieval) database provided by the U.S. Securities and Exchange Commission (so-called SEC filings; see www.sec.gov/edgar.shtml) which contains financial data and other types of information. Various analysts, investors, and academics use this database for their research. Such a database might be an option for enhancing market discipline in the insurance industry.

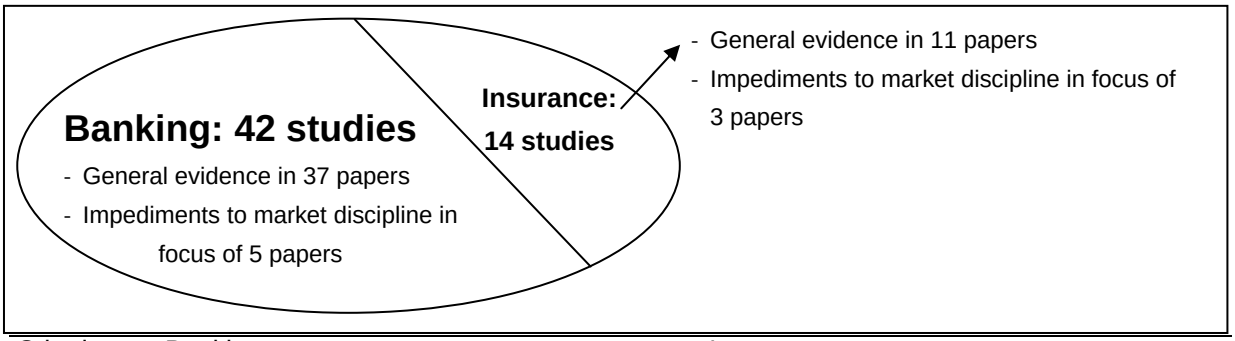
Table 3 also allows us to identify elements unique to the insurance sector that might be used to measure market discipline. Among these are product ratings, surplus participation, complaints or other published statistics. Using complaint statistics might be viewed as a bit questionable, especially by readers from the U.S., since in that country insurance complaint data are often of insufficient quality. Such is not necessarily the case in other countries, however. For example, in Germany, insurance complaints data are of relatively good quality since reporting complaints to the regulator has been required of insurers since 1996. The data are complete even for very small insurers and no post-processing or manipulation is conducted. An important aspect is that the data are also used by intermediaries as a marketing device, and thus it might be interesting to analyze these in the context of market discipline. This would, however, be a test of customer sensitivity to changes in product quality rather than a test of risk sensitivity. Product ratings and yearly surplus participation are also used as marketing devices, but this type of data is not systematically collected, making them more difficult to analyze.

3. Evidence for market discipline (including facilitators and impediments)

This section contains a review of 56 peer-reviewed empirical studies on market discipline in the financial services industry with the goal being a summary of evidence on market discipline. For the field of insurance, we also include recent material presented at peer-reviewed conferences so as to increase the number of studies. Even with this extension, however, only 14 of the 56 studies address the insurance industry. The other 42 studies are from the banking literature and considering these we can see that a much broader range of research has been published in banking, at least in terms of research questions and countries analyzed. Some of the insights from these studies, however, can be transferred to the insurance industry, e.g.,

[9] In non-life insurance, payments are linked to claim events and insurers are funded in advance. In life insurance, surrendering a contract has disadvantages, such as lapse costs, so that the policyholder has a limited incentive to terminate the contract. See Eling and Schmeiser (2010).

with regard to safety nets. The three main messages from the structured literature review can be summarized as follows. (1) There is a long history of research on market discipline in banking and a great deal of evidence; banking regulators could use these experiences when they designed Basel II. (2) Compared to banking, we know much less about market discipline in insurance; however, much can be learned from the work done on the banking industry. (3) Both academics and practitioners need to do a lot more work toward understanding market discipline in insurance.[10]



Criteria	Banking	Insurance
Countries covered	- Cross-country: 4 papers - U.S.: 31 papers - Europe: 3 papers - Asia: 4 papers	- Cross-country: 0 papers - U.S.: 13 papers - Europe: 1 paper - Asia: 0 papers
Measures for market discipline	- Equity prices: 13 papers - (Subordinated) debt prices: 14 papers - (Uninsured) deposits: 11 papers - Other: 4 papers	- Equity prices: 2 papers - Prices of insurance: 3 papers - Premium/number of contracts: 3 papers - Other: 6 papers
Results	- Market discipline (MD) in equity prices is found in 11 of 13 papers - MD in debt prices found in 8 of 14 papers - MD in deposits found in 8 of 11 papers - Reduction (enhancement) of market discipline by (reducing) safety nets is documented in 4 of 5 papers; 2 papers also document market discipline in off-balance sheet activities of banks	- MD in equity prices found in 2 papers - Negative relation between risk and price of insurance in 3 papers - MD in premiums/number of contracts found in 3 papers - MD in lapse found in 2 papers - Impact of guarantee funds on risk taking found in 3 papers; impact of ratings on asset risk discussed in 1 paper

Table 3: Results of structured literature review

3.1. Evidence for market discipline in banking

There is a long and vast literature on market discipline, especially for the banking industry; research on the topic in this field dates back to the 1980s. The background is that innovation, e.g., in financial engineering, enabled financial intermediaries to become involved in complex financial operations that were very costly to monitor. Furthermore, excessive risk taking in the 1980s resulted in the failure of some depository institutions, which raised concern over safety and prompted calls for stricter regulation. Thus, by the 1980s, banking regulators had market

[10] A summary of the 56 studies based on consistent criteria (measurement, results, conclusions, sample size, and period) is available upon request. We also identified studies in other sectors of financial services, such as mutual funds (see, e.g., Dangl, Wu, and Zechner, 2008), but to reduce the complexity of the review we did not include these. Given the broadness of literature on market discipline in banking, we also cannot claim that our collection of 56 studies is complete, but we do believe that the most important studies are included. Please also note that the experimental evidence such as Wakker, Thaler, and Tversky (1997) is mentioned in our paper but has not been added in Table 5.

discipline on the policy agenda (see Park and Peristiani, 1988). Research in this area was given a boost when market discipline was made one of the three pillars of Basel II.

Two empirical results in regard to market discipline are found in the banking literature. 1) There is evidence of market discipline in banking over the last decades across a variety of measures and countries, i.e., with regard to stock prices (e.g., Baer and Brewer, 1986), with regard to debt (Avery, Belton, and Goldberg, 1988; Sironi, 2003), and with regard to deposit growth (Park and Peristiani, 1998).[11] 2) The evidence makes it quite clear that investors in bank stocks have the strongest incentives to be risk sensitive,[12] while market discipline in debt is often hampered by safety nets (in principle, debtholders should also be risk sensitive, but the incentives are limited by safety nets). Safety nets of all kinds create moral hazard and reduce market discipline (Billett, Garfinkel, and O'Neal, 1998; Demirgüç-Kunt and Huizinga, 2004; Nier and Baumann, 2006). There is also a great deal of evidence that reducing safety nets increases market discipline (Flannery and Sorescu, 1996). A resulting policy implication is that regulators should enforce modifications of existing guarantee schemes to bring market discipline into play. In this context, a number of authors (e.g., Benink and Wihlborg, 2002) advocate for banks to issue a substantial amount of uninsured deposits in order to enhance market discipline. Many other aspects are highlighted in the banking literature that might be relevant to the insurance industry:

- The strength of market discipline might depend on the line of business. Morgan and Stiroh (2001), e.g., show differences for credit card, commercial, and industrial lending, all of which carry a penalty in terms of higher spreads.
- Sironi (2003) found differences depending on ownership structure, i.e., less discipline was found for government-owned institutions. This is an important finding in light of the traditional separation of stock, mutual, and public companies in the insurance industry and the resulting differences in agency conflicts (e.g., expense preference hypothesis; managerial discretion hypotheses; see Eling and Luhnen, 2010).
- Niers and Baumann (2006) emphasize that market discipline depends on the level of competition, i.e., while competition leads to greater risk-taking, market discipline is more effective in curbing this behavior in countries where competition is strong.

[11] There are also authors who find no evidence of market discipline (Gorton and Santomero, 1990) , but compared to the number of papers with evidence their number is limited. Of special relevance to Solvency II because of the focus on European data is the work by Sironi (2003), who finds that European banks' debenture spreads reflect risk. More recently and also using European bank data, Distinguin, Rous, and Tarazi (2006) observe that the accuracy of models in predicting bank financial distress through use of stock market information depends on the extent to which bank liabilities are tradable. Models that account for these nuances, therefore, will be more valuable.

[12] In spite of their residual claimholder position and their risk of total loss this result is not trivial, since with limited liability equity holders might have incentives to increase risk taking as shown by Merton (1977). One might thus argue that equity holders are less suitable monitors. Empirically, however, and also in more complex theoretical models the risk increasing influence is not clear. See De Ceusters and Masschelein (2003).

- Pop (2006) finds international differences in market discipline and argues that much work needs to be done, especially in Japan and certain European countries, to level the playing field so that market discipline can operate.
- Cakici and Chatterjee (1993) emphasize that market discipline may not only be related to firm risk but also to other external risk sources; they model the complex interaction effects arising from the joint uncertainties of firm risk and interest rate risk.
- Both before the financial crisis (e.g., Flannery and Soresu, 1996) as well as more recent studies (e.g., Pop and Pop, 2009) discuss adverse incentives with regard to very large banks ("too-big-too-fail"). Although larger firms are in general more in focus of the public, this does not necessarily mean market discipline to be stronger. The relationship between size and market discipline is thus not trivial.
- Almost all studies address the monitoring element of market discipline, which means that they measure changes in risk and their influence on prices. Bliss and Flannery (2002) is an exception in that the authors try to directly measure this component by developing an influence regression using equity returns and expected managerial behavior. Their results show that the market influence is weak.

3.2. Evidence for market discipline in insurance

The insurance literature is not as extensive as that found in the banking field and it rarely employs non-U.S. data. Some of this work offers implications rather than direct tests of market discipline. For example, Sommer (1996), Phillips, Cummins, and Allen (1998), and Cummins and Danzon (1997) all find a negative relationship between proxies of property-casualty prices and firm risk, which is consistent with market discipline. But as lower prices could also cause greater risk, ferreting out the cause and effect relationship is difficult. In a controlled environment using experiments, Wakker, Thaler, and Tversky (1997) show risk sensitivity of policyholders in that an increase in default risk severely affects policyholder willingness to pay. Similar experimental evidence could be given by Albrecht and Maurer (2000), Zimmer, Schade, and Gründl (2009), and Zimmer, Gründl, and Schade (2009). An important result of these studies is that in a transparent setting, market discipline will work, since knowledge of differences in default risk severely affects policyholder behavior.

In regard to life insurance, Fenn and Cole (1994) and Brewer and Jackson (2002) find that insurers with risky assets experience larger stock price declines than those with less risky assets during downturns in the real estate and bond markets. In another study on life insurance, Baranoff and Sager (2007) observe reduced demand for life insurance products (measured by the number of policies written) when ratings decline. As to consumer influences, Zanjani (2002) finds a positive relationship between policyholder lapse rates and insurer default risk. Liu, Epermanis, and Cox (2005) study the influence of guaranteed investment contracts (GICs) as a disciplinary mechanism for bondholders and find some market discipline influences. The agency conflict risk-shifting behavior has, however, a much stronger influence.

Research in insurance is limited by the fact that the majority of insurers are not publicly traded, giving rise to a search for nontrading market measures. One of these is a firm's credit rating. Several papers thus use ratings to study the influence of franchise value on firm risk. Yu et al. (2008) find that insurer investment in risky assets and the volatility of asset portfolios are inversely related to franchise value, i.e., ratings. This finding supports the notion that investors impose market discipline to protect their franchise value. Zanjani (2002) uses A.M. Best ratings as his measure of financial risk to study its relationship with life insurer lapse rates. As noted above, he finds some evidence of market discipline, with a positive relationship between risk (i.e., ratings) and lapse. And, as also mentioned, Baranoff and Sager (2007) find that life insurance demand declines after a rating downgrade.

Epermanis and Harrington (2006) consider insurer ratings in a property/casualty context and observe significant premium declines following rating downgrades, particularly for firms that had low ratings even before the downgrade. They also note the concentration of premium declines in commercial lines, which tend not to be protected by guarantee associations. Eling and Schmit (2009) analyze market discipline in the German insurance market using Epermanis and Harrington's (2006) research design and find premium declines as well as increased lapse rates following rating downgrades. Their findings are consistent with Epermanis and Harrington (2006), but they are less significant than the results reported for the U.S. market. The authors thus conclude that market discipline in the German insurance market is not as strong as it is in the U.S.

Finally, Harrington (2005) argues that market discipline is greater in insurance than in banking and concludes that capital requirements should be less stringent for insurers. Based on an analysis of risk sensitivity, buyer sophistication, search costs, and franchise value, he argues that overall market discipline is highest in reinsurance, moderate in life and non-life, and low in banking (see Table 1 in Harrington, 2005).

Overall, it thus appears that market discipline is reasonably strong in most insurance markets, but that there is some variation due to legal form (Liu, Epermanis, and Cox, 2005), the line of business (Epermanis and Harrington, 2006), and between countries (Eling and Schmit, 2009). All these results are confirmed on a broader empirical basis in the banking sector. We can use these insights to derive facilitators of and impediments to market discipline in insurance.

3.3. Derivation of facilitators and impediments to market discipline in insurance

Market discipline is strongly affected by outside factors, which can either facilitate or impede it. Recently, government rescue efforts and direct intervention into the insurance and, especially, the banking markets have created a lot of distortions that affect market discipline to a significant degree. These interventions give rise to some complicated, but highly interesting, questions involving moral hazard, the role of guarantee funds, the structure of rescue opera-

tions, the obligations of the firm being rescued, and the impact intervention has on competition. The most important impediments to market discipline in insurance are the following.

- Several pieces of work in banking find that guarantee associations are an impediment to market discipline (see, e.g., Demirgüç-Kunt and Huizinga, 2004). Without guarantee schemes, bank managers have strong incentives to avoid risky loans and risky investments; however, mandated deposit insurance eliminates much of the risk involved in these activities. There are also insurance studies that observe increased risk taking following the establishment of guarantee associations (see Lee, Mayers, and Smith, 1997; Downs and Sommer, 1999). One study also finds that risk levels increase when the amount of insurance sold expanded in jurisdictions where guarantee associations exist (Brewer, Mondschean, and Strahan, 1997). These findings are in line with the expectation that the establishment of guarantee funds limits the monitoring incentives and thus negatively affects market discipline. There could thus be a difference in market discipline for different lines of business or different regions depending on the insurance guarantee fund design in place.
- In addition to these direct market distortions, there might also be indirect or implicit market distortions. An example is bailout schemes, such as the "too-big-to-fail" concept, where governments feel obliged to rescue a troubled bank or insurer because they fear financial contagion.
- The financial crisis has revealed impediments to market discipline, e.g., the complexity of financial products. Financial institutions are often highly complex both in their ownership structure and in the nature of their business. For example, many insurers have dozens of reinsurance arrangements that primarily aim to diversify risk, but these also reduce transparency and can sometimes mask financial problems (see Harrington, 2004).
- Harrington (2004) mentions the judgment-proof problem as an impediment to market discipline. Under a compulsory insurance regime (e.g., auto liability, workers compensation or professional liability) individuals with few assets to insure might simply buy the cheapest insurance they can find, with no regard to insolvency risk. The combination of compulsory insurance and judgment-proof buyers reduces the risk sensitivity of demand.

There are thus a number of reasons to expect differences in market discipline depending on the line of business. (1) The judgment-proof problem impedes market discipline in conjunction with requirements for compulsory insurance. (2) If the government or a privately organized fund guarantees all insurance claims and benefits, there is no reason to expect market discipline. Reducing coverage, however, could be quite conducive to market discipline. (3) Differences in lines of business due to products and business complexity will also affect the degree of market discipline. With standardized products it is easier to identify differences between insurers, something that is more difficult for complex products and businesses. (4) An increase in financial leverage increases company risk. Life insurers typically have a much higher leverage than non-life insurers and this might affect the risk sensitivity of inves-

tors. (5) Market discipline could be stronger in commercial lines compared to personal lines. Policyholders in personal lines have less resources and competence (e.g., in terms of education to read financial reports) to conduct efficient monitoring than do policyholders in commercial lines, which are usually larger and have more resources. On the other hand, however, personal line insurance decisions directly affect an individual's own wealth, whereas commercial insurance decisions do not usually have much of a personal impact on the decision maker. This can create moral hazard problems, which lowers the efficiency of monitoring in commercial lines. Nonetheless, evidence indicates that market discipline in commercial lines is stronger than in personal lines (Epermanis and Harrington, 2006).

In this context, we would also expect more market discipline in reinsurance than in insurance because reinsurance only covers commercial business, while insurance covers both commercial and personal lines. An implication for policymakers is thus that when comparing personal and commercial insurance, it appears that market discipline is weak in some areas and strong in other areas.

This last point is also true with focus on legal form. Insurers listed on the stock market are subject to more extensive reporting requirements than are mutual insurers. Liu, Epermanis, and Cox (2005) document that agency effects are more common among mutual insurers, which generally have lower informational requirements than do stock insurers. These results can be interpreted to mean that relying on market discipline is appropriate in some areas, but that formal regulation will work better in others. In particular, formal regulation is likely to be the more effective course in the presence of informational deficits (i.e., with mutuals). Market discipline will be more effective when information is generally available (i.e., with stocks).

With regard to facilitators, information seems to be key in enhancing market discipline. In this context, an important result from the experimental literature (Wakker/Thaler/Tversky, 1997; Zimmer/Gründl/Schade, 2009) is that if all necessary information is available, customers will discipline insurance companies by changing their demand. But more information is not necessarily better information. In a theoretical world, Holmström (1979) shows that in moral hazard problems more information about the agent is never detrimental to the principal and, under mild assumptions, is always actually beneficial. In the real world, however, things can be quite different, especially when the cost of information is taken into consideration. Furthermore, more information can be useful only if it is consistently accessible and provided in a standardized form so that market participants can understand it and make appropriate comparisons between insurers. Standardization, consistency, and accessibility are thus important requirements for effective market discipline.

Based on the above discussion, we now develop a framework for market discipline using the flow chart shown as Figure 1. Figure 1 is adapted from Hess and Feng (2007)[13] and extended to fit to the insurance industry. The framework is subdivided into monitoring and influencing. The monitoring part (upper part) shows the two identified requirements for market discipline: stakeholders need to consider themselves at risk and they need to be able to observe risk efficiently, i.e. at reasonable costs. Reasons why risk sensitivity might be limited are shown in the upper-right part of the figure. Even if stakeholders consider themselves at risk, there can be impediments to monitoring if accessing the necessary information is too costly. Furthermore, we might see adverse selection if some stakeholders have more information than others.[14]

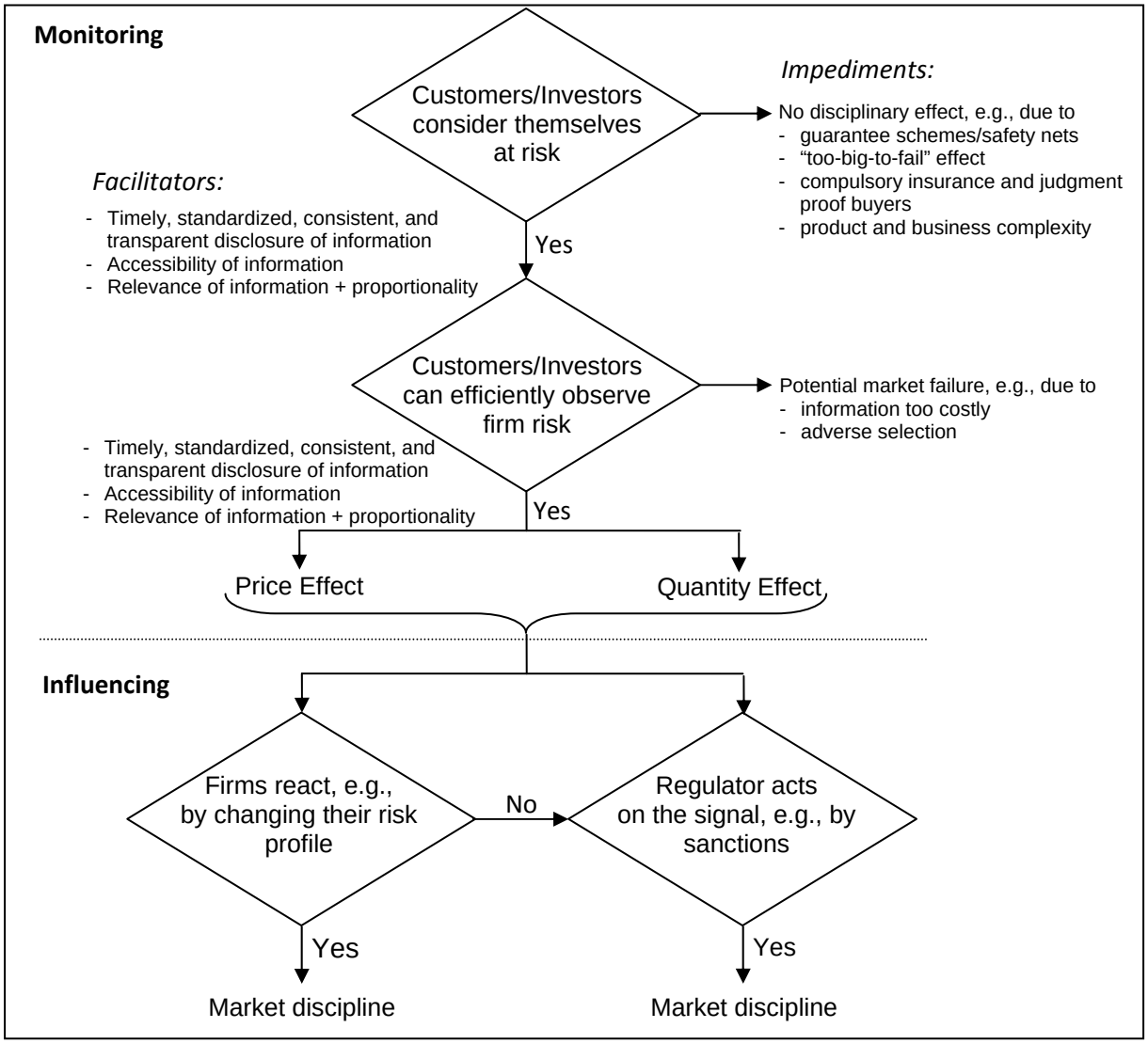


Figure 1: Framework for market discipline

[13] Hess and Feng (2007) develop a framework for market discipline in banking and base their framework on ideas by Flannery (2001). A couple of comparable frameworks have been presented in the banking literature, but we have not yet seen one for insurance.

[14] Note that we do not consider intermediaries in Figure 1 because they mainly affect customer and investor decisions and thus have an indirect impact. One might, however, argue that they directly affect management, e.g., when a rating downgrade is discussed. In this context, intermediaries also play an important role as facilitators of market discipline, since they summarize information in a standardized form and make it available to the public.

Only if these two criteria are fulfilled market discipline will work. Market discipline will then manifest in either a reduction in the willingness to pay (price effect) or in a reduction in demand for insurance from a particular provider (quantity effect). Influencing (lower part of Figure 1) can manifest either directly by managers shifting their risk exposure or indirectly by the regulators acting on the signal.[15]

4. Conclusions and future research

Market discipline focuses on the risk sensitivity of customer demand for insurance products and on investor willingness to pay for equity and debt. It can be defined as *monitoring* and *influencing* conducted by *customers*, *investors*, and *intermediaries*. The insurance sector is unique in its widespread use of intermediaries (which enhances the monitoring element) and in its legal form and financing (which hampers the influencing component, e.g., rarely traded equity and debt). Furthermore, there is a limited risk of a bank run, which is one of the main elements in banking market discipline, and the absence of such a serious disciplinary measure makes effective market discipline more difficult in the insurance sector. There are, however, other aspects that facilitate market discipline, at least in selected lines of business, such as higher buyer sophistication in reinsurance (see Harrington, 2005).

Evidence from the banking sector shows that market discipline can work very efficiently. However, the banking sector is fundamentally different from the insurance sector, so findings and lessons from banking may not be generalizable to the insurance industry. The few studies available from insurance are not sufficient to provide an in-depth impact assessment, but they do indicate that market discipline appears to vary in terms of strength between the German insurance market (Eling and Schmit, 2009) and the U.S. market (Epermanis and Harrington, 2006). Furthermore, there are important drivers of (standardization and accessibility) and impediments (market distortions such as guarantee funds) to market discipline that regulators should keep in mind when attempting to enhance market discipline.

Of special relevance in this context are differences between lines of business and legal forms. With regard to insurance lines, market discipline is affected by the level of guarantee fund protection, compulsory insurance schemes and judgment-proof buyers, and product and business complexity, as well as by the type of customers (personal versus commercial). Differences in legal form (stocks versus mutual insurers) mean that market discipline might be an appropriate approach in some areas, but that regulatory efforts will work better in others. In par-

[15] Note that the price and quantity effect focuses on customer market discipline, which is the main source of market discipline in insurance. It might, however, also be applied to investors with reduced willingness to pay for a stock.

ticular, formal regulation is likely more appropriate in the presence of informational limitations. Market discipline will be more effective when information is generally available.

If market participants (a) are not aware of risk and (b) not able to evaluate risk at reasonable costs, there will be no market discipline. Many countries use guarantee schemes in selected lines of business. Either the reduction of coverage amount or the charge of risk-adequate premiums (riskier undertakings should pay more) are instruments to increase risk sensitivity and thus to enhance market discipline. A second instrument to enhance market discipline could be a standardized information platform, perhaps to be posted on regulator webpage. Another important aspect is to carefully consider the unique characteristics of the insurance industry when designing market discipline; for example, how banking and insurance differ, the impact on market discipline in different lines of insurance, and how the costs intrinsic to the reporting process will impact insurers of different size.[16]

There are many avenues future research can take. There is a great need for empirical tests of the risk sensitivity of policyholder demand, especially for countries other than the United States.[17] Regarding potential investor-driven market discipline, it might, e.g., be interesting to analyze spreads of credit default swaps, data that are available at least for large insurers and reinsurers. For large insurers and reinsurers listed on stock markets, analyzing stock prices might be useful. It might also be interesting to see how risk sensitivity varies across countries by comparing data from different regions and countries, and across different legal forms by comparing mutual and stock insurer data. Such empirical tests might then be compared with results from other insurance and banking studies. Another interesting task would be to measure the influence of market discipline in insurance with the methodology used by Bliss and Flannery (2002). We also need more theoretical studies on market discipline in insurance, e.g., models that analyze the implications of market discipline on competition in the insurance sector or models on the role of franchise value in insurance and how this is affected by risk. These theoretical models could then be tested with empirical data to increase our knowledge of market discipline in the insurance industry.

[16] Note that the aim of this section is not to propose certain types of regulatory activities, but to outline the potential measures regulators could take to enhance market discipline.

[17] Experimental evidence such as Wakker/Thaler/Tversky (1997) or Zimmer/Gründl/Schade (2009) is helpful in understanding that in a transparent environment with no informational problems customer market discipline might work. Harrington (2005) argues that market discipline should be even stronger in insurance than in banking, especially in reinsurance where no guarantee funds are available and buyer sophistication is higher. However, empirical evidence is limited in insurance.

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Appendix: 56 studies on market discipline in banking and insurance (selection of collected information, more information is available upon request)*

#	Authors	Title	Industry	Country	Message		Main results
1	Beighley, Boyd and Jacobs (1975), Journal of Bank Research	Bank Equities and Investor Risk Perceptions: Some Entailments to Capital Adequacy Regulation	Banking	US	evidence for market discipline	… in stock prices	Share prices of bank stocks are estimated as a function of capital ratios, earnings and growth of earnings, asset size, and loss rates; banks with higher capital ratios and lower loss rates tend to have higher share prices.
2	Crane (1976), Journal of Bank Research	A Study of Interest Rate Spreads in the 1974 CD Market	Banking	US	evidence for market discipline is weak	… in uninsured deposits	The determinants of CD rates are evaluated using factor analysis; a factor that reflects profit rates and capital ratios is not a significant variable in explaining CD rates.
3	Pettway (1976), Journal of Finance	Market Tests of Capital Adequacy of Large Commercial Banks	Banking	US	evidence for market discipline is weak	... in subordinated notes and debentures	The rate premium is estimated as a function of the capital ratio of banks and other variables; the coefficient on the capital ratio is not significant.
4	Beighley (1977), Journal of Bank Research	Bank Equities and Investor Risk Perceptions: Some Entailments to Capital Adequacy Regulation	Banking	US	evidence for market discipline	... in subordinated notes and debentures	The rate premium is estimated as a function of several measures of risk including a less ratio and a leverage ratio; the coefficients on the loss and leverage ratios are positive and significant.
5	Fraser and McCormack (1978), Journal of Financial and Quantitative Analysis	Large Bank Failures and Investor Risk Perceptions: Evidence from the Debt Market	Banking	US	evidence for market discipline is weak	... in subordinated notes and debentures	The rate premium is estimated as a function of the capital ratio and the variability of profits divided by total assets; none of the independent variable has a significant coefficient.
6	Pettway (1980), Journal of Financial and Quantitative Analysis	Potential Insolvency, Market Efficiency, and the Bank Regulation of Large Commercial Banks	Banking	US	evidence for market discipline	… in stock prices	Considering several large banks that failed returns to shareholders are simulated for several years prior to their failure. Returns on the stocks of banks that failed decline relative to simulated returns two years before failure.
7	Brewer and Lee (1986), Federal Reserve Bank of Chicago Economic Perspectives	How the Market Judges Bank Risk	Banking	US	evidence for market discipline	… in stock prices	Betas are estimated as functions of accounting ratios; some of the measures chosen to reflect risk have positive, significant regression coefficients.
8	Cornell and Shapiro (1986), Journal of Banking and Finance	The Reaction of Bank Stock Prices to the International Debt Crisis	Banking	US	evidence for market discipline	… in stock prices	The percentage that Latin American loans was of total assets had a significant, negative impact on returns in 1982 Energy loans had a negative impact in 1982-83. Loans purchased from Penn Square Bank had a negative impact on returns in the month in which that bank failed.
9	Shome, Smith and Heggestad (1986), Journal of Financial Research	Capital Adequacy and the Valuation of Large Commercial Banking Organization	Banking	US	evidence for market discipline	… in stock prices	Stock prices are estimated as functions of earnings and capital ratios; the coefficient on the capital ratio is positive and significant for some years, insignificant for other years.
10	Baer and Brewer (1986), Economic Perspectives	Uninsured deposits as a source of market discipline: Some new evidence	Banking	US	evidence for market discipline	… in stock prices (weak evidence in uninsured deposits)	Coefficients on risk measures used by bank supervisors are not significant. Measures of the level and variability of stock prices help explain CD rates; Even when banks are solvent, the deposit market does charge riskier banks more for fund; Evidence suggests that proposals to restrict bank reliance on uninsured, purchased deposits are not costless. While such proposals might reduce the likelihood of bank runs, they would at the same time reduce banks' incentives to control risk.
11	Smirlock and Kaufold (1987), Journal of Business	Bank Foreign Lending, Mandatory Disclosure Rules, and the Reaction of Bank Stock Prices to the Mexican Debt Crisis	Banking	US	evidence for market discipline	… in stock prices	The coefficient on the ratio of Mexican debt to equity capital is negative and significant, Banks were not required to disclose their Mexican debt at the time of the 1982 moratorium.
12	Hannan and Hanweck (1988), Journal of Money, Credit and Banking	Bank Insolvency Risk and the Market for Large Certificates of Deposit	Banking	US	evidence for market discipline	… in uninsured deposits	These three variables have significant coefficients CD rates tend to be hiqher at banks with more variable income and lower capital ratios, holding constant the influence of total assets.
13	Avery, Belton, and Goldberg (1988), Journal of Money, Credit and Banking	Market discipline in regulating bank risk: New evidence from the capital markets	Banking	US	evidence for market discipline is weak	... in subordinated notes and debentures	SND risk premiums are weakly related to Moody's and Standard and Poor's ratings, but uncorrelated with the FDIC Index and any balance-sheet variables. Moreover, the FDIC Index of bank riskiness is found to be negatively related to the public bond ratings. Findings suggest that in the current environment, the impact of the cost of SNDs on banks´ risk-taking behavior is unlikely to coincide with the directions desired by bank regulators.
14	Cargill (1989), Journal of Financial Services Research	CAMEL Ratings and the CD Market	Banking	US	evidence for market discipline	… in stock prices	The change in the market value of loans to less-developed countries has a positive, significant coefficient which is not significantly different from unity.
15	Randall (1989), New England Economic Review	Can the Market Evaluate Asset Quality Exposure in Banks?	Banking	US	evidence for market discipline is weak	… in stock prices	Stock prices of the BHCs that reported relatively large losses declined relative to market average stock prices only after the problems became public knowledge, not during the periods which the banks began assuming relatively high risk.
16	Gorton and Santomero(1990), Journal of Money, Credit and Banking	Market discipline and bank subordinated debt: Note	Banking	US	evidence for market discipline is weak	... in subordinated notes and debentures	Virtually no relation between a bank's risk measures and its implied asset volatility; results offer little support for the presence of market discipline in the subordinated debt market.
17	Ellis and Flannery (1992), Journal of Monetary Economics	Does the debt market assess large banks' risk? Time series evidence from money center CDS	Banking	US	evidence for market discipline	… in CD (certificate of deposit) rates	CD rates paid by large money center banks include significant default risk premia.
18	Hassan, Karels, and Peterson (1994), Journal of Banking and Finance	Deposit insurance, market discipline and off-balance sheet banking risk of large US commercial banking	Banking	US	evidence for market discipline	… in off-balance sheet activities	The authors examine the riskiness of off-balance sheet activities by employing option-pricing models to calculate bank asset risk.
19	Koppenhaver and Stover (1994), Journal of Banking and Finance	Standby letters of credit and bank capital: Evidence of market discipline	Banking	US	evidence for market discipline	… in off-balance sheet contingent liability	The model assumes uninsured claimant reactions to standby letters of credit and capital decisions and shows that market discipline causes these decisions to be made simultaneously; As the ratio of uninsured funds relative to total assets increases the presence of effective market discipline is likely to lead to stronger relationship between bank capital & SLC; This relationship is most likely for banks that are most active in this market or for those that are most subject to the discipline of the purchased funds market.

20	Fenn and Cole (1994), Journal of Financial Economics	Announcements of asset-quality problems and contagion effects in the life insurance industry	Insurance	US	evidence for market discipline	… in stock prices	The authors investigate contagion effects in the stock returns of life insurance companies at the time of announcements by First Executive and Travelers of significant problems in their investment portfolios; Evidence shows that effects on shareholder wealth are larger for companies with significant junk bond/commercial mortgage assets and readily mobile customers as represented by guaranteed investment contracts (GICs).
21	Park (1995), Quarterly Review of Economics and Finance	Market discipline by depositors: evidence from reduced-form equations	Banking	US	evidence for market discipline	… large time deposits	Riskier banks offered higher interest on large time deposits but attracted less such depositors; large time depositors forced risky banks to pay risk premiums and these premiums were not significantly affected by the TBTF policy.
22	Flannery and Sorescu (1996), Journal of Finance	Evidence of bank market discipline in subordinated debenture yields: 1983-1991	Banking	US	reduction of safety nets increases market discipline	… in subordinated debt yields	SND yields become more closely correlated with indicators of bank risk as regulatory treatment of failed banks' debentures became more harsh; Investors have rationally reflected changes in the government's policy toward absorbing private losses in the event of a bank failure.
23	Sommer (1996), Journal of Risk and Insurance	The Impact of Firm Risk on Property-Liability Insurance Prices	Insurance	US	evidence for market discipline	… in price of insurance	Negative relationship between product price and risk.
24	Cummins and Danzon (1997), Journal of Financial Intermediation	Price, Financial Quality, and Capital Flows in Insurance Markets	Insurance	US	evidence for market discipline	… in price of insurance	Negative relationship between product price and risk.
25	Lee, Mayers, and Smith (1997), Journal of Financial Economics	Guaranty funds and risk-taking Evidence from the insurance industry	Insurance	US	safety nets reduce market discipline	… impact of guarantee funds	Evidence suggests that the risk of insurers assets portfolio increases after the enactment of state guaranty funds; this effect is significant only for stock insurers.
26	Brewer, Mondschean, and Strahan (1997), Journal of Risk and Insurance	The Role of Monitoring in Reducing the Moral Hazard Problem Associated with Government Guarantees: Evidence from the Life Insurance Industry	Insurance	US	safety nets reduce market discipline	… impact of guarantee funds	Risk taking by life insurers is higher in states with guaranty funds that are underwritten by taxpayers. In states where taxpayers pay for the costs of resolving insolvencies, life insurers hold portfolios with higher overall stock market risk and higher levels of risky assets. By contrast, in states where the guaranty funds are underwritten by the industry, overall risk is no higher than in states without these funds.
27	Billett, Garfinkel, and O'Neal (1998), Journal of Financial Economics	The cost of market versus regulatory discipline in banking	Banking	US	safety nets reduce market discipline	... insured deposit are significant impediments to market discipline	Evidence that insured deposit financing shields banks from the full costs of market discipline; Moody´s downgrades (indicators of increasing risk) are associated with negative abnormal equity returns that are increasing in the bank´s reliance on insured deposits; banks raise their use of insured deposits following increases in risk; Findings highlight the potential for regulation to undermine market discipline in regulated industries.
28	Phillips, Cummins, and Allen (1998), Journal of Risk and Insurance	Financial Pricing of Insurance in the Multiple-Line Insurance Company	Insurance	US	evidence for market discipline	… in price of insurance	Negative relationship between product price and risk.
29	Mondschean and Opiela (1999), Journal of Financial Services Research	Bank time deposit rates and market discipline in Poland: the impact of state ownership and deposit incurance reform	Banking	Poland	evidence for market discipline	… in partial deposit insurance	Establishment of explicit deposit insurance lowers incentive for monitoring; factors encouraging MD even with deposit insurance (full coverage up to a threshold, partial coverage up to a 2nd threshold, no coverage thereafter); insurance coverage per depositor per bank forces to spread (concentration) risk; in pre-insurance period a price for risk was exacted; MD is weak with fully guaranteed banks; business-deposit ratio appears to serve relatively well as proxy for greater monitoring as exceeding insurance limit; even though in the post-insurance period state-owned banks pay lower deposit rates than private ones due to be viewd having more implicit coverage.
30	Downs and Sommer (1999), Journal of Risk and Insurance	Monitoring, Ownership, and Risk-Taking: The Impact of Guaranty Funds	Insurance	US	safety nets reduce market discipline	… impact of guarantee funds	Empirical results provide support for the risk-subsidy hypothesis and demonstrate the essential link between insider ownership and risk-taking.
31	Martinez Peria and Schmukler (2001), Journal of Finance	Do depositors punish banks for bad behavior? Market discipline, deposit insurance, and	Banking	cross-country (Argentina, Chile, and Mexico)	safety nets do not reduce market discipline	... deposit insurance and the impact of banking crises on market discipline	Depositors discipline banks by withdrawing deposits and by requiring higher interest rates; deposit insurance does not appear to diminish the extent of market discipline; investors' responsiveness to bank risk => there is interaction between market discipline and deposit insurance and an impact of banking crises on market discipline.
32	Morgan and Stiroh (2001), Journal of Financial Services Research	Market discipline of banks: The asset test	Banking	US	evidence for market discipline	… in bond spreads	Bond spreads reflect the asset mix; credit card and commercial and industrial lending also carry a penalty in terms of higher spreads; Banks contemplating a shift into riskier activities, e.g., in trading, can expect to pay higher spreads
33	Jagtiani and Lemieux (2001), Journal of Economics and Business	Market discipline prior to bank failure	Banking	US	evidence for market discipline	… in BHC bonds during period prior to failure	Bond spreads start rising (up to 100 %) as early as 6 quarters prior to failure as financial condition and credit rating deteriorates; increase MD by increasing subordinated debt would be effective at the BHC level; increase accurate market disclosure in timely fashion will effectively enhance MD; regulators' BOPEC ratings capture bank specific characteristics more completely than ratings assigned by rating agencies
34	Bliss and Flannery (2002), Review of Finance	Market discipline in the governance of US bank holding companies: Monitoring vs. Influencing	Banking	US	evidence for market discipline is weak	… here focus on influence (market influence is weak)	Influence regression using equity returns and expected managerial behavior
35	Sironi (2002), Journal of Banking and Finance	Strengthening banks' market discipline and leveling the playing field: Are the two compatible	Banking	cross country (US & Europe)	evidence for market discipline	... in subordinated debt	Spread/rating-relationship is same for US & European banks; US banks tend to pay higher average spread because of poorer rating; controlling on default risk US banks pay lower average spread than corresponding European rating ones; spreads rise when ratings worsen; strengthening MD does not contrast the level-playing-field with exception of European public sector banks
36	Brewer and Jackson (2002), Federal Reserve Bank of Chicago	Inter-Industry Contagion and the Competitive Effects of Financial Distress Announcements: Evidence from Commercial Banks and Insurance Companies	Insurance	US	evidence for market discipline	… in stock prices	Insurers with risky assets experience larger stock price declines than those with less risky assets during downturns in the real estate and bond markets
37	Zanjani (2002), Federal Reserve Bank of New York	Market Discipline and Government Guarantees in Life Insurance	Insurance	US	evidence for market discipline	… lapse	Uses A.M. Best ratings as his measure of financial risk to study its relationship with life insurer lapse rates; finds some evidence of market discipline, with a positive relationship between risk (i.e., ratings) and lapse
38	Sironi (2003), Journal of Money, Credit and Banking	Testing for market discipline in the European banking industry: Evidence from subordinated debt issues	Banking	Europe	evidence for market discipline	... in European subordinated notes and debentures	Results support the hypothesis that SND investors are sensitive to bank risk, with the exception of SND issued by public sector banks, i.e., government owned or guaranteed institution; sensitivity of SND spreads to measures of stand-alone risk has been increasing from the first to the second part of the 1990s
39	Park and Peristiani (1998), Journal of Money, Credit and Banking	Market Discipline by Thrift Depositors	Banking	US	evidence for market discipline	… debt and deposit (in thrift institutions)	Empirical findings support the presence of market discipline; effects of depository institutions' risk on the pricing and growth of uninsured deposits; Riskier thrifts are found to pay higher interest rates and attract smaller amounts of uninsured deposits. We also find that qualitative results are similar for fully insured deposits, although statistical significance is substantially lower.

40	Demirgüç-Kunt and Huizinga (2004), Journal of Monetary Economics	Market discipline and deposit insurance	Banking	cross-country	safety nets reduce market discipline	... deposit insurance limits market discip-line	Explicit deposit insurance reduces required deposit interest rates, while at the same time it lowers market discipline on bank risk taking
41	Goyal (2005), Journal of Financial Intermediation	Market discipline of bank risk: Evidence from subordinated debt contracts	Banking	US	evidence for market discipline	… in subordinated debt with restrictive covenants	Market discipline through writing restrictive covenants (on investments, payment of dividends, financing) in bank debt contracts; deregulation leads to higher risk-taking so private incentives to monitor bank's risk taking are stronger.
42	Liu, Epermanis, and Cox (2005), Working Paper	Agency Conflicts and Market Discipline: Evidence from Guaranteed Investment Contracts	Insurance	US	evidence for market discipline	… in guaranteed investment contracts	Study the influence of guaranteed investment contracts (GICs) as a disciplinary mechanism for bondholders and find some market discipline influences. The agency conflict risk-shifting behavior has, however, a much stronger influence.
43	Nier and Baumann (2006), Journal of Financial Intermedia-tion	Market discipline, disclosure and moral hazard in banking	Banking	cross-country	safety nets reduce market discipline	... government safety nets reduce market discipline	Government safety nets result in lower capital buffers and stronger market discipline resulting from uninsured liabilities and disclosure results in larger capital buffers, all else equal. results point to the effectiveness of market discipline mechanisms in general, we also find that the effect of disclosure and uninsured funding is reduced when banks enjoy a high degree of govern-ment support; results finally suggest that while competition leads to greater risk taking incentives, market discipline is more effective in curbing these incentives in countries where competition among banks is strong.
44	Distinguin, Rous, and Tarazi (2006), Journal of Financial Services Research	Market discipline and the use of stock market data to predict bank financial distress	Banking	Europe	evidence for market discipline	… in stock prices	Logit early warning model, designed for European banks, which tests if market based indicators add predictive value to models relying on accounting data. link between market information and financial downgrading in the light of the safety net and asymme-tric information hypotheses.
45	Epermanis and Harrington (2006), Journal of Money, Credit and Banking	Market Discipline in Property/Casualty Insurance: Evidence from Premium Growth	Insurance	US	evidence for market discipline	… in premium growth	Consider insurer ratings in a property/casualty context and observe significant premium declines following rating downgrades, particularly for firms that had low ratings even before the downgrade.
46	Imai (2006), Journal of Banking and Finance	Market discipline and deposit insurance reform in Japan	Banking	Japan	evidence for market discipline	… deposit insurance reform on partly insured time depo-sits	Reform raised sensitivity of deposit rates and growth to bank default risk; interest rate difference between partially insured time-deposits and fully insured deposits increased for risky banks; reform had positive effects on MD by reducing supply of time deposits of risky banks; BUT: TBTF-policy exerts more influence on pricing of deposits after the reform.
47	Park and Peristiani (2007), Journal of Banking and Finance	Are bank shareholders enemies of regulators or a potential source of market discipline?	Banking	US	evidence for market discipline	… in stock prices	Shareholders' risk-taking incentives were confined to a small fraction of highly risky institutions; even though shareholders have incentives to transfer wealth by pursuing riskier strategies, this risk taking is mostly outweigh trough the possibility of losing charter value; more rigorous regulation and supervision encourages banks to protect charter value and reduces incentives of moral hazard; regulators can count on bank shareholders as a source of MD to a large extent; risk turning point is high even during the turbulent period; for publicly held BHCs the interests of shareholders and regulators are aligned except for a small subset of extremely risky ones.
48	Spiegel and Yamori (2007), Journal of Banking and Finance	Market price accounting and depositor discipline: The case of Japanese regional banks	Banking	Japan	evidence for market discipline	… in deposit levels (evidence for depositors discipline)	Banks pricing to market had more intense depositors discipline; depositors in price-to-market-sample are more sensitive to bank financial condition.
49	Baranoff and Sager (2007), Working Paper	Market Discipline in Life Insurance: Insureds' Reaction to Rating Downgrades in the Context of Enterprise Risks	Insurance	US	evidence for market discipline	… in premium growth (number of policies), life insur-ance	Observe reduced demand for life insurance products (measured by the number of policies written) when ratings decline.
50	Ashcraft (2008), Journal of Financial Intermediation	Does the market discipline banks? New evidence from regulatory capital mix	Banking	US	evidence for market discipline	… increase in subordinated debt in regulatory capital	FDICIA has significant impact on the influence of debt investors over bank outcomes – has increased market discipline; increase in subordinated debt has important positive effect in helping a bank recover from financial distress; fixed income investors able to exert significant influence on behavior of distressed institution; also bank holding companies.
51	Curry, Fissel, and Hanweck (2008), Journal of Banking and Finance	Equity market information, bank holding company risk, and market discipline	Banking	US	evidence for market discipline	… in stock prices	Market has influence in prediction of changes in bank holding company risk ratings; MD is effective if market factors influence decision making; market improves prediction of ratings; inclusion of market data enhances the overall goodness-of-fit of the models; market variables do not trigger examinations; equity market info adds power in forecasting BOPEC rating -> evidence of market efficiency; enhanced transparency could further improve MD & permits financial markets to better predict banks' risks and influence bank risk taking.
52	Lin, Oppenheimer, and Chen (2008), Risk Management and Insurance Review	Intangible Assets, Going-for-broke and Asset Risk Taking of Property and Liability Insur-ance	Insurance	US	evidence for market discipline	… asset risk and ratings	Intangible assets play an important role in P&L insurers' asset risk taking incentives; negative relationship between insurers' asset risk and intangible assets.
53	Eling and Schmit (2009), Working Paper	Is There Market Discipline in the European Insurance Industry? An Analysis of the German Insurance Market	Insurance	Germany	evidence for market discipline	… in premium growth, lapse	Analyze market discipline in the German insurance market using Epermanis and Harrington's (2006) research design and find premium declines as well as increased lapse rates following rating downgrades.
54	Carow, Heron, Lie, and Neal (2009), Journal of Corporate Finance	Option grant backdating investigations and capital market discipline	Banking	US	evidence for market discipline	… in banks with option grant patterns related to agency-costs	Capital markets are proactive in disciplining companies for heightened agency problems even if there aren't formal inquiries to that matter; capital markets began to anticipate which firms would have backdating problems and bid their stock prices down during time of more information; capital market participants began to scrutinize the option grant histories of all firms-
55	Uchida and Satake (2009), Journal of International Financial Markets, Institutions and Money	Market discipline and bank efficiency	Banking	Japan	evidence for market discipline	… in banks with more outstanding deposits / more depositors	Banks with more depositors have lower cost inefficiency, which is consistent with the hypothesis that depositors put a substantial pressure on bank management; Being listed at the stock market has a positive impact on cost inefficiency which isn't consistent to the MD hypothesis, which assumes a reduction b/c of market pressure - it might be implied that listed banks can afford to be inefficient-
56	Pop and Pop (2009), Quarterly Review of Economics and Finance	Requiem for market discipline and the specter of TBTF in Japanese banking	Banking	Japan	evidence in market discipline is weak	… in stock prices of too-big-to-fail companies	The TBTF-doctrine exacerbates moral hazard and imposes market discipline; the optimistic view on the functioning and virtues of market discipline in Japanese banking may no longer be valid in the post-Resona period (bailout); embracing the TBTF doctrine public authorities created a hostile environment for effective market discipline; incentives to monitor and influence risk taking behavior are comprised; the usefulness of market information for supervisory purposes appears to be limited-

*: The first 16 of the 56 papers are also summarized in Gilbert (1990), Federal Reserve Bank of St. Louis Economic Review.