Recovery determinants of distressed banks: Regulators, market discipline, or the environment?

Thomas Kick
(Deutsche Bundesbank)

Michael Koetter
(University of Groningen and CIBIF)

Tigran Poghosyan
(International Monetary Fund, Washington D.C.)

Discussion Paper
Series 2: Banking and Financial Studies
No 02/2010

Deutsche Bundesbank, Wilhelm-Epstein-Straße 14, 60431 Frankfurt am Main,
Postfach 10 06 02, 60006 Frankfurt am Main

Tel +49 69 9566-0
Telex within Germany 41227, telex from abroad 414431

Please address all orders in writing to: Deutsche Bundesbank,
Press and Public Relations Division, at the above address or via fax +49 69 9566-3077

Internet http://www.bundesbank.de

ISBN 978-3–86558–612–4 (Printversion)
ISBN 978-3–86558–613–1 (Internetversion)

Abstract

Based on detailed regulatory intervention data among German banks during 1994-2008, we test if supervisory measures affect the likelihood and the timing of bank recovery. Severe regulatory measures increase both the likelihood of recovery and its duration while weak measures are insignificant. Results seem not to be driven by regulators directing measures to particularly bad banks. That is, our results remain intact when we exclude banks that eventually exit the market due to restructuring mergers or moratoria. More transparent publication requirements of public incorporation that indicate more exposure to market discipline are barely or not at all significant. Increasing earnings and cleaning credit portfolios are consistently of importance to increase recovery likelihood, whereas earnings growth accelerates the timing of recovery. Macroeconomic conditions also matter for bank recovery. Hence, concerted micro- and macro-prudential policies are key to facilitate distressed bank recovery.

Key words: bank distress, capital support, regulation, recovery
JEL: G28, C41, G21

Non-technical summary

Between 1994 and 2008, German universal banks received in 473 cases capital support measures from sectoral insurance schemes. We identify the determinants of recovery probabilities, defined as repayment of capital injections, and the duration capital support spells. Our focus is on the effects of regulatory actions and we test two hypotheses pertaining to recovery probabilities and duration, respectively.

We use a split-population duration model to simultaneously estimate the likelihood and the duration until recovery and control for bank-specific and (regional) macroeconomic factors. We also specify different regulatory measures administered to re-capitalized banks, the occurrence of non-scheduled supervisory audits, and an indicator for public limited incorporation as a proxy for market-based governance due to more frequent and detailed publication requirements associated with these incorporation choices.

The results support the "regulatory insider hypothesis". Severe measures (e.g. the prohibition to distribute profits) based on the regulator's inside knowledge about the true state of the bank due to, for example, on- and off-site monitoring and compulsory reporting by banks, increase the likelihood of recovery. The duration of capital support spells, in turn, is increased by severe measures. Unscheduled audits have the same effect while leaving recovery probabilities unaffected. This supports the so-called "sustainability hypothesis", which conjectures that regulators prefer diligent and sustainable restructuring efforts over fast but potentially short-sighted repayment of capital support schemes. For both hypotheses we assume that the regulator's objective function is different from the goals defined by the bank management.

Results seem not to be driven by regulators directing measures to particularly bad banks. With the benefit of hindsight we identify the most troubled banks as those that were forced to either merge with another bank or to exit due to a moratoria. We control for these most severely troubled banks by means of sub-sample selection and indicator variables, none of which altering the main results. Weak regulatory measures, such as official warning letters by banking supervision, have no statistically significant effect on either recovery odds or duration. Potentially, such measures are effective for banks exhibiting less severe levels of distress, i.e. did not require capital support.

Only for the unrestricted sample over the entire time span, we find statistically weak evidence that public incorporation influences banks' recovery probabilities positively. But when controlling for severely troubled banks and certain years this effect can no longer be detected. This could reflect the relatively limited role of capital markets for corporate governance purposes in Germany's bank-based system relative to market-based systems such as for example the U.S. Finally, (regional) macro-conditions affect recovery aspects, too, suggesting that prudential supervision policies require both micro and macro consideration.

Nichttechnische Zusammenfassung

Zwischen 1994 und 2008 haben deutsche Universalbanken in 473 Fällen kapitalerhaltende Maßnahmen durch ihre jeweiligen Einlagensicherungssysteme erhalten. Wir identifizieren die Bestimmungsfaktoren sowohl von der Gesundungswahrscheinlichkeit eines Instituts (definiert als Wahrscheinlichkeit der Rückzahlung der Rekapitalisierung), als auch die Determinanten der Dauer des Gesundungsprozesses. Der Fokus der Analyse ist dabei auf die Wirkung regulatorischer Maßnahmen gerichtet, wobei wir zwei Hypothesen zur Gesundung eines in Schieflage geratenen Instituts überprüfen.

Als Schätzverfahren wird ein sog. “Split-population duration” Modell herangezogen, welches die Gesundungswahrscheinlichkeit und -dauer einer Bank simultan bestimmt und gleichzeitig um bankspezifische und (regionale) makroökonomische Faktoren kontrolliert. Darüber hinaus überprüfen wir verschiedene regulatorische Maßnahmen, welche gegenüber rekapitalisierten Instituten getroffen wurden, sowie die Durchführung ungeplanter Sonderprüfungen nach § 44 KWG. Außerdem spezifizieren wir eine Indikator-Variable für die in Form einer Aktiengesellschaft geführten Banken, welche wir als Proxy für Marktdisziplin aufgrund strengerer Publikationsvorschriften interpretieren.

Die Ergebnisse stützen die “Regulatory insider”-Hypothese, nach der harte Maßnahmen (wie bspw. eine Gewinnausschüttungsbeschränkung) die Gesundungswahrscheinlichkeit erhöhen. Die Maßnahmen basieren dabei auf Insiderwissen des Regulators zum tatsächlichen Zustand einer Bank, welches bspw. aufgrund von bankenaufsichtlichen Prüfungen sowie obligatorischen Meldungen durch die Institute selbst verfügbar ist. Gleichzeitig wird durch eine harte Maßnahme die Dauer der Rekapitalisierung erhöht. Den gleichen Effekt haben unangekündigte Sonderprüfungen, allerdings ohne dabei die Gesundungswahrscheinlichkeit signifikant zu beeinflussen. Dieses Ergebnis stützt wiederum die “Sustainability”-Hypothese, welche davon ausgeht, dass Bankenaufseher eine ordentliche und nachhaltige Restrukturierung gegenüber einer schnellen, aber möglicherweise kurzsichtigen Rückzahlung der Kapitalhilfen präferieren. Für beide Hypothesen nehmen wir an, dass sich die Zielfunktion des Regulators von der des Bankmanagements unterscheidet.

Die Ergebnisse scheinen nicht dadurch getrieben zu sein, dass Bankenaufseher Maßnahmen vorwiegend auf schlechte Institute konzentrieren. Mittels bankenaufsichtlicher Informationen können wir die schlechtesten Banken als solche identifizieren, d. h. wir kontrollieren (durch Bildung von Subsamples sowie durch Indikatorvariablen) um Institute, die letztendlich den Markt aufgrund einer Sanierungsfusion oder eines Moratoriums verlassen müssen. Keine der beiden Robustheitsprüfungen verändert dabei unsere Hauptergebnisse. Schwache regulatorische Maßnahmen, wie bspw. offizielle Warnschreiben durch die Bankenaufsicht, haben weder auf die Gesundungswahrscheinlichkeit, noch auf die Gesundungsdauer einen statistisch signifikanten Einfluss. Möglicherweise wirken solche Maßnahmen auf In-

stitute, die sich weitaus weniger stark in Schieflage befinden, d. h. Institute, die (noch) keine kapitalerhaltenden Maßnahmen benötigen. Aufgabe der Bankenaufsicht sollte es damit sein, durch kapitalerhaltende Maßnahmen gestützte Institute ("begleitend") mit hinreichend starken regulatorischen Maßnahmen zu belegen, um hierdurch deren Gesundungswahrscheinlichkeit zu erhöhen.

Im Hinblick auf die Theorie, dass Banken, die in Form einer Aktiengesellschaft geführt werden (und damit einer strengeren Kontrolle durch den Markt unterliegen) eine höhere Gesundungswahrscheinlichkeit aufweisen, lässt sich nur schwache statistische Evidenz finden. In Robustheitsprüfungen mit unterschiedlichen Zeiträumen oder wenn für sehr schlechte Institute kontrolliert wird, kann dieser Effekt nicht länger nachgewiesen werden. Grund hierfür könnte im bankbasierten deutschen Finanzsystem die relativ eingeschränkte Bedeutung von Kapitalmärkten für Corporate Governance sein - im Gegensatz zu einem marktbasierten System, wie es bspw. in den USA vorherrscht. Schließlich beeinflussen auch (regionale) makroökonomische Faktoren die Gesundung von Banken, was darauf hindeutet, dass Bankenaufsicht sowohl eine mikro- als auch eine makroökonomische Betrachtung erfordert.

Contents

1. Introduction

The International Monetary Fund (IMF) estimates that aggregate write-downs due to the financial crisis borne by banks could reach the staggering amount of $2.6 trillion by 2010 (IMF, 2009b). The deterioration of asset prices paired with only slowly ceasing grid lock in money markets implies liquidity shortages, and ultimately insolvency threats, for many banks in the global financial system. Deleveraging stressed banks requires according to the IMF, among other things, to swiftly re-capitalize stressed banks. Hoshi and Kashyap (2008) add as a lesson from the Japanese banking crisis in the 1990s that re-capitalization also has to be large enough to be effective and the IMF estimates that around $375 billions of capital injections are required for euro area banks to ensure gross equity ratios of 4%. [1] At the same time, an active role for the supervisor in terms of assessing the viability of impaired institutions as well as imposing corrective actions is advocated as one of the key elements of a global bank stress resolution strategy.

In light of these recommendations, we ask in this paper whether active supervisory intervention affects the repayment (or recovery) from such capital support schemes. Numerous studies analyze recovery determinants of non-financial firms. Acharya et al. (2007) emphasize that industry-wide distress reduces recovered present values of failed firms. This is particularly relevant for the banking industry where systemic distress is more likely due to higher interdependency of financial institutions, for instance through interbank exposures (Upper and Worms, 2004; Liedorp and van Lelyveld, 2006). The lack of evidence on the determinants of bank recovery in general and the role of supervisory measures in particular is therefore surprising. While the determinants of bank distress are well understood

[1] Additionally, capital injection estimates to support UK and other European banks amount to $125 billion and $100 billion, respectively.

(see, for example, Lane et al., 1986; Cole and Gunther, 1995; Estrella et al., 2000; DeYoung, 2003), only Dahl and Spivey (1995) analyze determinants of bank recovery and its duration albeit without assessing the role of supervisory interventions. The present paper seeks to fill this gap. We investigate to what extent severe regulatory measures that restrict the scope of the managerial choices of banks having received capital assistance and unscheduled supervisory audits influence recovery from distress. We test simultaneously whether regulatory covenants increase the likelihood of repaying capital injections and if the duration of repayment is reduced once regulators impose certain restrictions on the banking firm.

In Europe, banking supervision is nationally fragmented (IMF, 2009a). One approach is to provide distressed banks with capital support so as to permit independent recovery and to avoid disruptions of confidence in the financial system that may follow from outright closure of banks (Garcia and Nieto, 2005). [2] To the extent that we estimate the likelihood and the duration of repaying such capital support measures, our paper relates to literature that analyzes different modes of dealing with insolvent non-financial firms: re-organization (Chapter 11) or liquidation (Chapter 7). Bris et al. (2006) finds that the cost of failure resolution by means of the former are on average smaller. [3] But Kalaya et al. (2007) also report that the benefits of re-organization accrue primarily to distressed firms rather than acquiring firms, competitors, or the public. This might be different in banking, where the social cost of bank failures due to negative externalities, possible spill-overs to other industries, and risks of contagion are presumably larger compared to non-financial

[2] See Nieto and Wall (2006) for the (lacking) use of prompt corrective action in Europe and Koetter et al. (2007) on the use of restructuring mergers to resolve distress in Germany.
[3] The effects of Chapter 11 on ultimate failure rates are debated in the finance literature, see e.g. Bandopadhyaya (1994) for evidence on increasing failure rates, Bandopadhyaya and Jaggia (2001) on determinants of repetitive Chapter 11 filings, or Dahiya et al. (2003) reporting faster recovery of Chapter 11 firms with access to debtor-in-possession finance.

firms (Dell'Ariccia et al., 2005). [4]

Partly because of the importance of highly leveraged financial institutions for the real economy, banks are heavily regulated and closely supervised in industrialized economies. On- and off-site monitoring of banks by supervisors generates information both for micro (Flannery and Houston, 1999; Berger et al., 2000) and macro prudential policy purposes (Peek et al., 1999). Such additional information generation compared to financial markets and other stakeholders that monitor the bank (e.g. depositors) may enable independent supervisors to neutralize inevitable moral hazard problems inherent to the provision of additional equity capital to distressed banks (see Kane, 1989; Cobos, 1989). Insider knowledge could allow supervisors to identify more precisely banks with large recovery potential and/or systemic relevance and to impose adequate constraints on the management to align behavior with shareholder and depositor interests, i.e avoid excessive risk-taking. We coin this the "regulatory insider" hypothesis and test if additional audits and regulatory covenants levied upon banks that receive capital injections increase the likelihood of recovery.

Alternatively, the policy of (conditionally) injecting capital resembles the forbearance practice pursued in the U.S. during the S&L crisis of the 1980s. [5] Numerous empirical studies document the lacking success of this strategy (see, for example, DeGennaro et al., 1993; DeGennaro and Thomson, 1996; Brinkmann et al.,

[4] See also Bongini et al. (2001) for evidence on well-connected South East Asian financial institutions that enjoyed forbearance benefits prior to the Asian crisis. However, close ties with industry groups or important families eventually increased the likelihood of distress during the Asian crisis by stern regulators.

[5] Cobos (1989) defines forbearance as "... any program or set of procedures whereby supervisory restraint is exercised toward an insured depository institution that fails to meet established safety-and-soundness criteria." He indicates that forbearance is a "deliberate and intentional" policy. When applied appropriately, it can reduce failures and limit losses to the insurance fund. Capital forbearance took many forms during the 1980s, ranging from lax enforcement of existing safety-and-soundness rules to capital augmentation.

1996; Guo, 1999; Gupta and Misra, 1999). Two key impediments to smooth "self-healing" forwarded by Kane (1989, 1990) are perverted incentives to bank managers and capture of regulators. First, a flat rate deposit insurance scheme induces excessive risk taking of bank managers because of no risk-adjusted pricing of the insurance. Second, numerous academics emphasized the interest of federal regulators to camouflage the true state of thrifts and banks so as to ensure their own reputation and career prospects (see next to Kane also McKenzie et al., 1994; Cole, 1993). Instead, already Benston et al. (1986) advocated prompt corrective actions (PCA) to avoid the participation of weak institutions for too long in the financial system (see also Benston, 1994; Kaufman, 1995; DeYoung, 2007).[6] In essence, PCA requires regulators to swiftly liquidate a troubled bank or merge it with a healthy institute. One of the main insights from the US savings and loan crisis was thus to avoid unconditional support of distressed banks and to replace supervisory discretion with rules.[7] From this follows our alternative "regulatory capture" hypothesis, which implies that the probability of repayment is negatively affected by regulatory actions.

In addition to the likelihood of repayment, we also test the effect of regulatory measures on the duration of capital support. We define recovery as the complete repayment of received capital support, since successfully restructuring the bank should enable it to generate enough (retained) earnings so as to independently reach sufficient capitalization levels. It remains a priori unclear whether the time required to reach sustainable levels of capital is positively or negatively affected

[6] Following the insolvency of the Federal Savings and Loan Insurance Corporation (FSLIC), a variant of such structured early intervention and resolution policies were enacted in the 1991 Federal Deposit Insurance Corporation Improvement Act (FDICIA).

[7] Note that Hoshi and Kashyap (2008) compare contemporaneous US bailout policies with the recent experience of the Japanese banking crisis in the 1990s and report "eerie" similarities of policies starkly at odds with the philosophy of PCA. Likewise, Udell (2009) cautions that current policies resemble some of the mistakes made during the S&L crisis.

by regulatory intervention. On the one hand, intervention may substitute for poor governance due to a lack of a functioning market for corporate control among the mostly non-listed small German universal banks. Active intrusions into the business of the bank, for example restrictions to take deposits or distribute profits, may then facilitate a more efficient choice of production plans, which ultimately should speed up recovery. Alternatively, measures that aim to discipline previous mis-management and induce thorough restructuring of the bank are likely to take a considerable amount of time. Moreover, banks that have received capital injections may be exactly those that are most severely troubled. Therefore, more time might be required until portfolios are set straight and processes are re-designed so as to ensure sustainable banking business. Given this ambiguity regarding the relation between regulatory measures and recovery time, we test empirically these competing "acceleration" and "sustainability" hypotheses. Table (1) summarizes these four hypotheses.

Table 1
Description of hypotheses

Hypotheses	**Impact of supervisory measures on:**	
	Probability of recovery	**Duration of recovery**
Regulatory capture	–	n/a
Regulatory insider	+	n/a
Acceleration	n/a	–
Sustainability	n/a	+

We use a unique dataset on equity injections in which German universal banks received capital injections in 473 cases from banking-sector specific insurance funds during the period 1994 to 2008. [8] We distinguish weak and severe interventions issued by the German Financial Supervision Authority (Bundesanstalt fuer

[8] We describe the institutional framework of bank insurance in Germany below.

Finanzaufsicht, BaFin) and control for unscheduled supervisory audits, too. This information is augmented by financial account and audit report data, all of which has been collected systematically by the German central bank, the Bundesbank.

Our results support the "regulatory insider" and the "sustainability" hypotheses. Severe regulatory measures increase the likelihood of recovery while additional audits have no effect. Both unscheduled audits and severe regulatory measures increase the duration until capital injections are fully repaid. Regulators seem to prefer diligent, but potentially time-consuming restructuring efforts. While possibly effective tool for less severely distressed banks without capital support, weak regulatory measures, such as official warning letters by banking supervision, have no significant impact on repaying injected capital. Results are robust also after accounting for a possible selection bias of very troubled banks, to which regulators direct more (severe) measures or audits. With the benefit of hindsight, we identify most severely troubled institutions as those that were forced to merge with another bank or closed due to a moratorium without changes to our results. Market discipline, approximated by an indicator whether the bank is publicly incorporated [9], and thus subject to more stringent reporting standards, is only weakly related to recovery odds and not at all to recovery duration. This could reflect the limited role of capital markets for corporate governance in Germany. It might also reflect some crowding out of monitoring bank managers by equity and debt holders by a fairly active regulator. Finally, (regional) macroeconomic factors (interest spreads and real income) consistently affect both recovery odds and duration. This suggests that prudential supervision policies have both a macro- and a micro-economic component that should both be considered.

The remainder of the paper is organized as follows. We start by describing the

[9] So-called "Aktiengesellschaft (AG)", "Kommanditgesellschaft auf Aktien (KGaA)", and "Aktiengesellschaft und Co. KG (AG & Co. KG)".

regulatory framework in Germany. Next, we introduce the data on capital injections and recovery timing. We then describe the split-population duration method to disentangle probabilities from duration determinants of recovery and discuss further covariates. Finally, we present and discuss estimation results before concluding with the main findings.

2. Regulatory background of capital measures

The core principles issued by the Basel Committee of Banking Supervision that apply to Europe are largely in line with the PCA requirements: independence of supervisory body from the political and judicial systems, access to a broad range of supervisory measures, provision of supervisors with adequate resolution procedures, and access to accurate and timely financial information on banks' financial condition (Nieto and Wall, 2006). However, the European regulatory environment continues to differ considerably from that of the US in many respects and disclosure of distress among banks as well as resolution procedures are much more opaque. Also, supervisory responsibilities rest with national rather than one pan-European authority (Garcia and Nieto, 2005). Even within countries, multiple institutions often participate in the bailout process, as is also the case for Germany (IMF, 2009a).

In Germany, privately-owned financial institutions are required by law to participate in a legal deposit insurance (DI) scheme. The DI scheme guarantees 90% of each customer's deposits up to a maximum amount of 20,000 Euro. Voluntary DI schemes of banking associations supplement legal DI. [10] Voluntarily DI schemes guarantee substantially larger deposit volumes. Both DI schemes aim to protect

[10] Such as the Deposit Guarantee Fund of the Federal Association of German Banks ("Einlagensicherungsfonds des Bundesverbandes deutscher Banken") or the Federal Association of German Public Banks ("Bundesverbandes oeffentlicher Banken Deutschlands").

private persons and (in particular small) firms. In general, each scheme is based on the insurance principle. Support of distressed banks is financed by contributions from member institutions as well as re-payments from granted capital injections in previous years. Moreover, the fund receives returns from capital investments, and there are administrative expenses to cover.

Exceptions from the legal deposit insurance scheme are government-owned savings banks [11] and credit cooperatives, which are protected by banking sector-specific insurance schemes. The Insurance protection by the Federal Association of Cooperative Banks ("Bundesverband der Deutschen Volksbanken und Raiffreisenbanken, BVR") comprises two elements: (1) deposit insurance and (2) institutional warrants ("Institutssicherung"). Purpose of the deposit insurance is to save member banks (which are currently distressed or threatened to become distressed) by means of capital injections or warrants by the fund. This centralized federal fund is financed by risk-oriented annual contributions by the member banks, repayment of previous capital injections, or returns from capital investments. Second, institutional warrants (by member banks) constitute a further reaching insurance against insolvency in the cooperative banking sector. These warrants are, however, limited to a predefined maximum amount per member bank. Condition for a distressed member bank to make use of institutional warrants is an expected recovery within the next five years.

The protection by the German Savings and Giro Association ("Deutscher Sparkassen und Giroverband, DSGV") is differently financed. The DSGV-system relies on a pre-defined, risk-oriented funds volume that is financed by direct payments into the fund (at least one third) and by the obligation for additional contributions (up to two thirds). Reductions of the fund due to bank rescues imply an obligation

[11] Local, central, and mortgage savings banks ("Sparkassen", "Landesbanken", "Landesbausparkassen").

to immediately restock the fund, resulting in a fairly constant fund size over time. The DSGV-system comprises 11 regional funds to insure regional savings banks and one fund respectively for central savings and mortgage savings banks. In case of the rescue of a savings bank the according regional fund is initially liable but recourse with the other regional as well as both central and mortgage savings bank funds is possible, too. [12]

3. Capital injections and recovery

Table 2 provides descriptive statistics for the recovery and injection data obtained from the Bundesbank. The sample comprises up to 2,165 observations on 473 banks that received at least one capital injection during the 1994 – 2008 period. We define recovery as full repayment of injected capital. [13]

Capital injections are a fairly frequently used instrument to deal with troubled banks, also in non-crisis times. Each year, between 3 and 42 of all active universal banks, which comprise commercial, savings, and cooperative banks, [14] received either cash injections or lines of equity according to annual audit reports compiled by the Bundesbank, which we consider here jointly. [15] From the perspective of re-

[12] Every recourse includes the obligation for additional contributions.

[13] Once a bank recovered, we treat it as a new bank, since it might re-enter distress and receive capital support again (see also Bandopadhyaya and Jaggia, 2001, for evidence on non-financial firms re-entering Chapter 11). Repetitive capital injections took place for 45 banks in our sample. Our estimations suggest that duration of recovery from first capital injection tends to be longer than recovery from subsequent capital injections.

[14] Most banks in our sample are mutually owned cooperatives that, just like savings banks, cannot tap complete financial markets for equity as an alternative source of emergency recapitalization. In fact, even few commercial banks are listed, thus reflecting the relative unimportance of equity markets as source of funding in Germany.

[15] Non-reported results separating commitments and actual injections yield qualitatively identical results. We prefer the definition of full repayment here since it represents the most conservative estimate of the recovery of distressed banks.

Table 2

Capital injections, recovery, and exit 1994-2008

This Table presents descriptive statistics for capital injections, intervention, and exit patterns in German banking between 1994 and 2008. Injections are the number of capital preservation measures taken by banking-sector specific insurance schemes. Strong interventions are the number of active intrusions of the regulator at the going concern of the bank comprising four specific types: (i) Threat of measures pursuant to §36 of the Banking Act, (ii) Prohibition of profit distribution, (iii) Measure pursuant to §46 of the Banking Act, and (iv) Threat of a measure pursuant to §46 of the Banking Act. Weak measures comprise official letters or warnings sent by supervisory authorities. Audits are the number of unscheduled audits according to §44 of the Banking Act. Exit is the frequency of forced closures by means of moratoria by the Federal Agency for Financial Market Supervision (BaFin) or participation in restructuring mergers. Recoveries indicate the number of banks that repaid capital preservation measures in full and Censored shows banks exiting the sample before recovering.

Years	**All banks**	**Injections**	**Interventions**		**Audits**	**Merger &**	**Recoveries**	**Censored**
			Strong	*Weak*		**Moratoria**		
1994	3640	129	0	0	1	4		
1995	3533	40	0	0	0	5	35	7
1996	3422	42	0	0	1	3	22	21
1997	3317	37	2	0	5	13	16	19
1998	3139	27	5	1	22	14	29	11
1999	2895	31	2	9	27	14	13	15
2000	2636	33	1	10	27	19	15	11
2001	2425	36	3	6	0	12	14	11
2002	2261	38	3	4	22	14	15	4
2003	2121	20	2	9	36	16	21	12
2004	2047	14	1	7	9	16	22	10
2005	1973	14	1	7	23	9	29	5
2006	1922	3	0	4	5	1	17	1
2007	1892	6	0	6	11	0	18	3
2008	1846	3	0	0	3	0	27	50
Total		473	20	63	192	140	293	180

ceiving banks, the size of capital injections is substantial, too. Mean capital support measures account for approximately 83% of total gross equity at year end when injections occurred. However, for the industry as a whole capital support measures seem to have been geared especially to small banks since the mean share of equity of supported banks in the total industry does not exceed 2%.

Since our sample is dominated by the years prior to the 2008 banking crisis, recovery estimates obtained here represent an optimistic scenario for repayment behavior since sampled banks did not face further adverse industry effects empha-

sized by Acharya et al. (2007) to reduce recovery odds further. [16]

On average, 62% of all banks that received support eventually settled their scores with respective insurance schemes during the sample period. The mean duration until recovery is 4.6 years. This corroborates earlier conjectures by, for example, BIS (1999) and Hoshi and Kashyap (2008) that turning around distressed banks takes time. Banks that did not repay by the end of 2008 or exited the sample either voluntarily or due to ordered restructuring mergers and closure are censored. By the end of our sample period, 50 banks did not yet repay received capital injections but might still do so. About 30% of banks ultimately exit due to restructuring mergers or closure enforced by the regulator despite capital support (see column Merger & Moratoria). We control for this group of particularly troubled banks because restructuring mergers and closures represent in fact alternative policy tools in line with the PCA philosophy to ensure smooth but swift exit of banks considered too weak to remain in the banking system. Regulatory measures might have a negative (positive) impact on recovery probabilities (duration) if especially very weak banks attract regulatory attention. Therefore, we compare the below baseline estimates with those that (i) include an indicator for banks that ultimately are subject to enforced exit and (ii) are based on a sample excluding banks censored for these two reasons. Thereby, we test (indirectly) whether regulators focus their measures on, with hindsight, very weak banks. [17]

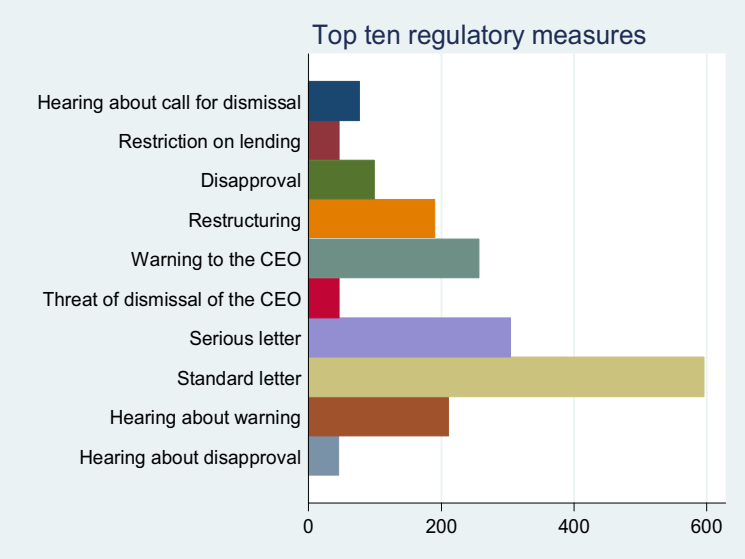
Figure 1 illustrates the activity stance of German supervisors, taking 1,737 regu-

[16] Also note that we consider only those capital injections by banking-sector specific insurance systems and therefore exclude further capital preservation measures conducted either via the direct acquisition of outstanding equity by the government or preservation measures administered by the Banking Sector Stabilization Fund ("Sonderfonds Finanzmarktstabilisierung, Sofin'"), which was founded on October 17, 2008. These federal schemes were tapped for many support measures during 2008, which explains the low number of support incidence of *regular* insurance schemes.

[17] Merger & Moratoria are more frequent than censoring in some years since distressed banks can be the surviving partner in a restructuring merger, see also Koetter et al. (2007).

latory measures since 1993. [18] The scope of these measures varies widely and most have an early warning character, for example official hearings or formal letters.

Figure 1. Top ten regulatory measures administered to all German banks (1994-2008)



For the present sample of capital supported banks, a total of 440 measures was issued. Only 4.5% were severe interventions as shown in column four of Table 2. [19] We construct one dummy variable comprising 63 weak incidences of sending standardized warning letters and another indicator that takes value one if one out of four severe measures was issued to a bank that received a capital injection: [20]

(1) Threat of dismissal of managers pursuant to §36 of the Banking Act.

(2) Prohibition of profit distribution.

(3) Actions pursuant to §46 of the Banking Act comprising:

- issue instructions on the management of the institution's business,

[18] Note, that not only banks that received capital injections were subject to regulatory scrutiny, but also those experiencing weaker forms of distress, see Kick and Koetter (2007).
[19] Four of these measures were in fact repeated actions, which means that merely 3.3% of supported banks were also subject to severe regulatory scrutiny.
[20] In total, the Bundesbank recorded 33 different types of measures, which are issued by the BaFin. The ten most frequent interventions account for almost 89% of all measures.

- prohibit the taking of deposits or funds or securities of customers and the granting of loans,
- prohibit proprietors and managers from carrying out their activities,
- or limit such activities, and appoint supervisors.

(4) Threat of the former measures.

In addition, we specify an indicator if non-scheduled on-site audits were conducted. Column Audit in Table (2) highlights that this tool is used in 41% of the cases, corroborating that supervisors monitor supported banks actively. Since on-site audits are exactly the source of inside information available only to regulators, we specify it below as a separate covariate to predict recovery spells and likelihood. We turn next to the determinants of recovery probabilities and duration.

4. Methodology and covariates

4.1. Methodology

To predict simultaneously the likelihood of repaying received capital injections and the duration required to repay capital support measures, we use the split-population duration model suggested by Schmidt and Witte (1989). Cole and Gunther (1995) and DeYoung (2003) employed this model to predict the failure of (de novo) banks and Dahl and Spivey (1995) to predicted recovery probabilities and duration of capital support in the US. Especially the latter study is close to ours but differs in an important respect since it does not test to what extent regulatory covenants influence recovery likelihood and/or timing. Given the ample evidence on failure to facilitate recovery when supporting banks without any restrictions regarding their risk-taking, this is key in our analysis. We test to what extent con-

ditions tied to capital injections affect the recovery probability of troubled institutions.

The split population duration model distinguishes between banks that recover (i.e. repay the injected capital) and banks that do not. Let Q be an unobservable binary variable that takes value 1 for banks that recover at time t and value 0 for banks that do not recover. The model takes into account that the recovery can take place either during the sample period, $t \in [1, T]$, or thereafter, $t > T$. The probability that bank i will eventually recover (δ_i) is modeled using a logistic model:

$$\delta_i = \frac{exp(X_i'\alpha)}{1 + exp(X_i'\alpha)}, \tag{1}$$

where X_i are variables determining the recovery probability of bank i, and α is the vector of coefficients. Larger coefficients α imply higher likelihood of recovery. Denote $f(t)$ and $F(t)$ as the probability density and cumulative density functions of the time until recovery, respectively, conditional on the actual recovery taking place ($Q = 1$). The contribution of banks that recover during the sample period to the total density function is $\delta_i f(t)$. The contribution of banks that do not recover during the sample period is a sum of two components: the probability of no recovery, $(1 - \delta_i)$, and probability that recovery will take place after the sample ends, $\delta_i(1 - F(T))$. The total likelihood function can then be expressed as (Schmidt and Witte, 1989):

$$L = \Pi_{i=1}^{N} [\delta_i f(t)]^{Q_i} \times [(1 - \delta_i) + \delta_i S(T)]^{(1-Q_i)}, \tag{2}$$

where N is the total number of banks that received capital injections, and $S(T) = 1 - F(T)$ is the survival function.

We parameterize equation (2) using the log-logistic distribution. The main advantage of this distribution is that it generates a non-monotonous hazard function

that first rises and then declines, which corresponds to the empirical regularities observed in banking data (Cole and Gunther, 1995). The survival and density functions of the log-logistic distribution are given by:

$$S(t) = \frac{1}{[1+(\lambda t)^p]} \tag{3}$$

$$f(t) = \frac{\lambda p(\lambda t)^{(p-1)}}{[1+(\lambda t)^p]^2} \tag{4}$$

where p and λ are parameters to be estimated. $p > 0$ is the parameter governing the shape of the distribution: $p > 1$ implies unimodal hazard function, which dispersion increases with the magnitude of the parameter, while $p \leq 1$ suggests monotonically decreasing hazard. For $p > 1$, the mean of the distribution is proportional to the inverse of the parameter λ. [21] Therefore, to model the timing of recovery for bank i as a function of corresponding bank-specific and regional covariates X_i, the following specification is used:

$$\lambda_i = exp(-X_i'\beta) \tag{5}$$

Positive coefficients β in equation (5) imply a longer time required for the recovery.

4.2. Covariates and expectations

We distinguish three sets of covariates: governance measures including supervisory action and incorporation, bank-specific, and environmental variables capturing the (regional) macroeconomic conditions. Following earlier duration analyzes, we use the mean of each covariate over the time of the spell. [22]

The first panel in Table 3 shows that the time to recovery varies considerably

[21] More specifically, the mean of the log-logistic distribution can be written as: $\frac{\pi/p}{\lambda \sin(\pi/p)}$. The mean is not determined for $p \leq 1$.

[22] Robustness checks using starting values yield by and large qualitatively similar results.

across banks having received capital support. We construct a dummy for regulatory measures if banks were subjected to one of the four severe measures detailed in subsection 3, which applies to 4.5% of the sample. Unscheduled audits are conducted at 41% of banks that received equity injections. In line with Flannery and Houston (1999), this could indicate efforts of regulators to generate additional information by closely monitoring supported banks. Corrective actions by regulators could also reflect failure of other governance systems that are supposed to ensure prudent behavior of managers. Usually, financial markets ensure to align principal and agent's interests. Therefore, we specify a dummy equal to one for those few banks in Germany that incorporated as private or public limited companies. While not all of these banking firm's stocks are traded freely, stricter publication requirements should proxy for the influence of outsider share- and stakeholders to assess the recovery efforts of the bank. [23]

Panel two depicts bank-specific determinants of recovery. [24] The accumulation of core capital is key to allow repayment. Therefore, we specify both Tier I capital ratios as well as hidden reserves. Higher mean capital ratios during the spell of support serve as a stabilizing signal to the market and should thus enhance recovery odds. Troubled banks typically exhibit high shares of non-performing loans (NPL) (see e.g. Cole and Gunther, 1995; Dahl and Spivey, 1995) and we expect a negative relation with recovery odds. Severely distressed banks are characterized by high losses (see e.g. Gan, 2004). Successfully improving earnings as measured by return on equity (RoE) should therefore have a positive effect on recovery odds. The dispersion in both variables also indicates that numerous banks manage to improve

[23] The share of 7% mimics the population representation of incorporated banks in Germany. Since this measure is highly correlated with commercial banks and because most banks are cooperatives in our sample, we are unable to estimate the model for banking groups separately or with banking group dummies and the incorporation indicator.
[24] Choices are inspired by previous hazard rate studies of German banks (Kick and Koetter, 2007).

Table 3

Summary statistics on regulatory, bank, and environmental covariates

The Table shows descriptive statistics for 473 banks that received capital injections. All data are obtained from the Bundesbank. Shares, ratios, and growth rates are measured in percent unless noted otherwise. Core capital ratio: Tier I capital to risk-weighted assets; Hidden reserve ratio: hidden equity reserves according to §340f commercial code (HGB) to total assets; NPL share: non-performing loans to total assets; RoE (growth): (growth during the injection spell of) return on equity; RWA growth: growth of risk-weighted assets during the spell; Customer loan growth: growth of customer loans during the spell; GDP: log of real gross domestic product per county; Interest spread: difference between 10-year and 1-year federal government bonds.

	Mean	**St.dev.**	**Percentiles**			**Expected sign**	
Variable			*5th*	*50th*	*95th*	*Recovery*	*Duration*
Capital injections and governance							
Dummy recovery	0.62	0.49	0	1	1		
Duration of recovery	4.58	3.01	1	4	11		
Regulatory measure(s)	0.03	0.18	0	0	0	+/-	+/-
Special audit(s)	0.33	0.47	0	0	1	-	+
Joint stock companies	0.07	0.26	0	0	1	+	-
Bank							
Core capital ratio	8.99	5.46	5.35	7.70	16.04	+	
Hidden reserve ratio	0.43	0.54	0.00	0.24	1.58	+	
NPL share	10.57	6.88	2.00	9.28	24.31	-	
RoE	3.64	14.39	-20.68	4.90	23.22	+	
RoE growth	-36.93	270.09	-446.26	-16.65	310.54		-
RWA growth	-0.99	8.15	-12.50	-1.43	12.03		-
Customer loan growth	2.42	12.19	-11.36	-0.34	24.75		+/-
Macro							
Log of real GDP	8.56	1.04	7.24	8.36	10.69	+	-
Interest spread	1.72	0.61	0.66	1.74	2.80	+	-

their profitability and to rectify the quality of their loan portfolio to conventional levels. But other supported banks apparently maintain very risky credit portfolios. Thus, we test if regulatory and other disciplining mechanisms can predict eventual recovery of banks choosing fairly different production plans.

To explain the duration until repayment, we focus on the growth of three variables during the period when capital injection was in place. First, re-establishing a strong earnings base is central to accumulate retained earnings. We expect faster ROE growth to reduce the time-to-recovery. Second, banks that received capital presumably hold risky portfolios. To mitigate threats of undercapitalization, deleveraging the bank can be achieved by reallocating portfolios to less risky asset classes. Therefore, we specify growth of risk-weighted assets as a determinant and expect a negative relation with recovery duration. Third, and related to deleveraging distressed banks, we control for possible attempt to shrink the balance sheet (see also Bandopadhyaya and Jaggia, 2001, for evidence of higher recovery probabilities of low-growth firms). At the same time, generating revenues is a necessary condition to generate (retained) earnings. The effect of customer loan activity, the main line of business of banks in our sample, is therefore ambiguous a priori.

Recent banking crisis studies, such as Hoshi and Kashyap (2008) or Quagliariello (2008), and corporate finance literature on non-financial firm failure (Acharya et al., 2007), emphasize the importance of macroeconomic conditions for the effectiveness of regulatory policy. To control for regional macroeconomic conditions, we specify the log of real GDP at the county (*Kreis*) level. Higher real income indicates larger demand for financial services, which *ceteris paribus* should increase recovery probabilities and ease banks' efforts to repay capital injections. Since one of the key intermediation functions of banks includes maturity transformation, we specify also the spread between long- and short-term government bond rates. Larger spreads should permit banks to earn higher margins on their transformation function and thus enhance recovery probabilities an reduce the time until repaying injected capital.

5. Results

Table 4 shows results from three specifications, each depicting in the first column estimates of the probability of recovery and the duration of recovery thereafter. For all specifications [1] through [3], the shape parameter $\gamma = 1/p$ is significant, thus supporting the split-population model over a conventional duration specification that would neglect the possibility of not recovering. Given that $\gamma < 1$, the value of p is larger than unity, implying unimodal distribution of the log-logistic distribution and existence of the mean, which is modeled as a function of covariates.

Top panel results in Table 4 regarding recovery probabilities support the "regulatory insider" hypothesis. Imposing severe regulatory measures increases the likelihood of recovery by around four times relative to the likelihood of not intervening. This suggests that German regulators had superior information at their disposal to take adequate action that facilitated bank recovery.

An important caveat concerns endogenous regulatory intervention at banks that are in more severe distress, and thus simply need more time for recovery. The positive effect of regulatory measures on recovery duration might therefore merely reflect that banks are asked by the regulator to thoroughly, i.e. over a longer period of time, restructure operations and "clean" balance sheets. To control for this possible selection bias, we use the benefit of hindsight and define banks that ultimately exit the sample due to ordered restructuring mergers or moratoria as the most severely troubled institutes. If measures are mainly applied to banks exhibiting higher degree of distress, the effect of regulatory intervention proxies should vanish and other factors should determine recovery. Specification [2] reports results for the subsample excluding most severely troubled banks. Specification [3] is based on the full sample but includes an indicator variable for supported banks that eventually were

Table 4

Split-population duration on injection recovery between 1994 and 2008

The Table shows parameter estimates without (column pairs [1] and [2]) and with (column pair [3]) controls for bad banks. Standard errors are in brackets. Regulatory measures comprise four severe measures described in section 3. Variables are defined as in Table 2. *,**,*** denote significance at the 1, 5, and 10 percent levels, respectively.

	[1]		[2]		[3]	
Dependent variable	Recovery	Duration	Recovery	Duration	Recovery	Duration
Governance						
Severe measure(s)	4.604***	0.5903***	8.3467**	0.3921***	4.215***	0.5129***
	[0.9396]	[0.1381]	[3.8979]	[0.1507]	[1.0872]	[0.1288]
Bad bank indicator					-0.0933	0.3262***
					[0.8664]	[0.1012]
Special audit(s)	0.4454	0.5662***	4.9384*	0.7386***	0.3226	0.5293***
	[0.4988]	[0.0800]	[2.6252]	[0.0745]	[0.6777]	[0.0877]
Joint stock company	4.1612***	0.106	9.4902*	0.2091	3.6478*	0.1277
	[1.5165]	[0.1317]	[5.0613]	[0.1431]	[2.2125]	[0.1351]
Bank						
Core capital ratio	0.2993***		1.1822**		0.3069***	
	[0.0950]		[0.5957]		[0.0997]	
Hidden reserve ratio	0.596		0.162		0.2665	
	[0.4564]		[0.9885]		[0.5352]	
NPL ratio	-0.2157***		-0.5181**		-0.2447***	
	[0.0466]		[0.2187]		[0.0595]	
RoE	0.027		0.0423		0.02	
	[0.0180]		[0.0443]		[0.0248]	
RoE growth		-0.0003**		-0.0003**		-0.0003**
		[0.0002]		[0.0002]		[0.0002]
RWA growth		0.0071		0.013***		0.0069
		[0.0059]		[0.0043]		[0.0057]
Customer loan growth		-0.0037		-0.0081***		-0.0034
		[0.0040]		[0.0030]		[0.0038]
Macro						
Log of real GDP	-0.1833	-0.1225***	-0.8389	-0.1029***	-0.2541	-0.1093***
	[0.2779]	[0.0382]	[0.5943]	[0.0354]	[0.3159]	[0.0352]
Interest rate spread	1.2912***	-0.3659***	4.4532**	-0.4364***	1.6995***	-0.4246***
	[0.4796]	[0.0738]	[1.9516]	[0.0756]	[0.6010]	[0.0755]
Constant	-0.4589	3.2803***	-2.6624	3.0848***	0.3271	3.1731***
	[2.4695]	[0.3724]	[4.0382]	[0.3588]	[2.7973]	[0.3662]
Statistics						
Log-likelihood	-979.7		-544.4		-958.4	
Akaike IC	1,999.3		1,128.7		1,960.8	
Schwartz-Bayes IC	2,112.9		1,229.0		2,085.7	
γ=1/p	0.2872***		0.2525***		0.2811***	
	[0.0121]		[0.0123]		[0.0124]	
Observations	2165		1111		2165	

forced to a distressed merger or to exit the market. Both specifications corroborate the main conclusion in favor of the "regulatory insider" hypothesis.

The evidence for recovery duration supports the "sustainability" hypothesis. Dealing with weak banks apparently requires patience. The estimated coefficient for regulatory action of 0.51 entails that recovery is delayed by 1.9 years compared to "laissez-faire". The alternative policy instrument to generate more information about supported banks by means of unscheduled audits also lengthens the spell of supported banks. The likelihood of recovery, in turn, is barely significant for the sample of banks that are not eventually forced to cease as a going concern and vanishes entirely when controlling explicitly for most severely distressed banks. Hence, additional scrutiny alone does not enhance the odds of recovery but seems to primarily serve as a conduit to generate necessary information that facilitates thorough and sustainable restructuring efforts.

Conventional monitoring mechanisms that should ensure that managers having received a bailout do not shirk are only of limited importance among German banks. The indicator variable for incorporated banks, and associated stricter publication requirements, exhibits a comparable impact on both recovery odds and duration compared to the one of regulatory intervention. To some extent this result is in line with the finding by Berger et al. (2000) of a complementarity role of both financial markets and supervisors to discipline distressed banks. But statistical significance turns weak once most severely troubled banks are excluded. Market based governance therefore seems primarily of importance for substantially distressed banks that receive capital support.

The middle panel of Table 4 highlights that, in contrast to conventional failure rate studies, only few bank-specific variables affect recovery. We find in line with expectations that rebuilding capitalization and the reduction of non-performing

loans is of central importance to increase the chances of recovery. In contrast, profitability and alternative capital reserves have no significant effect. The time of capital support spells, in turn, is shortened for all supported banks if earnings grow faster. For the sub-sample excluding most severely troubled banks, we provide evidence that increasing risk-weighted assets lengthen the spell. This could be because higher capital requirements following from larger risk-weighted assets postpone or even preclude repayment. In contrast, expanding the volume of banks core business, customer loans, appears to provide less severely distressed banks with additional scope to accumulate retained earnings and therefore reduce support duration.

Positive regional economic conditions generally ease recovery as indicated by a negative coefficient for the log of real GDP for the duration equation. Likewise, the positive (negative) effect of interest rate spreads on recovery probability (duration) indicate that next to regulatory and bank-specific measures, a favorable macroeconomic environment is important to facilitate bank recovery. But relying on favorable business conditions would be an insufficient policy to foster recovery since it does not affect the likelihood of recovery significantly.

In sum, severe regulatory measures and market discipline increase recovery probabilities. Unscheduled audits, in turn, lengthen the duration of recovery spells together with regulatory measures, corroborating the conjecture by various academics and policy makers that a thorough turnaround of troubled banks takes time. While different in magnitude, these effects appear robust to the separation of most troubled banks. Market imposed discipline, in turn, does not affect the time until repayment once we control for the most troubled institutions. This underlines the relatively limited role of financial markets for corporate governance purposes in Germany's bank-based financial system (Levine, 2002).

5.1. Severity of measures

As indicated in section 3, the vast majority of regulatory measures are weak and have an early warning character. In Table 5 we show that only the coefficient for the few severe interventions has a significant effect on both the recovery probability and the duration of capital support spells. Specification [2], in contrast, highlights that weak measures by the regulator, such as warning letters, have no statistically significant impact on the recovery pattern of banks that received capital injection. This result is confirmed in non-reported regressions specifying an indicator of all measures issued by the authorities. Note that these results do not preclude that such measures can be effective for less severely distressed banks, i.e. those without need to tap equity support schemes. Our results show, however, that once banks received capital, only stern regulatory action has a significant effect.

In line with sub-sample results in Table 3, market governance as measured by the indicator variable for incorporation is eliminated once we control for weaker measures taken by regulators. Potentially, monitoring by equity and debt holders of distressed, incorporated banks is crowded out by regulatory attention independent of whether actions taken effectively facilitate recovery of the bank or not.

5.2. Time span sensitivity

Our sample is subject to two further limitations. First, available capital support data does not permit identification of the exact timing of injections prior to 1994. Second, some results might partly be driven by including the year 2008, which is when the global financial crisis fully unfolded and induced the government to directly or indirectly support banks by providing guarantees or acquiring common

Table 5

Separating different severity of interventions

The Table shows parameter estimates for weak regulatory measures (column pairs [1]), severe regulatory measures (column pairs [2]), and both types of regulatory measures (column pairs [3]) including a dummy to control for bad banks. Standard errors are in brackets. The individual measures are described in section 3. Variables are defined as in Table 2. *,**,*** denote significance at the 1, 5, and 10 percent levels, respectively. 2,165 observations.

Specification	[1: Severe]		[2: Weak]		[3: Both]	
Dependent variables	Recovery	Duration	Recovery	Duration	Recovery	Duration
Governance						
Severe measure(s)	4.215***	0.5129***			4.1377***	0.4615**
	[1.0872]	[0.1288]			[1.2365]	[0.1971]
Weak measure(s)			-0.116	0.192	0.3565	0.2078
			[2.0762]	[0.2400]	[6.3434]	[0.4951]
Bad bank indicator	-0.0933	0.3262***	0.1334	0.5084***	0.0923	0.5006***
	[0.8664]	[0.1012]	[1.0205]	[0.1105]	[1.9722]	[0.1904]
Special audit(s)	0.3226	0.5293***	-0.2181	0.2996**	0.0302	0.3206*
	[0.6777]	[0.0877]	[1.0411]	[0.1190]	[2.0002]	[0.1946]
Joint stock company	3.6478*	0.1277	3.2864	0.1208	3.7872	0.1267
	[2.2125]	[0.1351]	[2.1018]	[0.1337]	[3.3163]	[0.1486]
Bank						
Core capital ratio	0.3069***		0.2679**		0.2743	
	[0.0997]		[0.1148]		[0.2056]	
Hidden reserve ratio	0.2665		0.3949		0.3884	
	[0.5352]		[0.5196]		[0.6329]	
NPL ratio	-0.2447***		-0.2218***		-0.239***	
	[0.0595]		[0.0527]		[0.0599]	
RoE	0.02		0.0226		0.0237	
	[0.0248]		[0.0283]		[0.0515]	
RoE growth		-0.0003**		-0.0004**		-0.0003**
		[0.0002]		[0.0002]		[0.0002]
RWA growth		0.0069		0.0072		0.0072
		[0.0057]		[0.0056]		[0.0056]
Customer loan growth		-0.0034		-0.0041		-0.0037
		[0.0038]		[0.0039]		[0.0045]
Environmental						
Log of real GDP	-0.2541	-0.1093***	-0.1471	-0.0996**	-0.0985	-0.0967
	[0.3159]	[0.0352]	[0.3708]	[0.0438]	[0.9734]	[0.0920]
Interest rate spread	1.6995***	-0.4246***	1.5977***	-0.4295***	1.7439***	-0.42***
	[0.6010]	[0.0755]	[0.5607]	[0.0758]	[0.6351]	[0.0777]
Constant	0.3271	3.1731***	-0.2516	3.1142***	-0.9195	3.0476***
	[2.7973]	[0.3662]	[3.1920]	[0.4430]	[7.6491]	[0.7821]
Statistics						
Log-likelihood	-958.4		-962.0		-955.9	
Akaike IC	1,960.8		1,968.1		1,959.8	
Schwartz-Bayes IC	2,085.7		2,093.0		2,096.1	
γ=1/p	0.2811***		0.2822***		0.2792***	
	[0.0124]		[0.0121]		[0.0140]	

equity. Here, we measure capital injections by banking-sector specific insurance funds, which have been tapped less frequently under these extreme conditions. However, low frequency of such 'conventional' support schemes is deceptive since it does not indicate healthy banks per se but might rather reflect substitution of capital preservation measures by federal government actions.

Ideally, we would consider all types of capital preservation activities by any government or non-government agency explicitly, but such data is unavailable. Therefore, we limit our robustness check in Table 6 to the exclusion of the uncertain starting year 1994, or the crisis year 2008, or both.

The results corroborate the main conclusion that only stern regulatory action significantly influences recovery odds positively but also lengthens the duration of capital support schemes. As such, the "regulatory insider" hypothesis as well as the "sustainability" hypothesis are consistently accepted. Across specifications in Tables 4 through 6, signs, significance, and magnitudes of bank-specific effects point consistently into the same direction.

The ability of banks to clean credit portfolios and reduce the share of risky loans paired with the accumulation of capital buffers increases the likelihood of recovery. The duration of capital support spells, in turn, primarily depends on increasing earnings growth. Independent of controlling for different sample years and the presence of particularly bad banks, an increase of ROE growth by one percentage point reduces the time until recovery by around a year. Evidence for reduced support durations due to asset or credit growth is weak since significant results are not only sensitive to the specification of multiple types of measures, but also time spans. [25]

[25] In unreported regression, we tested the robustness of our results for alternative covariate construction: values at the start of the capital injection spell as well as those from the period preceding support measures. Results are qualitatively unaffected.

Table 6

Exclusion of uncertain and crisis years

The Table shows robustness check results for the following subsamples of data: excluding 1994 (column pairs [1]), excluding 2008 (column pairs [2]), and excluding both 1994 and 2008 (column pairs [3]). All specifications include a dummy to control for bad banks. Standard errors are in brackets. The individual measures are described in section 3. Variables are defined as in Table 2. *,**,*** denote significance at the 1, 5, and 10 percent levels, respectively.

Specification	[1: 1995-2008]		[2: 1994-2007]		[3: 1995-2007]	
Dependent variables	Recovery	Duration	Recovery	Duration	Recovery	Duration
Governance						
Regulatory measure(s)	4.1298***	0.6464***	5.1207***	0.6347***	5.3333***	0.8305***
	[1.1775]	[0.1791]	[1.4417]	[0.1743]	[1.2573]	[0.2390]
Bad bank indicator	0.0788	0.4634***	-0.3245	0.4323***	1.0049	0.5712***
	[1.0197]	[0.1395]	[0.7460]	[0.0934]	[1.0654]	[0.1166]
Special audit(s)	0.4141	0.699***	0.5901	0.3968***	-0.3948	0.5707***
	[0.8019]	[0.1210]	[1.3873]	[0.1104]	[0.7418]	[0.1137]
Joint stock company	3.9122*	0.1899	2.7835	0.1524	4.0927	0.2579
	[2.1988]	[0.1958]	[9.8356]	[0.2115]	[3.2764]	[0.1786]
Bank						
Core capital ratio	0.3322***		0.3684***		0.4047***	
	[0.1052]		[0.1259]		[0.1155]	
Hidden reserve ratio	0.2021		0.0422		-0.1257	
	[0.5499]		[0.8503]		[0.5499]	
NPL ratio	-0.2521***		-0.2713***		-0.2979***	
	[0.0632]		[0.0938]		[0.0766]	
RoE	0.0226		0.0232		0.0324	
	[0.0257]		[0.0704]		[0.0324]	
RoE growth		-0.0005**		-0.0003*		-0.0005**
		[0.0002]		[0.0002]		[0.0002]
RWA growth		0.0113		0.0108**		0.0183**
		[0.0094]		[0.0055]		[0.0081]
Customer loan growth		-0.0059		-0.0049		-0.0092
		[0.0066]		[0.0032]		[0.0057]
Environmental						
Log of real GDP	-0.3528	-0.1548***	-0.2299	-0.0994**	-0.3797	-0.1478***
	[0.3322]	[0.0507]	[0.4848]	[0.0482]	[0.3692]	[0.0543]
Interest rate spread	1.6814***	-0.6105***	1.8562***	-0.4266***	1.9269***	-0.6277***
	[0.6506]	[0.1059]	[0.6562]	[0.0989]	[0.7377]	[0.1076]
Constant	1.1632	3.6079***	-0.3831	3.0694***	0.9761	3.561***
	[2.9425]	[0.5156]	[4.4983]	[0.5582]	[3.1092]	[0.5393]
Statistics						
Log-likelihood	-946.9		-857.2		-844.6	
Akaike IC	1937.8		1758.4		1733.2	
Schwartz-Bayes IC	2057.3		1882.6		1851.7	
γ=1/p	0.3927***		0.2757***		0.3921***	
	[0.0176]		[0.0165]		[0.0185]	
Observations	1692		2087		1618	

6. Conclusion

We test if and how regulatory intervention affects the recovery probability and duration of re-capitalized banks, respectively. We use detailed data of a total of 440 supervisory measures and 192 non-scheduled audits applied to all 473 universal banks that received capital support from banking-sector specific insurance schemes in Germany. The first hypothesis tested is that regulators generate and process additional information that mitigates moral hazard after capital support ("regulatory insider" view) and therefore facilitate recovery versus the hypothesis that regulators are entrenched with their subjects and therefore delay necessary, but potentially painful decisions, ultimately hindering recovery ("regulatory capture" view). Given the probability that a bank recovers, we also hypothesize that regulatory intervention affects the duration of such capital support spells. We test whether supervisory prudence implies thorough restructuring ("sustainability" hypothesis) or enables the bank to recover faster by enforcing necessary restructuring measures ("acceleration" hypothesis). We estimate conditional recovery probability and duration using the split-population duration model for the period 1994 to 2008.

Estimation results provide support for "regulatory insider" and "sustainability" hypotheses. Severe regulatory measures that can limit the scope of managerial choices substantially enhance recovery probabilities but also lengthen the time until repayment. Unscheduled audits, in turn, only lengthen the capital support spell and thus seem to primarily serve the purpose of generating additional insider information to permit thorough and sustainable restructuring. Regulatory intervention lenghtening the time until repayment corroborates the conjecture by various academics and policy makers that a thorough turnaround of troubled banks takes time (BIS, 1999; Hoshi and Kashyap, 2008; IMF, 2009b).

A first important qualification of our main result is the absence of significant effects on recovery patterns by weak regulatory action. Official warning letters do neither reduce recovery time nor increase likelihood of recovery. Because the majority of regulatory actions in fact resembles weaker measures, this result bears the important policy implication that once banks are sufficiently distressed to receive capital support, only stern regulatory action has a statistically significant influence on recovery. Weak, frequently atomized measures in turn might only be suited for less severely troubled banks that did not tap capital support schemes.

Second, we find only limited evidence of effective market-imposed discipline, measured by incorporation indicators and the associated stricter publication requirements. Positive effects on recovery odds turn insignificant once we control with the benefit of hindsight for the presence of severely distressed banks, defined as those that are ultimately forced to merge or closed due to moratoria. Hence, market governance appears to be of relatively limited importance in Germany's bank-based corporate governance culture.

Bank's ultimate production choices matter, too. Capitalization and non-performing loan share levels are the main driver of recovery odds, while earnings growth is the prime determinant for recovery duration. In addition to these bank-specific factors, both regional real GDP as well as federal interest rate spreads are economically significant co-determinants of recovery probabilities and duration. This highlights the importance to coordinate both macro- and micro-prudential supervision policies to foster the recovery of supported banks.

References

Acharya, V. V., S. T. Bharath, and A. Srinivasan (2007). Does industry-wide distress affect defaulted firms? Evidence from creditor recoveries. *Journal of Financial Economics 85*, 787–821.

Bandopadhyaya, A. (1994). An estimation of the hazard rate of firms under chapter 11 protection. *The Review of Economics and Statistics 76*, 346–350.

Bandopadhyaya, A. and S. Jaggia (2001). An analysis of second time around bankruptcies using a split-population duration model. *Journal of Empirical Finance 8*, 201–218.

Benston, G. (1994). Universal banking. *Journal of Economic Perspectives 8*(3), 121–143.

Benston, G., P. Eisenbeis, R. Horvitz, E. Kane, and G. Kaufman (1986). *Perspectives on Safe and Sound Banking: Past, Present, and Future*. MA: Cambridge.

Berger, A. N., S. M. Davies, and M. J. Flannery (2000). Comparing market and supervisory assessments of bank performance: Who knows what when? *Journal of Money, Credit, and Banking 32*, 641–667.

BIS (1999). Bank Restructuring in Practice. *Bank for International Settlements Policy Paper 6*.

Bongini, P., S. Claessens, and G. Ferri (2001). The political economy of distress in east asian financial institutions. *Journal of Financial Services Research 19*, 5–25.

Brinkmann, E., P. Horvitz, and Y. Huang (1996). Forbearance: An empirical analysis. *Journal of Financial Services Research 10*(1), 27–41.

Bris, A., I. Welch, and N. Zhu (2006). The costs of bankruptcy: chapter 7 liquidation versus chapter 11 reorganization. *Journal of Finance 61*, 1253–1303.

Cobos, D. (1989). Forbearance: Practices and proposed standards. *FDIC Banking Review Spring/Summer*, 20–28.

Cole, R. A. (1993). When are thrift institutions closed? an agency-theoretic model. *Journal of Financial Services Research 7*(4), 283–307.

Cole, R. A. and J. W. Gunther (1995). Separating the likelihood and timing of bank failure. *Journal of Banking and Finance 19*, 1073–1089.

Dahiya, S., K. John, M. Puri, and G. Ramirez (2003). Debtor-in-possession financing and bankruptcy resolution: Empirical evidence. *Journal of Financial Economics 69*, 259–280.

Dahl, D. and M. F. Spivey (1995). Prompt corrective action and bank efforts to recover from undercapitalization. *Journal of Banking and Finance 19*, 225–243.

DeGennaro, R., L. Lang, and J. Thomson (1993). Troubled savings and loan institutions: Turnaround strategies under insolvency. *Financial Management 20*, 163–175.

DeGennaro, R. and J. Thomson (1996). Capital forbearance and thrifts: Examining the costs of regulatory gambling. *Journal of Financial Services Research 10*(3), 199–211.

Dell'Ariccia, G., E. Detragiache, and R. Rajan (2005). The real effect of banking crises. *IMF Working Paper 05/63*.

DeYoung, R. (2003). The failure of new entrants in commercial banking markets: A split-population duration analysis. *Review of Financial Economics 12*, 7–33.

DeYoung, R. (2007). Safety, soundness, and the evolution of the US banking industry. *Federal Reserve Bank of Atlanta Economic Review First and Second Quarters*, 41–66.

Estrella, A., S. Park, and S. Peristiani (2000). Capital ratios as predictors of bank failure. *Federal Reserve Bank of New York: Economic Policy Review*, 33–52.

Flannery, M. J. and J. F. Houston (1999). The value of a government monitor for U.S. banking firms. *Journal of Money, Credit, and Banking 31*, 14–34.

Gan, J. (2004). Banking market structure and financial stability: Evidence from

the texas real estate crisis in the 1980s. *Journal of Financial Economics 73*, 567–601.

Garcia, G. G. H. and M. J. Nieto (2005). Banking crisis management in the European Union: Multiple regulators and resolution authorities. *Journal of Banking Regulation 6*, 206–226.

Guo, L. (1999). When and why did FSLIC resolve insolvent thrifts? *Journal of Banking and Finance 23*, 955–990.

Gupta, A. and L. Misra (1999). Failure and failure resolution in the US thrift and banking industries. *Financial Management 28*, 87–105.

Hoshi, T. and A. K. Kashyap (2008). Will the US bank recapitalization succeed? lessons from japan? *NBER Working Paper 14401*.

IMF (2009a, January). *Country Report No. 09/15 Germany: 2008 Article IV Consultation*. Washington.

IMF (2009b, April). *Global Financial Stability Report*. Washington.

Kalaya, A., R. Singhal, and E. Tashjian (2007). Is chapter 11 costly? *Journal of Financial Economics 84*, 772–796.

Kane, E. (1989). Changing incentives facing financial-services regulators. *Journal of Financial Services Research 3*, 265–274.

Kane, E. (1990). Principal-agent problems in S&L salvage. *Journal of Finance 20*, 755–764.

Kaufman, G. G. (1995). FDICIA and bank capital. *Journal of Banking and Finance 20*, 191–220.

Kick, T. and M. Koetter (2007). Slippery slopes of stress: Ordered failure events in german banking. *Journal of Financial Stability 3*, 132–148.

Koetter, M., J. W. B. Bos, F. Heid, J. W. Kolari, C. J. M. Kool, and D. Porath (2007). Accounting for distress when predicting bank mergers. *Journal of Banking and Finance 32*, 3200–3217.

Lane, W. R., S. Looney, and J. Wansley (1986). An application of the Cox proportional hazards model to bank failure. *Journal of Banking and Finance 10*(4), 511–531.

Levine, R. (2002). Bank-based or market-based financial systems: Which is better? *Journal of Financial Intermediation 11*, 398–428.

Liedorp, F. R. and I. van Lelyveld (2006). Interbank contagion in the Dutch banking sector. *International Journal of Central Banking 2*, 99–132.

McKenzie, J., R. A. Cole, and R. Brown (1994). Moral hazard, portfolio allocation, and asset returns for thrift institutions. *Journal of Financial Services Research 20*, 315–339.

Nieto, M. J. and D. Wall, Larry (2006). Preconditions for a successful implementation of supervisors' prompt corrective action: Is there a case for a banking standard in the EU? *Journal of Banking Regulation 7*, 721–722.

Peek, J., E. S. Rosengren, and G. M. B. Tootell (1999). Is bank supervision central to central banking? *Quarterly Journal of Economics 114*(2).

Quagliariello, M. (2008). Does macroeconomy affect bank stability? a review of the empirical evidence. *Journal of Banking Regulation 9*, 102–115.

Schmidt, P. and A. D. Witte (1989). Predicting criminal recidivism using 'split-population' survival time models. *Journal of Econometrics 40*, 141–159.

Udell, G. F. (2009). Wall street, main street and a credit crunch: Some thoughts on the current financial crisis. *Business Horizons*, forthcoming.

Upper, C. and A. Worms (2004). Estimating bilateral exposures in the German interbank market: Is there a danger of contagion? *European Economic Review 48*, 827–849.

The following Discussion Papers have been published since 2009:

Series 1: Economic Studies

01	2009	Spillover effects of minimum wages in a two-sector search model	Christoph Moser Nikolai Stähler
02	2009	Who is afraid of political risk? Multinational firms and their choice of capital structure	Iris Kesternich Monika Schnitzer
03	2009	Pooling versus model selection for nowcasting with many predictors: an application to German GDP	Vladimir Kuzin Massimiliano Marcellino Christian Schumacher
04	2009	Fiscal sustainability and policy implications for the euro area	Balassone, Cunha, Langenus Manzke, Pavot, Prammer Tommasino
05	2009	Testing for structural breaks in dynamic factor models	Jörg Breitung Sandra Eickmeier
06	2009	Price convergence in the EMU? Evidence from micro data	Christoph Fischer
07	2009	MIDAS versus mixed-frequency VAR: nowcasting GDP in the euro area	V. Kuzin, M. Marcellino C. Schumacher
08	2009	Time-dependent pricing and New Keynesian Phillips curve	Fang Yao
09	2009	Knowledge sourcing: legitimacy deficits for MNC subsidiaries?	Tobias Schmidt Wolfgang Sofka
10	2009	Factor forecasting using international targeted predictors: the case of German GDP	Christian Schumacher

11	2009	Forecasting national activity using lots of international predictors: an application to New Zealand	Sandra Eickmeier Tim Ng
12	2009	Opting out of the great inflation: German monetary policy after the breakdown of Bretton Woods	Andreas Beyer, Vitor Gaspar Christina Gerberding Otmar Issing
13	2009	Financial intermediation and the role of price discrimination in a two-tier market	Stefan Reitz Markus A. Schmidt, Mark P. Taylor
14	2009	Changes in import pricing behaviour: the case of Germany	Kerstin Stahn
15	2009	Firm-specific productivity risk over the business cycle: facts and aggregate implications	Ruediger Bachmann Christian Bayer
16	2009	The effects of knowledge management on innovative success – an empirical analysis of German firms	Uwe Cantner Kristin Joel Tobias Schmidt
17	2009	The cross-section of firms over the business cycle: new facts and a DSGE exploration	Ruediger Bachmann Christian Bayer
18	2009	Money and monetary policy transmission in the euro area: evidence from FAVAR- and VAR approaches	Barno Blaes
19	2009	Does lowering dividend tax rates increase dividends repatriated? Evidence of intra-firm cross-border dividend repatriation policies by German multinational enterprises	Christian Bellak Markus Leibrecht Michael Wild
20	2009	Export-supporting FDI	Sebastian Krautheim

21	2009	Transmission of nominal exchange rate changes to export prices and trade flows and implications for exchange rate policy	Mathias Hoffmann Oliver Holtemöller
22	2009	Do we really know that flexible exchange rates facilitate current account adjustment? Some new empirical evidence for CEE countries	Sabine Herrmann
23	2009	More or less aggressive? Robust monetary policy in a New Keynesian model with financial distress	Rafael Gerke Felix Hammermann Vivien Lewis
24	2009	The debt brake: business cycle and welfare consequences of Germany's new fiscal policy rule	Eric Mayer Nikolai Stähler
25	2009	Price discovery on traded inflation expectations: Does the financial crisis matter?	Alexander Schulz Jelena Stapf
26	2009	Supply-side effects of strong energy price hikes in German industry and transportation	Thomas A. Knetsch Alexander Molzahn
27	2009	Coin migration within the euro area	Franz Seitz, Dietrich Stoyan Karl-Heinz Tödter
28	2009	Efficient estimation of forecast uncertainty based on recent forecast errors	Malte Knüppel
29	2009	Financial constraints and the margins of FDI	C. M. Buch, I. Kesternich A. Lipponer, M. Schnitzer
30	2009	Unemployment insurance and the business cycle: Prolong benefit entitlements in bad times?	Stéphane Moyen Nikolai Stähler
31	2009	A solution to the problem of too many instruments in dynamic panel data GMM	Jens Mehrhoff

32	2009	Are oil price forecasters finally right? Regressive expectations toward more fundamental values of the oil price	Stefan Reitz Jan C. Rülke Georg Stadtmann
33	2009	Bank capital regulation, the lending channel and business cycles	Longmei Zhang
34	2009	Deciding to peg the exchange rate in developing countries: the role of private-sector debt	Philipp Harms Mathias Hoffmann
35	2009	Analyse der Übertragung US-amerikanischer Schocks auf Deutschland auf Basis eines FAVAR	Sandra Eickmeier
36	2009	Choosing and using payment instruments: evidence from German microdata	Ulf von Kalckreuth Tobias Schmidt, Helmut Stix
01	2010	Optimal monetary policy in a small open economy with financial frictions	Rossana Merola
02	2010	Price, wage and employment response to shocks: evidence from the WDN survey	Bertola, Dabusinskas Hoeberichts, Izquierdo, Kwapil Montornès, Radowski
03	2010	Exports versus FDI revisited: Does finance matter?	C. M. Buch, I. Kesternich A. Lipponer, M. Schnitzer
04	2010	Heterogeneity in money holdings across euro area countries: the role of housing	Ralph Setzer Paul van den Noord Guntram Wolff
05	2010	Loan supply in Germany during the financial crises	U. Busch M. Scharnagl, J. Scheithauer

06	2010	Empirical simultaneous confidence regions for path-forecasts	Òscar Jordà, Malte Knüppel Massimiliano Marcellino
07	2010	Monetary policy, housing booms and financial (im)balances	Sandra Eickmeier Boris Hofmann
08	2010	On the nonlinear influence of Reserve Bank of Australia interventions on exchange rates	Stefan Reitz Jan C. Ruelke Mark P. Taylor

Series 2: Banking and Financial Studies

01	2009	Dominating estimators for the global minimum variance portfolio	Gabriel Frahm Christoph Memmel
02	2009	Stress testing German banks in a downturn in the automobile industry	Klaus Düllmann Martin Erdelmeier
03	2009	The effects of privatization and consolidation on bank productivity: comparative evidence from Italy and Germany	E. Fiorentino A. De Vincenzo, F. Heid A. Karmann, M. Koetter
04	2009	Shocks at large banks and banking sector distress: the Banking Granular Residual	Sven Blank, Claudia M. Buch Katja Neugebauer
05	2009	Why do savings banks transform sight deposits into illiquid assets less intensively than the regulation allows?	Dorothee Holl Andrea Schertler
06	2009	Does banks' size distort market prices? Evidence for too-big-to-fail in the CDS market	Manja Völz Michael Wedow
07	2009	Time dynamic and hierarchical dependence modelling of an aggregated portfolio of trading books – a multivariate nonparametric approach	Sandra Gaisser Christoph Memmel Rafael Schmidt Carsten Wehn
08	2009	Financial markets' appetite for risk – and the challenge of assessing its evolution by risk appetite indicators	Birgit Uhlenbrock
09	2009	Income diversification in the German banking industry	Ramona Busch Thomas Kick
10	2009	The dark and the bright side of liquidity risks: evidence from open-end real estate funds in Germany	Falko Fecht Michael Wedow

11	2009	Determinants for using visible reserves in German banks – an empirical study	Bornemann, Homölle Hubensack, Kick, Pfingsten
12	2009	Margins of international banking: Is there a productivity pecking order in banking, too?	Claudia M. Buch Cathérine Tahmee Koch Michael Koetter
13	2009	Systematic risk of CDOs and CDO arbitrage	Alfred Hamerle, Thilo Liebig Hans-Jochen Schropp
14	2009	The dependency of the banks' assets and liabilities: evidence from Germany	Christoph Memmel Andrea Schertler
15	2009	What macroeconomic shocks affect the German banking system? Analysis in an integrated micro-macro model	Sven Blank Jonas Dovern
01	2010	Deriving the term structure of banking crisis risk with a compound option approach: the case of Kazakhstan	Stefan Eichler Alexander Karmann Dominik Maltritz
02	2010	Recovery determinants of distressed banks: Regulators, market discipline, or the environment?	Thomas Kick Michael Koetter Tigran Poghosyan

Visiting researcher at the Deutsche Bundesbank

The Deutsche Bundesbank in Frankfurt is looking for a visiting researcher. Among others under certain conditions visiting researchers have access to a wide range of data in the Bundesbank. They include micro data on firms and banks not available in the public. Visitors should prepare a research project during their stay at the Bundesbank. Candidates must hold a PhD and be engaged in the field of either macroeconomics and monetary economics, financial markets or international economics. Proposed research projects should be from these fields. The visiting term will be from 3 to 6 months. Salary is commensurate with experience.

Applicants are requested to send a CV, copies of recent papers, letters of reference and a proposal for a research project to:

Deutsche Bundesbank
Personalabteilung
Wilhelm-Epstein-Str. 14

60431 Frankfurt
GERMANY