Systemic Risk and Regulatory Compliance

Rym AYADI
HEC Montréal

Sami BEN NACEUR
International Monetary Fund

Barbara CASU
Cass Business School, City, University of London

Barry QUINN
Queen's Management School, Queen's University Belfast

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Extended Abstract

Summary: The global financial crisis highlighted how losses at individual financial institutions can spread across the financial system, giving rise to systemic risk, and underscored the importance of regulation and supervision to a well-functioning banking system. This paper aims to assess the contribution of international regulatory compliance on reducing systemic risk. We focus specifically on the adoption of international capital standards and the Basel Core Principles for Effective Bank Supervision (BCP). We measure systemic risk following the approach proposed by Adrian and Brunnermeir (2016), ΔCoVaR, that captures the (cross-sectional) tail-dependency between the whole financial system and a particular institution. While the post-crisis regulatory reforms aimed at improving the safety and soundness of banking sectors worldwide, we argue that during periods of increasing regulatory pressure and compliance constraints, banks tend to choose correlates risks and invest in correlated assets. This could increase 'herding" as bank managers have to benchmark themselves to regulatory imposed industry standards. This type of market inefficiency could increase, rather than decrease systemic risk. Overall, our results suggest that regulatory compliance has a slight risk increasing effect, which is particularly evident for capital regulation. However, supervisory regulation compliance has a potentially risk reducing effect.

Background: The Basel Core Principles for Effective Bank Supervision (BCP) were issued in 1997 by the Basel Committee on Bank Supervision, have since become the global standards for bank regulation, widely adopted by regulators in developed and developing countries. The severity of the 2007–09 financial crisis has cast doubt on the effectiveness of these global standards and a process of regulatory reforms took place in several countries. The initial crisis-induced assessment of regulatory failure is now giving way to a more complex regulatory dialogue and detailed evaluation of the principles underlying international regulatory standards as well as the implications of their adoption, in terms of banks' safety and soundness. In addition, the burden of compliance with international regulatory standards is becoming increasingly onerous, and financial institutions worldwide are developing compliance frameworks to enable management to meet more stringent regulatory standards. As regulators refine and improve their approach and methodologies, banks must respond to more stringent compliance requirements. This has implications for risk management and resource allocation, and, ultimately, on systemic risk.

The goal of this paper is to advance the existing literature by examining the relationship between the observance of international regulatory standards and systemic risk, defined as to the possibility that a triggering event, such as the failure or distress of an individual firm, will spillover across institutions and markets and harm the broader economy.

Methodology: To investigate the relationship between BCP regulatory compliance and the systemic risk of individual banks our empirical design will use a two-part estimation procedure applied to three different systems over the period 1990Q1-2015Q4.

In the first part of the estimation, systemic risk is calculated using information on all publicly traded financial institutions that make up a pre-defined financial system. Following Adrian and Brunnermeier (2016), insurance companies and real estate firms are included in the definition of a financial system. In the second part of the estimation, the causal effect of BCP compliance on an individual bank's contribution to systemic risk is assessed using a dynamic difference in difference (DiD) regression framework. For ease of interpretation the first part uses the negative of a return metric to produce a systemic risk measure where larger values represent higher systemic risk contribution.

Systemic Risk Estimation (ΔCoVaR Methodology): We use the Adrian and Brunnermeier (2016) *CoVaR* approach to systemic risk contribution estimation (hereafter AB (2016)), which extends the *Value at Risk (VaR)* concept to the system. *CoVaR* can be thought of as the *VaR* of the whole system conditional on institution *i* being in a particular state. Systemic risk is approximated using *ΔCoVaR;* the difference between the *CoVaR* conditional on the distress of an institution and the *CoVaR* conditional on the median state of that institution. *ΔCoVaR* is best thought of as a reduced form[1] analytical tool which captures statistical tail dependency or the part of systemic risk that co-moves with the distress of an institution.

Formally, the *CoVaR* of the system given an institution being in a particular state can be implicitly defined as the q%-quantile of the conditional probability distribution:

$$(1) Pr(X^{system} | X^i = VaR_q \leq CoVaR_q^{system|X^i=VaR_q}) = q\%$$

where X is defined as return losses allowing greater risk to be associated with a higher $CoVaR_q^{system|X_i=VaR_q}$.

This in turn can be used to extract the part of the systemic risk which is attributed to institution *i* as:

$$\Delta CoVaR_q^{system|i} = CoVaR_q^{system|X_i=VaR_q^i} - CoVaR_q^{system|X_i=VaR_{50}^i}$$

To allow comparison across different sized institutions, we create a monetary equivalent to our risk measure by multiplying by size:

$$(3) \Delta^{\$} CoVaR_q^{system|i} =^{\$} Size^i \times \Delta CoVaR_q^{system|i}$$

We quantify size by the market equity of the institution. $\Delta^{\$} CoVaR$ captures the monetary change in *CoVaR* as an institution shifts from its median return in normal times to its adverse return (equal to VaR^i_q) when experiencing distress.

Typically, to obtain *CoVaR* estimates we condition on the situation where an institution *i's* losses are at or above certain *VaR* levels; a median level (q=50%) and a distressed level (q= 95% or 99%).

[1] As it is a reduced form measure, it does not casually allocate the source of systemic risk to the different financial institutions.

Time-varying ΔCoVaR Estimation: To capture all forms of risk, including the risk of adverse asset price movements and funding liquidity risk, we estimate *ΔCoVaR* using weekly return losses from 1990:Q1 to 2015:Q4 for all publicly traded commercial banks, diversified financials, insurance companies and real estate companies. Following AB (2016), losses are measured as the return losses on market equity of the publicly traded institution,

$$X_{t+1}^{i} = -\Delta ME_{t+1}^{i}/ME_{t.}^{i}$$

We use quantile regressions to estimate time varing CoVaR, where time variation in the joint distribution of X^{system} and X^{i} is captured using a set of lagged state variables.

We estimate the following quantile regressions on weekly data:

$$(1) X_t^i = \alpha_q^i + \gamma_q^i M_{t-1} + \epsilon_{q,t}^i$$
$$(2) X_t^{system|i} = \alpha_q^{system|i} + \gamma_q^{isystem|i} M_{t-1} + \beta_q^{system|i} + X_t^i + \epsilon_{q,t}^{system|i}$$

These regressions are then used to obtain the following predicted values

$$(3) VaR_{q,t}^i = \hat{\alpha}_q^{system|i} + \hat{\gamma}_q^{i\,system|i} M_{t-1}$$

$$(4) CoVaR_{q,t}^i = \hat{\alpha}_q^{system|i} + \hat{\gamma}_q^{i\,system|i} M_{t-1} + \hat{\beta}_q^{system|i} + VaR_{q,t}^i$$

Finally, *ΔCoVaR* is computed for each institution:

$$(5) \Delta CoVaR_{q,t}^i = CoVaR_{q,t}^i - CoVaR_{50,t}^i = \hat{\beta}_q^{system|i}(VaR_{q,t}^i - VaR_{50,t}^i)$$

Following AB (2016), we include a set of state variables, measured at the system level, [2] which adequately capture the time variation in the conditional moments of returns, and therefore the mean and volatility of the risk measures. The variables are:

A. Change in the three-month yield measures as the change in the three-month t-bill rate.
B. Change in the slope of the yield, measured as the change in the spread between the long-term composite bond and the three-month treasury bill rate.
C. TED spread measured as the difference between the three-month LIBOR rate and the three-month secondary market treasury bill rate.

[2] In the case of the European system, the state variables are sourced from either the ECB or the German bund market rates.

D. Change in the credit spread measures as the change in the spread between the 10-year BAA rated bonds and the 10-year treasury bonds.
E. Weekly market returns.
F. Weekly housing sector returns.
G. Equity volatility which is computed as the 22-day rolling standard deviation of daily equity market returns.

We perform the systemic risk estimation using all four types of financial institution to insure the complete systemicity of the risk assessment. In subsequent regression analyses, we use the resultant risk estimates for banks.

Difference in Difference (DiD) Regression Analysis: We assess the effects of BCP regulatory compliance on systemic risk by employing a difference in difference (DiD) empirical design. This method can remove undesirable changes in the treatment group, leaving only the effects of the policy change under investigation. Typically, the approach compares the effects of BCP compliance on two groups (a treatment and control group) in pre- and post- intervention periods. This method subtracts the average change in the control group from the average change in the treatment group. This results in the removal of potential biases in temporal comparisons due to time trends and permanent (observable and unobservable) group differences which may impact the outcome variable in the post intervention period (Imbens & Wooldridge 2009). With multiple groups and time periods we apply the general framework for DiD proposed by (Bertrand et al. 2004). The bank level specification is

$$(6)\ \Delta^{\$}CoVaR^{i}_{q,t} = \alpha_i + \theta_j + \delta BCP_{j,t-k} + \gamma X_{i,t-k} + \omega M_{t-k} + \epsilon_{i,t}$$

where i indexes individual banks, j indexes countries, t indexes quarters, and k represents the lag order. The model has a full set of bank effects (denoted by α_i) and country effects (denoted by θ_j). X includes bank balance sheet characteristics that are identified as key determinants of systemic risk. These are: (i) leverage, measured as the ratio total assets to common equity; (ii) maturity mismatch, measured as short term borrowings to total assets; (iii) size, measured as the log of market equity and (iv) an asset price boom indicator, which is the number of consecutive quarters of being in the top decile of the price to book ratio across all firms. M includes the state variables discussed previously and ε_{it} represents individual firm specific random errors.

The dependent variable is the stationary dollar value of $\Delta CoVaR$ for institution *i* at distress state *q* in quarter q. We generate a weekly panel of $\Delta^{\$}CoVaR^{i}_{q,t}$ by multiplying $\Delta CoVaR^{i}_{q,t}$ by the respective market equity ME^{i}_{t}. Quarterly measures are obtained by averaging observations within each quarter. Finally, to obtain stationary variables, we divide each $\Delta^{\$}CoVaR^{i}_{q,t}$ by the cross-sectional average of market equity, ME^{i}_{t}. BCP includes group/time covariates for Basel core principles regulatory compliance. This vector will assess the effect of overall BCP compliance and disaggregate this effect into what the supervisors are doing and what the supervisors want the banks to do. Since our BCP data are integers measuring the extent of regulatory compliance, δ captures the sensitivity of systemic risk to change in compliance. As suggested by AB (2016), Newey-West standard errors are used to allow up to five periods of autocorrelation.

Data and Summary Statistics. We start with daily equity data from Bloomberg for the four GICS financial sector industries, banks, diversified financials[3], insurance and real estate for all available countries. The daily data is collapsed to weekly data and merged with quarterly balance sheet data from Bloomberg. The quarterly data is filtered to only include observations which have price to book ratio and leverage values in the interval [0,100]. We further apply a truncation to the maturity mismatch variable at the 1st and 99th percentile. The macroeconomic state variables are collected from Thomson Reuters Datastream. We have a total of 2023 financial institutions in our sample of which 1073 are banks, 480 are real estate companies, 198 are insurance firms and 272 are diversified financials. To ensure reasonable inferences from the relatively short sample period the main part of the risk estimation is carried out using weekly data.

Given the changing nature of the financial institutions over the sample period and the likelihood of merger and failure activities we use quintile portfolio to estimate our risk measure. These portfolios are formed on financial characteristics that are identified by theories of the margin spiral as being determinants of systemic risk. For the four financial sectors we form sets of quintile portfolios based on maturity mismatch, size, leverage, price to book, and equity return volatility. These portfolios are sorted at the beginning of each quarter, based on previous quarter financial characteristics[4]. The resultant portfolio risk estimates are mapped back to individual institutions using a weighted average approach. To construct the overall financial system portfolio, we compute the average market equity weighted returns, weighted by the lagged market equity of the institutions.

Basel Core Principles for Effective Bank Supervision (BCP). The principal variable of interest, BCP compliance, is derived from the IMF and World Bank Basel Core Financial Sector Assessment Program (FSAP) database.[5] Our study extends the coverage of the work of (Ayadi et al. 2016) by using assessment data covering 1999–2015.[6] The Basel Core FSAP is an exhaustive global exercise, capturing the compliance features of banking industries in both developed and developing economies. The BCP core principles are considered by regulators and by international organizations to be the best practice to date of compliance with banking regulation and supervision. These principles were issued in 1997 by the Basel Committee on Banking

[3] This category includes custody banks, investment banks, brokerage firms and consumer finance.

[4] Quintile cut offs are weight so that each portfolio has approximately the same size within each industry.

[5] For detailed information on the assessments of the Basel Core Principles, we refer the reader to their founding documents (Basel Committee on Banking Supervision 1997, 1999, 2006, 2011a, 2011b, 2012).

[6] Ayadi et al (2016) uses assessment data covering 1999-2012.

Supervision, and have been adopted by most countries in the world. Since 1999, the IMF and the World Bank have conducted regular assessments to gauge a country's compliance with these principles, mainly within their joint FSAP. In 2012, the Basel Committee on Banking Supervision completed a comprehensive review of the 25 core principles set out in the 2006 Core principle methodology. The review resulted in a revised set of 29 core principles reorganized to foster their implementation through a more logical structure, highlighting the difference between what supervisors do and what they expect banks to do. Principles 1 to 13 address supervisory powers, responsibilities and functions, focusing on effective risk-based supervision, and the need for early intervention and timely supervisory action. Principles 14 to 29 cover supervisory expectations of banks, emphasizing the importance of good corporate governance and risk management, as well as compliance with supervisory standards. The revised core principle methodology includes a mapping of the previous structures onto this 2012 framework which allows us to create consistent compliance measures for our 1999-2015 sample. Table A2 present the coverage of BCP data in our analysis.

Following (Ayadi et al. 2016), the level of bank compliance is assessed using an aggregate BCP compliance score and a disaggregated approach, to distinguishing between what supervisors do and what they expect banks to do. The variable "Overall BCP" specifies a measure of compliance for each country in our sample at one point in time. Quarterly bank-level and country-level information are matched with the year of assessment to produce a panel of observations. More specifically, to assess the compliance rate with each of the 29 principles, a five-point scale ranging from noncompliant to compliant. Numerical values are assigned to each of the grades (from 1 for noncompliant to 5 for compliant). An overall index of compliance is computed based on the sum of the 29 regulatory dimensions. Two more indexes of compliance are then calculated, "Supervisors BCP" and "Banks BCP", based on the principles 1 to 13 and 14 to 29 respective. Finally, a deeper analysis on what banks are expected to do is performed using the individual core principles. All indices are normalized to take values in the interval [0, 100]. This normalization also has the intuitively appealing property of a percentage compliance interpretation. Table 1 presents summary statistics for our risk measures, bank level financial characteristics and BCP compliance indices by system.

Dynamic Difference in Difference Regression Results. The above estimation procedure is applied to three samples producing three distinct measure of systemic risk:

1. Global: a sample of publicly traded financial institutions which have been identified as having systemic importance either domestically or globally by a regulatory authority.
2. North America: a sample of all publicly traded US and Canadian financial institutions.
3. A sample of all publicly traded European financial institutions.

Overall, the main results suggest a positive relationship between BCP compliance and a bank's systemic risk contribution. Further analysis suggests that this relationship can be decomposed into a negative (risk reducing) effect deriving from what supervisors are doing and a positive (risk increasing) effect deriving from supervisor's expectation of a bank's conduct. A more in-depth chapter-level investigation of the latter finding shows the key driver of this positive effect is capital adequacy regulatory compliance, thus suggesting the presence of strategic complementarity effects in bank capital regulation (Vives (2014)).

More in detail, the main results presented are estimated using k=4 in equation 6 to ensure temporal consistency with our key variable of interest which has an annual frequency. For robustness k = (1 and 8) was also estimated and the results were qualitatively similar. Table 2-5 present DiD regression results. Table 2 presents the systemically important banks sample; Table 3 and 4 presents results for our North American and European system samples respectively, and table 5 presents the results for all three systems on the investigation of the core principles specific to what banks are expected to do. Encouragingly, the coefficient estimates on the individual characteristic and state variables are broadly similar to the predictive regressions in Table 5 of A&B (2016).

Robustness Tests: We carried out several robustness tests and the results are qualitatively consistent with the main analysis. We tested the following:

1. The use of principal component analysis to calculate the BCP indices.
2. Using a shorter time-period 1998-2015, which matches the BCP exercise period.
3. Using a sample which includes all the financial institutions.
4. Using lags at t=1 and t=8 in the regression analysis as per A&B (2016).

Appendix

Table A1: Quarterly Summary Statistics

Variables	**European Financial Institutions** *Mean*	*Standard Deviation*	*Observations*	**North American Financial Institutions** *Mean*	*Standard Deviation*	*Observations*
$\Delta\$CoVaR^i_{95,t}$	160.67	933.36	10828	175.95	768.16	46509
$\Delta\$CoVaR^i_{99,t}$	237.29	1243.83	10828	381	1694.54	46509
$VaR^i_{95,t}$	55.18	24.55	10273	33.69	20.18	46430
$VaR^i_{99,t}$	95.90	39.93	10273	70.41	39.96	46430
Leverage %	77.36	25.62	10273	81.10	20.43	46430
Size	0.75	0.24	10184	0.68	0.27	46194
Maturity Mismatch %	11.19	12.91	10273	5.58	9.74	46430
Boom	0.87	3.52	10273	0.88	4.37	46430
Overall BCP %	19.42	8.70	1079	5.25	0.03	3257
Supervisors BCP %	22.32	10.93	1079	5.88	0.85	3257
Banks BCP %	19.11	11.07	1079	17.89	3.45	3257
Capital Adequacy BCP %	23.41	7.53	1079	20	0.1	3257
Credit Risk BCP %	28.33	9.86	1079	21	0.1	3257
Concentration Risk BCP %	30.83	10.15	1079	39.18	3.98	3257
Market Risk BCP %	30.44	12.43	1079	22.47	11.93	3257
Liquidity Risk BCP %	26.92	9.71	1079	36.66	7.46	3257
Operational Risk BCP %	31.51	12.64	1079	19	0.2	3257

Note: The table reports statistics of the quarterly variables used in the $\Delta\$CoVaR$ regressions. The data spans 1990:Q1-2015:Q4 and covers 1523 institutions, 460 in Europe and 1013 in North America. $VaR^i_{q,t}$ is expressed in quarterly percent. $\Delta\$CoVaR^i_{q,t}$ is normalised by the cross sectional average of market equity each quarter and is expressed in quarterly basis points.

Table A2: BCP country coverage

Country	Year(s) of Assessment	WEO Classification
Austria	2003, 2013	Advanced
Belgium	2004, 2013	Advanced
Bulgaria	2001	Emerging and Dev
Canada	1999, 2014	Advanced
Croatia	2001, 2007	Emerging and Dev
Cyprus	2005	Advanced
Czech Republic	2000, 2011	Advanced
Denmark	2005, 2014	Advanced
Finland	2001	Advanced
France	2004, 2012	Advanced
Germany	2003, 2011	Advanced
Greece	2005	Advanced
Hungary	2000	Emerging and Dev
Italy	2003, 2013	Advanced
Japan	2002, 2012	Advanced
Lithuania	2001	Emerging and Dev
Luxembourg	2001, 2011	Advanced
Poland	2000, 2011	Emerging and Dev
Romania	2003, 2008	Emerging and Dev
Slovakia	2002, 2007	Advanced, Emerging and Dev
Spain	2005, 2012	Advanced
Sweden	2001, 2011	Advanced
Switzerland	2001, 2014	Advanced
United Kingdom	2002, 2011	Advanced
United States	2010	Advanced

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Table 1: Quarterly Summary Statistics

	Systemically Important Banks			European Banks			North American Banks		
Variables	*Mean*	*Std Dev*	*Obs*	*Mean*	*Std Dev*	*Obs*	*Mean*	*Std Dev*	*Obs*
$\Delta\$CoVaR^{i}_{95,t}$	1173.85	2250.78	4378	264.29	1276.09	7828	137.14	789.93	39509
$\Delta\$CoVaR^{i}_{99,t}$	2320.44	4542.14	4378	370.18	1695.82	7828	290.92	1696.42	39509
$VaR^{i}_{95,t}$	45.52	24.12	4496	48.39	21.57	8273	26.8	14.8	40430
$VaR^{i}_{99,t}$	80.34	37.31	4496	76.62	25.56	8273	59.54	29.47	40430
Leverage %	92.76	3.15	4496	7.58	3.77	8273	10.45	7.41	40430
Size	1.10	0.19	4487	0.83	0.21	8184	0.63	0.24	40194
Maturity Mismatch %	13.66	11.40	4496	0.13	0.10	8273	0.05	0.07	40430
Boom	0.87	4.29	4496	1.02	3.68	8273	0.76	4.01	40430
Overall BCP %	12.59	7.74	318	18.97	9.41	879	5.26	0.02	2257
Supervisors BCP %	15.30	8.51	318	20.92	10.96	879	6.08	0.62	2257
Banks BCP %	17.92	7.85	318	19.8	11.4	879	18.59	2.64	2257
Capital Adequacy BCP %	23.14	7.29	318	24.02	8.02	879	20	0.1	2257
Credit Risk BCP %	23.08	7.23	318	27.52	9.70	879	21	0.1	2257
Concentration Risk BCP %	31.26	9.94	318	30.79	10.35	879	39.50	3.12	2257
Market Risk BCP %	25.85	11.11	318	29.35	12.03	879	21.50	9.37	2257
Liquidity Risk BCP %	29.12	9.98	318	26.17	9.64	879	38.58	5.13	2257
Operational Risk BCP %	23.90	9.66	318	31.17	13.94	879	19	0.2	2257

Note: The table reports statistics of the quarterly variables used in the $\Delta\$CoVaR$ DiD regressions. The data spans 1990:Q1-2015:Q4 and covers 1073 banks, 260 in Europe and 813 in North America. $VaR^{i}_{q,t}$ is expressed in quarterly percent. $\Delta\$CoVaR^{i}_{q,t}$ is normalised by the cross sectional average of market equity each quarter and is expressed in quarterly basis points.

Table 2: Systemically Important Banks

	Dependent variable:			
	Panel A: $\Delta\$CoVaR^{i}_{95,t}$		**Panel B: $\Delta\$CoVaR^{i}_{99,t}$**	
	(1)	(2)	(3)	(4)
VaR95	7.89***	7.63***		
	(3.02)	(2.71)		
VaR99			14.73***	14.73***
			(2.37)	(2.35)
Overall BCP	8.31***		9.93***	
	(1.74)		(4.04)	
Supervisors BCP		-1.22***		-7.36***
		(0.47)		(1.09)
Banks BCP		6.71***		8.41***
		(2.18)		(1.26)
Leverage	37.45***	37.55***	164.82***	164.71***
	(12.20)	(12.26)	(67.39)	(67.55)
Size	11,984.85***	11,980.87***	23,834.06***	23,836.67***
	(1,112.51)	(1,121.50)	(2,376.87)	(2,381.34)
Maturity mismatch	29.13***	29.20***	69.51***	69.45***
	(8.53)	(8.52)	(21.63)	(21.60)
Boom	34.68***	34.58***	74.05***	74.04***
	(10.48)	(10.49)	(19.77)	(19.79)
Equity Volatility	9.73***	10.43***	88.18***	88.54***
	(4.30)	(4.26)	(8.87)	(8.78)
Three-month yield change	-370.45****	-371.92***	-609.22***	-610.80***
	(120.18)	(120.22)	(214.30)	(214.25)
TED spread	-28.78***	-29.01***	-38.70***	-41.02***
	(9.39)	(9.18)	(6.87)	(7.02)
Credit spread change	-405.12***	-436.10***	-223.94***	-213.34***
	(30.52)	(36.69)	(20.35)	(29.47)
Term spread change	-14.05***	-13.49**	-71.03***	-71.13***
	(7.01)	(7.19)	(8.26)	(7.60)
Market return	11.66**	11.62**	24.57****	24.62****
	(5.62)	(5.62)	(3.63)	(3.65)
Housing	9.23*	9.27**	20.98*	21.06*
	(4.86)	(3.87)	(10.81)	(10.82)
Constant	14,747.19**	14,762.24**	38,063.54***	38,050.38***
	(5,791.14)	(5,793.11)	(9,899.40)	(9,908.94)
Country Fixed Effects	Yes	Yes	Yes	Yes
Observations	3,082	3,082	3,082	3,082
R^2	0.61	0.61	0.60	0.60
Adjusted R^2	0.61	0.61	0.60	0.60

Note: This table reports coefficients from difference in difference regression for $\Delta\$CoVaR^{i}_{95,t}$ on one year lag of the BCP variables and firm characteristics in panel A and for $\Delta\$CoVaR^{i}_{95,t}$ in panel B. Each regression has a panel of firms. Newey-west standard errors allowing for up to five periods of autocorrelation are displayed in parentheses *p<0.1;**p<0.05;***p<0.01.

Table 3: North American Banks

	Dependent variable:			
	Panel A: $\Delta\$CoVaR^i_{95,t}$		**Panel B: $\Delta\$CoVaR^i_{99,t}$**	
	(1)	(2)	(3)	(4)
VaR95	11.48***	11.46***		
	(2.59)	(2.59)		
VaR99			3.31***	3.27***
			(1.21)	(1.21)
Overall BCP	19.04**		31.28**	
	(8.63)		(15.81)	
Supervisors BCP		-45.28**		-72.26***
		(6.24)		(19.73)
Banks BCP		53.10***		131.15***
		(20.18)		(49.85)
Leverage	6.78***	6.80***	13.44***	13.48***
	(1.28)	(1.28)	(2.65)	(2.65)
Size	1,672.63***	1,672.96***	3,291.59***	3,292.51***
	(270.08)	(270.01)	(584.06)	(584.08)
Maturity mismatch	9.68*	9.72*	20.71*	20.80*
	(5.03)	(5.04)	(12.57)	(12.58)
Boom	6.23	6.29	16.22*	16.38*
	(4.27)	(4.27)	(9.66)	(9.67)
Equity Volatility	42.44***	42.07***	11.85**	11.04***
	(9.96)	(9.93)	(5.23)	(4.28)
Three-month yield change	-57.36***	-56.90***	-109.52***	-108.52***
	(14.64)	(14.58)	(31.28)	(31.18)
TED spread	-174.46***	-177.89***	-267.49***	-274.21***
	(43.97)	(44.44)	(86.69)	(87.23)
Credit spread change	-608.06***	-632.71***	-1,159.01***	-1,217.16***
	(195.84)	(198.49)	(359.77)	(365.64)
Term spread change	-18.19***	-18.33***	-9.80**	-9.84*
	(6.64)	(6.66)	(4.15)	(5.16)
Market return	2.49**	2.50**	1.09**	2.14**
	(1.02)	(1.02)	(0.54)	(1.04)
Housing	1.44**	1.40**	1.92**	1.83***
	(0.77)	(0.77)	(0.59)	(0.58)
Constant	1,472.26***	1,459.30***	2,871.45***	2,843.68***
	(338.27)	(336.31)	(736.40)	(732.10)
Country Fixed Effects	Yes	Yes	Yes	Yes
Observations	34,876	34,876	34,876	34,876
R^2	0.25	0.25	0.24	0.24
Adjusted R^2	0.25	0.25	0.24	0.24

Note: This table reports coefficients from difference in difference regression for $\Delta\$CoVaR^i_{95,t}$ on one year lag of the BCP variables and firm characteristics in panel A and for $\Delta\$CoVaR^i_{95,t}$ in panel B. Each regression has a panel of firms. Newey-west standard errors allowing for up to five periods of autocorrelation are displayed in parentheses *p<0.1;**p<0.05;***p<0.01.

Table 4: European Banks

	Dependent variable:			
	Panel A: $\Delta\$CoVaR^{i}_{95,t}$		**Panel B: $\Delta\$CoVaR^{i}_{99,t}$**	
	(1)	(2)	(3)	(4)
VaR95	1.69*	1.79**		
	(1.01)	(1.04)		
VaR99			1.32***	1.34***
			(0.11)	(0.11)
Overall BCP	1.32***		1.97***	
	(0.25)		(.70)	
Supervisors BCP		-0.62***		-0.40***
		(0.20)		(0.17)
Banks BCP		1.89***		2.15***
		(0.58)		(1.01)
Leverage	36.98***	36.92***	48.77***	48.73***
	(5.92)	(5.88)	(3.91)	(3.89)
Size	1,915.98**	1,919.43**	2,644.59**	2,648.01**
	(869.28)	(870.36)	(1,157.77)	(1,158.93)
Maturity mismatch	5.52***	6.51***	8.11***	9.10***
	(2.73)	(2.73)	(3.68)	(3.68)
Boom	22.15***	22.13***	28.70***	28.68***
	(8.83)	(8.81)	(3.88)	(3.87)
Equity Volatility	6.70***	7.68***	4.36***	5.21***
	(1.09)	(1.83)	(1.00)	(1.73)
Three-month yield change	-22.62***	-42.67***	-111.76***	-99.54***
	(5.36)	(5.12)	(6.77)	(9.84)
TED spread	-35.50***	-35.77***	-53.47***	-53.93***
	(9.91)	(9.71)	(7.22)	(7.95)
Credit spread change	-499.61***	-482.27***	-664.30***	-643.92***
	(50.04)	(54.51)	(66.20)	(61.18)
Term spread change	-13.41***	-14.30***	-15.18***	-16.30***
	(3.73)	(3.64)	(4.99)	(4.94)
Market return	4.82**	4.69**	5.15***	5.01*
	(1.55)	(2.56)	(2.46)	(3.48)
Housing	3.53***	3.40**	3.64**	3.51**
	(1.40)	(1.42)	(1.37)	(1.39)
Constant	1,556.94*	1,562.81*	2,040.71*	2,046.03*
	(813.54)	(817.01)	(1,079.25)	(1,083.64)
Country Fixed Effects	Yes	Yes	Yes	Yes
Observations	6,794	6,794	6,794	6,794
R^2	0.51	0.51	0.54	0.54
Adjusted R^2	0.51	0.51	0.53	0.53

Note: This table reports coefficients from difference in difference regression for $\Delta\$CoVaR^{i}_{95,t}$ on one year lag of the BCP variables and firm characteristics in panel A and for $\Delta\$CoVaR^{i}_{95,t}$ in panel B. Each regression has a panel of firms. Newey-west standard errors allowing for up to five periods of autocorrelation are displayed in parentheses *p<0.1;**p<0.05;***p<0.01.

Table 5: Banking Core Principles Analysis

	Panel A: SIBs		Panel B: North American Banks		Panel C: European Banks	
Dependent variable:	$\Delta\$CoVaR^i_{95,}$	$\Delta\$CoVaR^i_{99,}$	$\Delta\$CoVaR^i_{95,}$	$\Delta\$CoVaR^i_{99,}$	$\Delta\$CoVaR^i_{95,}$	$\Delta\$CoVaR^i_{99,}$
VaR95	7.83*		11.46***		7.71***	
	(4.69)		(2.59)		(1.15)	
VaR99		14.65**		3.28***		7.27***
		(7.31)		(1.20)		(1.11)
Supervisors BCP	-23.30**	-44.49**	-21.74***	-27.99***	-13.38***	-16.68***
	(9.02)	(6.95)	(9.92)	(9.21)	(4.46)	(6.37)
Capital Adequacy	130.35**	141.33***	77.82***	82.60***	92.63***	94.20***
	(8.56)	(17.18)	(12.32)	(30.99)	(3.37)	(4.68)
Credit Risk	-11.02	-15.38	-9.02**	-8.38	-11.24***	-12.20**
	(15.04)	(31.18)	(5.04)	(5.18)	(3.87)	(5.39)
Concentration Risk	-2.04	-5.44	-6.58	-9.37	-5.30	-7.80
	(10.43)	(20.88)	(13.74)	(27.66)	(4.28)	(6.28)
Market Risk	-25.14**	-44.31***	-15.14**	-24.21***	-30.03**	-20.50***
	(11.52)	(3.78)	(3.52)	(3.78)	(3.65)	(5.59)
Liquidity Risk	-33.14***	-30.28***	-23.10***	-20.11***	-30.74***	-36.97***
	(14.50)	(6.04)	(7.10)	(4.04)	(6.12)	(9.11)
Operational Risk	-11.55	-12.85	-12.15	-9.15**	-11.39	-8.41
	(13.63)	(29.45)	(9.13)	(5.45)	(3.69)	(5.44)
Leverage	37.31***	64.07***	6.76***	13.36***	37.39***	49.48***
	(6.39)	(7.74)	(1.27)	(2.60)	(5.98)	(4.03)
Size	11,978.76***	23,848.51***	1,672.71***	3,291.83***	1,915.29**	2,642.04**
	(1,126.61)	(2,383.00)	(270.09)	(584.32)	(873.05)	(1,162.17)
Maturity Mismatch	29.55***	69.95***	19.71***	20.79*	10.42***	10.98***
	(8.61)	(21.77)	(5.04)	(12.59)	(2.75)	(3.69)
Boom	34.34***	74.05***	6.25**	16.23*	22.23	28.81
	(10.49)	(19.87)	(3.28)	(9.70)	(18.82)	(23.85)
Equity Volatility	51.86*	46.99***	41.91***	30.55***	36.19***	32.84***
	(34.14)	(8.27)	(9.96)	(8.33)	(15.83)	(18.64)
Three-month yield change	-377.14***	-611.38***	-56.87***	-108.41***	111.14***	118.40**
	(120.40)	(214.72)	(14.57)	(31.15)	(51.61)	(70.34)
TED spread	-28.97***	-36.98***	178.19***	-275.89***	-37.74***	-56.17***
	(9.44)	(17.56)	(44.45)	(87.26)	(5.25)	(6.32)
Credit spread change	-541.12***	-351.04***	-633.56***	-1,220.57***	-477.47***	-626.12***
	(140.65)	(131.81)	(198.73)	(366.52)	(56.08)	(23.32)
Term Spread Change	-11.05***	-74.72***	-18.47***	-10.39***	-14.12***	-16.08***
	(5.57)	(7.73)	(6.66)	(5.17)	(3.72)	(4.02)
Market Return	11.07***	23.29**	2.52**	1.19***	4.44**	4.59**
	(4.63)	(11.64)	(1.02)	(0.54)	(2.65)	(2.57)
Housing	9.36***	20.63**	8.40***	7.82***	3.32***	3.36***
	(2.87)	(10.83)	(0.77)	(1.59)	(1.45)	(1.41)
Observations	3,082	3,082	34,876	34,876	6,794	6,794
R^2	0.61	0.60	0.25	0.24	0.51	0.54
Adjusted R^2	0.61	0.60	0.25	0.24	0.51	0.53

Note: This table reports coefficients from difference in difference regression for $\Delta\$CoVaR^i_{95,t}$ on one year lag of the BCP variables and firm characteristics in panel A and for $\Delta\$CoVaR^i_{95,t}$ in panel B. Each regression has a panel of firms. Newey-west standard errors allowing for up to five periods of autocorrelation are displayed in parentheses *p<0.1;**p<0.05;***p<0.01.