Jnl Publ. Pol., **22**, *1*, 61–75
DOI: 10.1017/S0143814X02001034

Banking Regulation in Hard Times: Business Cycles, Bank Capital, and the Bank Failure – Credit Crunch Dilemma

THOMAS BERNAUER
and VALLY KOUBI *Political Science, Swiss Federal Institute of Technology (ETH), Zurich*

ABSTRACT

Restrictive policies aimed at reducing the likelihood of bank failures during recessions tend to increase the probability of a credit crunch. We examine whether this policy-dilemma is empirically observable, and whether policy-makers concentrate more on preventing bank failures or avoiding a credit crunch. We find that although capital-asset ratios in the total population of US banks in the 1990s are pro-cyclical, the most vulnerable banks (substantially undercapitalized ones) tend to increase their capital-asset ratios during recessions. These findings suggest that policy-makers are indeed experiencing a dilemma, and that they try to balance the relative probabilities of the two evils: they force the weakest banks to improve their capital-asset ratios while mitigating the risk of a credit crunch by accepting a reduction in the capital-asset ratios of less vulnerable banks.

Returns on bank assets usually decrease during recessions because some borrowers (firms, individuals, political entities) default or restructure interest payments and loan repayments, lending and underwriting activity in general slumps, and profits from portfolio investments decline (Mitchell 1941; Mishkin 1997). The deterioration in aggregate economic conditions can thus undermine the viability of some banks, especially those with a weak capital base and great risk exposure. Banks with little capital of their own (equity capital and retained profits) and many assets that might substantially decline in value (e.g. defaults on loans to companies or on mortgages, declining value of equity, bond or derivatives investments) obviously face greater risks in terms of their overall viability. To make things worse, the collapse of weaker banks can have systemic repercussions if it sparks bank panics that also undermine economically "healthier" banks. The Asian crisis, the reces-

sion in Japan in the 1990s, and the Mexican crisis of 1994, for example, drove several large and many small banks into insolvency (Mishkin 1997).

The increase in the probability of bank failures and also wider bank panics during recessions (see Gordon 1988) create a policy dilemma. This dilemma is non-trivial, particularly because financial intermediaries are a key-backbone of virtually every economy. If government regulators intervene in financial markets by toughening capital and other prudential requirements[1] or by enforcing existing ones more strictly they may succeed in lowering the probability of bank failures and bank panics. But their actions could lead to a credit crunch that might exacerbate the recession and create a vicious circle (Berger, Kyle and Scalise 2001; Gordon and Winton 2000). The risk of a credit crunch emanates from the fact that banks typically respond to stricter risk-weighted capital-asset requirement by reducing their assets and/or not acquiring new assets (e.g. providing loans), particularly riskier ones against which they must hold more capital. The credit crunch that followed the banking crisis in Asia in 1997–98 had significant negative amplification effects on macroeconomic conditions and represents a clear demonstration of this possibility (Burnside, Eichenbaum and Rebello 2001). Vice versa, if regulators are more lenient in regard to prudential requirements they may avoid a credit crunch, but probably at the price of more bank failures or even bank panics.

In this article we examine whether this policy-dilemma can be empirically observed, and whether policy-makers concentrate more on preventing bank failures or avoiding a credit crunch. We infer policy-makers' behavior from economic data in an effort to complement work that explores the issue on the basis of qualitative historical information on policy-preferences and -choices. In particular, we study risk-taking and capitalization (both are measured in the form of risk-weighted capital-asset ratios) of US banks in the 1990s. We focus particularly on those banks that are more likely to find themselves in trouble and hence constitute the main source of the policy dilemma. As indicators of trouble we take low capitalization, great exposure to non-performing loans, and low return on equity. The most important presumption underlying this analysis is that a pro-cyclical capital-asset ratio constitutes prima facie evidence that policy-makers are concerned more about preventing a credit crunch than about decreasing the probability of bank failures. A counter-cyclical pattern suggests that policy-makers worry more about bank failures.

We find that, for the total population of US banks in the 1990s (approximately 100,000 bank-years), the conditional association

between banks' capital-asset ratios and the strength of the economy in the US state where banks are located is positive. That is, we observe a pro-cyclical pattern. However, once we partition the sample into groups representing different degrees of bank vulnerability this relationship becomes negative and statistically significant for the weaker banks. That is, we observe a counter-cyclical pattern for poorly capitalized banks: the average bank lowers its capital-asset ratio when the economy slows down, but weak banks increase their capital-asset ratio under such economic conditions.

What inferences can we draw in regard to policy-makers' choices when they face a trade-off between policies that reduce the likelihood of a credit crunch but increase the probability of bank failures, or vice versa? Is there in fact such a policy-dilemma? If so, do policy-makers concentrate more on preventing bank failures or avoiding a credit crunch? To start with, any such inference assumes, of course, that regulators have a major influence on observed bank capital-asset ratios. The empirical evidence is largely supportive of this assumption. Berger, Kyle and Scalise (2001), for example, show that the supervisory environment varies systematically over the business cycle. Moreover, Peek and Rosengren (1995) demonstrate that credit tightening reflects responses forced by bank regulators, rather than voluntary behavior of banks' managements choosing to improve their capital position.

The observed pro-cyclical pattern of capital-asset ratios for the entire population of US banks implies that the risk of bank failures increases during recessions while the risk of a credit crunch is reduced. However, the fact that banks with low capital-asset ratios take remedial action during recessions implies that policy-makers attempt to preserve credit creation without taking excessive risks at the bank failure front. In other words, policy-makers clearly experience a dilemma, and they try to balance the relative probabilities of the two evils: they force the weakest banks to improve their capital-asset ratios while mitigating the risk of a credit crunch by accepting a reduction in the capital-asset ratios of less vulnerable banks.

Whether this balancing act is optimal from an economic welfare-perspective remains open and requires further research. In addition to macroeconomic stabilization, regulators may have other reasons for showing forbearance. For instance, Gorton and Winton (2000) argue that a bank's private cost of raising capital is higher during a recession and this leads to optimal regulatory forbearance.

The following section reviews the existing literature on bank regulation, bank failures and panics, and the credit crunch issue. In section 2 we present the results of the empirical analysis and section 3 concludes.

1. Bank panics, capital adequacy rules, and the credit crunch problem

Government regulation is usually justified in terms of correcting market failures emanating from public goods, externalities, monopolies, or information asymmetries between buyers and sellers. The conventional wisdom holds that banking regulation is needed primarily because depositors or investors more generally are unable to effectively monitor their banks' viability (asymmetric information) and because there is a risk of bank panic and wider systemic crisis. A bank panic occurs when a large number (or even all) depositors or investors of one or more banks request a transformation of their deposits or other investments into currency, and when the banks concerned are unable to satisfy this demand. Such panics can, and in the past often have, spilled over from weak to economically more viable banks, causing a systemic crisis in the entire financial sector.

Two types of theories have been advanced to explain bank panics.

The first one views such panics as random events that are unrelated to the "real" state of the economy as expressed by economic data, but are rooted in individual and/or collective beliefs. The first-come-first-served rule for bank repurchases of deposits or other investments (i.e. the return a depositor/investor receives depends on his place in line at the bank) further increases the probability that the banking system will collapse in panic. Diamond and Dybvig (1983: 410) argue, ". . . anything that causes [depositors/investors] to anticipate a run [bank panic] will lead to a run." Possible causes include "a bad earning report, a commonly observed run at some other bank, a negative government forecast, or even sunspots."

The second type of theory argues that panics are related to the occurrence of events that change depositors'/investors' perceptions of the risks that banks take. Because of asymmetric information between banks and depositors/investors, the latter are unable to accurately assess the risks of individual banks and thus resort to aggregate information. In that case all banks may be perceived to have become riskier, although only a few in fact have. In other words, the collapse of one bank, or even the possibility of it, may spill over to other banks and also damage the entire economy. Bank crises can entail high fiscal costs and reduce economic growth. The Economist (February 23, 2002), for example, reports that according to research by the Bank of England banking crises over the past 25 years have on average caused cumulative output losses equivalent to 15–20% of GDP.

This type of theory assumes that bank panics are mainly caused by recessions[2] because depositors/investors expect a larger number of banks to fail under such circumstances. Mitchell (1941), Fels (1959),

and Gordon (1988) regard recession as the primary cause of bank panics. Gordon (1988: 755) observes, "during the National Banking Era every major business cycle downturn was accompanied by a banking panic. During this period (1863–1914) seven of the eleven cycles contain panics." Moreover, Gordon (1988: 778) does not find evidence for a reverse causality (that bank panic causes recession) and concludes "... liabilities of failed businesses do Granger-cause losses on deposits."

Dwyer and Hafer (2001) examine whether a bank's ex ante riskiness is a reliable guide to its fate in a bank panic. Using data on bank runs in selected US state banking systems in 1860 (when many banks failed) they compare the riskiness of banks that failed with the riskiness of other banks. The two authors measure riskiness with a bank's portfolio and its leverage (the ratio of bonds to bank capital) since this measure reflects the risk borne by stockholders. They find that riskier banks were more likely to fail during this time and holders of notes of such banks were more likely to suffer losses. In other words, recession is a principal cause of bank panic, but the potential for spillover from weaker to stronger banks (i.e. systemic risk) is limited.

The probability of bank runs and systemic risks may, in principle, be reduced by a variety of measures, for example, the establishment of "narrow banks" (i.e. banks that invest only in low-risk assets), funding of banks with more equity rather than demand deposits, greater transparency, using central banks as lenders of last resort (see, e.g., Bagehot 1873), and deposit insurance (e.g. Diamond and Dybvig 1983). Though these policies may insulate banks from runs, most of them have serious drawbacks. The creation of narrow banks, for example, reduces investment particularly in economic sectors that are associated with greater business risks (but potentially greater opportunities). The lender of last resort policy and deposit insurance create a moral hazard problem (i.e. incentives of banks and depositors to accept risks they would otherwise not accept).

In view of these drawbacks, requiring banks to increase their capital-asset ratios seems to be the obvious regulatory response to weaknesses in the banking system (see Berger, Herring and Szego (1995) for the role of capital in financial institutions; Dewatripont and Tirole (1993), Santos (2000) for bank capital regulation). This measure rests on two assumptions: first, more capital (or reserves more generally) equip banks with a stronger financial "cushion", should they experience unexpected losses and/or a bank run. Second, increasing equity capital implies that the respective bank's risk-taking has a greater effect on shareholders, motivating the latter to more effectively monitor and, if necessary, constrain the management's risk-taking behavior.[3] In addi-

tion to pressure from regulators, banks may also have their own reasons for increasing capital-asset ratios during recessions: for instance, to signal to the market that they are economically strong, which tends to lower funding costs.

Regulatory capital requirements may, however, have unintended consequences, notably, a contraction in bank lending (i.e. a credit crunch). Banks can increase their capital-asset ratio either by increasing capital (particularly by issuing new equity), or by reducing their assets (divesting, reducing lending). Because raising new capital is difficult for banks during recessions, most weak banks are likely to focus more on divesting and loan reduction. This reduction of assets, particularly in the supply of loans, can cause a credit crunch.

A credit crunch occurs when banks refuse to make loans even though borrowers are willing to pay the requested interest rate or even a higher rate and restrict the size of loans to less than the full amount sough. Because of asymmetric information between lenders and borrowers, banks choose to ration credit in order to avoid adverse selection and negative incentive effects. Raising interest rates might reduce bank profits if adverse selection increases the average riskiness of potential borrowers and if incentive effects induce borrowers to switch from safe to risky projects after obtaining the loan. Moreover, by granting loans to borrowers that are not as large as the borrowers want, banks maximize the probability of loan repayment as more borrowers repay their loan if the loan amounts are small (Mishkin 1997). One could argue that recessions may also reduce demand for loans by individuals and businesses, thus forcing banks to reduce lending. The available evidence, however, points to banks' refusal to lend as the main reason for credit crunches (Peek and Rosengren 1995; Mishkin 1997).

Hancock and Wilcox (1993), Berger and Udell (1994), and Shrieves and Dahl (1995) investigate whether during the 1990–1991 period US banks made fewer loans to reduce risk. Hancock and Wilcox, and Shrieves and Dahl find that this factor played a role in the reduction of loans. Berger and Udell, on the other hand, find little support for this hypothesis.

Many analysts have blamed the credit crunch in the United States in the early 1990s on changes in regulatory capital requirements[4]. Similar arguments have been advanced for Japan in the mid to late 1990s. Berger and Udell (1994), and Hancock and Wilcox (1993) investigate whether regulatory capital actions based on leverage ratios (which mandated that banks hold at least 3 percent capital against non-risk-weighted assets), contributed to the reduction in bank loans. Whereas Hancock and Wilcox conclude that these measures contributed

significantly to the lending contraction, Berger and Udell find only weak support for this hypothesis.

Finally, Furlong (1992), Haubrich and Wachtel (1993), and Berger and Udell (1994) investigate whether the 8 percent capital backing for loans to private enterprises required by the 1988 Basle Accord encouraged banks to reallocate their assets from such loans to government securities (the latter require capital backing of only 0–1.6 percent). With the exception of Berger and Udell, these authors find evidence that the risk-based capital requirement set by the Basle Accord significantly contributed to the credit crunch.

To summarize, recessions increase the probability of bank failures and bank panics. To reduce these risks, policy-makers can introduce new or enforce more rigorously existing regulations, in particular those aimed at strengthening banks' capital-asset ratios. Because this strengthening typically takes place through a reduction in credit creation, it can produce a credit crunch that exacerbates the recession. Consequently, policy-makers face a dilemma between safeguarding the banking system (preventing bank failures and/or bank panics) and preventing a further deterioration in aggregate economic conditions (credit crunch).

Several authors have examined whether and how recessions cause bank failures and bank panics, and whether and how regulatory responses can cause a credit crunch (see above). Political scientists and economists have, however, not yet explored systematically how regulators behave when facing a trade-off between preventing bank failures and preventing a credit crunch. The only empirical evidence on this issue so far relates to particular historical episodes that have been reported in the press or (less frequently) the academic literature.

We know, for example, that in the mid to late 1990s regulators in Japan have in many instances shied away from closing massively undercapitalized banks because of worries that a credit crunch would accelerate the ongoing economic downturn. In other cases, Japanese regulators have forced undercapitalized banks to downsize, to merge with stronger banks, to re-capitalize (often with public subsidies), or to shut down.

While this evidence is interesting and useful, it remains predominantly anecdotal, qualitative, frequently colored by subjective judgment by the respective analyst, and difficult to aggregate into an overall assessment, be it for individual countries or groups of countries over longer time-periods. To avoid these problems, we study the cyclical behavior of bank capital-asset ratios in an effort to infer how policy-makers have responded to the policy dilemma. In other words, we claim that certain economic data (notably data indicating specific types of

bank behavior) are closely related to policy-makers' choices in regard to the bank failure – credit crunch problem.

2. *Empirical analysis*

The bank failure – credit crunch dilemma discussed above is likely to exist in all advanced, transition, and developing economies. A global analysis of the issue would therefore be desirable and would open up interesting avenues for explaining variation across countries in responses to the policy-dilemma. Unfortunately, many countries collect bank-level data on capital-asset ratios and other bank-specific variables, but extremely few publish such data.[5] We thus restrict the analysis to US banks, for which this data is available. We use a data set consisting of yearly observations on the entire population of US banks over the period 1990–1998.[6] This data set was constructed from data provided by the US Federal Deposit Insurance Corporation (see Table 1 for variable definitions).

The key (dependent) variable in the analysis is the capital-asset ratio of banks, $\mathbf{k}_{it}$. It is measured in terms of the *risk-weighted Tier 1 capital-asset ratio* (Tier 1 capital divided by total risk-weighted assets[7]). The Basle Accord, adopted in July 1988 and implemented since December 1992, established a common international definition of bank capital, which is divided into two tiers. Tier 1 capital -common to all signatory countries- consists of common stockholder equity and disclosed reserves (except for some forms of preferred stock that U.S. bank holding companies also include). Tier 2 capital includes any combination of eligible capital elements permitted by national regulators. Assets are weighted by a risk factor (e.g. 0 for government bonds, 1 for credits extended to companies, and so on). The minimum capital base mandated by the Basle Accord is 8 percent, with at least half of this met by Tier 1 capital.

TABLE 1: *Variables*

Name	Description	Source
K	Ratio of tier 1 capital to total risk-weighted assets	*US Federal Deposit Insurance Corporation (FDIC)*: RBC1RWAJ
Roe	Return on equity	*FDIC*: ROE
Nonp	Share of non-performing loans in total assets	*FDIC*: NPER/ASSET
DumBA	Basle Accord	
Gdp	GDP growth rate in the state	*BEA*
Asset	Total assets	*FDIC*: ASSET
Employees	Number of employees	*FDIC*: Number of Employees

The bank data are from 1990–2000. GDP data are from 1990–1998.

To assess whether capital-asset ratios are pro- or counter-cyclical to aggregate economic conditions, we regress $\mathbf{k}_{it}$ on **gdp** growth during the period 1990–1998 in individual US states where a bank is located.

To avoid omitted variable bias and to evaluate the robustness of the results we add several control variables. We begin with the *return on equity*, **roe**, and *non-performing loans*, **nonp**. The first control variable (roe) is an indicator of vulnerability and also of possible difficulties a bank may experience in raising new capital. The second control variable (nonp) is used as an indicator of bank vulnerability. We also use a *dummy variable* (**dumBA**) to capture *the introduction of the Basle Accord*. DumBA is likely to drive capital-asset ratios up because of tougher regulation and more scrutiny by markets in light of the Basle definitions. Before the Basle Accord, it was harder for markets to assess and compare banks' viability because there were no uniform criteria. So it was harder for markets to punish weak banks. Finally, we consider two control variables related to bank size: the *number of employees*, **emp**, and the *total value of assets*, **asset**.

Because some of the data are almost certainly reported with error (for instance, negative entries for k and nonp, implausibly large or small values for other variables), we purge the sample from a small number of outliers. Specifically, we include only those banks with a Tier 1 (k) capital-asset ratio between 0 and 100%, and roe values between -100% and 100%. Table 2 also reports summary statistics for the data used in the analysis. The correlations, which are reported in Table 2, show that better capitalized banks tend to have better performing assets but deliver a lower rate of return on equity.

To estimate the cyclical behavior of capital-asset ratios we rely on pooled cross-section times series regressions with a fixed-effects procedure[8]. Table 3 reports the results of a regression of k on gdp and a set of control variables.

TABLE 2: *Summary Statistics for Data Used in the Regressions*

Variable	Obs	Mean	Std. Dev.	Min	Max
k	133264	17.13	9.87	.01	100
nonp	126041	.0127	.023	.0	1.13
roe	133912	10.33	10.96	−100	100
gdp	111510	.0309	.023	−.097	.127

Correlation coefficients (obs=64256)

	k	nonp	roe	gdp
k	1.0000			
nonp	−0.1081	1.0000		
roe	−0.1489	−0.2740	1.0000	
gdp	−0.0029	−0.1193	0.0587	1.0000

TABLE 3: *Dependent variable: Risk-weighted Tier 1 capital-asset ratio (k)*
Fixed-effects regression
All banks

	Coef.	Std. Err.	t	P>|t|
gdp	10.20284	.7181021	14.208	0.000
nonp	−25.49246	1.134239	−22.475	0.000
roe	.0195386	.0016155	12.094	0.000
asset	−3.05e−08	6.21e−09	−4.913	0.000
dumBA	1.680664	.0441103	38.101	0.000
year	−.0012775	.0000907	−14.088	0.000
cons	270.1195	18.05298	14.963	0.000

N = 103984
R-sq = 0.0540
Prob > F = 0.0000

The estimated coefficient for gdp is positive, which indicates pro-cyclical variation in the capital-asset ratio. The other coefficients suggest that a higher return on equity contributes to a higher capital-asset ratio, while bank size and a large share of non-performing loans contribute to lower capital-asset ratios. Moreover, the implementation of the Basle Accord in the United States is associated with an increase in banks' capital-asset ratios. This finding supports our assumption that regulators play a substantial role in banks' choices of capital-asset ratios. As noted above, our inferences about policy-makers' behavior from banks' capital-asset ratios are drawn on the basis of this assumption. This finding may also indicate, however, that the implementation of the Basle Accord has strengthened market discipline as the riskiness of individual banks became easier to observe for market participants. This increased market discipline may then have contributed to higher bank capital-asset ratios.

Note that the low R-square is not a reason for concern in fixed effects estimation, as this procedure aims mostly at explaining the time variation in the capital-asset ratios rather than the differences across banks.

Before concluding from this finding that policy-makers completely discount bank failure and bank panic risks in order to mitigate the probability of a credit crunch during a recession, one must first examine whether this pro-cyclical pattern is uniform across banks independent of their vulnerability. We do so by introducing an interaction term into the regression, and by splitting the sample. Tables 4–5 provide some pertinent information.

Table 4 shows the results of a regression that includes an interaction term containing non-performing loans and economic growth, **gdp***

TABLE 4: *Dependent variable: Risk-weighted Tier 1 capital-asset ratio (k)*
Fixed-effects regression
All banks

	Coef.	Std. Err.	t	P>|t|
gdp	6.553768	.8408017	7.795	0.000
gdp*nonp	271972.7	32630.44	8.335	0.000
nonp	−30.71168	1.295229	−23.711	0.000
roe	.0182571	.0016222	11.254	0.000
asset	−3.09e-08	6.20e-09	−4.975	0.000
dumBA	1.672028	.0441055	37.910	0.000
year	−.0012125	.000091	−13.328	0.000
cons	257.2889	18.11158	14.206	0.000

N = 103984
R-sq = 0.0548
Prob > F = 0.0000

nonp. The estimated coefficient is positive, which suggests that banks with larger amounts of non-performing loans (i.e. weaker banks) prefer to have larger capital-asset ratios.

In the regression reported in Table 5, we split the sample to examine the behavior of the capital-asset ratio over the business cycle for banks with a low capital-asset ratio (defined as banks with a capital-asset ratio falling short of the mean ratio by one standard deviation).

The association between economic growth and banks' capital-asset ratios is now negative. That is, the average weak bank strengthens its capital-asset ratio during periods of weak economic activity. The estimated coefficient implies that a reduction in the economic growth rate by one percentage point leads to an increase in weak banks' capital-asset ratios – computed at the sample average value – of about

TABLE 5: *Dependent variable: Risk-weighted Tier 1 capital-asset ratio (k)*
Fixed-effects regression
Censored sample: k < mean(k)-sd(k)

	Coef.	Std. Err.	t	P>|t|
gdp	−3.622657	1.766804	−2.050	0.041
nonp	−7.509202	1.404361	−5.347	0.000
roe	.0160748	.0012461	12.900	0.000
asset	3.90e-09	7.23e-09	0.540	0.590
dumBA	.3390356	.1603472	2.114	0.035
callym	.0005293	.0003432	1.542	0.123
cons	−99.47257	68.32864	−1.456	0.146

N = 2167
R-sq = 0.2487
Prob > F = 0.0000

one percentage point (this corresponds to an average increase of 20 percent). This effect is quite substantial.

As an additional test, we split the sample according to non-performing loans and return on equity, thus again focusing on weak banks as the principal source of the policy-dilemma. The results are reported in Tables 6 and 7.

As can be seen, having a large share of non-performing loans or low return on equity does not induce banks to take remedial action. This result suggests that neither regulators nor the markets pay much attention to these two indicators of bank vulnerability.

3. Conclusions

Recessions pose a serious dilemma for policy-makers in regard to banking regulation. If policy-makers focus stringently on the viability of

TABLE 6: *Dependent variable: Risk-weighted Tier 1 capital-asset ratio (k)*
Fixed-effects regression
Censored sample: nonp>mean (nonp)

	Coef.	Std. Err.	t	P>|t|
gdp	5.484132	1.192789	4.598	0.000
nonp	−1.039111	1.269635	−0.818	0.413
roe	.0564655	.0017887	31.567	0.000
asset	−6.72e-08	1.76e-08	−3.817	0.000
dumBA	1.112001	.0761118	14.610	0.000
year	.00248	.000175	14.170	0.000
cons	−480.7964	34.84632	−13.798	0.000

N = 32784
R-sq = 0.1524
Prob > F = 0.0000

TABLE 7: *Dependent variable: Risk-weighted Tier 1 capital-asset ratio (k)*
Fixed-effects regression
Censored sample: roe<−10

	Coef.	Std. Err.	t	P>|t|
gdp	4.272471	7.924045	0.539	0.590
nonp	−14.12023	4.615956	−3.059	0.002
roe	.0481853	.0071919	6.700	0.000
asset	−8.42e-07	5.87e-07	−1.434	0.152
dumBA	.5494055	.4971075	1.105	0.269
year	.0002439	.0013307	0.183	0.855
cons	−36.43996	264.9438	−0.138	0.891

N = 3332
R-sq = 0.0614
Prob > F = 0.0000

banks they may increase the probability of a credit crunch. If they focus on short run macroeconomic stabilization (avoiding a credit crunch) they may increase the probability of bank failures and bank panics.

In this article we have studied the cyclical behavior of bank capital-asset ratios in an effort to systematically infer policy-makers' behavior from economic data rather than from more anecdotal, qualitative evidence (e.g. statements by policy-makers or qualitative third party assessments of policy-makers' behavior). The results suggest that during recessions policy-makers do encounter a policy-dilemma, and that this dilemma influences regulatory responses.

Regulators appear willing to prevent a worsening of macroeconomic conditions by allowing average capital-asset ratios to fall during recessions. But they do so in a qualified fashion. While being more permissive in regard to economically stronger banks, they do not allow weaker (poorly capitalized) banks to participate in credit expansion. Weak banks end up raising their capital-asset ratios during recessions.

The research reported in this article could be extended in at least two directions. First, it would be useful to carry out similar analyses for other countries to the extent that the available data permit. Such analyses might reveal interesting variation in policy-responses to the dilemma across countries that could be explained in terms of country-specific variables, including institutional variables.

Second, inferring policy-makers' behavior from changes in capital-asset ratios allows for systematic aggregate analysis of the policy-dilemma problem. But it also has drawbacks. In particular, it rests on the assumption that policy-makers' actions play an important role in determining the relationship between the business cycle and bank capital-asset ratios. While this assumption receives strong support from the work of Peek and Rosegren (1995) and also from our analysis (notably, the effect of DumBA on k), one cannot rule out the possibility that there exist other important determinants of capital-asset ratios, which have been omitted from the analysis and which vary cyclically. To the extent that our assumption about regulatory effectiveness differs from reality, the estimated relations may be spurious. An important task is then to try to identify theoretically such other influences on capital-asset ratios and include them in the regressions in order to isolate the effect of policy actions.

NOTES

1. The most typical response by regulators in this situation is to examine weaker banks' assets and liabilities more closely, to force these banks to price their assets more realistically (banks in critical condition often overvalue risky assets in an effort to hide their problems from share-

holders and clients), and to request re-capitalization, larger reserves, reductions of dividends, and/or divestments of risky assets.

2. Extreme seasonal fluctuations in the economy and the unexpected failure of a large financial corporation are two more possible causes of a bank panic in the context of this type of theory (see Gordon 1988 for a detailed analysis of the main causes of bank panics).
3. Requiring banks to issue subordinated debt, extending the liability of bank shareholders, and restricting banks from holding certain risky assets are a few other regulations that may motivate banks to reduce risk-taking.
4. Other influences that are unrelated to regulatory capital requirements but may also have contributed to the observed reduction in lending in the early 1990s include: the depletion of bank capital from loan loss experiences in the 1980s; greater regulatory scrutiny (Peek and Rosengren 1995); a reduction in loan demand by businesses because of macroeconomic/regional recessions (Bernanke and Lown 1991); and/or a secular decline in the demand for bank loans because of the growth of alternative sources of credit (Berger and Udell 1994).
5. Non-governmental sources, such as BankScope, also provide data on non-US banks. For many of these banks, however, capital-asset ratios are not available. Moreover, the selection criteria for banks included in data bases such as BankScope usually remain unclear, which may lead to uncontrollable problems of selection bias.
6. This time period was chosen because capital-asset ratios (calculated according to the 1988 Basle Accord standards) are available only from 1990 on.
7. Using other measures for the capital-asset ratio (such as the total capital-asset ratio, that is, total risk-weighted capital divided by total risk-weighted assets) does not change the results significantly.
8. Estimates were obtained using the xtreg procedures in STATA. Using random-effects specifications does not change the results significantly.

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Acknowledgements
We would like to thank Harris Dellas, two anonymous referees, and the editor of this journal for their valuable comments. We are also grateful to the FDIC, and particularly to Pat Relich, for providing us with data. An earlier version of this paper was presented at the 2001 annual meeting of the American Political Science Association in San Francisco, and at the CIS colloquium at the Swiss Federal Institute of Technology, Zurich, Switzerland.

THOMAS BERNAUER
Center for International Studies
Swiss Federal Institute of Technology
(ETH) Zentrum SEI
CH-8092
e-mail: bernauer@ir.gess.ethz.ch

VALLY KOUBI
Center for International Studies
Swiss Federal Institute of Technology
(ETH) Zentrum SEI
CH-8092
e-mail: koubi@ir.gess.ethz.ch