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Financial Soundness Indicators and the Characteristics of Financial Cycles

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Abstract

Better "financial soundness" of banks could help mitigate the volatility of financial cycles by reducing banks' risk exposure. But trying to improve financial soundness in the midst of a downturn can do the opposite—further aggravating the contraction of credit. Consistent with this notion, the paper found that better initial scores in certain financial soundness indicators (FSIs) are associated with milder and shorter downturns; and improving FSIs during a downturn worsens the shrinkage of credit and amplifies the cycle. In this context, our results suggest that policy makers should be mindful about the timing of regulating changes in banks' FSIs.

JEL Classification Numbers:E44, E50, G01, G21

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I. INTRODUCTION

The global financial crisis has underscored the importance of studying the relationship between bank balance sheets and economic cycles. Since the onset of the crisis in 2008 and the collapse of several major financial institutions, banking supervisors in many countries have been vigilant in promoting "financial soundness." Banks are asked to boost capital and increase liquidity under the assumption that stronger financial soundness indicators (FSIs) imply safer banks. The assumption that stronger FSIs are associated with more resilient banking sectors is intuitive. Take the capital-asset ratio as an example. This ratio measures how much a bank's assets are financed by its own funds: higher capital-asset ratios signal higher capacity of the bank to bear risks on the asset side. Similarly, the liquid-asset ratio shows how much liquidity is available for a bank to meet its expected and unexpected demands for cash. The higher the ratio, the more capable the bank is to pay off its short-term debt obligations. At the individual bank level, it seems logical to surmise that "more financial soundness" could imply safer banks.

However, completely rational behavior at the micro level may not lead to optimal outcomes at the macro level. A collective increase in banks' financial soundness does not automatically translate into a safer financial system. Indeed, in the contraction phase of a credit cycle when credit and money supply have already been shrinking, a boost in the "financial soundness" of banks may aggravate the downturn of the cycle. The reasoning is the following. To increase its capital-asset ratio, a bank can shrink assets (mainly loans and securities) or raise more capital, or do a mix of both. To shrink assets, the bank can either make fewer loans while previous loans are being paid-off, which directly reduces credit volume, or sell securities, which depresses companies' asset prices and make it harder for them to borrow; both indirectly reduce credit in the economy.[2] Raising capital, which is more difficult to do in a downturn, can also indirectly reduce credit in the system because at the macro level, more funding for the banks means less funding for the rest of the private sector, though this effect is arguably quite small. A similar rationale applies to raising the liquid-asset ratio. In boom times, an increase in the liquid-asset ratio can be a natural result of increasing values of a bank's investment portfolio. This is generally not true in a downturn, when increasing liquid assets more likely entails a trade-off between liquidity and other types of assets, including loans.

In sum, increasing financial soundness ratios may worsen a contraction or credit crunch during the downturn phase of a credit cycle, while its credit-damping effect is probably compensated during a boom. The question is: how relevant are FSIs in gauging the soundness of the financial system? This paper argues that FSIs are very relevant. By definition, highly capitalized banks with sufficient liquidity are, in general, better at coping with unexpected shocks and downside risks than other banks. The issue is simply one of timing—the banking system should prepare

[2] Additionally, banks may also shift the composition of their asset holdings to government securities, at the cost of lending to the private sector.

itself against future shocks and raise its financial soundness levels during good times, instead of scrambling to become "safer" when things go south.

In this paper, we investigate whether this argument has an empirical basis. We found that during the downside of a credit cycle, the higher the increase in capital-asset ratio and liquid-asset ratio are, the larger the magnitude of credit shrinkage is. On the other hand, when banks have larger capital and liquidity at the onset of a downturn, the credit contraction turns out to be either shorter or more moderate.

We also look at the cyclical impact of changes in the ratio of net open position (NOP) in foreign exchange to total capital (NOP-capital ratio). The possible impact is two-fold. First, the banks whose foreign assets match foreign liabilities (low NOP) have lower exposure to foreign exchange risks, which may provide additional stability especially during a downturn. Moreover, since foreign liabilities are more volatile than domestic liabilities due to exchange rate movements, countries with large negative open positions (net open liabilities) may be more susceptible to capital flight when a downturn hits and thus may have more turbulent cycles. We found downturns that start with higher NOP-capital ratio and lower absolute value of NOP-capital ratio are milder in terms of amplitude/slope, and upturns that start with higher NOP last longer and are less abrupt.

The theoretical basis for some of our results can be found in the current literature on the cyclicality of bank capital requirements. Covas and Fujita (2009), for example, use a general equilibrium model to show that output is more volatile, and household welfare is reduced, when capital requirements are procyclical. N'Diaye (2009) argues that countercyclical prudential regulations can help reduce output fluctuations and reduce the risk of financial instability. Resende, Dib, Lalonde, and Perevalov (2011) show that countercyclical capital requirements have a significant stabilizing effect on key macroeconomic variables, and mostly after financial shocks.

Our analysis also draws on the empirical literature on banking indicators and their relationship with economic cycles. Cihak & Schaeck (2010), for example, analyzed the performance of certain financial stability indicators in detecting imminent banking crises and found that the use of FSIs as leading indicators are limited.[3] Babihuga (2007) assessed the relationship between selected annual FSIs and macroeconomic indicators for 96 countries during 1998–2005,[4] and found that FSIs fluctuate considerably with both business cycles and interest rates. Quagliariello (2003) and Bikker and Metzemakers (2002) looked at country case studies on the determinants of FSIs and found the determinants of FSIs include macroeconomic factor as well as bank specific factor.

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[3] For example, Kaminsky, Lizondo, & Reinhart (1998); Hardy & Pazarbasioglu (1998).

[4] In Babihuga (2007), the quarterly FSIs used are capital to assets, regulatory capital to risk-weighted assets, non-performing loans, return on assets, and return on equity.

Our paper attempts to empirically assess how FSIs are associated with financial cycles. We calculate monthly FSIs using the Monetary and Financial Statistics database of the IMF; consequently, our FSI data are of much higher frequency than recent research. We define the financial cycle as the cycles of bank credit to the private sector, and use the Bry–Boschan Quarterly (BBQ) algorithm advocated by Harding and Pagan (2002) to identify cyclical phases (see Section II.B).

Other papers have also used this method to quantify credit/business cycles, such as Claessens et al. (2011) and Drehmann et al (2012). Claessens et al. (2011) identified 473 credit cycles from 21 countries during 1960–2007. In their data, the durations of downturns are usually five to seven quarters, while upturns are much longer. A typical credit cycle including both upturn and downturn features about a four percent change in credit. Drehmann et al (2012) identified financial cycles for seven countries over 1960–2011, focusing on what they called "short-term cycles" (one to eight years) and "medium-term cycles" (eight to 30 years), also finding that duration tends to be shorter for contraction phases.

The paper is organized as follows. Section II introduces the dataset and the calculation of FSIs and credit cycle variables. Section III uses a panel VAR model to investigate how the changes in FSIs move with credit growth over the contraction and expansion phases of credit cycles. Section IV looks at the relationship between FSIs and the characteristics of credit cycles in terms of amplitude, duration, and slope. Section V presents some conclusions.

II. Data

A. Data on FSIs

Our analysis draws on data from the *Monetary Financial Statistics (MFS)* collected by the IMF to calculate FSIs. Under the *MFS* the IMF introduced Standardized Report Forms (SRFs), which are designed for countries to report balance-sheet data for their depository corporations, insurance corporations, pension funds, and other types of financial corporations.[5] Currently, 127 economies report SRF-type data to the IMF.[6] We calculate three monthly FSIs from the SRF data over the period January 2002–March 2012—we refer to these as SRF-FSIs—capital-asset ratios, liquid-asset ratios, and NOP-capital ratios. Summary statistics for these three SRF FSIs are shown in Table 1, based on 118 economies for capital-asset ratios, 116 economies for liquid-asset ratios, and 109 economies for NOP-capital ratios. These SRF-FSIs have their counterparts in the IMF's FSIs database, but are lower frequency and cover fewer countries than our SRF-FSIs. The IMF-FSI database was established together with the international community, with the aim of supporting macroprudential analysis and assessing strengths and vulnerabilities of

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[5] The methodology of the *MFS* and SRFs follows IMF (2000).

[6] Aggregate SRF-Type data are published in the *International Financial Statistics.*

financial systems.[7] Currently 80 economies report FSIs to the IMF database with varying time periods and breaks in the data, which make them difficult to use for regression analysis.

A closer look at the SRF-FSIs:

- Capital–asset ratio: This is the ratio of banks' total capital to total assets which are not risk-weighted, and it measures capital adequacy of the deposit-taking sector. In certain situations, adverse trends in this ratio may signal increased exposure to risk and possible capital adequacy problems. Knowing this, banks may have the incentive to increase this ratio during crisis periods when systemic uncertainties may also be increasing.

- Liquid–asset ratio: This ratio is calculated as liquidity to total assets, indicating how much liquidity is available to meet potential demands for cash. Liquidity here includes cash and deposits, as well as short-term Treasury bills issued by governments. Under uncertainty (bad times), this ratio could increase due to banks' incentive to prepare for adverse shocks, provided that banks are not under constrained in their liquidities. In contrast, in good times, the ratio would decline because the opportunity cost of holding liquid assets is higher, but it could also increase as a result of banks' better financial performance.

- Net open position (NOP)-capital ratio: This is the ratio of deposit takers' net open position in foreign exchange to total capital. Net open position in foreign exchange is calculated by summing the foreign currency positions, including net position on foreign currency debt instruments, foreign exchange denominated equity assets, and other foreign exchange exposure. This ratio indicates deposit takers' exposure to exchange rate risks compared with capital. It measures the mismatch of foreign currency net positions to assess the potential vulnerability of deposit takers' capital position to exchange rate movements.

Figure 1 plots the trends in FSIs for selected advanced, periphery, and emerging European countries around the recent crisis. Regarding capital-asset ratios, as shown in Figure 1, panels 1 and 2, the ratios for both advanced and periphery Europe had been relatively stable or in decline during the boom years prior to 2008, but in some countries the ratio has increased since the onset of the crisis. In comparison, Figure 1, panel 3 shows there is less of a significant pattern for this ratio relating to the crisis in emerging Europe countries. Regarding liquid-asset ratios, Figure 1, panel 4 and 5 show that while the ratio for advance Europe (except Belgium and the Netherlands) was relatively stable, the ratio for periphery European countries was generally on decreasing trends during the pre-crisis period, and has started to recover after the crisis. In particular, Spanish banks had been active in alternative investments and shown larger decreases

[7] More detailed information on the FSI database is found in *Compilation Guide on Financial Soundness Indicators*, IMF, or fsi.imf.org.

in this ratio during the pre-crisis period. The ratios for emerging Europe tended to decline until 2008–2009 and started to recover in some countries (Figure 1, panel 6). Regarding NOP-capital ratios, Figure 1, panels 7 and 8 show that this ratio has declined since the crisis for some of the countries in both advanced and periphery Europe. One reason can be that during the crisis, banks are pressured to strengthen their capital position while reducing foreign exchange exposure, leading to overall decreases in this ratio. The trend for emerging Europe is more diverse. (Figure 1, panel 9).

Figure 1. Development of FSIs for Selected European Countries, 2005–2011

(January 2005=100)

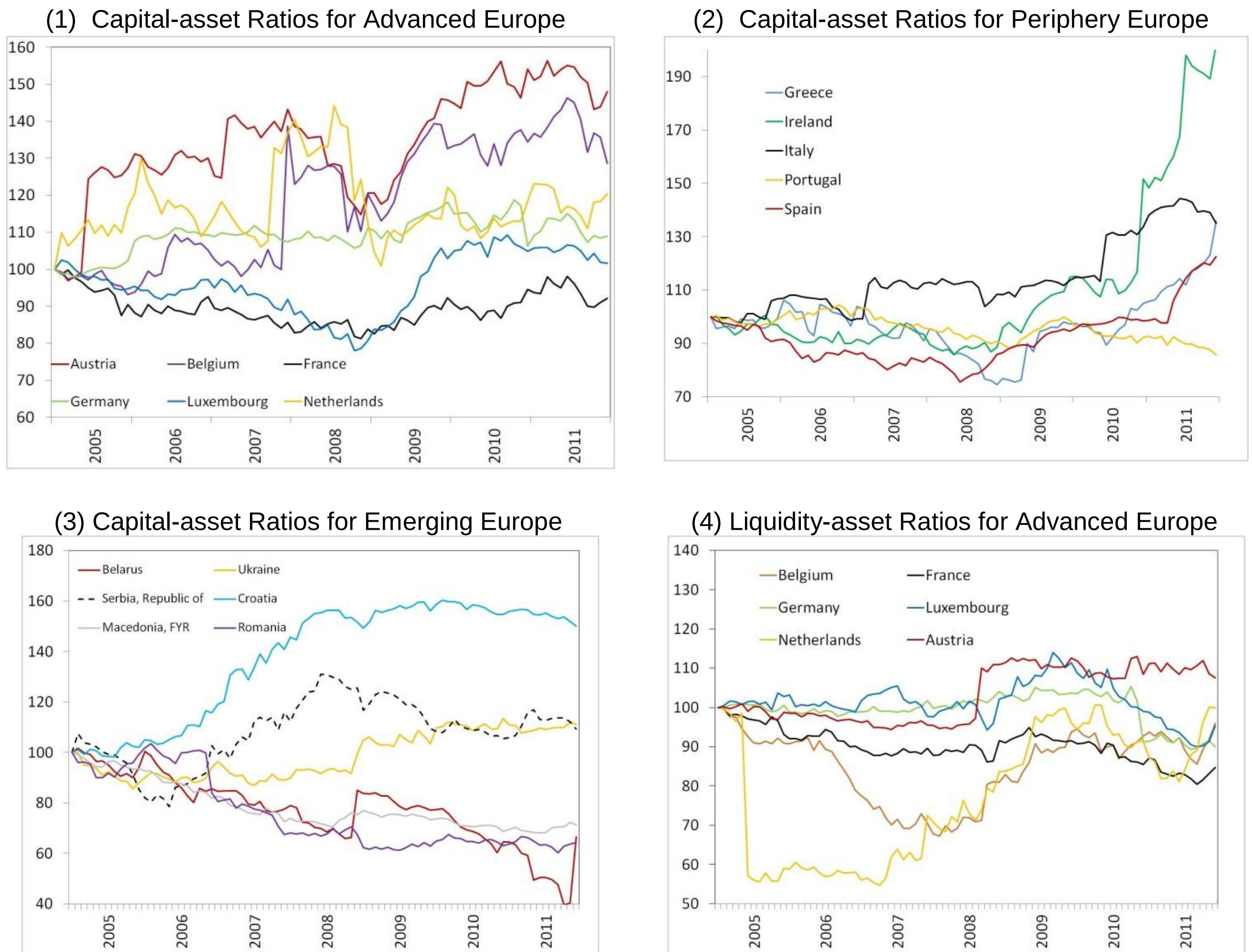
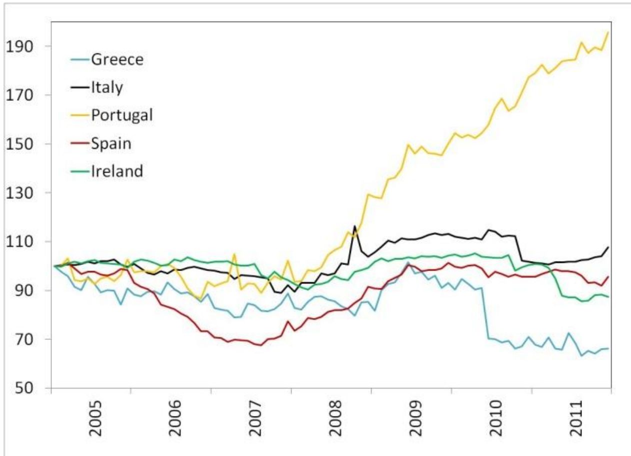
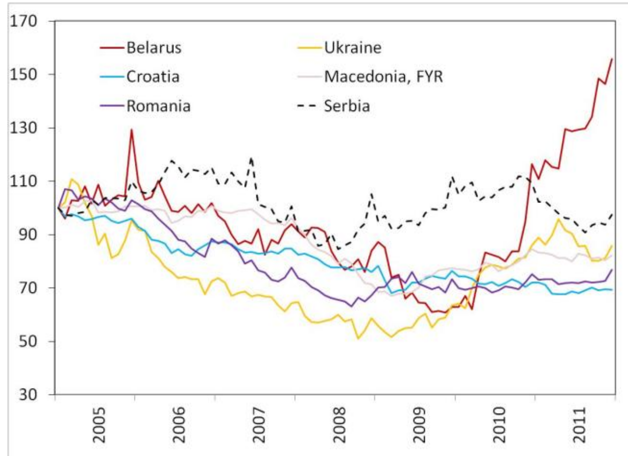


Figure 1. Development of FSIs for Selected European Countries, 2005–2011 (continued)
(January 2005=100)

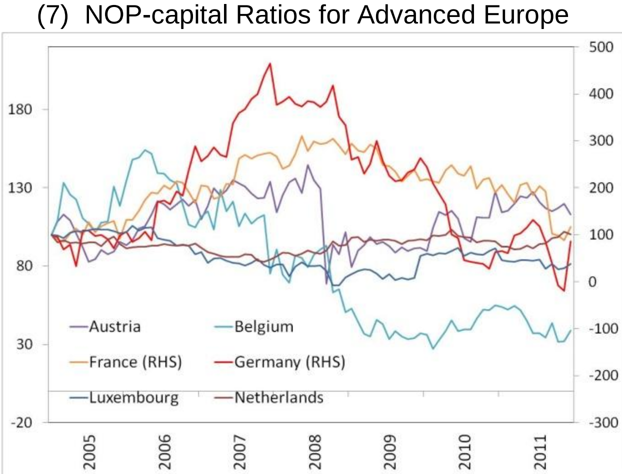
(5) Liquid-asset Ratios for Periphery Europe



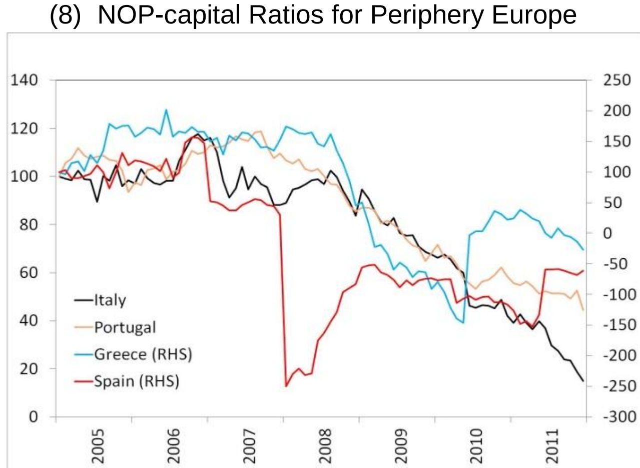
(6) Liquid-asset Ratios for Emerging Europe



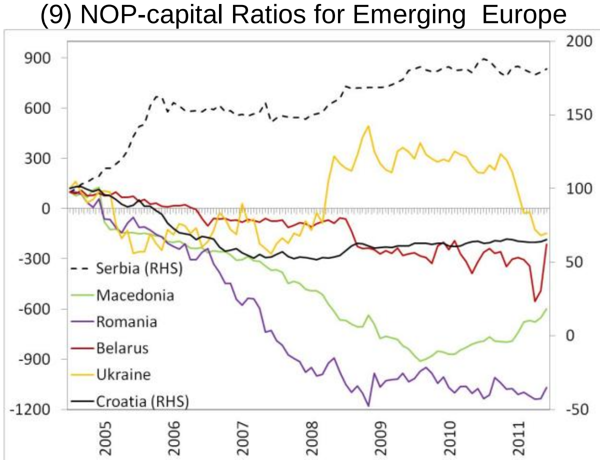
(7) NOP-capital Ratios for Advanced Europe



(8) NOP-capital Ratios for Periphery Europe



(9) NOP-capital Ratios for Emerging Europe



Sources: IMF data reported in Standardized Report Forms (SRFs).

We next compare SRF-FSIs with IMF-FSIs. However, due to limited data availability of IMF-FSIs and differences in frequency, comparing the two series is not straightforward.[8] To do a fair comparison, we extrapolated the quarterly IMF-FSI data to monthly frequency, starting in 2009/Q1. We then ran fixed-effect panel regressions of the SRF-FSIs on the extrapolated IMF-FSIs. As the results in Table 2 show, the correlations between the two series are positive and significant for the capital-asset ratio and liquid-asset ratio, with R^2 of 0.53 and 0.19 respectively. The estimated coefficient for the NOP-capital ratio is positive but insignificant, and the R^2 of the regression is very small.

A reason why these two series may not move together could stem from the methodological differences between *MFS* data and IMF-FSIs, including i) consolidation basis, ii) intragroup consolidation adjustment, and iii) recording of total assets. First, the *MFS* data are compiled mostly on domestic consolidation basis, and includes the data of resident deposit takers along with their branches and subsidiaries that are resident in the domestic economy. The *MFS* framework does not include the data of the branches and subsidiaries of a resident deposit taker that are located abroad, but does include the branches and subsidiaries of a foreign bank that are located domestically. On the other hand, for IMF-FSIs, the consolidation basis is not homogeneous and differs from country to country, with many countries choosing to include foreign subsidiaries of their banks in the calculation.[9] Although *MFS*'s consolidation basis may not reflect the risk exposed to a domestic bank's foreign subsidiaries and branches, for the purpose of this paper, it is mostly adequate, as we are interested in the deposit taking entities that are likely to be active and influential in a country's domestic credit market, regardless of their origins. Second, regarding intragroup consolidation adjustments, all intragroup consolidation adjustments for positions are carried out for the IMF-FSIs, but in the *MFS*, no intragroup adjustments are made for balance sheet positions, except those between parents and branches. Third, as for recording of assets, total assets are net of specific provisions for IMF-FSIs, while those in *MFS* are recorded on a gross basis (provisions for losses on impaired assets are not netted out).

B. Calculating Financial Cycles

Harding and Pagan (2002) introduced a method to identify turning points in a logarithmic time series. We use their method and apply it to the monthly private sector credit volume data to define the peaks, troughs, and related phases of the financial cycle. The idea is that the local maximum and local minimum points of the credit volume are identified as the peaks and troughs of the series. The turning points and the phases have to satisfy certain criteria. In our case, the turning points need to be the local maxima/minima over a time window that is at least 10 months

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[8] While the SRF-based data are available from 2001 for many economies, most of the IMF-FSIs have been reported for only the last several years.

[9] IMF (2006) encourages the compilation of FSIs using cross border data that will duly reflect the impact of foreign branches of local deposit takers.

long, and a phase of a cycle must be longer than five months. More specifically, a peak is identified at time t if

$$y_{t-5},...y_{t-1} < y_t > y_{t+1},...y_{t+5}$$

and a trough is reached at time t if

$$y_{t-5},...y_{t-1} > y_t < y_{t+1},...y_{t+5}$$

where y_t is the logarithm of credit volume at a monthly frequency.[10] The time between a trough and the next peak is called the expansion phase of a cycle, and the time between a peak and the next trough is the contraction phase. As the credit volume is upward trending over the long run for most countries, we also HP-filtered the time series of y_t and calculated the turning points and phases of the cyclical components of the filtered series. We call the cycle identified from the filtered series "credit growth cycle," as opposed to the "credit cycle" identified from y_t itself. To distinguish from the phases of the latter, we call the upturns and downturns of the credit growth cycle "surges" and "slowdowns." Section IV below includes summary statistics of the durations, amplitudes, and slopes of these cycle phases.

III. SRF-FSIs and Credit Growth

In this section we look at the response of credit growth to changes in SRF-FSIs, capital-asset ratio, liquid-asset ratio, and NOP-capital ratio, over different phases of the credit cycle. Simply regressing credit growth on changes in these FSIs is problematic, as the latter are not exogenous.[11] Therefore, we use a panel-data vector autoregression approach in the estimation. This method allows all variables in the system to be endogenous, while taking into account cross-sectional heterogeneity across countries. The first order VAR model is as follows:

$$Z_{it} = \Pi_0 + \Pi_1 Z_{it-1} + f_i + \mathrm{E}_t \qquad (1)$$

where Z_t is the vector $\{\Delta r, \Delta ex, GROWCREDIT, GROWCAP, GROWLIQUID, GROWNOP\}$. *GROWCREDIT* is the year-on-year credit growth rate. *GROWCAP*, *GROWLIQUID*, and *GROWNOP* are the growth rates of capital-asset ratio, liquid-asset ratio, and NOP-capital ratio, respectively. Δr and Δex are the year-on-year change of average real lending rate and exchange

[10] To smooth out the (extreme) short-term fluctuations and noises in the credit volume, we aggregated the monthly data into quarterly for each month. i.e., let Y_t be the monthly credit volume at time t; the series we used for cycle identification is $y_t = \ln(Y_t + Y_{t-1} + Y_{t-2})$.

[11] The FSIs we analyze in this paper are created from information of deposit takers' balance sheet, and thus the FSIs are impacted by credit conditions and macroeconomic fundamentals. For example, capital-asset can be high in the downturn because there is little lending opportunities. Other types of FSIs—for example, those on household sectors or housing markets—could be more exogenous factors.

rate. f_i is the country fixed effect and E_t is the vector of error terms, with each component assumed to be i.i.d.

Because the shocks are orthogonalized, the impulse response function of credit growth to the changes in SRF-FSIs isolates the effect of the latter on credit growth, keeping other factors constant. Notice that the different variables in the vector are not entirely "equal," in the sense that the variables placed earlier in the vector affect the following variables both contemporaneously and with a lag, while the variables placed later only affect the previous variables with a lag. Therefore our specification assumes, for example, that current shocks in credit growth affect the current and one-period-ahead capital-asset ratio, but shocks in the growth of capital-asset ratio only affect credit growth with a lag. This is a reasonable assumption because an increase in credit implies expanded total assets, other things equal; and that mechanically translates into a lower capital-asset ratio that has total assets as the denominator. In contrast, changes in credit growth as a result of shifts in the capital-asset ratio likely involves portfolio adjustments which takes time to happen. We also assume that interest rate growth and inflation are the most exogenous variables in the system, as they are determined by various macroeconomic factors outside of the banks.

Our goal in the empirical analysis is to compare the response of credit growth to changes in SRF-FSIs during the downturn to the response during the upturn. The hypothesis is that during the downturn, improving SRF-FSI ratios in an attempt to boost soundness of the banking system tends to "crowd out" credit and makes the contraction phase of the financial cycle even worse; while during a boom, there is much less of a trade-off between strengthening SRF-FSIs and increasing credit. That is, the latter should not be much affected by the former. We split the sample into two, the contraction phases and the expansion phases, according to the methodology documented in Section II. B and estimate equation (1) for the two subsamples.

We want to allow for country heterogeneity in the regression, as the levels of credit growth in different countries are quite diverse due to reasons not captured in the model. We accomplish this by introducing fixed effects in the regression. However, the fixed effects produced by taking the mean out of a variable, as commonly practiced, are correlated with lagged autoregressive variables and would produce biased estimates. To solve this problem, we use the so-called "Helmert procedure", which only takes out the mean of all future observations of a variable to product the fixed effect.[12]

Table 3a and 3b report the estimation results of equation (1) for the downturn and upturn subsamples, respectively. The results show that credit growth responds negatively to an increase in the capital-asset and liquid-asset ratios over the downturn. In contrast, over the boom period,

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[12] The computer program for this procedure and for the panel VAR estimation model is written by Inessa Love (Love & Zicchino, 2006).

credit responds positively to increases in the liquid-asset ratio, as well as increases in the capital-asset ratio, though the estimate for the latter is not significant. The result confirms our hypothesis: in boom times the improvement in financial soundness ratios can be the natural derivative of the favorable financial performance of banks instead of the outcome of deliberate efforts to strengthen "soundness;" and the greater availability of liquidity and capital subsequently gives the banks more space to extend credit. During the contraction phase of the credit cycle, improvements in the financial soundness ratios are more likely to come at the cost of further credit reduction. Change in the NOP-capital ratio is insignificant in the estimation for both downturns and upturns. Figure 2 reports the impulse response of credit growth to shocks in growth in capital-asset ratio, liquid-asset ratio, and net open position-capital ratio in the two subsamples. The impulse response functions present very similar patterns as the regression results.

Figure 2. Impulse Responses of Credit Growth to Shocks in Growth in Capital-asset Ratio, Liquid-asset Ratio, and Net Open Position-capital Ratio

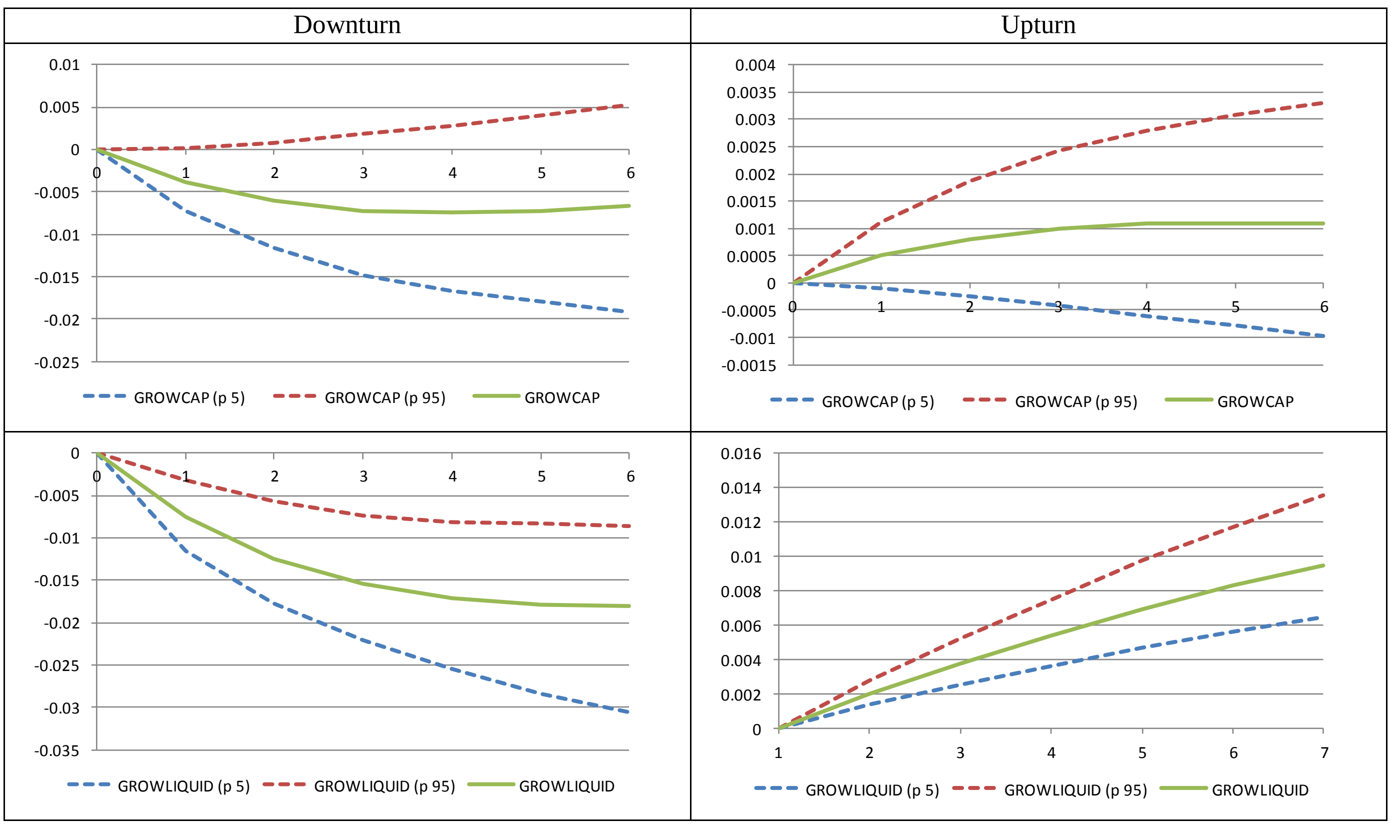


Figure 2. Impulse Responses of Credit Growth to Shocks in Growth in Capital-asset Ratio, Liquid-asset Ratio, and Net Open Position-capital Ratio (continued)

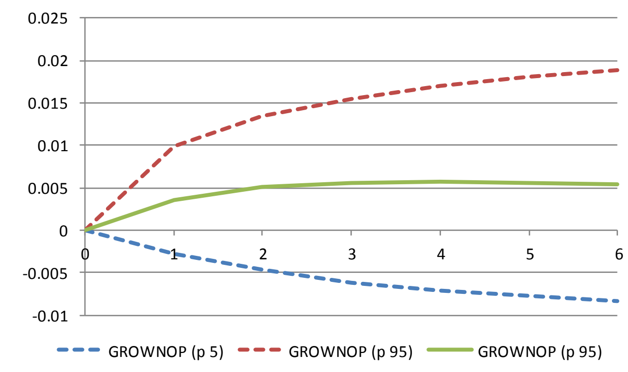
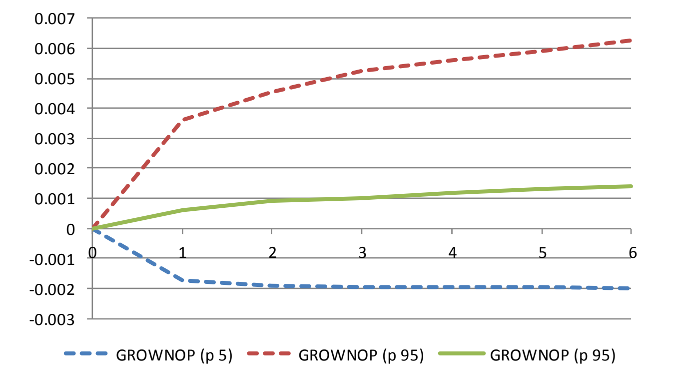
Downturn	Upturn
	

Table 4 reports the variance decomposition for credit growth. It indicates the proportions of variation in credit growth that are explained by shocks to the variables in the system. The table reports the effect of shocks over a 10 month time horizon. The results show, consistent with the regression results, that among the three SRF-FSIs in the system the liquid-asset ratio has the largest influence on credit growth, explaining about 10 percent of the variations in the latter during the downturn and eight percent during the upturn. The capital-asset ratio has a larger effect on credit growth during the downturn, explaining about two percent of the variance, than in the upturn. Finally, changes in the NOP-capital ratio have very little effect on credit.

To summarize, the panel VAR estimates and impulse-response functions indicate that increases in the capital-asset ratio and liquid-asset ratios lead to slower credit growth during contraction phases of credit cycles when credit is already declining; in contrast, during a credit boom, increases in the liquid-asset ratio is associated with even faster growth in credit, while changes in the capital-asset ratio do not have much of an effect on credit. These patterns are consistent with our hypothesis—during the downturn, to raise financial soundness banks have to further sacrifice lending, as liquidity is short and capital is hard to come by. In the upturn, such tradeoffs are not apparently a binding constraint.

Our results do suggest that policymakers should be cautious about the risk that the policies aiming to enhance banking system's soundness during downturn—a credit crunch or economic contraction—could bring unintended consequences such as decrease in credit growth or larger volatility of the financial cycle. On the other hand, the results do not imply that policymakers should discount FSIs as a tool to maintain the stability of financial system. As the next section attempts to show, favorable (or stronger) FSIs are indeed related to more stable credit cycles.

IV. SRF-FSIs AND THE CHARACTERISTICS OF FINANCIAL CYCLES

In this section, we investigate the relationship between SRF-FSIs and the magnitude of financial cycles. We use three variables to characterize cyclical phases—amplitude, duration, and slope.[13] The amplitude of an upturn or downturn is the absolute vertical distance between the highest point (peak) and the lowest point (trough) of the phase. The duration of a phase is the time between one turning point and the next turning point. The slope of a phase, which measures the "sharpness" of cyclical changes, is equal to amplitude/duration. Figure 3 presents a graphic example of the definitions of these cyclical characteristics for the downturn phase.

Figure 3. Amplitude, Duration, and Slope of a Downturn

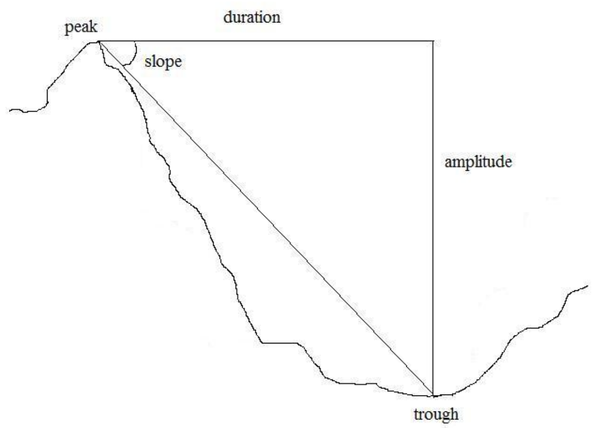


Table 5 presents summary statistics of cycle characteristics for both a normal credit cycle and a credit growth cycle (see Section II.B). On average, upturns are three times longer and larger than downturns, making the average slopes of the two phases about the same. On the other hand, when the trend element is taken out, the cyclical ups and downs are quite symmetrical, with slowdowns and surges in the growth cycle about equal in their average duration, amplitude and slope.

Although the existing literature that explores the possibility of using FSIs as early warning indicators of crisis/downturn achieved various degree of success, this approach of studying FSIs may be missing some factors. For example, FSIs are affected as much by the deliberate strategies of regulators and banks as by cyclical forces. It is true that they do have cyclical patterns. But trying to use them as indicators to predict future downturns largely assumes passivity on the banks' and regulators' part and neglects the real usefulness of FSIs, that is, as an active tool to maintain the financial system's stability. We take the occurrence of financial cycles as determined by complicated macroeconomic factors that are largely outside the control of banks and regulators. Abundant capital and liquidity of banks are not going to eliminate downturns. But

[13] See Harding and Pagan (2002).

they make the banks better prepared when the downturn hits and thus on the macro level, may serve to reduce the severity and volatility of credit cycles.

Therefore, our goal in this section is to investigate whether stronger SRF-FSIs prior to a cyclical phase have an effect on the characteristics of the phase. Specifically, we regress the characteristics of cyclical phases, including duration, amplitude, and slope, on the levels of SRF-FSIs—capital-asset ratio, liquid-asset ratio, NOP-capital ratio or the absolute value of the NOP-capital ratio—at the onset of the phase, plus control variables (price, interest rate, and exchange rate levels, also at the beginning of the phase) and country fixed effects.

We use the Weibull function to approximate the duration of downturns and upturns in studying the relationship between cycle duration and the FSIs. The estimation results of the Weibull duration model with country fixed effects are presented in Table 6. The parameter p signals the extent of duration dependence. Here the results indicate positive duration dependence in the duration of cycle phases ($p>1$), i.e., the longer a phase has lasted, the more likely it is to end.

The first two columns of Table 6 show that a higher liquid-asset ratio at the beginning of the downturn is associated with shorter downturn durations. This is also true for the slowdown phase of the growth cycle, as column 5 and 6 of the table show. On the other hand, neither capital-asset ratio nor NOP-capital ratio has any significant impact on the duration of downturns. Turning to the upturns and surges, higher liquid-asset ratio, capital-asset ratio and NOP-capital ratio lead to longer upturns and surges (column 3 and 7). Finally, the absolute value of the NOP-capital ratio is insignificant in any of the duration regressions.

A second cycle characteristics we are interested in is the amplitude of phases, which represents the magnitude of the increase/decrease of credits over a phase. Table 7 presents the results of fixed effect regressions of cycle amplitudes on the levels of the SRF-FSIs at the beginnings of the phases. Higher liquid-asset ratio reduces the amplitudes of downturns and slowdowns. Same thing can be said for higher capital-asset ratio, the coefficient of which is mostly negative and significant in the downturn regressions. Higher NOP-capital ratio is also associated with lower amplitudes of the downturns and slowdowns. This shows that reducing the risk from foreign liability exposure helps reducing the amplitude of the downturn. Reducing the foreign exchange risk seems to have a similar effect, as the absolute value of NOP-capital ratio enters the downturn regression with a positive and significant sign. But this latter effect is likely to be weaker, as the sign of absNOP is negative in the regression for the slowdown phase. For the upside of the cycles, none of the FSIs seems to have much of an effect on the amplitude, as the estimated SRF-FSI coefficients are all insignificant in the regressions for upturn and surge phases.

Table 8 presents estimation results for the regressions of slopes of cycle phases on SRF-FSIs. As mentioned, the slope of a phase indicates the “sharpness” of the cyclical movements, or the “speed” of rise or decline of a phase. The table shows that higher capital-asset ratio is mostly associated with smaller slopes of downturn and slowdown phases (columns 1, 2, 5, and 6).

Higher capital-asset ratio is also somewhat significantly associated with smaller slopes for the upturn phases (columns 3 and 4). This result is intuitive—higher capital-asset ratio means lower leverage on the banks' part, which limits the speed the banks can expand their lending. Higher liquid-asset ratio also makes the downturns and slowdowns less sharp, as shown in column 1, 2, 5, and 6, but liquid-asset ratio does not have any significant effect on the upsides of the cycles. Higher NOP-capital ratio, in contrast, is significantly related to smaller slopes of the upturns and surges. One explanation for this result is that higher NOP-capital ratio—indicating higher foreign asset holding or lower foreign borrowing—limits the resources available to fuel credit expansion, thus curbs the speed of the expansion, provided that the NOP takes time to change. Finally, the absolute value of NOP-capital ratio turns out positive in the downturn regression, showing that exposure to foreign exchange risk makes lending contract faster. A possible explanation is that the banking systems that carry more foreign exchange risks tend to turn very conservative when the downturn hits.

To sum up, our empirical results in this section confirms the general wisdom that financial soundness of banks helps create a more stable financial system through "calming" the cycles. Higher capital-asset ratio, liquid-asset ratio, NOP-capital ratio, and lower absolute value of the NOP-capital ratio at the beginning of the downturn are associated with more moderate (smaller amplitude) and less sharp (smaller slope) downturns. On the other hand, upturns that start with higher capital-asset ratio, liquid-asset ratio, and NOP-capital ratio are shown to be more durable, other things being equal.

V. Conclusion

When a financial or economic crisis hits, banks and policymakers are often pressured to take actions to stabilize and safeguard the financial system. Since better capitalized and more liquid banks are seen as safer, in the downturn banks and regulators are often enticed to the idea of boosting the capital base and liquidity of the banking system. There is nothing wrong with this logic at the micro level, but at the aggregate level, attempts to strengthen banks' FSIs when credit to the private sector is already shrinking may have adverse consequences. Our empirical analysis suggest that, during credit contractions, improvement in FSIs such as capital-asset ratio and liquid-asset ratio are associated with further decline in credit, while such negative relationships do not exist during boom times. This result suggests that during recessions, the tradeoff between bank lending and improving FSIs is especially sharp, thus any policy advice or even regulatory changes that try to strengthen the stability in the banking system may push the system further into recession.

On the other hand, when strengthened at the right time, better FSIs do seem to contribute to a more stable financial system. Our analysis indicates that downturns are milder—measured in terms of lower magnitudes in the duration, amplitude and slope of the recession phase—when certain FSIs are higher at the onset of the recession.

The policy conclusion from the empirical analysis in this paper is one that emphasizes the timing of FSI adjustments. The best time to make the banks "safer" is probably during a salient credit boom, so that the banks are well prepared for the "rainy days," i.e., in the event that the economy enters a recession. In contrast, trying to tighten FSI requirements in the midst of a recession may be counterproductive.

Table 1. Summary Statistics of SRF-FSIs

		Number of observations	Mean	Std dev.	Min	Max
Capital-asset ratio	Advanced	1830	0.065	0.023	0.010	0.160
	Emerging	7149	0.100	0.057	-0.734	0.314
	Low income	4585	0.112	0.054	-0.089	0.326
Liquid-asset ratio	Advanced	1707	0.278	0.096	0.061	0.504
	Emerging	7021	0.365	0.145	0.077	0.924
	Low income	4583	0.408	0.147	0.073	0.856
Net open position-capital ratio	Advanced	1657	-0.463	1.112	-3.445	3.783
	Emerging	6543	0.094	8.464	-262.740	288.629
	Low income	4614	0.548	1.401	-19.846	34.057

Table 2. Regression of SRF-FSIs on IMF-FSIs (with country fixed effects)

	SRF FSIs		
	Capital-asset ratio	Liquid-asset ratio	Net open position-capital ratio
IMF-FSIs:			
Capital-asset ratio	0.27** (0.044)		
Liquid-asset ratio		0.54** (0.026)	
Net open position-capital ratio			0.0045 (0.0014)
constant	8.32** (0.428)	15.14** (0.74)	-0.502 (0.011)
N	756	792	468
r2	0.53	0.19	0.012

Note: ***, **, and * are significance level at one percent, five percent, and 10 percent respectively.

Table 3a. Panel VAR: Credit Growth and Changes in SRF-FSIs During Downturns

Downturn	Response of			
	GROWCREDIT	GROWCAP	GROWLIQUID	GROWNOP
Response to				
Δr	0.05***	0.10	-0.04**	0.17
	(0.01)	(0.16)	(0.02)	(0.38)
Δex	-0.08***	-0.49	0.06**	3.03**
	(0.02)	(0.43)	(0.03)	(1.50)
L. GROWCREDIT	0.85***	-0.24	0.02	1.57
	(0.06)	(0.35)	(0.07)	(1.90)
L. GROWCAP	-0.01*	0.84***	0.00	0.12
	(0.00)	(0.09)	(0.01)	(0.22)
L. GROWLIQUID	-0.10***	-0.33	0.89***	2.62
	(0.04)	(0.27)	(0.08)	(3.27)
L. GROWNOP	0.00	0.01	0.00	0.63***
	(0.00)	(0.01)	(0.00)	(0.09)
N=532				

Note: ***, **, and * are significance level at one percent, five percent, and 10 percent respectively. Panel VAR regression for the subsample where the system is in a downturn phase at time t. GROWCREDIT: credit growth; GROWCAP: increase in capital-asset ratio; GROWLIQUID: increase in liquid-asset ratio; GROWNOP: increase in NOP-capital ratio; Δr: change in real interest rate; Δex: change in exchange rate.

Table 3b. Panel VAR: Credit Growth and Changes in SRF-FSIs During Upturns

Upturn	Response of			
	GROWCREDIT	GROWCAP	GROWLIQUID	GROWNOP
Response to				
Δr	-0.02***	-0.05	0.01*	-2.53*
	(0.00)	(0.03)	(0.01)	(2.13)
Δex	-0.01	0.00	0.02*	36.30***
	(1.00)	(0.03)	(0.06)	(8.07)
L. GROWCREDIT	1.00***	-0.08	-0.09**	-6.49
	(0.02)	(0.07)	(0.02)	(4.08)
L. GROWCAP	0.00	0.75***	0.00	-1.16
	(0.00)	(0.08)	(0.00)	(0.84)
L. GROWLIQUID	0.03***	-0.04	0.87***	5.45
	(0.01)	(0.03)	(0.03)	(8.73)
L. GROWNOP	0.00	-0.00	0.00	0.10*
	(0.00)	(0.00)	(0.00)	(0.06)
N=2356				

Note: ***, **, and * are significance level at one percent, five percent and 10 percent respectively. Panel VAR regression for the subsample where the system is in an upturn phase at time t. GROWCREDIT: credit growth; GROWCAP: increase in capital-asset ratio; GROWLIQUID: increase in liquid-asset ratio; GROWNOP: increase in NOP-capital ratio; Δr: change in real interest rate; Δex: change in exchange rate.

Table 4. Variance Decomposition for Credit Growth

	Variance decomposition of GROWCREDIT					
	Δi	$\Delta \pi$	GROWCREDIT	GROWCAP	GROWLIQUID	GROWNOP
Downturn	0.043	0.239	0.586	0.015	0.106	0.011
Upturn	0.020	0.102	0.795	0.001	0.080	0.002

Note: the numbers are percent of variation in credit growth 10 periods ahead that can be explained by the row variables. GROWCREDIT: credit growth; GROWCAP: increase in capital-asset ratio; GROWLIQUID: increase in liquid-asset ratio; GROWNOP: increase in NOP- capital ratio; Δi : growth in interest rate; $\Delta \pi$: inflation rate.

Table 5. Summary Statistics of Cycle Properties

		observations	Average Duration (in months)	average amplitude	average slope
Cycle	downturn	87	9	0.10	0.01
	upturn	63	27	0.34	0.01
Growth cycle	slowdown	300	17	0.14	0.01
	surge	327	16	0.14	0.01

Table 6. Cycle Durations and SRF-FSIs

	Duration							
	Cycle				Growth cycle			
	Downturn		Upturn		Slowdown		Surge	
CAP	-9.07	-10.38	-55.33**	-65.73	-4.82	-5.27	-7.83*	-5.56
	(10.52)	(12.29)	(26.88)	(43.22)	(5.80)	(6.37)	(4.60)	(4.76)
LIQUID	11.43***	11.50***	-22.08***	-21.82***	9.30***	9.31***	-2.91*	-2.87*
	(3.81)	(3.84)	(8.08)	(6.64)	(1.94)	(1.99)	(1.71)	(1.58)
NOP	0.09		-0.90***		0.10		-0.48***	
	(0.25)		(0.35)		(0.18)		(0.15)	
absNOP		-0.07		-1.07		-0.05		0.02
		(0.37)		(0.87)		(0.24)		(0.20)
CPI	-0.06***	-0.06***	-0.11***	-0.10***	-0.01*	-0.01*	-0.02***	-0.02***
	(0.02)	(0.02)	(0.04)	(0.04)	(0.01)	(0.01)	(0.01)	(0.01)
INS	0.05	0.06	-0.04	0.02	0.01	0.01	-0.00	-0.01
	(0.04)	(0.04)	(0.15)	(0.08)	(0.02)	(0.02)	(0.02)	(0.02)
EXR	0.00	0.00	0.09**	0.06	-0.00	-0.00	0.00	0.00
	(0.00)	(0.00)	(0.04)	(0.05)	(0.00)	(0.00)	(0.00)	(0.00)
CON	-1.55	-1.41	8.60*	9.76	-8.75***	-8.59***	-1.95**	-2.41**
	(2.15)	(2.22)	(4.58)	(6.13)	(1.09)	(1.17)	(0.91)	(1.00)
ln(p)								
	0.49***	0.49***	1.66***	1.60***	0.64***	0.64***	0.55***	0.52***
	(0.12)	(0.12)	(0.30)	(0.29)	(0.09)	(0.09)	(0.09)	(0.09)
N	109	109	109	109	414	414	414	414

Note: ***, **, and * are significance level at one percent, five percent, and 10 percent respectively. Weibull duration model with country fixed effect of cycle amplitude on FSIs. CAP: capital-asset ratio; LIQUID: liquid-asset ratio; NOP: NOP--capital ratio; INS: interest rate; CPI: inflation rate; EXR: exchange rate. ln(p) is the log of Weibull distribution parameter.

Table 7. Cycle Amplitudes and SRF-FSIs

	Amplitude							
	Cycle				Growth cycle			
	Downturn		Upturn		Slowdown		Surge	
CAP	-3.04***	0.97	0.97	2.81	-1.36***	-1.60***	-0.30	-0.35
	(0.88)	(1.35)	(6.38)	(6.81)	(0.37)	(0.43)	(0.48)	(0.52)
LIQUID	-0.12	-0.45*	1.06	1.24	-0.65***	-0.66***	0.10	0.09
	(0.21)	(0.25)	(2.28)	(2.25)	(0.12)	(0.12)	(0.16)	(0.16)
NOP	-0.07***		0.06		-0.02*		0.00	
	(0.02)		(0.11)		(0.01)		(0.02)	
absNOP		0.06**		0.12		-0.03*		-0.00
		(0.03)		(0.14)		(0.01)		(0.02)
CPI	0.00	-0.00	-0.00	-0.00	0.00**	0.00*	-0.00*	-0.00*
	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
INS	0.01**	0.01	-0.01	-0.01	0.00**	0.00**	-0.00	-0.00
	(0.00)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
EXR	0.00	-0.00	0.00	0.01	0.00	0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
CON	0.23	0.05	0.28	-0.83	0.34***	0.39***	0.25**	0.26**
	(0.14)	(0.17)	(1.72)	(2.19)	(0.08)	(0.09)	(0.11)	(0.12)
N	59	59	45	45	196	196	208	208
r2	0.65	0.48	0.15	0.19	0.29	0.29	0.06	0.06

Note: ***, **, and * are significance level at one percent, five percent, and 10 percent respectively. Country fixed effect regressions of cycle amplitude on FSIs. CAP: capital-asset ratio; LIQUID: liquid-asset ratio; NOP: NOP-capital ratio; INS: interest rate; CPI: inflation rate; EXR: exchange rate.

Table 8. Cycle Slopes and SRF-FSIs

	Slope							
	Cycle				Growth cycle			
	Downturn		Upturn		Slowdown		Surge	
CAP	-0.50**	0.13	-0.33**	-0.22	-0.08***	-0.07**	0.01	0.02
	(0.22)	(0.21)	(0.12)	(0.18)	(0.02)	(0.03)	(0.03)	(0.03)
LIQUID	-0.07	-0.10**	-0.01	-0.01	-0.02**	-0.02*	0.00	0.00
	(0.05)	(0.04)	(0.04)	(0.06)	(0.01)	(0.01)	(0.01)	(0.01)
NOP	-0.00		-0.01**		-0.00		-0.00*	
	(0.00)		(0.00)		(0.00)		(0.00)	
absNOP		0.02***		-0.00		0.00		-0.00
		(0.00)		(0.00)		(0.00)		(0.00)
CPI	-0.00	-0.00	-0.00	-0.00	0.00	0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
INS	0.00**	0.00	0.00	0.00	0.00**	0.00*	-0.00	-0.00*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
EXR	0.00	-0.00	0.00	-0.00	0.00	0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
CON	0.05	0.03	0.04	0.06	0.01***	0.01**	0.01**	0.01*
	(0.03)	(0.03)	(0.03)	(0.06)	(0.01)	(0.01)	(0.01)	(0.01)
N	59	59	45	45	196	196	208	208
r2	0.49	0.70	0.56	0.25	0.14	0.13	0.10	0.07

Note: ***, **, and * are significance level at one percent, five percent, and 10 percent respectively. Country fixed effect regressions of cycle slope on FSIs. CAP: capital-asset ratio; LIQUID: liquid - asset ratio; NOP: NOP-capital ratio; INS: interest rate; CPI: inflation rate; EXR: exchange rate.

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